

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TOPSOE INC.,
Petitioner

v.

CASALE SA,
Patent Owner

Case IPR2025-01454
U.S. Patent No. 11,286,168

PATENT OWNER'S PRELIMINARY RESPONSE

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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 petition for *inter partes* review IPR2025-01454 (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

¹ Patent Owner has also filed a brief requesting that the Director discretionarily deny the Petition. *See* Paper 7; Paper 3100.

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 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.”).

Preliminary Response is supported by the Declaration of Colin A. Wolden, Ph.D.
See EX2006.

I. INTRODUCTION AND SUMMARY OF ARGUMENT

The Petition asserts three 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, while Petitioner submits that “no formal claim constructions are necessary,” the Petition implicitly construes the claim term “furnace” in Claim 1 in a futile effort to twist the Petition’s references to meet the claim limitation. Because Claim 1 is the only independent claim of the '168 Patent, the Petition can be denied based on this improper implicit construction alone.

³ The three grounds rely on *2007 IFA*, *Rytter*, and *Fjellhaug* as the primary references, respectively, but expand into fifteen 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 IPR2025-01455, asserting two additional grounds of purported unpatentability against the Challenged Claims of the '168 Patent.

Second, Petitioner’s implicit claim construction of the term “furnace” is inaccurate, because it rewrites and improperly expands the express definition provided in the specification of the ’168 Patent. Because none of the references relied upon for claim 1 disclose the claimed “furnace” as properly construed, Petitioner has failed to meet its burden 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).

Finally, the Petitioner improperly relies on hindsight bias throughout the Petition. *See, e.g.*, Petition at 10 (“A POSA seeking to reduce carbon emissions in a syngas process would have been motivated to apply ordinary skill and knowledge to 2007 IFA ***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.

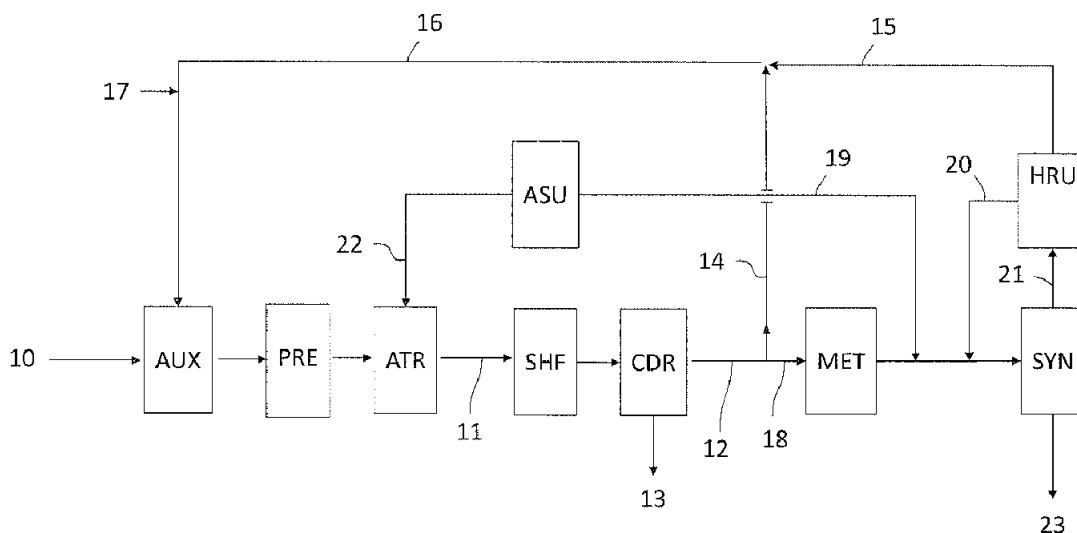


FIG. 1

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 a reference in this Petition (Grounds 1E, 2C, and 3D) and has also asserted as a primary reference in the co-pending IPR. *See* Petition at 1-2; EX1009; IPR2025-01455, 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. *See* 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. *See* 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 below, Petitioner implicitly proposes an incorrect construction for the claim term “furnace” in Claim 1 of the ’168 Patent. *See infra* Section V(A).

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. However, the Petition implicitly construes the claim term “furnace” in claim limitation 1[c]. Because Claim 1 is the only independent claim of the ’168 Patent, this improper implicit construction impacts the analysis of every challenged claim across all Grounds in the Petition.

In the first ground presented, the Petition cobbles together from two distinct and separate places in the specification a construction of the claim term “furnace” in the limitation “wherein said fuel fraction is fed as fuel to at least one furnace”:

According to the ’168 Patent, the fuel is used in a furnace, which is ‘understood as meaning an apparatus chosen from among...a steam

generator....’ (EX1001, 2:47-49) and gas turbines for generating electricity (*id.* 7:44-53).

Petition at 17 (discussing claim limitation 1[c] as defined by the Petition). The Petition then relies on expert testimony to assert that the “furnace” limitation in claim 1 is met: “A POSA would have understood that, by definition, a gas turbine operates by means of combustion and therefore includes a ‘furnace.’” Petition at 17 (citing EX1005 ¶¶ 56, 60).

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

Beyond ignoring the express requirement that the Petition must set forth “how the challenged claim is to be construed,” 37 C.F.R. § 42.104(b)(3), the Petitioner’s implicit construction of “furnace” is also facially incorrect in view of the intrinsic record. 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 [sic], which operate by means of combustion, are identified by the term “fired heater.”

EX1001, at 2:47-52. Notably, this definition does not include “gas turbine,” but Petitioner’s invalidity arguments require a “gas turbine” to meet the definition of “furnace.” So, while the Petition’s implicit construction starts with the first part of this express definition, it then proceeds to both omit words from the express definition and improperly add an unrelated reference to a “gas turbine” from column seven of the ’168 Patent (five columns later):

According to the ’168 Patent, the fuel is used in a furnace, which is ‘understood as meaning an apparatus chosen from among...a steam generator....’ (EX1001, 2:47-49) and gas turbines for generating electricity (id. 7:44-53).

Petition at 17 (emphasis added). A cursory review of the specification reveals that the reference to a “gas turbine” in column seven is not to one of the “chosen” apparatuses in the definition of “furnace,” but is rather disclosed as a “way” to generate electricity when the specification is explaining that “the invention also allows to produce the electricity necessary” for the ammonia synthesis process. EX1001, at 7:44-53. The reason for the Petition’s implicit (and incorrect) construction of “furnace” becomes clear when looking at the Petition’s analysis of claim limitation 1[c] in each of Grounds 1, 2, and 3, as explained below: Petitioner’s

references are otherwise missing the required “furnace.” *See infra* Sections V(B)(2), V(C), V(D)(2).

Moreover, a POSA understands that a furnace as claimed in the ’168 Patent and a gas turbine are not synonymous and serve very different purposes within a process. EX2006 ¶ 26. The claimed “furnace” is a relatively simple unit that involves combustion of fuel followed by the transfer of thermal energy from the hot combustion gas to another fluid. *Id.* A turbine by contrast is a much more complex device. *Id.* In a turbine air is typically compressed, combusted with fuel at elevated pressure, but instead of transferring heat the energy is converted first into mechanical energy and secondly into electrical energy. *Id.* Thus, while both involve combustion, a “furnace” simply transfers thermal energy while a turbine transforms thermal energy into first mechanical and then electrical energy. *Id.*

Because the Petition fails to explicitly construe “furnace” and its implicit construction of the same is facially incorrect in view of the intrinsic record, the Petition should not be instituted.

B. Petitioner Has Not Demonstrated a Reasonable Likelihood of Success for Ground 1

Ground 1 in the Petition asserts that 2007 IFA anticipates Claim 1 of the ’168 Patent. Grounds 1A through 1E 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 Ground 1, Grounds 1A through 1E fail for at least the same reasons.

1. 2007 IFA is Not Prior Art

A petitioner in an *inter partes* review may challenge a patent's claims "only on the basis of prior art consisting of patents or printed publications." 35 U.S.C. § 311(b) (emphasis added). "[A]t the institution stage, the petition must identify, with particularity, evidence sufficient to establish a reasonable likelihood that [a] reference was publicly accessible before the critical date of the challenged patent and therefore that there is a reasonable likelihood that it qualifies as a printed publication." *Hulu, LLC v. Sound View Innov., LLC*, IPR2018-01039, Paper 29 at 13 (PTAB Dec. 20, 2019) (precedential). Public accessibility is "[a] dispositive issue" when deciding whether to institute. *Air Liquide Large Indus. U.S. LP v. Praxair Tech., Inc.*, IPR2015-01074, Paper 11 at 5 (PTAB Oct. 26, 2015).

Public accessibility "has been called the touchstone in determining whether a reference constitutes a 'printed publication'...." *Blue Calypso, LLC v. Groupon, Inc.*, 815 F.3d 1331, 1348 (Fed. Cir. 2016). A "'given reference is publicly accessible upon a satisfactory showing that such document has been disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art exercising reasonable diligence, can locate it.'" *Air Liquide Large Indus.*, IPR2015-01074, Paper 11 at 5 (quoting *SRI Int'l, Inc., v. Internet Sec.*

Sys., Inc., 511 F.3d 1186, 1194 (Fed. Cir. 2008)). “[T]he reference must have been sufficiently accessible to the public interested in the art; dissemination and public accessibility are the keys to the legal determination whether a prior art reference was published.” *In re Cronyn*, 890 F.2d 1158, 1160 (Fed. Cir. 1989).

“[A] presentation that includes a transient display of slides is . . . not necessarily a ‘printed publication.’” *In re Klopfenstein*, 380 F.3d 1345, 1349 n.4 (Fed. Cir. 2004). Petitioners fail to show that slide presentations are publicly available when there is no corroborating evidence on whether the slides were “ever presented at the conference, or evidence establishing the nature of the presentation and dissemination of the information” and “insufficient evidence that the slides were publicly available at the website as of the critical date.” *Air Liquide Large Industries*, IPR2015-01074, Paper 11 at 6; *see also Adaptics Limited v. Perfect Company*, IPR2018-01596, Paper 20 at 23 (PTAB March 6, 2019) (denying petition where petitioner didn’t address whether the reference had been “meaningfully indexed and could be located by a POSITA using a reasonably diligent search” or whether it was “widely disseminated to persons of ordinary skill in the art”). In *ABS Global, Inc. v. Inguran, LLC*, IPR2016-00927, Paper 33 at 20-21 (PTAB Oct. 2, 2017), the petitioner offered a printout of a webpage that stated the offered prior art was published on May 28, 2002. However, this was not sufficient because it:

[did] not constitute a showing that the publication in question was publicly accessible as of May 28, 2002. For example, it [did] not indicate that the publication itself was disseminated or otherwise made available to the public as of May 28, 2002. It [did] not indicate that anyone received the publication on May 28, 2002. It [did] not indicate that one of ordinary skill in the art could have located the information necessary to order the publication on May 28, 2002.

Id.

Here too, Petitioner has failed to show that the 2007 IFA slide presentation was publicly accessible prior to the Critical Date (which Petitioner asserts is February 15, 2017). **First**, while Petitioner's expert, Dr. Ritter, explains that the slide presentation is **now** available to download via IFA's website, he provides no evidence that it could be downloaded prior to February 15, 2017. Indeed, Dr. Ritter admits that when using a capture of IFA's website which appears to be dated March 10, 2010 (the only capture available), he was **not** able to download the 2007 IFA slide presentation. *See* Ex. 1005, at ¶ 88. Yet Dr. Ritter contends that the 2007 IFA slide presentation was publicly accessible prior to February 15, 2017, because *one* paper, written by P. Lako and published by the Energy Research Center of the Netherlands in 2009, cites two values from the 2007 FAI slide presentation. *Id.* ¶¶ 89-91. The fact that one paper cited the 2007 IFA slide presentation does not show that it was publicly available or widely disseminated to persons of ordinary skill in the art. There's nothing to show that P. Lako obtained this presentation online

through publicly available searching rather than directly from the 2007 IFA presenters through a request.

Second, P. Lako's citation to the 2007 IFA slide presentation, if anything, only shows that the one slide, slide 4, P. Lako relied upon was available. *See* Ex. 1005, at ¶¶ 90-91; Ex. 1006, at 2. Petitioner does not rely on slide 4, instead relying on two schematics from the slide presentation that appear on slides 16 and 18, and quotes on slides 15 and 20. *See* Petition §§ V(A)-(F); Ex. 1006, at 8-10. Petitioner has not shown that any of these slides were publicly available in their current form prior to February 15, 2017.

Third, Petitioner does not assert or provide evidence regarding the dissemination of the 2007 IFA slide presentation at the conference. Interestingly, the presentation appears to have been drafted and presented by an employee of Petitioner's parent company, Haldor Topsoe A/S. Presumably, if Petitioner could have submitted some evidence of dissemination it would have. The lack of any evidence related to dissemination indicates it was not publicly available.

Petitioner cites several cases in support of its argument that the 2007 IFA slide presentation was public. Petition at 7 n.1. All of these cases support Patent Owner's argument that Petitioner has provided insufficient evidence of public availability.

In *Blue Calypso*, the court found that the defendant (the party arguing invalidity) failed to show that the reference at issue, called "Ratismor," was publicly

available prior to the critical date. 815 F.3d at 1349-50. This finding was based on several reasons: (a) even if Ratismor was publicly available on the author's personal webpage, there was not "any evidence indicating that Ratsimor was viewed or downloaded;" (b) "there was no evidence that the ordinarily skilled artisan would know of [the author's] personal webpage or its web address;" and (c) there was no evidence "that a query of a search engine before the critical date, using any combination of search words, would have led to Ratsimor appearing in the search results." *Id.* Here, Petitioner has similarly not shown that the 2007 IFA slide presentation was viewed or downloaded—indeed, Petitioner has not even shown that it was available on the internet prior to the critical date. And while Dr. Ritter has opined that he was able to find the 2007 IFA slide presentation by searching the IFA website today (Ex. 1005, ¶ 85), this still does not show that the slide presentation could have been found through any publicly used common search engine as of the critical date.

In *In re Klopfenstein*, the court analyzed whether a slide presentation displayed first at a meeting of chemists and later at a university was publicly accessible. 380 F.3d at 1347. The presentation was displayed continuously for two and a half days at the meeting of chemists and one day at the university. *Id.* Although no copies of the presentation were disseminated, there was no prohibition on notetaking or copying. *Id.* The court found the presentation was publicly accessible

and relied heavily on the duration of the display, noting “[t]he more transient the display, the less likely it is to be considered a ‘printed publication.’” *Id.* at 1350. Additionally, the court found that it would have been simple for viewers to copy down the slides because they were relatively simple. *Id.* at 1351. Petitioner here has provided no evidence of how long the 2007 IFA slide presentation was displayed or to how large the viewing audience was (even though it was apparently drafted and presented by an employee of Petitioner’s parent company). Nor is the slide at issue relatively easy to copy: it’s a complex diagram with many different pieces of equipment and arrows shown. *See* Ex. Ex. 1006, at 8-9.

In *Mass. Inst. of Tech. v. AB Fortia*, 774 F.2d 1104, 1106, 1108-09 (Fed. Cir. 1985), the court held that a presentation given by the patentee, which was attended by 50 to 500 POSAs and later distributed to a number of individuals, was prior art. Again, Petitioner here has not provided the specificity concerning who attended and their level of skill in the art required to show that the 2007 IFA slide presentation was prior art. Finally, in *Jazz Pharms., Inc. v. Amneal Pharms., Inc.*, 895 F.3d 1347, 1356 (Fed. Cir. 2018), the court and the Board specifically found that there was evidence that the presentation at issue was publicly available two months before the critical date. As discussed above, Petitioner has provided no evidence supporting the contention that the slide deck was publicly available at all.

Because Petitioner has failed to show that the 2007 IFA slide presentation was publicly available before the Critical Date, at least Ground 1 should not be instituted.

2. The Petition Fails to Show how *2007 IFA* Anticipates Claim 1

Limitation 1[c] of Claim 1 requires “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 points to the “gas turbine” in *2007 IFA* (EX1006) and relies on expert testimony to assert that this claim limitation is met: “A POSA would have understood that, by definition, a gas turbine operates by means of combustion and therefore includes a ‘furnace.’” Petition at 17 (citing EX1005 ¶¶ 56, 60). However, for the reasons explained above in Section V(A), the gas turbine of *2007 IFA* is not a “furnace” as claimed in Claim 1 of the ’168 Patent. At best, *2007 IFA* proposes only that excess H₂ may be used for electricity production, not as fuel in a furnace of the reforming process. EX2006 ¶ 59. And Ground 1 only asserts anticipation based on *2007 IFA* for Claim 1—no obviousness grounds for Claim 1 based on *2007 IFA* are asserted. *See* Petition at 1. For at least this reason, even if *2007 IFA* qualifies as prior art, Petitioner fails to meet its burden for Ground 1.

C. Ground 2: The Petition Fails to Show how *Rytter* Anticipates or Renders Obvious Claim 1

Ground 2 in the Petition asserts that *Rytter* anticipates or renders obvious Claim 1 of the '168 Patent. Grounds 2A through 2C 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 Ground 2, Grounds 2A through 2C fail for at least the same reasons.

Rytter, titled “Cogeneration of Methanol and Electrical Power,” is specifically directed at the production of, as the title suggests, methanol and electrical power—not ammonia.

As discussed above, limitation 1[c] of Claim 1 requires “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*”

The Petition does not identify which of the components of *Rytter* it is citing as the claimed “at least one furnace.” *Id.* at 42. This is for good reason, as *Rytter* discloses that the referenced “heat-generating stations” are using fuel for the station’s “gas turbines” “in the production of electrical power.” EX1008 at 1:33-36. Just as with 2007 IFA, the gas turbine of *Rytter* is not a “furnace” as that term is defined by the '168 Patent. *Rytter* is not focused on improvements in the conversion section but targets potential efficiency improvements derived from using the syngas for the co-generation of methanol, dimethyl ether (DME), and electricity. EX1008,

at 4:63-67 (“Further, it will be beneficial that the streams from the reformer are distributed between the methanol synthesis reactor and heat generating station depending on the demand of methanol, dimethyl ether and oxidation products thereof and electrical power respectively.”); *id.* at 6:8-12 (“The surplus of the hydrogen, which is separated in the separator 6, may be passed to a hydrogen power station 7, which is also supplied with air for the combustion of the hydrogen gas to steam producing electrical power.”). Methanol synthesis, unlike ammonia synthesis, utilizes carbon (the carbon in CO and CO₂) and processes focused on methanol synthesis will therefore have less CO₂ emissions to manage as compared to processes focused on ammonia synthesis. EX2006 ¶ 62.

Petitioner’s cited expert testimony, EX1005 at Paragraphs 96, 142-143, does not cure the deficiencies in the Petition. In Paragraph 96, Petitioner’s expert identifies multiple purported uses of a hydrogen stream but fails to specifically identify any as the “furnace” of limitation 1[c]. Paragraphs 142-143 recite “at least one furnace” but then merely string cite the same citations from *Rytter* as the Petition and parrot the same quoted language. *Compare* EX1005 at ¶ 142, *with* Petition at 42. Finally, the expert testimony describing the purported “rationale for combining *Rytter* and ordinary knowledge” for obviousness does not address the “furnace” limitation (noting “used for fuel” without discussion of what component the fuel is fueling).

For at least these reasons, Petitioner fails to meet its burden for Ground 2.

D. Ground 3: The Petition Fails to Show how *Fjellhaug* Anticipates or Renders Obvious Claim 1

Ground 3 in the Petition asserts that *Fjellhaug* anticipates Claim 1 of the '168 Patent, and Ground 3B asserts that *Fjellhaug* in view of *Rytter* renders Claim 1 obvious. Grounds 3A, 3C, and 3D 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 3 and 3B, Grounds 3A, 3C, and 3D fail for at least the same reasons.

Fjellhaug, titled “Process For Generating Electric Energy, Steam and Carbon Dioxide From Hydrocarbon Feedstock,” is specifically directed at low CO₂ electricity generation—not ammonia production: “The main object of the present invention is to provide an improved process for generating power.” EX1010, at 2:55-56. As explained below, Petitioner fails to meet its burden for Grounds 3 and 3B 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;

Fjellhaug does not disclose conversion with oxygen-enriched air or with oxygen. The Petition admits that *Fjellhaug* discloses an “air driven” ATR unit.

Petition at 54; EX1010, at 2:13-20; 2:43-48; 3:6-7; 6:16. But *Fjellhaug* expressly *teaches away* from using “an oxygen driven reactor.” EX1010, at 2:13-20 (emphasis added):

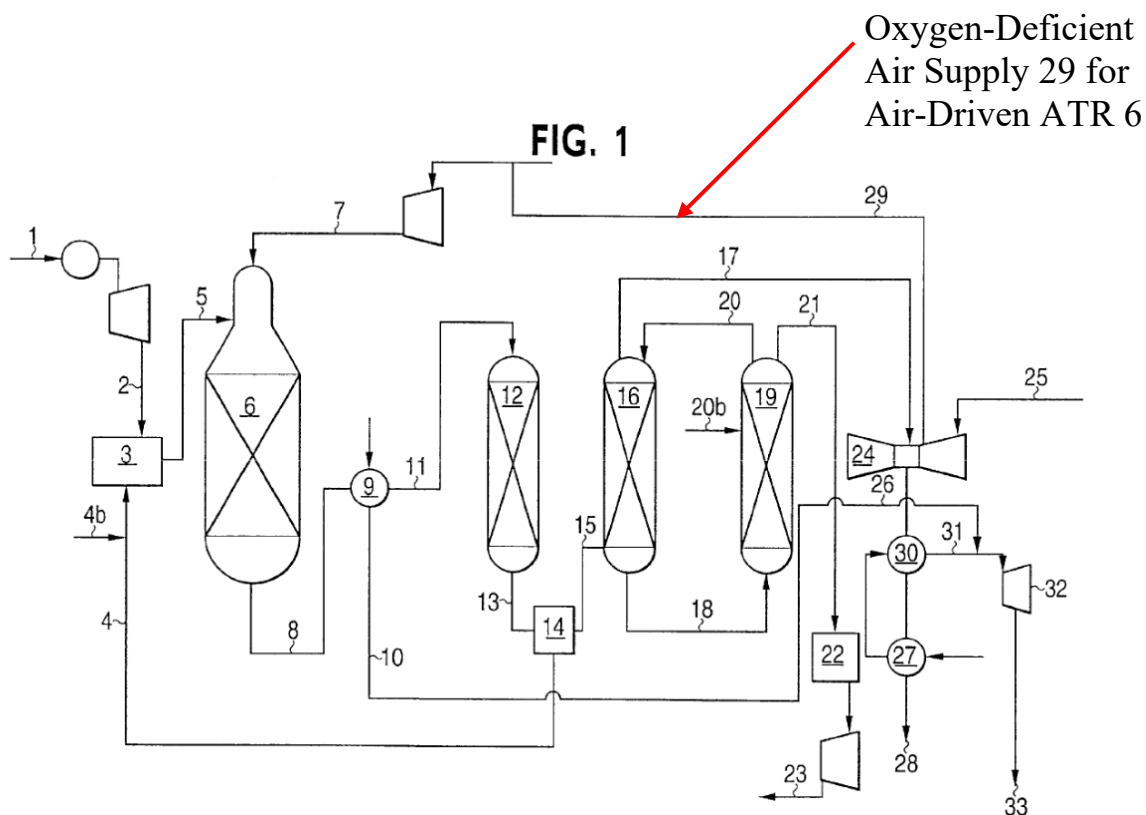
Having considered various methods, the inventors found that an ATR would give several advantages and it was decided to investigate further the best way of running the ATR. ***Contrary to what was taught by the above Japanese patent application, it was found that the ATR should be an air driven reactor, i.e., not an oxygen driven reactor.***

Relying on expert testimony, the Petition asserts that a POSA would have understood that the air supplying the ATR is “oxygen-enriched” based on the statement at *Fjellhaug* 3:28-29 that “at least part of the exhaust from the gas turbine can be recycled to the ATR as an oxygen source or combined with the air supply to the gas turbine.” Petition at 54.

The Petition ignores, however, that the exhaust from the gas turbine is primarily steam and nitrogen, with minor amounts of oxygen being present only if the turbine was supplied with excess air. EX2006 ¶ 71. The oxygen source referred to in *Fjellhaug* 3:28-29 is primarily in the form of the steam that is required by the ATR unit. *Id.* The air component of the turbine exhaust would be highly ***oxygen-deficient***, so a POSA reviewing *Fjellhaug* would not expect that the addition of any oxygen from the gas turbine exhaust would create ***oxygen-enriched*** air. *Id.*

As explained by *Fjellhaug*, the gas stream 17 fed to the gas turbine 24 “consists mainly of hydrogen and nitrogen, with minor amounts of CO, CO, CH.” EX1010, at 4:33-37. Air 25 is also supplied to the gas turbine 24. *Id.* Combustion in the gas turbine (“for production of electric energy” (EX1010 at Abstract)) uses the oxygen in Air 25. As explained by *Fjellhaug*, “part of an air supply 29 can be supplied from a gas turbine air compressor” with the remainder being “[a]t least part of the exhaust from the gas turbine.” *Id.* at 3:28-30, 4:6-8. The former has the composition of standard air (25) and as described above the turbine exhaust is highly oxygen deficient. Thus, the resulting air supply 29 (and compressed air supply through conduit 7) is oxygen-deficient air, that is, air that contains less oxygen than ambient air. EX2006 ¶ 72. A POSA would not expect that adding the turbine exhaust would create “oxygen-enriched air.”⁶ *Id.*

⁶ The compressor shown between stream 29 and conduit 7 would compress and perhaps heat stream 29; it would not change the composition of stream 29. *See* EX1010, at 3:67-4:1 (“Compressed air is supplied through a conduit 7 to the ATR 6”); EX2006 ¶ 73.



A POSA would further not look to the disclosure of *Rytter* “to supplement *Fjellhaug*.” See Petition at 63-64, *see also id.* at 59. The Petition asserts that “*Rytter* is relied on based on its teachings of well-known aspects of ATRs, e.g., that they can be supplied with oxygen and/or oxygen-enriched air.” *Id.* But beyond broadly stating that a “POSA would readily have relied upon *Rytter* to modify the disclosure of *Fjellhaug* to have optimum or workable ranges,” the Petition does not explain *why* a POSA looking at the complete process disclosed in *Fjellhaug* and its focus on generating energy would look to the complete process disclosed in *Rytter* and its disclosure of generating both methanol and power for improvements, beyond that “each reference is directed towards hydrocarbon synthesis.” See *In re Stepan Co.*, 868 F.3d 1342, 1346 (Fed. Cir. 2017) (“Stating that a person of ordinary skill in the

art would have arrived at the claimed invention through routine optimization falls short Missing from the Board’s analysis is an explanation as to *why* it would have been routine optimization to arrive at the claimed invention. Similar to cases in which the Board found claimed inventions would have been ‘intuitive’ or ‘common sense,’ the Board must provide some rational underpinning explaining why a person of ordinary skill in the art would have arrived at the claimed invention through routine optimization.”)

The Petition further does not explain specifically *how* a POSA would modify the process of *Fjellhaug* to incorporate “steps disclosed” in *Rytter*, or even identify what specific “steps” would be removed from *Fjellhaug* and replaced with “steps” from *Rytter*. See Petition at 63-64. Instead, the Petition relies on hindsight to broadly assert that a “POSA would have known that one process that discloses, e.g., conversion of natural gas in a conversion section, a CO-shift reaction, and CO₂ removal, ***could be modified by applying process steps used in another process*** that discloses the same overlapping steps. *Id.* (emphasis added); *In re Van Os*, 844 F.3d at 1361.

Further, as noted above, *Fjellhaug* teaches away from using an oxygen-driven ATR in its process. EX1010, at 2:13-20 (“[I]t was found that the ATR should be an air driven reactor, i.e., not an oxygen driven reactor.”); EX2006 ¶ 74. Petitioner’s expert, Dr. Ritter, does not acknowledge this disclosure in *Fjellhaug* when opining

that “a POSA would have been motivated to modify the conversion section disclosed in *Fjellhaug* to be supplied with oxygen or oxygen-enriched air, as disclosed in *Rytter*.” EX1005, at ¶ 279. Even assuming “it was well-known in the art to supply a conversion section, particularly an ATR, with oxygen or oxygen enriched air,” *id.*, a POSA looking at *Fjellhaug* would not look to make that modification, as the inventors appear to have expressly considered and rejected it: “it was decided to investigate further the best way of running the ATR. Contrary to what was taught by the above Japanese patent application, it was found that the ATR should be an air driven reactor, i.e., not an oxygen driven reactor.” EX1010, at 2:13-20; EX2006 ¶ 75; *see also Wenzhou Xin Xin Sanitary Ware*, IPR2023-01332, Paper 13, at 24 (denying institution where the primary reference “explicitly describes advantages associated with the approach [the primary reference] uses” and rejecting Petitioner’s conclusory assertions that modifying the primary reference “as the Petitioner proposes would minimize the number of components in the apparatus ‘for cost and reliability,’ and would provide ‘increased standalone stability.’”).

In addition, as expressly recognized by *Fjellhaug*, it would increase the cost of the process to use oxygen or oxygen-enriched air, and a POSA looking at *Fjellhaug* would not be looking for ways to make the process more expensive or resource intensive. EX2006 ¶ 76; EX1010, at 1:45-52 (when discussing the prior art: “This process requires oxygen, demanding a power consuming PSA [pressure swing

adsorption] unit. According to the application flow sheet, the natural gas must be decompressed nearly to ambient pressure to permit the addition of oxygen. After the PSA separation, the oxygen must be compressed a second time. All of these extra compressions reduce the efficiency of the process.”).

For at least these reasons, Petitioner fails to demonstrate a reasonable likelihood of success in its Ground 3 (alleged anticipation based on *Fjellhaug*) or Ground 3B (alleged obviousness of claim 1 based on *Fjellhaug* and *Rytter*).

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 55. The Petition points to “[t]he gas stream 17 ... used as fuel.” *Id.* (citing EX1010, at 4:64-65). But limitation 1[c] requires “said fuel fraction is fed as fuel *to at least one furnace*.” EX1001, at claim 1. *Fjellhaug* discloses that “[t]he gas stream 17 will then be used as fuel for a combined cycle gas turbine 24”—not a “furnace” as that claim term is expressly defined in the ’168 Patent. EX1010, at 4:34-36; *see also* Petition at 55 (annotated version of Fig. 2 of *Fjellhaug* showing a highlighted “gas stream 17” to “gas turbine 24.”).

The Petition’s reliance on expert testimony for this limitation is not helpful—the Petitioner’s expert Dr. Ritter acknowledges that “[t]he gas stream 17 will then be used as fuel for a combined cycle gas turbine 24” and fails to identify the claimed “furnace.” EX1005 at ¶ 110 (cited in the Petition for limitation 1[c]). As explained in Section V(A) *supra*, a gas turbine is not a “furnace” as claimed in claim 1. Rather, just like the gas turbines in *2007 IFA* and *Rytter*, the gas turbine 24 in *Fjellhaug* is used to produce electric energy. *See also* EX1001, at 7:44-53 (gas turbine may be used to produce electricity for the synthesis process).

The Petition’s reliance on *Rytter* to supplement *Fjellhaug* in Ground 3B also fails. The complete section for limitation 1[c] states: “*Fjellhaug* and *Rytter* disclose splitting the CO₂-depleted syngas stream into a first stream and a second stream. *See supra* Sections V(G)(1)(d); V(K)(1)(d).” Petition at 59. The Petition does not assert that *Fjellhaug* or *Rytter* disclose the claimed “furnace,” and the references to Sections “V(G)(1)(d)” and “V(K)(1)(d)” merely cite back to the deficient sections discussing limitation 1[c] for *Rytter* and *Fjellhaug* in Grounds 2 and 3, respectively. This Preliminary Response has already addressed the deficiencies in those sections.

For at least these reasons, Petitioner fails to demonstrate a reasonable likelihood of success in its Ground 3 (alleged anticipation based on *Fjellhaug*) or Ground 3B (alleged obviousness of claim 1 based on *Fjellhaug* and *Rytter*).

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 1, 2, 3, and 3B 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 7,184 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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