

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TOPSOE INC.,
Petitioner

v.

CASALE SA,
Patent Owner

Case IPR2025-01455
U.S. Patent No. 11,286,168

PATENT OWNER'S PRELIMINARY RESPONSE

TABLE OF CONTENTS

I.	Introduction and Summary of Argument	2
II.	Background.....	4
A.	Technology Overview and the '168 Patent.....	4
B.	Prosecution History of the '168 Patent	6
III.	A Person of Ordinary Skill in the Art ("POSA")	7
IV.	Claim Construction.....	8
V.	The Board Should Deny Institution of the Petition.....	9
A.	The Petition Improperly Attempts to Shift the Burden of Claim Construction to the Board and Patent Owner.....	9
B.	Ground 4: The Petition Fails to Show how <i>Terrien</i> Anticipates or Renders Obvious Claim 1	11
1.	Limitation 1[a]: conversion of a charge of desulphurized natural gas and steam, with oxygen-enriched air or with oxygen, into a synthesis gas containing hydrogen, CO and CO ₂ , in a conversion section including an autothermal reformer downstream from a pre-reformer and without a primary reformer therebetween;.....	12
2.	Limitation 1[c]: separation of a part of said CO ₂ -depleted synthesis gas as fuel fraction, wherein said fuel fraction is fed as fuel to at least one furnace and wherein said separation of the fuel fraction includes the split of said CO ₂ -depleted synthesis gas into at least a first stream and a second stream, said first and second streams having the same wherein the first stream forms the fuel fraction	15
C.	Ground 5: The Petition Fails to Show how <i>Licht</i> Renders Obvious Claim 1	16

1.	Limitation 1[a]: conversion of a charge of desulphurized natural gas and steam, with oxygen-enriched air or with oxygen, into a synthesis gas containing hydrogen, CO and CO ₂ , in a conversion section including an autothermal reformer downstream from a pre-reformer and without a primary reformer therebetween;.....	18
2.	Limitation 1[c]: separation of a part of said CO ₂ -depleted synthesis gas as fuel fraction, wherein said fuel fraction is fed as fuel to at least one furnace and wherein said separation of the fuel fraction includes the split of said CO ₂ -depleted synthesis gas into at least a first stream and a second stream, said first and second streams having the same wherein the first stream forms the fuel fraction	21
VI.	The Petition Fails As To The Dependent Claims.....	25
VII.	Conclusion	25

TABLE OF AUTHORITIES

	Page(s)
Cases	
<i>Advanced Lighting Concepts LLC v. mate LLC</i> , IPR2023-01259, Paper 9 (Feb. 13, 2024)	13
<i>ams AG v. 511 Innovations, Inc.</i> , IPR2016-01792, Paper 15 (PTAB Mar. 16, 2017)	9
<i>Blackberry Corp. v. Facebook, Inc.</i> , IPR2019-01593, Paper 9 (PTAB Apr. 17, 2020).....	10
<i>In re Van Os</i> , 844 F.3d 1359 (Fed. Cir. 2017).....	3
<i>Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.</i> , 821 F.3d 1359 (Fed. Cir. 2016).....	12
<i>Microsoft Corp. v. IPA Techs. Inc.</i> , 2022 U.S. App. LEXIS 8711 (Fed. Cir. Apr. 1, 2022)	13
<i>Phillips v. AWH Corp.</i> , 415 F.3d 1303 (Fed. Cir. 2005).....	10
<i>Saltpeter v. ARP Wave, LLC</i> , IPR2019-01384, Paper 12 (Jan. 27, 2020).....	13
<i>Samsung Elecs. Co. v. Immersion Corp.</i> , IPR2018-01468, Paper 10 (PTAB Feb. 20, 2019).....	1
<i>Wenzhou Xin Xin Sanitary Ware Co., Ltd. v. Delta Faucet Company</i> , IPR2023-01332, Paper 13 (PTAB Feb. 7, 2024).....	10
Statutes	
35 U.S.C. § 21	1
35 U.S.C. § 312	12

Regulations

37 C.F.R. § 1.7	1
37 C.F.R. § 42.100	8, 10
37 C.F.R. § 42.104	9, 10, 11
37 C.F.R. § 42.107	1

LISTING OF EXHIBITS

Exhibit No.	Description
2005	CV of Patent Owner's Expert, Colin A. Wolden, Ph.D.
2006	Expert Declaration of Colin A. Wolden, Ph.D., in Support of Patent Owner's Preliminary Response

Patent Owner Casale SA (“Patent Owner”) submits this Preliminary Response pursuant to 37 C.F.R. § 42.107 in opposition to the ***second*** petition for *inter partes* review IPR2025-01455 (the “Petition”) filed by Topsoe, Inc. (“Petitioner”) regarding claims 1-11 and 17-19 (the “Challenged Claims”) of U.S. Patent No. 11,286,168 (EX1001, the “’168 Patent”).¹ This Preliminary Response is filed within three months of the August 29, 2025 delivery of the Notice of Filing Date Accorded. *See* Paper 4.² This Preliminary Response is supported by the Declaration of Colin A. Wolden, Ph.D. *See* EX2006.

¹ Patent Owner has also filed a brief requesting that the Director discretionarily deny this Petition based on, among other things, the fact that Petitioner ranked this Petition second to the one filed in IPR2025-01454 on the same day. *See* Paper 6; Paper 2 (Petitioner’s ranking).

² Three months from August 29, 2025, was Saturday, November 29, 2025. Pursuant to 35 U.S.C. § 21(b), the deadline for filing moved to Monday, December 1, 2025. 35 U.S.C. § 21(b); *see also Samsung Elecs. Co. v. Immersion Corp.*, IPR2018-01468, Paper 10, at 14-19 (PTAB Feb. 20, 2019) (applying Section 21(b)’s “statutory grace period that applies to ‘any action’ in the PTO to a Petition for IPR”); 37 C.F.R. § 1.7(a) (“When the day, or the last day fixed by statute or by or under this part for taking any action or paying any fee in the United States Patent and

I. INTRODUCTION AND SUMMARY OF ARGUMENT

The Petition asserts two grounds³ of purported unpatentability challenging claims of the '168 Patent.⁴ Each ground falls far short of demonstrating “a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a).

First, in Ground 4, the Petition fails to demonstrate how the primary reference, *Terrien*, discloses at least three of the limitations of Claim 1, the only independent claim in the '168 Patent. The Petition attempts to shore up *Terrien*'s shortcomings

Trademark Office falls on Saturday, Sunday, or on a Federal holiday within the District of Columbia, the action may be taken, or the fee paid, on the next succeeding business day which is not a Saturday, Sunday, or a Federal holiday.”).

³ The two grounds rely on *Terrien* and *Licht* as the primary references, respectively, but expand into nine grounds when considering the different reference combinations the Petition asserts against dependent claims of the '168 Patent. *See* Petition at 1-2.

⁴ Petitioner filed a second co-pending petition in IPR2025-01454, asserting three additional grounds of purported unpatentability against the Challenged Claims of the '168 Patent. As discussed in Patent Owner's Discretionary Denial Brief (Paper 6), Petitioner ranked the Petition in the current proceeding second to the one filed in IPR2025-01454.

for Claim 1 with *Price*, but *Price* also fails to disclose the conversion section limitation (limitation 1[a]) that the Petition specifically cites the reference for.

Second, Ground 5 relies on a reference, *Licht*, that the USPTO expressly considered and issued Claim 1 over during *ex parte* reexamination in 2024. Alleging only obviousness (presumably in light of this prosecution history), the Petition then relies on the same primary reference as Ground 4 (*Price*) that fails to disclose the conversion section limitation (limitation 1[a]) that the Petition (again) specifically cites the reference for.

Finally, the Petitioner relies on improper hindsight bias throughout the Petition. *See, e.g.*, Petition at 8-9 (“A POSA seeking to reduce carbon emissions in a syngas process would have been motivated to apply ordinary skill and knowledge to *Terrien to reach the requirements of the challenged claims.*”) (emphasis added); *In re Van Os*, 844 F.3d 1359, 1361 (Fed. Cir. 2017) (“Absent some articulated rationale, a finding that a combination of prior art would have been ‘common sense’ or ‘intuitive’ is no different than merely stating the combination ‘would have been obvious.’ Such a conclusory assertion with no explanation is inadequate to support a finding that there would have been a motivation to combine. This type of finding, without more, tracks the *ex post* reasoning *KSR* warned of...”). For these and the other reasons discussed herein, the Petition should not be instituted.

II. BACKGROUND

A. Technology Overview and the '168 Patent

The '168 Patent discloses an improved ammonia synthesis process that minimizes CO₂ emissions by redesigning how synthesis gas is generated and used. Unlike conventional plants that burn natural gas for furnace fuel, the process disclosed in the '168 Patent diverts a portion of CO₂-depleted synthesis gas—essentially hydrogen-rich gas after decarbonation—as the fuel fraction for furnaces, thereby eliminating most combustion-related CO₂. As the Abstract explains, “a part of the CO₂-depleted synthesis gas...is separated and used as fuel fraction for one or more furnaces of the conversion section.” EX1001 at Abstract. In ammonia production the synthesis loop is preceded by hydrogen production through hydrocarbon reforming and purification. EX2006 ¶ 38. Often the amount of hydrogen produced in the former exceeds the requirements of the synthesis loop, and prior art processes focused on efficient utilization of this excess hydrogen to produce additional chemicals (e.g. methanol, hydrocarbons) or electricity. *Id.* ¶ 39. In contrast, the '168 Patent teaches the use of this excess hydrogen to decarbonize the hydrogen production process itself. *Id.* ¶ 40.

Figure 1 illustrates this core concept. Desulfurized natural gas and steam are first pre-heated in a furnace (AUX) before being converted using a prereformer (PRE) followed by an autothermal reformer (ATR) supplied with oxygen-enriched

air (22) to form synthesis gas, which is then treated in a shift reactor (SHF) and CO₂-removal unit (CDR). EX1001, at 12:51-13:8; *id.* at Fig. 1; EX2006 ¶ 41. After decarbonation, part of the resulting CO₂-depleted syngas (14) is routed back as furnace fuel for AUX, while the remainder (18) proceeds to ammonia synthesis. EX1001, at 13:14-17; *id.* at Fig. 1; EX2006 ¶ 41.

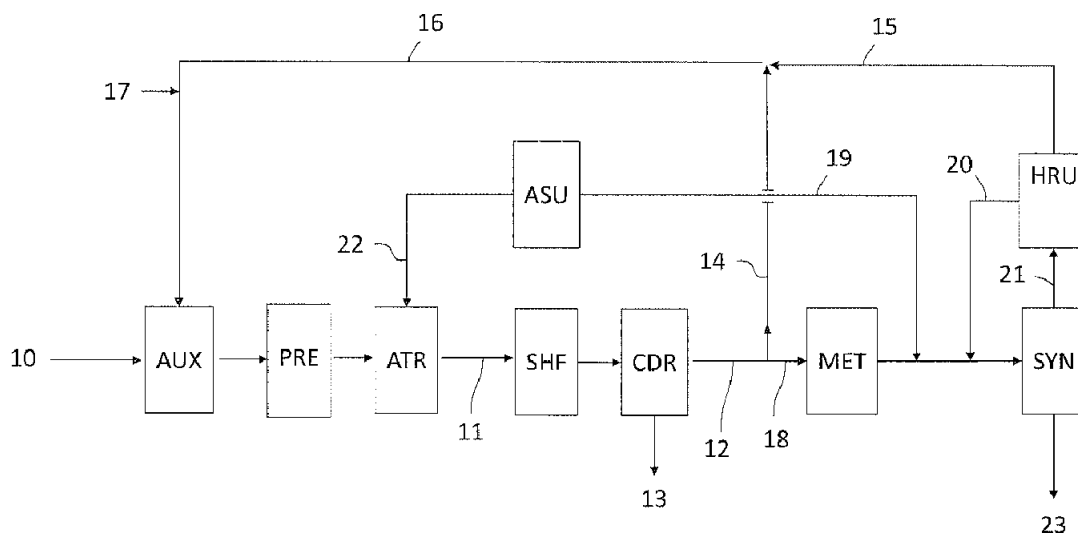


FIG. 1

This internal recycling of low-carbon syngas allows the plant to supply its own heat demand without relying on fossil-fuel combustion. EX2006 ¶ 42. The inventors of the '168 Patent recognized that diverting hydrogen-rich process gas—rather than flue-gas scrubbing or external CO₂ capture—can achieve near-zero-emission ammonia production (as low as 0.05 t CO₂ per t NH₃) while maintaining process efficiency and compatibility with plant revamps. EX1001, at 10:57-60; EX2006 ¶ 43.

B. Prosecution History of the '168 Patent

The application that issued as the '168 Patent was filed on January 31, 2018. EX1001. An Office Action rejected all pending claims as obvious over two prior art references. EX1002, at 290. In response to the Office Action, Patent Owner traversed the rejections by arguing, among other things, that the cited prior art did not teach that “said first and second streams [have] the same composition.” *Id.* at 314-15. The Examiner allowed the claims, and the '168 Patent issued on March 29, 2022.

In February 2023, Patent Owner proactively submitted a Request for Supplemental Examination based on prior art asserted against a European counterpart in two Notices of Opposition filed with the European Patent Office. *See* EX1003 (File history for Supp. Exam. No. 96/000,424). This art included Licht (U.S. Patent No. 8,137,422), which Petitioner has asserted as the primary reference in Ground 5 in this Petition (as well as a secondary reference in Ground 4D and in Grounds 1E, 2C, and 3D in the co-pending IPR). *See* Petition at 1-2; EX1009; IPR2025-01454, Paper 1.

The USPTO found the request raised a substantial new question of patentability and instituted *ex parte* reexamination on May 11, 2023. Patent Owner amended independent claim 1 to recite “a conversion section including an autothermal reformer downstream from a pre-reformer and without a primary reformer therebetween.” EX1003, at 631, 638-42, 908, 914-15. The Examiner

allowed the amended claims, and the Reexamination Certificate issued on July 16, 2024. *Id.* at 1184.

III. A PERSON OF ORDINARY SKILL IN THE ART (“POSA”)

Patent Owner submits that a POSA at the relevant time would have had at least a four-year bachelor’s degree in chemical engineering, or similar, and at least two years of experience working with ammonia production systems, or an advanced degree in chemical engineering or the like. EX2006 ¶ 49. This skill level reflects familiarity with ammonia production systems and emissions reduction processes. *Id.*

Petitioner asserts that a POSA at the relevant time “would have had at least a *graduate degree* in chemical engineering (M. Sc. or higher), *and* with at least 3-5 years’ experience working in an industry or field that involves syngas production, which may include operations in the syngas and/or ammonia production industry and experience with reforming methane, water gas shift processes, and syngas purification processes.” Petition at 3 (emphasis added). While Patent Owner submits that Petitioner’s definition of a POSA requires too much (a graduate level degree and several years of industry experience), the difference is not material for purposes of this Preliminary Response or the Board’s decision regarding institution. Dr. Wolden exceeds both definitions—by the Critical Date (February 2017), he held a Ph.D. in Chemical Engineering from MIT and had thirty years of experience in

research and development in materials and processing technologies pertinent to energy applications. EX2006 ¶¶ 6-15, 51; EX2005.

IV. CLAIM CONSTRUCTION

Terms of a claim subject to a *inter partes* review are “construed using the same claim construction standard that would be used to construe the claim in a civil action..., including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b).

“Petitioner submits that no formal claim constructions are necessary.” Petition at 2. However, as explained in Patent Owner’s Preliminary Response to the Petition filed in IPR2025-01454, the Petitioner implicitly proposes an incorrect construction for the claim term “furnace” in Claim 1 of the ’168 Patent in that Petition.

Consistent with the express definition in the specification, Patent Owner submits that the term “furnace” in Claim 1 should be construed as: “an apparatus chosen from among: a steam reformer or a charge preheater or a steam generator or a steam superheater.” EX1001, at 2:47-52 (“The term ‘furnace’ is understood as meaning an apparatus chosen from among: a steam reformer or a charge preheater or a steam generator or a steam superheater. These apparatus, which operate by means of combustion, are identified by the term ‘fired heater.’”); *see also infra* Section V(A).

Outside of that claim term, denial of the Petitioner’s challenge to the validity of the Challenged Claims of the ’168 Patent does not require analysis under anything other than the plain and ordinary meaning of the claim terms, and for this reason, Patent Owner proposes ordinary and customary constructions of all other terms of the Challenged Claims.⁵

V. THE BOARD SHOULD DENY INSTITUTION OF THE PETITION

A. The Petition Improperly Attempts to Shift the Burden of Claim Construction to the Board and Patent Owner

A Petitioner *must* include a statement that identifies “[h]ow the challenged claim is to be construed.” 37 C.F.R. § 42.104(b)(3). Where the Petitioner sets forth arguments or observations of what a claim term means, but does not provide an explicit construction for the claim term, “the Petitioner improperly attempts to shift the burden of construing the claim term . . . to the Board[,]” and institution should be denied. *ams AG v. 511 Innovations, Inc.*, IPR2016-01792, Paper 15 at 13 (PTAB Mar. 16, 2017) (“[U]nder the circumstances discussed above, including that the parties disagree over whether the prior art discloses or suggests the claimed ‘minimal height,’ Petitioner fails to meet its burden under 37 C.F.R. § 42.104(b)(3) of

⁵ Patent Owner reserves the right to present additional claim construction arguments in the concurrent litigation or this proceeding if necessary, and to opine on the scope of the plain and ordinary meaning of terms subject to claim construction.

providing a claim construction for the term ‘minimal height.’ Therefore, we decline to institute an *inter partes* review.”); *see also Blackberry Corp. v. Facebook, Inc.*, IPR2019-01593, Paper 9 at 3 (PTAB Apr. 17, 2020) (“[I]t is Petitioner’s burden to show *in the Petition* its contentions regarding how the challenged claim *is to be construed...*”) (emphasis in original); *Wenzhou Xin Xin Sanitary Ware Co., Ltd. v. Delta Faucet Company*, IPR2023-01332, Paper 13 at 29 (PTAB Feb. 7, 2024) (denying institution where “on the record before us, the Petitioner’s conclusory assertion ... is not sufficient to establish [that the claimed phrase is met], particularly in view of the Petitioner’s failure to provide an express construction of this phrase as required under 37 C.F.R. § 42.104(b)(3)–(b)(4).”).

Here, “Petitioner submits that no formal claim constructions are necessary.” Petition at 2. But claims in an IPR proceeding “shall be construed using the same claim construction standard that would be used to construe the claim in a civil action.” 37 CFR § 42.100(b). When construing claim terms, “the inventor’s lexicography governs.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1316 (Fed. Cir. 2005). Here, the specification of the ’168 Patent provides an express definition of the claim term “furnace”:

The term “furnace” is understood as meaning an apparatus chosen from among: a steam reformer or a charge preheater or a steam generator or a steam superheater. These apparatus, which operate by means of combustion, are identified by the term “fired heater.”

EX1001, at 2:47-52.

Because Petitioner fails to meet its burden under 37 C.F.R. § 42.104(b)(3) of providing a claim construction for the term “furnace” in the only independent claim of the ’168 Patent, the Petition should not be instituted.

B. Ground 4: The Petition Fails to Show how *Terrien* Anticipates or Renders Obvious Claim 1

Ground 4 in the Petition asserts that *Terrien* anticipates Claim 1 of the ’168 Patent. Ground 4A asserts that *Terrien* in view of “ordinary knowledge” renders Claim 1 obvious, while Ground 4B asserts that *Terrien* in view of *Price* renders Claim 1 obvious. Grounds 4C through 4E address dependent claims of Claim 1, but do not otherwise address the limitations of Claim 1. *See* Petition at 1 (listing specific grounds asserted). Accordingly, because the Petition does not meet its burden for Grounds 4, 4A, and 4B, Grounds 4C through 4E fail for at least the same reasons.

Terrien, titled “Process For the Production of Hydrogen and Carbon Dioxide,” is specifically directed at, as the title suggests, the production of hydrogen and carbon dioxide. EX1007. While unnecessary for purposes of this Preliminary Response or the Board’s decision regarding institution given the Petition’s failure on other limitations, Patent Owner disputes Petitioner’s assertion that limitation 1[d] “may have no patentable weight” to read out Claim 1’s requirement that “the second stream is process gas intended for the synthesis of ammonia.” Petition at 14; *see also* Section V(A) *supra*; EX1001 (titled “Process for the Synthesis of Ammonia with

Low Emissions of CO₂ in Atmosphere”) at Claim 1 (“A process for synthesis of ammonia...). The Petition admits that *Terrien* does not discuss synthesis of ammonia, and instead relies on impermissible hindsight reach this limitation. (“POSA *would have understood* that *Terrien’s* front-end hydrogen synthesis process *could be used* as the front-end of an ammonia synthesis plant”) Petition at 14 (emphasis added). Indeed, the only reference to “ammonia” in *Terrien* is for use as “an external coolant” for cooling a carbon dioxide rich stream. EX1007 at [0039].

As explained below, Petitioner fails to meet its burden for Grounds 4, 4A, and 4B for several independent reasons.

1. Limitation 1[a]: conversion of a charge of desulphurized natural gas and steam, with oxygen-enriched air or with oxygen, into a synthesis gas containing hydrogen, CO and CO₂, in a conversion section including an autothermal reformer downstream from a pre-reformer and without a primary reformer therebetween;

Terrien does not disclose conversion “with oxygen-enriched air or with oxygen” as required by limitation 1[a]. The Petition implicitly admits as much, as it makes no mention of this claim requirement in its anticipation argument in Ground 4. Petition at 11. “It is of the utmost importance that petitioners . . . adhere to the requirement that the initial petition identify ‘with particularity’ the ‘evidence that supports the grounds for the challenge to each claim.’” *Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3)). A petitioner must address every element of every limitation in its

petition. *See Microsoft Corp. v. IPA Techs. Inc.*, 2022 U.S. App. LEXIS 8711, at *30 (Fed. Cir. Apr. 1, 2022) (affirming denial of petition where petitioner “fail[ed] to address the language of claim 50 Without providing a detailed explanation tying its argument to the claim language, [petitioner did] not met its burden of showing how the prior art teaches the recited limitation.”); *Advanced Lighting Concepts LLC v. mate LLC*, IPR2023-01259, Paper 9, at 23 (Feb. 13, 2024) (denying institution where “Petitioner fail[ed] to address the portion of the limitation Petitioner merely concludes that this limitation is met.”); *Saltpeter v. ARP Wave, LLC*, IPR2019-01384, Paper 12, at 16 (Jan. 27, 2020) (same).

And while limitation 1[a] specifically requires “an autothermal reformer downstream from a pre-reformer and without a primary reformer therebetween,” the Petition states only that “*Terrien*’s conversion section disclosed various components including a prereformer, a steam CH₄ reformer, and an ATR.” Petition at 11. The Petition does not explain how these “various components” disclose the specific arrangement required in Claim 1’s “conversion section including an autothermal reformer downstream from a pre-reformer and without a primary reformer therebetween.”

Ground 4A (alleged obviousness based on *Terrien* and “ordinary knowledge”) fails for the same reasons, as it fails to further discuss the missing requirements of limitation 1[a] referenced above. *See* Petition at 17.

For Ground 4B, the Petition asserts that “[t]o the extent that *Terrien* does not disclose an ATR downstream from a prereformer without a primary reformer therebetween, *Price* does.” Petition at 25. The Petition cites to [0056] of *Price*, but *Price* merely discloses “[t]he reforming section consists of a steam reformer followed by an autothermal reformer.” EX1011 at [0056]. The Petition (and supporting expert testimony) admits that the “steam reformer” of *Price* is not a prereformer—the next sentence in the Petition asserts that “***A POSA would have understood*** that the step of reforming the syngas prior to the ATR step can be accomplished by a prereformer, a steam reformer, or any other reformer, reformers, or combinations thereof,” citing to seven different paragraphs of expert testimony. Petition at 25 (emphasis added). This “plug and play” approach for Claim 1’s conversion section that relies entirely on expert testimony is impermissible hindsight.

Moreover, a steam reformer and a prereformer are fundamentally distinct components that operate differently and serve different purposes. EX2006 ¶ 65. A prereformer is conducted adiabatically, meaning it requires no heating, while a steam reformer requires heat. *Id.* ¶ 66. A prereformer is typically used to convert heavier hydrocarbons to methane which allows for more efficient reforming downstream (hence the name “pre” reformer), while a steam reformer typically converts lighter hydrocarbons such as methane to syngas. *Id.* ¶ 67. A POSA would not consider the

“steam reformer” of *Price* (EX1011 at [0056]) to be a prereformer as required by Claim 1. *Id.* ¶ 68.

For at least these reasons, Petitioner fails to meet its burden for Grounds 4, 4A, and 4B.

2. Limitation 1[c]: separation of a part of said CO₂-depleted synthesis gas as fuel fraction, wherein said fuel fraction is fed as fuel to at least one furnace and wherein said separation of the fuel fraction includes the split of said CO₂-depleted synthesis gas into at least a first stream and a second stream, said first and second streams having the same wherein the first stream forms the fuel fraction

The Petition also does not identify “at least one furnace” as required by limitation 1[c]. Petition at 12-14. The Petition admits as much, as it relies on expert testimony for limitation: “A POSA *would have understood* that a H₂-rich stream used as fuel to a conversion section *can be directed* to a furnace or any other suitable device.” Petition at 14 (emphasis added). The Petition does not state that *Terrien* discloses “said fuel fraction is fed as fuel to at least one furnace.” The Petition does not even identify a furnace in *Terrien*. Petition at 12-14.

Ground 4A (alleged obviousness based on *Terrien* and “ordinary knowledge”) fails for the same reason, as it merely asserts for limitation 1[c] that “this element is anticipated by *Terrien*,” pointing to the discussion of Ground 4. *See* Petition at 18.

Finally, Ground 4B (alleged obviousness based on *Terrien* and *Price*) fails for the same reason, as it merely asserts for limitation 1[c] that “this claim element is

anticipated and/or obvious over *Terrien*, pointing to the discussion of Grounds 4 and 4A. Ground 4B does not rely on *Price* for limitation 1[c]. *See* Petition at 26.

For at least these reasons, Petitioner fails to meet its burden for Grounds 4, 4A, and 4B.

C. Ground 5: The Petition Fails to Show how *Licht* Renders Obvious Claim 1

Ground 5 in the Petition asserts that *Licht* in view of *Price* renders obvious Claim 1 of the '168 Patent. Grounds 5A and 5B address dependent claims of Claim 1, but do not otherwise address the limitations of Claim 1. *See* Petition at 1-2 (listing specific grounds asserted). Accordingly, because the Petition does not meet its burden for Ground 5, Grounds 5A and 5B fail for at least the same reasons.

As discussed above in Section II(B) and Patent Owner's Discretionary Denial Brief (Paper 6), *Licht* was already (recently) considered by the USPTO because Patent Owner submitted *Licht* to the USPTO in a Request for Supplemental Examination based on prior art asserted against a European counterpart in Notices of Opposition filed with the European Patent Office. *See* EX1003 (File history for Supp. Exam. No. 96/000,424). The Office found that *Licht* (among other references) raised a substantial new question of patentability as to the claims of the '168 Patent, a Supplemental Examination Certificate including *Licht* issued, and *ex parte* reexamination was ordered. EX1003 at 588, 590, 592. *Licht* was further cited in multiple rejections. EX1003 at 597-603. Following the rejections, Patent Owner

amended claim 1 to include “conversion of a charge of desulphurized natural gas and steam, with oxygen-enriched air or with oxygen, into a synthesis gas containing hydrogen, CO and CO₂, in a conversion section *including an autothermal reformer downstream from a pre-reformer and without a primary reformer therebetween.*” EX1003 at 630-631. Following the amendment, the reexamination certificate issued on July 16, 2024. EX1001.

As noted above with respect to Ground 4, while unnecessary for purposes of this Preliminary Response or the Board’s decision regarding institution given the Petition’s failure on other limitations, Patent Owner disputes the Petition’s assertion that limitation 1[d] “may have no patentable weight” to read out the Claim 1’s requirement that “the second stream is process gas intended for the synthesis of ammonia.” Petition at 43; *see also* Section V(A) *supra*; EX1001 (titled “Process for the Synthesis of Ammonia with Low Emissions of CO₂ in Atmosphere”) at Claim 1 (“A process for synthesis of ammonia...). The Petition admits that Licht does not discuss synthesis of ammonia and instead relies on impermissible hindsight to reach the limitation (“a POSA **would have understood** Licht’s front-end H₂-synthesis process **to be applicable to** a process including ammonia”). Petition at 44 (emphasis added).

As explained below, Petitioner fails to meet its burden for Ground 5 for several independent reasons.

1. Limitation 1[a]: conversion of a charge of desulphurized natural gas and steam, with oxygen-enriched air or with oxygen, into a synthesis gas containing hydrogen, CO and CO₂, in a conversion section including an autothermal reformer downstream from a pre-reformer and without a primary reformer therebetween;

The Petition admits that “*Licht* does not explicitly disclose a prereformer followed by an ATR without a primary reformer therebetween.” Petition at 41. This conclusion aligns with the recent conclusion of the USPTO after *Licht* was considered during the *ex parte* reexamination: “The claims, as amended, require an autothermal reformer downstream [sic] from a pre-reformer and without a primary reformer therebetween *which arrangement is not taught by the cited prior art.*” EX1003 at 777 (emphasis added).

Petitioner’s expert, Dr. Ritter, similarly concedes that “*Licht* discloses a primary reformer.” EX1005 ¶ 129. Dr. Ritter then relies on *Licht*’s discussion regarding minimizing the size of the primary reformer (EX1009 at 8:35-42) to support his opinion that “A POSA would have understood that *Licht*’s disclosure of a minimized primary reformer could support removal of the primary reformer altogether.” EX1005 ¶ 129. Petitioner’s expert’s conjecture is classic hindsight—using Claim 1’s requirement of no primary reformer as a road map for removing the primary reformer specifically required by *Licht*.

Moreover, Patent Owner submits that such a disclosure actually teaches away from omitting the primary reformer—“optimizing” the “feedstock processed in the

reformer furnace 100” (i.e. the primary reformer) suggests that the primary reformer cannot be removed, or at minimum removal is not preferred. *See* EX2006 ¶ 84 (*Licht* does not suggest removing the primary reformer and further optimizing the process of *Licht* to make the primary reformer smaller does not suggest or “support” removing the primary reformer altogether). Moreover, the “removal of the primary reformer [of *Licht*] altogether” creates other problems which become clear when looking at limitation 1[c], discussed *infra*.

The Petition further asserts that “[t]o the extent that *Licht* does not disclose an ATR downstream from a prereformer without a primary reformer therebetween, *Price* does.” Petition at 41. The Petition cites to [0056] of *Price*, but *Price* merely discloses “[t]he reforming section consists of a steam reformer followed by an autothermal reformer.” EX1011 at [0056]. The Petition (and supporting expert testimony) admits that the “steam reformer” of *Price* is not a prereformer—the next sentence in the Petition asserts that “***A POSA would have understood*** that prereforming the syngas prior to the ATR step can be accomplished by a steam reformer,” citing to seven different paragraphs of expert testimony. And as discussed above with respect to Ground 4, *see* Section V(B)(1) *supra*, a steam reformer and a prereformer are fundamentally distinct components that operate differently and serve different purposes. EX2006 ¶ 81. A prereformer is conducted adiabatically, meaning it requires no heating, while a steam reformer requires heat. *Id.*; EX1009 at

5:59-6:3 (*Licht*) (prereformer “is characterized by the lack of direct heating by a combustion flame”); *id.* at 6:34-6:36 (“Prereforming is a term used to describe reforming before the main reforming step, for example in a fired reformer.”). A prereformer is typically used to convert heavier hydrocarbons to methane which allows for more efficient reforming downstream (hence the name “pre” reformer), while a steam reformer typically converts lighter hydrocarbons such as methane to syngas. EX2006 ¶ 82; EX1009 at 59:59-6:3 (*Licht*) (“A prereformer generally employs a different type of catalyst than a primary reformer, for example a high activity, high nickel content catalyst”). A POSA would not consider the “steam reformer” of *Price* (EX1011 at [0056]) to be a prereformer as required by Claim 1. EX2006 ¶ 82.

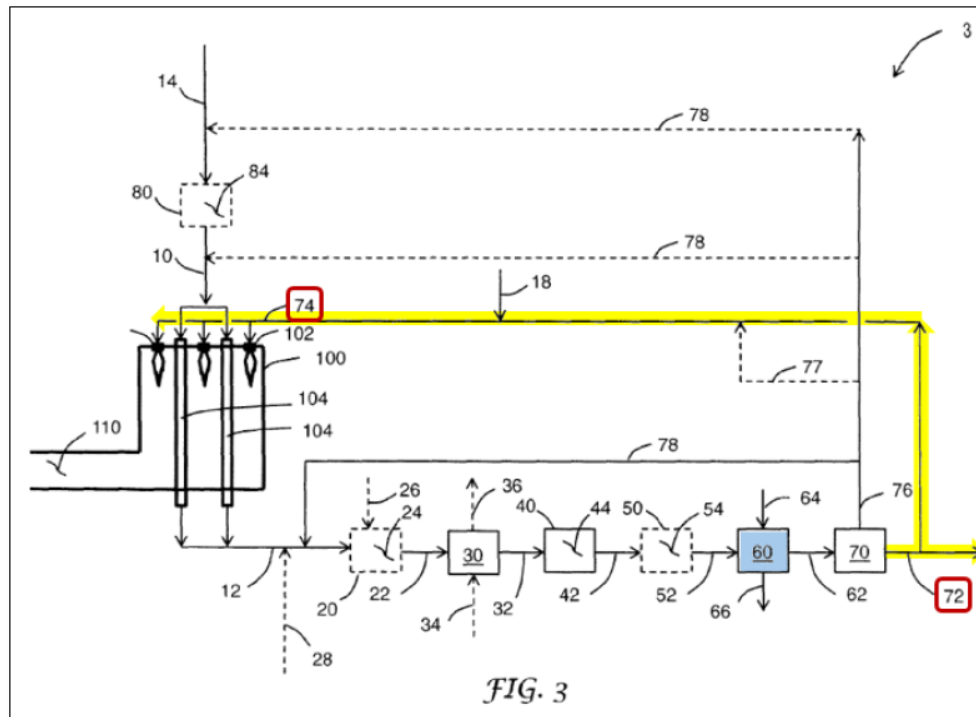
Moreover, *Licht* already expressly considers the use of a prereformer alongside and in conjunction with the primary reformer. *See* EX1009 at 6:2-3 (“A prereformer and a reformer may be physically connected.”); 5:56-57 (“FIG. 2 and FIG. 3 show additional optional features, for example a so-called prereformer 80”); 6:34-36 (“Prereforming is a term used to describe reforming before the main reforming step, for example in a fired reformer.”). While the prereformer of *Licht* is expressly “optional,” the primary reformer is not. EX2006 ¶ 83. Accordingly, a POSA would not look to a reference that omits the primary reformer (even if *Price*

disclosed such a configuration, which it does not) to replace the conversion section of *Licht. Id.*

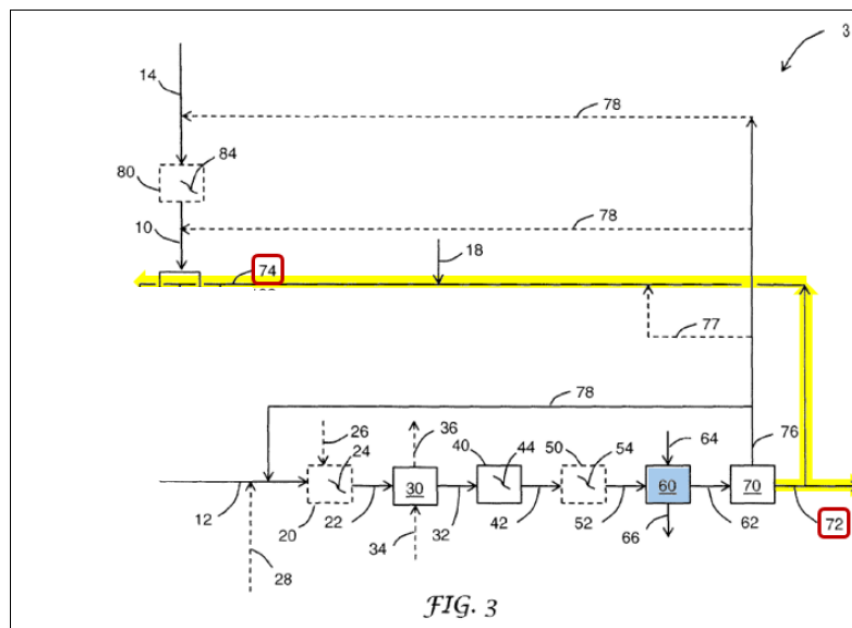
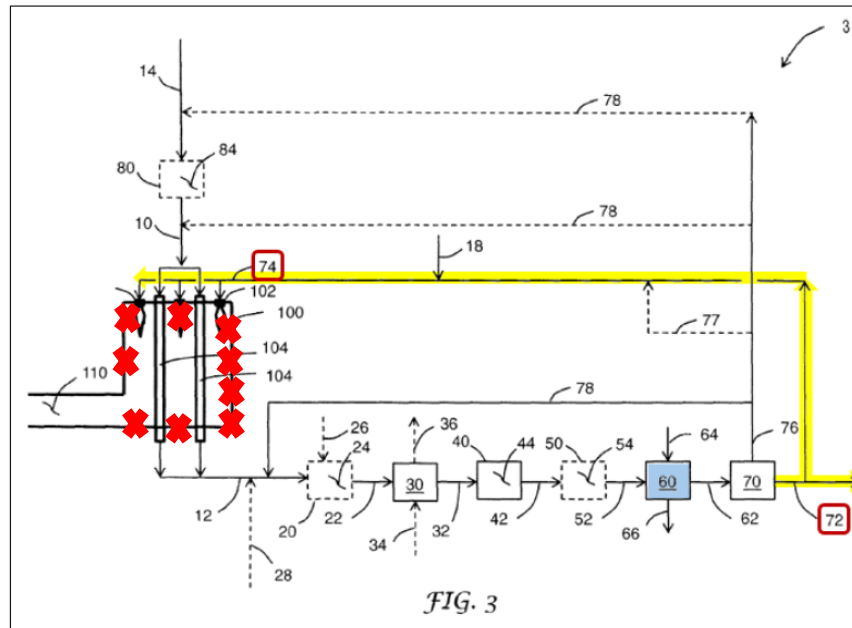
For at least these reasons, Petitioner fails to meet its burden for Ground 5.

2. Limitation 1[c]: separation of a part of said CO₂-depleted synthesis gas as fuel fraction, wherein said fuel fraction is fed as fuel to at least one furnace and wherein said separation of the fuel fraction includes the split of said CO₂-depleted synthesis gas into at least a first stream and a second stream, said first and second streams having the same wherein the first stream forms the fuel fraction

The Petition also does not explicitly identify a “furnace” disclosed by *Licht* as required by Limitation 1[c]. By highlighting streams “72” (the so-called “H₂-containing gas”) and “74” (the so-called “fuel gas”) as the disclosure for “splitting the CO₂-depleted syngas stream into a first stream-the fuel faction-and a second stream,” the Petition is implicitly identifying “reformer furnace 100” / “primary furnace 100” (*see* EX1009 at 3:29-30, 12:50, Fig. 3) as the required “furnace.” The Petition highlights streams “72” and “74” in an annotated image of Figure 3 of *Licht* (Petition at 43), which shows “fuel gas” “74” flowing to “reformer furnace 100” / “primary furnace 100”:



The issue, however, with “reformer furnace 100” / “primary furnace 100” serving as the “furnace” in limitation 1[c] is that the Petition relies on the **removal** of “reformer furnace 100” / “primary furnace 100” from *Licht* for its arguments for limitation 1[a]. *See* Section V(C)(1) *supra*. Petitioner’s expert, Dr. Ritter, opines that “A POSA would have understood that *Licht*’s disclosure of a minimized primary reformer **could support removal of the primary reformer altogether.**” EX1005 ¶ 129. But if one removes the primary reformer of *Licht* to satisfy limitation 1[a], there is no furnace to satisfy limitation 1[c], that is, there is no “fuel faction [] fed as fuel to at least one furnace” as required by limitation 1[c]:



(Further annotated versions of Fig. 3 from Petition at 43.)

When addressing the split of CO₂-depleted synthesis gas in limitation 1 [c] the Petition also discusses “portion 78 of the by-product gas 76,” which is “a divided portion of the by-product stream 76 formed from the separation of the carbon

dioxide-depleted stream 62”. Petition at 43 (citing EX1009 at 5:7-14). *Licht* discloses that “portion 78” will “have the same composition as the by-product stream 76 formed from the separation of the carbon dioxide-depleted stream 62” (EX1009 at 5:7-14), but neither “portion 78” nor “by-product stream 76” can be the “CO₂-depleted synthesis gas” required by limitation 1[c]. The “by-product stream 76,” comprises “methane and carbon monoxide.” EX1009 at 4:35-39.

But as the Petition recognizes elsewhere, the “CO₂-depleted synthesis gas” in limitation 1[c] is “essentially hydrogen (H₂).” *See* Petition at 42; EX1001 at 3:18-21; 3:29-32 (“The process gas part (fuel fraction) is suitably separated after a CO₂ removal treatment, and as explained further above, it contains essentially hydrogen which may burn without forming CO₂”); Claim 1 (“synthesis gas containing hydrogen, CO, and CO₂,” “shift reaction of the carbon monoxide into CO₂,” “subsequent separation of CO₂ from the gas, thus obtaining a CO₂-depleted synthesis gas and a CO₂-rich gaseous flow containing the CO₂ separated from the gas”). Thus, “by-product stream 76” and “portion 78”(which contain carbon) cannot be the “CO₂-depleted synthesis gas” required by limitation 1[c].

Finally, the Petition does not rely on *Price* for limitation 1[c]. *See* Petition at 42 (no discussion of, or citation to, *Price*).

For at least these reasons, Petitioner fails to meet its burden for Ground 5.

VI. THE PETITION FAILS AS TO THE DEPENDENT CLAIMS

Claims 2 through 19 of the '168 Patent are all dependent on Claim 1. Thus, for at least the reasons described above with respect to Claim 1, the Petition fails as to each of the dependent claims as well. The specific grounds not discussed in this Preliminary Response challenge only dependent claims and do not address the limitations of claim 1 but rather rely on the Petition's arguments for claim 1 in Grounds 4, 4A, 4B, and 5 already discussed herein.

VII. CONCLUSION

For at least the reasons discussed above, Patent Owner respectfully requests the Board deny institution of the Petition. For brevity, Patent Owner may not have addressed all characterizations of the applied references and the Challenged Claims and reserves the right to do so should institution be granted. The absence of a response by Patent Owner to any of the positions presented in the Petition or the associated expert declaration is not a concession to those positions. The fact that Patent Owner's Preliminary Response has focused on particular arguments is not a concession that there are no other arguments for patentability of the Challenged Claims.

Dated: December 1, 2025

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CERTIFICATION OF WORD COUNT UNDER 37 C.F.R. §42.24

Under the provisions of 37 C.F.R. §42.24(d), the undersigned hereby certifies that the word count for the foregoing Patent Owner Preliminary Response totals 5,436 words, excluding the parts exempted by 37 C.F.R. §42.24(a). Accordingly, this Patent Owner Preliminary Response is under the word count limit of 14,000 words. This word count was made by using the built-in word count function tool in the Microsoft® Word for Microsoft 365 MSO (Version 2502 Build 16.0.18526.20546) 64-bit used to prepare the document.

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e)(4), the undersigned certifies that on December 1, 2025, a complete and entire copy of this Patent Owner's Preliminary Response was served on the Petitioner via electronic mail at the following addresses:

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