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**Datasheet for the decision  
of 3 March 2026**

**Case Number:** T 1077/24 - 3.3.02

**Application Number:** 18743786.8

**Publication Number:** 3658494

**IPC:** C10K3/06, C01B13/02, C01B3/38,  
C07C29/151

**Language of the proceedings:** EN

**Title of invention:**  
METHOD FOR THE PREPARATION OF SYNTHESIS GAS

**Patent Proprietor:**  
Haldor Topsøe A/S

**Opponents:**  
CASALE SA  
JOHNSON MATTHEY PUBLIC LIMITED COMPANY

**Headword:**  
Haldor Topsøe / SYNTHESIS GAS PREPARATION

**Relevant legal provisions:**  
EPC Art. 54, 56  
RPBA 2020 Art. 12(4), 12(6), 13(1), 13(2)

**Keyword:**

Main request - Novelty - (no)

Admissible auxiliary requests - Inventive step - (no)

Late-filed requests - should have been submitted in first-  
instance proceedings (yes)

Submissions after Art. 15(1) RPBA communication - exceptional  
circumstances (no)

**Decisions cited:**

T 0012/07, T 1968/08, T 1045/12, T 0895/23

**Catchword:**



**Beschwerdekammern**  
**Boards of Appeal**  
**Chambres de recours**

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Case Number: T 1077/24 - 3.3.02

**D E C I S I O N**  
**of Technical Board of Appeal 3.3.02**  
**of 3 March 2026**

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**Decision under appeal:**

**Interlocutory decision of the Opposition  
Division of the European Patent Office posted on  
3 July 2024 concerning maintenance of the  
European Patent No. 3658494 in amended form.**

**Composition of the Board:**

**Chairman**            M. O. Müller  
**Members:**            M. Maremonti  
                             R. Romandini

## Summary of Facts and Submissions

I. The appeals by the patent proprietor and opponents 1 and 2 ("the opponents") were filed against the opposition division's interlocutory decision, according to which European patent No. 3 658 494 ("the patent") as amended in the form of auxiliary request 3, the claims of which were filed by letter dated 13 March 2024, and the invention to which it relates, meets the requirements of the EPC.

II. Claim 1 as granted reads as follows:

*"1. Method for the preparation of synthesis gas comprising the steps of*

*(a) separating atmospheric air into a separate oxygen containing stream and into a separate nitrogen containing stream;*

*(b) preparing a separate hydrogen containing stream and a separate oxygen containing stream by electrolysis of water and/or steam;*

*(c1) partial oxidizing or autothermal reforming in an autothermal reformer at least a part of a hydrocarbon feed stock with at least a part of the oxygen containing stream obtained by the separation of atmospheric air in step (a) and at least a part of the oxygen containing stream obtained by the electrolysis of water and/or steam in step (b) to a process gas comprising hydrogen, carbon monoxide and carbon dioxide; and*

*(d) introducing at least part of the separate hydrogen containing stream from step (b) into the process gas from step (c1) wherein the electrolysis is operated such that all of the separate hydrogen containing*

*stream produced in step (b) is added to the process gas from step (c1) and the module M, where*  
 $M = (H_2 - CO_2) / (CO + CO_2)$ , *of the resulting mixture of hydrogen and the process gas from step (c1) is between 1.9 and 2.2 or preferably between 2 and 2.1."*

III. The oppositions were filed invoking the grounds under Article 100(a) and (c) EPC. Reference was made to the following documents, *inter alia*:

D1: US 2003/0065042 A1

D4: WO 2008/122399 A1

D5: US 2017/0002281 A1

D6: US 6,846,951 B1

D8: US 2013/0345325 A1

D9: US 2009/0165459 A1

D10: US 2004/0063798 A1

D13: WO 2013/013895 A1

D14: US 2016/0325253 A1

D17: Appl, Max, "*Ammonia Methanol Hydrogen Carbon Monoxide, Modern Production Technologies*", 1997 CRU Publishing Ltd., pages 87-91

D18: FR 2 969 998 A1

D19: Appl, Max, "*Ammonia Methanol Hydrogen Carbon Monoxide, Modern Production Technologies*", 1997 CRU Publishing Ltd., pages 19-21 and 87-89

During opposition proceedings, the patent proprietor maintained the patent as granted as its main request and, by letter dated 13 March 2024, filed sets of claims of auxiliary requests 1 to 6.

- IV. The opposition division's conclusions in the decision under appeal included the following.
- The subject-matter of claim 1 as granted was novel over the disclosure in document D18.
  - The subject-matter of claim 1 as granted and claim 1 of auxiliary requests 1 and 2 lacked an inventive step in view of D18 taken as the closest prior art.
  - Auxiliary request 3 was admitted into the proceedings.
  - The subject-matter of claim 1 of auxiliary request 3 involved an inventive step in view of D18 taken as the closest prior art.
- V. Since in the case in hand the patent proprietor and the opponents are both appellants and respondents, the board will refer to them as the patent proprietor and opponents in the following.
- VI. In its statement of grounds of appeal and its reply to the opponents' appeals, the patent proprietor submitted, *inter alia*, that the claimed subject-matter was novel and involved an inventive step. The patent proprietor maintained all the claim requests filed before the opposition division. Auxiliary requests 3 to 6 were renumbered as auxiliary requests 4 to 7. Additionally, new auxiliary requests 3 and 4a were filed. Therefore, auxiliary request 4 on appeal is identical to auxiliary request 3 filed before and found allowable by the opposition division.
- VII. In their statements of grounds of appeal and their replies to the patent proprietor's appeal, the opponents submitted, *inter alia*, that the claimed subject-matter lacked novelty and inventive step. Opponent 2 substantiated its arguments by filing the

following new documents (denoted D21 and D22 by opponent 2; new numeration introduced by the board):

A21: WO 2012/110781 A1

A22: EP 0 989 094 A2

- VIII. The parties were summoned to oral proceedings as per their requests. In preparation for the oral proceedings, the board issued a communication under Article 15(1) RPBA. In this communication, the board expressed, *inter alia*, the preliminary opinion that the subject-matter of claim 1 as granted lacked novelty over the disclosure in document D18. The board further stated that it was minded not to admit auxiliary requests 3 and 4a into the proceedings.
- IX. The patent proprietor replied to the board's preliminary opinion by letter dated 29 January 2026 and made further submissions, *inter alia*, in support of the novelty of claim 1 as granted and the admittance of auxiliary requests 3 and 4a. Opponent 1 also replied to the board's communication.
- X. Oral proceedings before the board were held on 3 March 2026 by videoconference in the presence of all parties.
- XI. Final substantive requests relevant to the decision
- The patent proprietor requested that the decision under appeal be set aside and that the oppositions be rejected, meaning that the patent be maintained as granted (main request). The patent proprietor alternatively requested that the patent be maintained in amended form on the basis of the claims of one of auxiliary requests 1 to 4, 4a or 5 to 7. Maintenance on the basis of auxiliary request 4 implied a request that the opponents' appeals be dismissed.

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

- XIII. As regards the parties' submissions that are relevant to the decision, reference is made to these in the reasons for the decision set out below.

### **Reasons for the Decision**

Patent proprietor's submission on novelty made in the letter dated 29 January 2026 - admittance into the proceedings under Article 13(1) and (2) RPBA

1. In its reply dated 29 January 2026 to the board's preliminary opinion on the lack of novelty of the subject-matter of claim 1 as granted over the disclosure in D18, the patent proprietor submitted (point 1.1.1 on page 2 of the letter) that it was known in the art, e.g. from paragraph [0079] of D1, that using all the oxygen from the electrolyser in a plant as disclosed in D18 produced an excess of hydrogen in addition to the hydrogen required for obtaining a module M of about 2 as required by claim 1 as granted (point II above). On the basis of this submission, the patent proprietor concluded that D18 did not disclose a module M as defined in claim 1 as granted.
  - 1.1 At the oral proceedings, the opponents requested that this submission not be admitted.
  - 1.2 Under Article 13(1) RPBA, any amendment to a party's appeal case after it has filed grounds of appeal and/or a reply may be admitted only at the board's discretion, exercised in view of, *inter alia*, the current state of the proceedings and the need for procedural economy.

Under Article 13(2) RPBA, any amendment to a party's appeal case made after notification of a communication under Article 15(1) RPBA shall, in principle, not be taken into account unless there are exceptional circumstances, which have been justified with cogent reasons by the party concerned.

- 1.2.1 The patent proprietor argued that the above-mentioned submission had been triggered by the board's communication under Article 15(1) RPBA. According to the patent proprietor, in this communication the board had for the first time considered figure 1 of D18 to represent an embodiment of D18, disclosing all the features of claim 1 as granted in combination. Until the board's communication, the opponents had contested the novelty of the claimed subject-matter merely by combining various passages of D18. This new objection raised by the board represented exceptional circumstances justifying the filing of the above submission in support of novelty.
- 1.2.2 However, the board notes that, as pointed out by opponent 2, an objection of lack of novelty of the subject-matter of claim 1 as granted in view of the embodiment shown in figure 1 of D18 had been raised in opponent 2's notice of opposition; see pages 3 and 4 (D18 denoted as D1). Opponent 2 had then reiterated this objection in its statement of grounds of appeal (pages 3 and 4). In its communication under Article 15(1) RPBA under points 5.3.2 and 5.3.3, the board had merely summarised this objection by opponent 2.
- 1.2.3 Therefore, the board's communication under Article 15(1) RPBA did not give rise to any exceptional circumstances justifying the patent proprietor's above-mentioned novelty submission in its letter dated 29 January 2026, i.e. about one month prior to oral

proceedings before the board. The patent proprietor should have filed this submission before the opposition division or, at the latest, in its reply to opponent 2's appeal.

1.2.4 Admitting this submission would have created a fresh case on the issue of novelty, to be addressed at the oral proceedings for the first time, i.e. at the latest possible stage of the appeal proceedings. This would have been detrimental to procedural economy and contrary to the primary object of the appeal proceedings to review the decision under appeal in a judicial manner (Article 12(2) RPBA).

1.3 For these reasons, the board decided not to admit the patent proprietor's above-mentioned submission made under point 1.1.1 on page 2 of the letter dated 29 January 2026, pursuant to Article 13(1) and (2) RPBA.

Patent proprietor's submission on novelty made at the oral proceedings - admittance into the proceedings under Article 13(1) and (2) RPBA

2. At the oral proceedings, the patent proprietor submitted that D18 did not disclose a module M as defined in claim 1 as granted (point II above). It referred to figure 1 (reproduced below) and page 5, lines 8 to 14 of D18, submitting that D18 disclosed a module equal to 2 for the synthesis gas stream (52). This stream (52) was formed by the stream (46) coming from the autothermal reformer (ATR) (30), the stream (50) coming from the electrolyser (22) and the recycle stream (62) coming from the separation unit (20). By contrast, the module M as defined in claim 1 as granted belonged to the mixture of synthesis gas formed only by the stream exiting the ATR and the hydrogen stream exiting the electrolyser. No other stream, let alone a

recycle stream, contributed to the calculation of the module M according to the claimed wording. According to the patent proprietor, the values reported in table 1 on page 8 of D18 confirmed that the module M of the mixture of the sole streams (46) and (50) of figure 1 of D18 was outside the claimed range.

- 2.1 The opponents requested that this submission not be admitted.
- 2.2 Given that the patent proprietor made the above submission on novelty at the oral proceedings, the above-mentioned provisions of Article 13(1) and (2) RPBA apply.
  - 2.2.1 The patent proprietor argued as follows.
    - (a) The patent proprietor's submission was not new; it was merely a refinement of its interpretation of how the module M of claim 1 as granted was defined. This interpretation had been set out on page 6 of its reply to the opponents' appeals under point 2.3 and accepted by the board in its communication under Article 15(1) RPBA, point 4.2.3.
    - (b) In any case the submission made at the oral proceedings had been triggered by the board's communication under Article 15(1) RPBA, in which the board had for the first time considered figure 1 of D18 to represent an embodiment of D18, disclosing all the features of claim 1 as granted in combination.
  - 2.2.2 As regards argument (a), the board notes that the submission under point 2.3 on page 6 of the patent proprietor's reply to the opponents' appeals, referred to by the patent proprietor, concerned the issue of added subject-matter and served to indicate the basis for some of the amendments made to claim 1 as granted.

This basis was found provisionally convincing by the board in its communication under Article 15(1) RPBA; see point 4.2.3. Therefore, this submission did not concern the issue of novelty over the disclosure in figure 1 of D18. It follows that the submission made at the oral proceedings does represent an amendment to the patent proprietor's appeal case on novelty. The provisions of Article 13(1) and (2) RPBA apply.

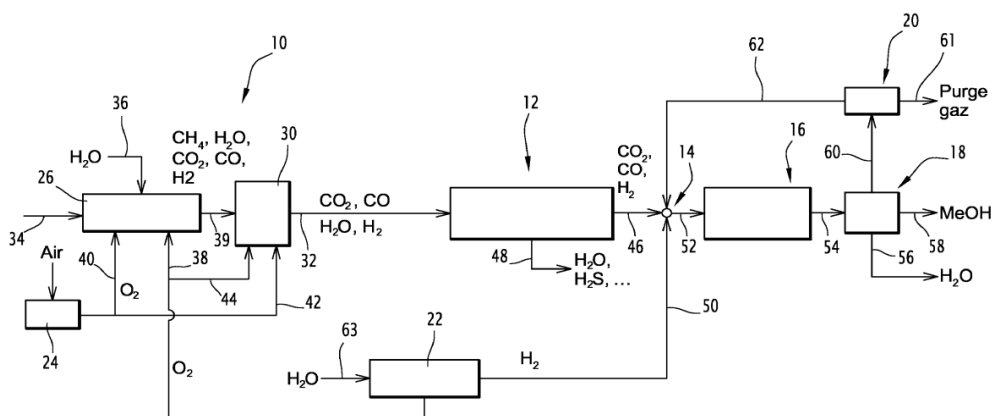
2.2.3 As regards argument (b), the same considerations apply as set out above by the board in relation to the patent proprietor's submission in its letter dated 29 January 2026. In its communication under Article 15(1) RPBA under points 5.3.2 and 5.3.3, the board had merely summarised the novelty objection raised by opponent 2. Therefore, the board's communication under Article 15(1) RPBA did not give rise to any exceptional circumstances justifying the patent proprietor's new novelty submission made at the oral proceedings.

2.2.4 Admitting this submission would have created a fresh case on the issue of novelty, to be addressed at the oral proceedings for the first time, i.e. at the latest possible stage of the appeal proceedings. This would have been detrimental to procedural economy and contrary to the primary object of the appeal proceedings to review the decision under appeal in a judicial manner (Article 12(2) RPBA).

2.3 For these reasons, the board decided not to admit the patent proprietor's above-mentioned submission made at the oral proceedings, pursuant to Article 13(1) and (2) RPBA.

Main request (patent as granted) - claim 1 - ground for opposition under Article 100(a) EPC - novelty under Article 54 EPC

3. The opponents contested the novelty of the subject-matter of claim 1 as granted in view of document D18, referring in particular to figure 1 of D18, reproduced below:



3.1 The board notes that, with reference to figure 1, D18 discloses (page 3, line 21 to page 4, line 5; page 4, line 31 to page 5, line 14; page 7, lines 19 and 20; the reference signs are those shown in figure 1 of D18) a method for producing methanol, comprising reforming a stream (39) containing methane and small quantities of light hydrocarbons originating from a gasifying unit (26) in a steam or autothermal reforming unit (30) to produce a synthesis gas stream (32). Said reforming unit (30) is fed with oxygen coming from a water electrolyser (22) and an air separation unit (24) via lines (44) and (42), respectively. The synthesis gas stream (32) is passed through a gas conditioning unit (12) and fed as a stream (46) to the unit (14), where it is mixed with a hydrogen stream (50) from the electrolyser (22) to produce a second synthesis gas stream (52). According to D18 (*loc. cit.*), the synthesis gas stream (52) contains 3 moles hydrogen per

mole CO<sub>2</sub> and 2 moles hydrogen per mole CO, meaning that the module M of this gas stream (52) is equal to 2 when the definition given in claim 1 as granted is applied:

$$\begin{aligned} M &= (H_2 - CO_2) / (CO + CO_2) = ((3CO_2 + 2CO) - CO_2) / (CO + CO_2) \\ &= 2(CO_2 + CO) / (CO_2 + CO) = 2 \end{aligned}$$

The synthesis gas stream (52) is then fed to a methanol production unit (16).

3.2 The patent proprietor referred in writing to table 1 of D18 (page 8), arguing that the stream (39) to the reformer (30) contained only a minor amount of methane (6.4%). Thus, D18 did not disclose a hydrocarbon feed to an autothermal reformer (ATR) as required by step (c1) of claim 1 as granted. Moreover, figure 1 of D18 had to be read in conjunction with the related description on page 3, lines 1 to 24, which disclosed that various features shown in figure 1 were optional or alternatives to each other. In particular, the electrolysis unit was an alternative to the air separation unit, and the ATR was an alternative to a steam reformer. In this respect, the patent proprietor also referred to page 7, lines 26 to 31 of D18. Thus, D18 did not directly and unambiguously disclose the combination of an ATR, a water electrolysis unit and an air separation unit as required by claim 1 as granted.

The patent proprietor further submitted that according to page 8, lines 1 to 4 of D18, the oxygen from the electrolyser (22) could either partially or completely be fed to the units (26) and/or (30) despite figure 1 not showing any reservoir or deviation. Thus, the same had to be true for the hydrogen stream originating from the electrolyser (22). This was confirmed by the disclosure in the passage bridging pages 4 and 5 of D18, which stated that a quantity of hydrogen from the electrolyser (22) was added to the synthesis gas stream

(46). Therefore, contrary to step (d) of claim 1 as granted, not all the hydrogen produced in the electrolyser (22) was added to the synthesis gas stream (46).

The patent proprietor thus concluded that the subject-matter of claim 1 as granted was novel over the disclosure in D18.

3.3 These arguments are not convincing.

3.3.1 Claim 1 as granted does not impose any limitation on the composition of the hydrocarbon feedstock undergoing partial oxidation or autothermal reforming according to step (c1). As stated above, the stream (39) fed to the steam or autothermal reformer (30) in the method of D18 comprises methane and light hydrocarbons. It is therefore a hydrocarbon feedstock within the meaning of claim 1 as granted.

3.3.2 Furthermore, it is acknowledged that page 3 of D18 states that some of the units shown in figure 1 of D18, including the air separation unit (24) and the electrolyser (22), are optional. However, the board concurs with the opponents that figure 1 of D18 directly and unambiguously discloses to the skilled person an embodiment in which both the air separation unit (24) and the electrolyser (22) are used in combination. According to D18 (*loc. cit.*), the stream (39) undergoes either steam or autothermal reforming in the unit (30). Hence, a single selection within figure 1 of D18 is needed to arrive at the combination of an air separation unit, a water electrolysis unit and an ATR as required by the method of claim 1 as granted.

3.3.3 As pointed out by the opponents, figure 1 of D18 further shows that all the hydrogen separated in the electrolyser (22) is mixed with the synthesis gas (46), thus satisfying the requirement of step (d) of claim 1

as granted. The passage bridging pages 4 and 5 of D18 invoked by the patent proprietor does not contradict this disclosure in figure 1. In fact, this passage of D18, as well as the following passage on page 5, lines 4 to 14, concerns the amount of hydrogen to be added to the synthesis gas (46) to allow methanol to be produced in the unit (16). The board concurs with the opponents that while this disclosure in D18 imposes some limitations on the size and capacity of the water electrolyser (22), it does not mean that only part of the hydrogen separated in the electrolyser (22) is mixed with the synthesis gas (46) in the unit (14). No indication of such a possibility is present in the disclosure of D18. The fact invoked by the patent proprietor that D18 discloses splitting the oxygen stream separated in the electrolyser (22) does not change this conclusion since D18 does not give any indication that a similar split would also apply to the separated hydrogen stream (50). In fact, contrary to the disclosure of an oxygen excess on page 8, lines 1 to 4 of D18, as pointed to by the patent proprietor, D18 does not disclose any hydrogen excess being produced by the electrolyser (22).

- 3.4 For these reasons, the board concludes that the subject-matter of claim 1 as granted lacks novelty over the disclosure in D18. The ground for opposition under Article 100(a) EPC in combination with Article 54 EPC prejudices maintenance of the patent as granted. Hence, the main request is not allowable.

Auxiliary request 1 - claim 1 - inventive step under Article 56 EPC

4. Claim 1 of auxiliary request 1 is amended in comparison with claim 1 as granted (point II above) in that the following feature is added at the end of the claim:

"wherein the separating of atmospheric air in step (a) and/or the electrolysis of water and/or steam in step (b) is powered at least in part by renewable energy."

4.1 Closest prior art

4.1.1 In line with the decision under appeal (point 5.1.4 on page 8), the opponents indicated, *inter alia*, document D18 as the closest prior art.

4.1.2 The patent proprietor disputed the selection of D18 as the closest prior art, arguing that D18 concerned the production of synthesis gas for methanol preparation from solid carbonaceous waste materials undergoing gasification. In figure 1 of D18 (see above), a feed stream (39) to a reformer (30) from a gasification unit (26) contained only minor amounts of methane and thus did not count as a hydrocarbon feedstock as required by step (c1) of claim 1 as granted. According to the patent proprietor, D18 was in a different technical field from the patent.

4.1.3 However, the board notes that according to the patent (see e.g. paragraphs [0028], [0042] and [0045] and claim 9), the synthesis gas produced by the claimed method is desirably used for preparing methanol, i.e. the same aim as disclosed in D18. Additionally, as set out above for the main request, claim 1 does not impose any limitation on the composition of the hydrocarbon feed used in step (c1) as regards, for example, the concentration of methane. It is further noted that in D18, the carbonaceous material to be gasified in the unit (26) is not limited to solid wastes, with, *inter alia*, plastics and oil by-products also being mentioned (page 2, lines 26 to 35).

Therefore, the board considers D18 to be a suitable starting point for assessing the inventive step of the claimed subject-matter.

4.2 Distinguishing features

In view of the board's conclusion above on the lack of novelty of the subject-matter of claim 1 as granted, claim 1 of auxiliary request 1 differs from the disclosure in D18 only in that "*the separating of atmospheric air in step (a) and/or the electrolysis of water and/or steam in step (b) is powered at least in part by renewable energy*".

4.3 Objective technical problem

4.3.1 The patent proprietor did not put forward any technical effect specifically linked to this distinguishing feature (see the patent proprietor's statement of grounds of appeal, page 14, point 2.2).

4.3.2 In the absence of any technical effect and as pointed out by the opponents, the objective technical problem deriving from the above-mentioned distinguishing feature has to be considered that of providing an alternative method for preparing synthesis gas.

4.4 Obviousness of the claimed solution

4.4.1 The patent proprietor argued that D18 did not contain any pointer to the air separation and/or electrolysis unit being powered at least in part by renewable energy. Therefore, the claimed solution was not obvious.

4.4.2 The board disagrees.

When the objective technical problem is to provide an alternative, no pointer or incentive is required. It is sufficient that the skilled person would have considered the claimed solution to be an alternative to the method of the closest prior art (see T 12/07, reasons, point 4.1.6; T 1968/08, reasons, point 5.5;

T 1045/12, reasons, point 4.7.7; T 895/23, reasons, point 10.2.1).

As stated by the opposition division (decision under appeal, points 7.7 to 7.9 on pages 12 and 13) and reiterated by the opponents, it would have been well known to the skilled person that at least some of the electricity available on the grid is produced by renewable energy. Moreover, the use of renewable energy for water electrolysis and/or air separation is known to the skilled person at least from D8, paragraphs [0002] and [0114], and D9, paragraph [0091].

It follows that the above-mentioned feature added to claim 1 of auxiliary request 1 would have been obvious to the skilled person looking for an alternative to the method of D18.

- 4.5 Therefore, the board concludes that the subject-matter of claim 1 of auxiliary request 1 does not involve an inventive step within the meaning of Article 56 EPC. Auxiliary request 1 is not allowable.

Auxiliary request 2 - claim 1 - novelty under Article 54 EPC

5. Claim 1 of auxiliary request 2 is amended in comparison with claim 1 as granted in that the following feature is added at the end of the claim:

*"wherein the hydrocarbon feed stock comprises natural gas, methane, LNG, naphtha or mixtures thereof either as such or pre-reformed and/or desulfurized."*

- 5.1 The opponents contested the novelty of the subject-matter of claim 1 of auxiliary request 2 in view of the disclosure in D18.
- 5.2 Similarly to its arguments in support of the novelty of claim 1 as granted, the patent proprietor argued that in D18 the stream fed to the reformer contained only a

minor amount of methane (6.4%). The mere presence of some methane in the gas stream did not mean that the gas stream was a hydrocarbon feedstock as required by step (c1) of claim 1.

5.3 These arguments are not convincing. Claim 1 of auxiliary request 2 merely requires the hydrocarbon feedstock to *comprise* methane, i.e. it does not impose any limitation on the methane concentration. Since the gas stream fed to the ATR (30) comprises methane in the method disclosed in D18 (see above), the feature added to claim 1 of auxiliary request 2 cannot establish novelty over the disclosure in D18.

5.4 It follows that the subject-matter of claim 1 of auxiliary request 2 lacks novelty over the disclosure in D18 (Article 54 EPC). Auxiliary request 2 is not allowable.

Auxiliary request 3 - admittance into the proceedings under Article 12(4) and (6) RPBA

6. Claim 1 of auxiliary request 3 differs from claim 1 of auxiliary request 2 (see above) in that methane is deleted from the list of components in the hydrocarbon feedstock.

6.1 Auxiliary request 3 was filed by the patent proprietor for the first time with its statement of grounds of appeal. The opponents requested that auxiliary request 3 not be admitted.

6.2 Since auxiliary request 3 is not among those filed before the opposition division, it represents an amendment to the patent proprietor's case within the meaning of Article 12(4) RPBA, to be admitted only at the board's discretion. The board exercises its discretion in view of, *inter alia*, the complexity of the amendment and the need for procedural economy.

Moreover, under Article 12(6) RPBA, the board shall not admit requests which should have been submitted before the opposition division.

- 6.3 The patent proprietor argued that auxiliary request 3 represented a reaction to the decision under appeal, in which the opposition division had considered the stream to the ATR in the method of D18 to be a hydrocarbon feedstock within the meaning of claim 1.
- 6.4 However, as already set out above, D18 had been filed at the very beginning of the opposition proceedings (denoted as D1 by opponent 2) and used against the novelty of the claimed method, it being argued, *inter alia*, that the stream to the ATR in the method of D18 comprised methane and was therefore a hydrocarbon feedstock as required by the claimed method. In its preliminary opinion dated 21 August 2023, the opposition division also considered D18 to anticipate the subject-matter of claim 1 as granted (point 4.3 on pages 5 to 7). Therefore, auxiliary request 3, aimed at establishing novelty over D18, could and should have been filed before the opposition division (Article 12(6) RPBA).
- 6.5 Moreover, admitting auxiliary request 3 would have created a fresh case on novelty and inventive step, to be discussed for the first time on appeal. This would have increased the complexity of the case and been detrimental to procedural economy (Article 12(4) RPBA).
- 6.6 Therefore, the board decided not to admit auxiliary request 3 pursuant to Article 12(4) and (6) RPBA.

Auxiliary request 4 and documents A21 and A22 - admittance

7. Auxiliary request 4 is identical to auxiliary request 3 on which the decision under appeal is based and which was admitted and found allowable by the opposition

division. Claim 1 of auxiliary request 4 is amended in comparison with claim 1 as granted (point II above) in that the following feature is added at the end of the claim:

*"wherein the hydrocarbon feed stock comprises natural gas, methane, LNG, naphtha or mixtures thereof and is pre-reformed and optionally desulfurized."*

7.1 Opponent 2 requested that auxiliary request 4 be excluded from the appeal proceedings, submitting that auxiliary request 4 had been filed as auxiliary request 3 only eight days before oral proceedings. The feature added to claim 1, whereby the hydrocarbon feedstock was pre-reformed, had not been made mandatory in any independent or dependent claim of any request in the proceedings until that point in time. There was no justification for filing auxiliary request 4 so late, since an objection of lack of novelty in view of D18 had been raised in the notice of opposition. Moreover, in its preliminary opinion, the opposition division had stated that the subject-matter was not novel over D18. Thus, auxiliary request 4 could and should have been filed earlier. The opponents were left without any time to properly react, e.g. by filing documents A21 and A22. Opponent 2 further submitted that auxiliary request 4 was not convergent with the previous auxiliary requests. Therefore, this request should not have been admitted by the opposition division. If the request was to be admitted, documents A21 and A22 should be admitted in response.

7.2 The patent proprietor argued, on the contrary, that accepted principles of the EPC gave an opposition division the discretion to admit claim requests even if they are filed after the date set under Rule 116 EPC. Auxiliary request 4 did not introduce any new feature into claim 1 since it was based on one alternative of

auxiliary request 1, filed on 13 March 2023 in reply to the notices of opposition, and corresponded to auxiliary request 2 considered in the decision under appeal. Hence, A21 and A22 could and should have been filed earlier. The patent proprietor further argued that these documents were in any case irrelevant and should not be admitted for this reason.

- 7.3 At the oral proceedings, the board decided that auxiliary request 4 formed part of the appeal proceedings. However, since this request was found not to be allowable (see below), no reasoning for this decision by the board is needed.
- 7.4 As noted in the board's communication under Article 15(1) RPBA (see point 13.3.1), claim 1 of auxiliary request 4 is different from claim 1 of auxiliary request 1 filed on 13 March 2023 in reply to the notices of opposition (identical to claim 1 of auxiliary request 2 discussed above). In claim 1 of auxiliary request 4, the pre-reforming of the hydrocarbon feedstock is mandatory, whereas it was merely optional in claim 1 of said auxiliary request 1. Therefore, contrary to the patent proprietor's view, filing auxiliary request 4 only eight days before the oral proceedings had changed the subject of the proceedings before the opposition division.
- 7.5 The board considers the filing of A21 and A22 to be a legitimate reaction by opponent 2 to this change of the subject of the proceedings shortly before the oral proceedings in view of the filing of auxiliary request 4. Therefore, the board decided to admit A21 and A22 into the proceedings.

Auxiliary request 4 - claim 1 - inventive step under Article 56 EPC

8. In view of the conclusion on lack of novelty for the subject-matter of claim 1 as granted, the parties agreed that the subject-matter of claim 1 of auxiliary request 4 differed from the above-mentioned disclosure in D18 only in that the hydrocarbon feedstock comprising, *inter alia*, methane "*is pre-reformed*". D18 does not disclose a pre-reforming step of the stream (39) fed to the ATR (30) (see figure 1 of D18 above).

8.1 Objective technical problem

8.1.1 The patent proprietor did not put forward any technical effect specifically linked to this distinguishing feature. Nor does the application as filed mention any advantage or technical effect associated with pre-reforming the hydrocarbon feedstock; see page 8, line 27 to page 9, line 1.

8.1.2 It follows that, as submitted by the opponents, the objective technical problem has to be considered that of providing an alternative method for preparing synthesis gas.

8.2 Obviousness of the claimed solution

8.2.1 The patent proprietor did not dispute that pre-reforming hydrocarbon gas streams was well known in the art. However, in line with the opposition division's conclusion (decision under appeal, points 13.7.6 and 13.7.7 on page 19), it submitted that the skilled person would not have combined D18 with any document disclosing pre-reforming, for example D4, D5, D6, D13, D17 and A22 as cited by the opponents. In each of these documents, a pre-reformer was used to pre-reform natural gas, i.e. a gas containing methane as the main component at concentrations higher than 75 mol%. The

pre-reformed gas, still containing methane as the main component, was then used as the feedstock for an ATR. By contrast, the gas stream (39) entering the ATR (30) in D18 contained only a minor amount of methane.

The patent proprietor further argued that using a pre-reformer was not meaningful in the process of D18 for two reasons. First, the stream (39) leaving the gasifier could contain small amounts, i.e. traces, of higher hydrocarbons. There was no need to pre-reform such a stream. Second, it was evident from the list of carbonaceous materials disclosed on page 2, lines 25 to 35 of D18 that the materials used for producing the synthesis gas in D18 contained considerable amounts of sulfur, which was eliminated in D18 in the gas conditioning unit (12), i.e. downstream of the ATR (30). It was known, e.g. from D4, that catalysts in pre-reformers were sensitive to sulfur and got poisoned. This poisoning was limited in reformers or autothermal reformers in view of the higher temperatures of the process. A21 confirmed that effluents from gasifiers were reformed, not pre-reformed, in view of the high temperatures disclosed on page 7, lines 28 to 32. The patent distinguished between reforming or autothermal reforming and pre-reforming. Thus, it was not meaningful to pre-reform the stream (39) exiting the gasifier of D18 because the pre-reforming catalyst would break down in a short amount of time.

In addition, the patent proprietor argued that the skilled person, aware of the fact that the catalyst disclosed in A21 might be used directly to reform effluents from gasifiers, would at most have used this catalyst in the ATR (30) of D18 to convert any higher hydrocarbons. The skilled person would not have added a further reactor into the process of D18 because this

would have made the process more complicated, with an additional unit to be controlled, and more cost-intensive. Moreover, A21 taught the skilled person that an additional step of decomposing higher hydrocarbons between gasification and reforming would not have resulted in any benefits in the process of D18 since the catalyst of A21 could reform both methane and higher hydrocarbons in the pre-existing ATR (30).

Lastly, the patent proprietor argued that even if it were accepted that the skilled person would have considered placing a pre-reformer upstream of the ATR (30) in D18, this would have required further changes to the process of D18, in particular moving the conditioning unit (12) upstream to remove sulfur. However, the unit (12) was also meant to remove water, which was needed for the methanol synthesis. Thus, there was no incentive in D18 to shift the position of the gas conditioning unit (12) upstream of the process.

#### 8.2.2 The board disagrees.

According to D18 (page 3, lines 26 to 32), the stream (39) fed from the gasifier (26) to the ATR (30) contains *inter alia* methane and small quantities of light hydrocarbons. As pointed out by the opponents, the composition of the stream (39) depends on the carbonaceous material fed to the gasifier (26) (D18, page 10, lines 23 to 27). This material can also include plastics and oil by-products (D18, page 2, lines 26 to 35), giving rise to varying concentrations of methane and heavier hydrocarbons in the stream (39) fed to the ATR (30) of D18.

It is undisputed that placing a pre-reformer upstream of a steam or autothermal reformer for the purpose of converting heavier hydrocarbons to methane, hydrogen and carbon oxides, in particular to reduce soot

formation in the steam reformer or autothermal reformer, is part of the common general knowledge; see e.g. D4: page 2, line 25 to page 3, line 3; D5: paragraphs [0027] and [0039]; D6: column 4, lines 36 to 39; D13: page 2, line 1 to page 4, line 3; A22: paragraph [0019].

On the basis of this common general knowledge, the skilled person would have considered pre-reforming the stream (39) in the method of D18 before feeding the stream to the ATR (30) depending on the circumstances, in particular depending on the concentration of hydrocarbons heavier than methane in the stream (39) at the exit of the gasifier (26). Therefore, the feature added to claim 1 of auxiliary request 4 does not contribute to any inventive step.

The board further notes that, as pointed out by the opponents, A21 teaches catalysts that can be used to reform effluents from coal or biomass gasifiers, in particular to reform methane and higher hydrocarbons (page 7, lines 4 to 6). In view of their stability, these catalysts can be used on the effluents as such or after the effluent is cooled (A21, page 7, lines 28 to 32). Moreover, these catalysts may also be used in pre-reforming (A21, page 6, lines 5 to 9). Therefore, the patent proprietor's argument that the skilled person would not have pre-reformed gasifier effluents in view of their sulfur content must also fail.

8.3 For these reasons, the board concludes that the subject-matter of claim 1 of auxiliary request 4 does not involve an inventive step within the meaning of Article 56 EPC. Auxiliary request 4 is not allowable.

Auxiliary request 4a - admittance into the proceedings under Article 12(4) and (6) RPBA

9. Claim 1 of auxiliary request 4a differs from claim 1 of auxiliary request 4 in that the desulfurisation of the hydrocarbon feedstock is mandatory, i.e. the feature at the end of the claim reads (emphasis added by the board):

*"wherein the hydrocarbon feed stock comprises natural gas, methane, LNG, naphtha or mixtures thereof **and is pre-reformed and desulfurized.**"*

- 9.1 Auxiliary request 4a was filed for the first time with the reply to the opponents' grounds of appeal. Since this request is not among those filed before the opposition division, it represents an amendment to the patent proprietor's case within the meaning of Article 12(4) RPBA, to be admitted only at the board's discretion. The board exercises its discretion in view of, *inter alia*, the complexity of the amendment and the need for procedural economy.

Moreover, under Article 12(6) RPBA, the board shall not admit requests which should have been submitted before the opposition division.

- 9.2 The patent proprietor submitted that filing auxiliary request 4a did not shift the subject of the proceedings to a process that had not been discussed in opposition. Rather, the combination of the desulfurisation and pre-reforming of the hydrocarbon feedstock was always part of the claims as granted and had been disclosed as a preferred embodiment of the claimed method. Moreover, auxiliary request 4a had been submitted in response to opponent 2's objection based on A21 and A22, which had been filed for the first time with the grounds of

appeal. Therefore, auxiliary request 4a could not have been filed earlier.

- 9.3 However, contrary to the patent proprietor's view, the combination of the desulfurisation and pre-reforming of the hydrocarbon feedstock had merely been included as an optional feature in dependent claim 6 as granted. Therefore, this combination was never discussed before the opposition division. The patent proprietor filed auxiliary request 4 before the opposition division. In claim 1 of auxiliary request 4, pre-reforming the hydrocarbon feedstock was amended to be mandatory, thus establishing a difference over the disclosure in D18 (see above). In the same way, auxiliary request 4a, aimed at establishing a further difference over D18, could and should have been filed before the opposition division, at the latest together with auxiliary request 4 (Article 12(6) RPBA). The patent proprietor did not indicate any reasons why this had not been done.

Admitting auxiliary request 4a would have created a fresh case on inventive step, to be discussed for the first time on appeal. This would have increased the complexity of the case and been detrimental to procedural economy (Article 12(4) RPBA).

Therefore, the board decided not to admit auxiliary request 4a pursuant to Article 12(4) and (6) RPBA.

- 9.4 In view of these reasons, the patent proprietor's further argument that auxiliary request 4a was a reaction to A21 and A22 only being filed on appeal is irrelevant. However, even if this argument is taken into consideration, it cannot succeed. As set out above, opponent 2 filed A21 and A22 as a reaction to auxiliary request 4 only being filed shortly before the oral proceedings before the opposition division. The patent proprietor cannot take advantage of its own late

filing of an auxiliary request in order to have the opportunity to file yet another request later on appeal.

Auxiliary requests 5 to 7 - claim 1 - inventive step under Article 56 EPC

10. Claim 1 of auxiliary requests 5 to 7 differs from claim 1 as granted (point II above) in that the following features were added at the end of the claim.

Claim 1 of auxiliary request 5:

*"comprising a further step of primary steam reforming part or all the hydrocarbon feed stock upstream step (c1)."*

Claim 1 of auxiliary request 6:

*"comprising the further step of steam reforming a part of the hydrocarbon feed stock and/or a second hydrocarbon feed stock in indirect heat transfer relationship with part or all the process gas leaving the autothermal reforming step (c1) and mixing the heat exchange steam reformed process gas with autothermal reformed process gas."*

Claim 1 of auxiliary request 7 is the combination of claim 1 of auxiliary requests 2 and 6. In other words, in addition to the feature added to claim 1 of auxiliary request 6, the claim further requires that *"the hydrocarbon feed stock comprises natural gas, methane, LNG, naphtha or mixtures thereof either as such or pre-reformed and/or desulfurized"*. Since this latter feature is known from D18 (see the above discussion of auxiliary request 2), claim 1 of auxiliary requests 6 and 7 differs from D18 on account of the same feature, i.e. the feature added to claim 1 of auxiliary request 6.

- 10.1 The patent proprietor's arguments as regards claim 1 of auxiliary request 5 were the same as for auxiliary request 4. In particular, it reiterated that a primary steam reforming was not beneficial to the method of D18 in view of the low concentrations of methane and heavier hydrocarbons in the feed to the ATR (30).
- 10.2 As set out above with respect to auxiliary request 4, these arguments are not convincing. Moreover, the claimed method also has the same disadvantage mentioned by the patent proprietor since, as set out above, claim 1 does not impose any limitation on the concentrations of methane and heavier hydrocarbons in the hydrocarbon feedstock. Furthermore, the board concurs with the opponents' view that the feature added to claim 1 of auxiliary request 5 is part of the common general knowledge; see in particular documents D13 (page 2, line 1 to page 4, line 3) and D17. In particular, D17 discloses (page 88) several advantages of using the combination of steam reforming and ATR, including reduced compression energy and reduced carbon dioxide emissions. Therefore, as with claim 1 of auxiliary request 4, the skilled person would have considered including this combination in the method of D18 depending on the circumstances, in particular depending on the concentration of hydrocarbons heavier than methane in the stream (39) at the exit of the gasifier (26). It follows that the feature added to claim 1 of auxiliary request 5 does not contribute to any inventive step (Article 56 EPC). Auxiliary request 5 is not allowable.
- 10.3 As regards claim 1 of auxiliary requests 6 and 7, the patent proprietor further submitted, besides the same arguments as for auxiliary requests 4 and 5, that although heat exchange reformer reactors were well known, the claimed combination of this heat exchange

reformer reactor with the use of an electrolysis unit for supplying hydrogen allowed the size of the heat exchange reformer to be reduced, this beneficial effect being neither known nor obvious from the prior art.

10.4 The board disagrees.

10.4.1 The patent proprietor's arguments in support of the inventive step of auxiliary requests 4 and 5 were not found to be convincing for the reasons set out above.

10.4.2 As regards the further arguments, the board concurs with the opponents' view that installing a heat exchange steam reforming unit in parallel with an ATR, with the aim of increasing the production of synthesis gas, is part of the common general knowledge; see documents D10 (paragraphs [0035] to [0037]), D13 (page 2, line 17 to page 4, line 18), D14 (paragraphs [0030] and [0048]), D17 (figure 94 and pages 88 to 90) and D19 (page 20). Depending on the circumstances, the skilled person would thus have considered such a combination in the method taught by D18 without exercising any inventive skill. The skilled person would have selected the size of the heat exchange reformer depending on requirements, particularly in view of the hydrogen stream coming from the electrolyser (22). Therefore, the subject-matter of claim 1 of auxiliary requests 6 and 7 does not involve an inventive step within the meaning of Article 56 EPC. Auxiliary requests 6 and 7 are thus not allowable.

11. The opponents had requested that auxiliary requests 5 to 7 not be admitted. However, in view of the board's conclusion that none of these auxiliary requests is allowable, there was no need to discuss this non-admittance request by the opponents.

Conclusions

12. None of the patent proprietor's claim requests is admissible and/or allowable.

**Order**

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

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:



A. Wille

M. O. Müller

Decision electronically authenticated