

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 REPLY IN SUPPORT OF CONTINGENT MOTION
TO AMEND UNDER 37 C.F.R. § 42.121 INCLUDING REQUEST FOR
PRELIMINARY GUIDANCE**

TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	THE NUMBER OF PROPOSED SUBSTITUTE CLAIMS IS REASONABLE.....	1
III.	THE PROPOSED SUBSTITUTE CLAIMS RAISED NO “NEW ISSUES”	1
IV.	PETITIONER HAD NOT SHOWN UNPATENTABILITY	2
A.	Proposed Substitute Claim 24 is Patentable.....	2
1.	Claim 24 is not anticipated or obvious over 2007 IFA.....	2
2.	Claim 24 is not anticipated or obvious over Rytter	4
3.	Claim 24 is not obvious over Fjellhaug in view of Rytter.....	5
4.	Claim 24 is not obvious over Terrien in view of Rytter	5
B.	Proposed Substitute Claim 25 is Patentable.....	5
1.	Claim 25 is not obvious over 2007 IFA in view of the '058 Patent and further in view of KAP 2004	5
2.	Claim 25 is not obvious over Terrien in view of the knowledge of a POSA, the '058 Patent, and KAP 2004	8
3.	Claim 25 is not obvious over Rytter or Fjellhaug in view of the '058 Patent and KAP 2004	10
C.	Proposed Substitute Claim 26 is Patentable.....	12
D.	Proposed Substitute Claim 27 is Patentable.....	12
V.	CONCLUSION.....	12

TABLE OF EXHIBITS

Exhibit No.	Description
2007	Expert Declaration of Colin A. Wolden, Ph.D., in Support of Patent Owner Response
2008	Transcript from April 30, 2026 Deposition of James Ritter, Ph.D.
2012	EP 17195305.2 (“EP ’305.2”)
2017	Transcript from September 2, 2026 Deposition of James Ritter, Ph.D.

I. INTRODUCTION

Patent Owner Casale SA (“Casale” or “Patent Owner”) files this Reply in support of its Motion to Amend (“MTA”) to address issues raised in Petitioner’s Opposition (“Opp.”). To date, the Board has not provided preliminary guidance pursuant to 37 C.F.R. § 42.121(e) as requested in the MTA. Paper 34 at 1.¹

II. THE NUMBER OF PROPOSED SUBSTITUTE CLAIMS IS REASONABLE

The proposed number of substitute claims complies with all requirements of 37 C.F.R. § 42.121. As described in Paper 34, the substitute claims respond to a ground of unpatentability, do not enlarge the scope of original Claim 10, and are needed from a validity perspective to cover each of the independently recited options in original Claim 10.

III. THE PROPOSED SUBSTITUTE CLAIMS RAISED NO “NEW ISSUES”

Petitioner may only respond to *new issues* arising from the proposed substitute claims and for such new issues may include evidence responsive to the amendment. Trial Practice Guide (Nov. 2019) at 72. The substitute claims do not

¹ Patent Owner reserves the right to seek additional briefing in response to any Preliminary Guidance, if issued, by the Board. Patent Owner anticipated receiving the Preliminary Guidance four weeks after the filing of the Opposition (*i.e.*, on or after August 24, 2026) pursuant to the Scheduling Order. Paper 24 at 10.

introduce any new issue, and Petitioner should not be permitted rely on new evidence. As described in Paper 34, the substitute claims merely separate the alternative options recited in original Claim 10 to allow them to be addressed separately rather than collectively. For this reason alone, the opposition arguments based on the new evidence may be disregarded and, if necessary, the amendments may issue.

IV. PETITIONER HAD NOT SHOWN UNPATENTABILITY

Even considering the new references, including the '058 Patent, KAP 2004, and Terrien, Petitioner fails to demonstrate the substitute claims are unpatentable.

A. Proposed Substitute Claim 24 is Patentable

1. Claim 24 is not anticipated or obvious over 2007 IFA

2007 IFA cannot anticipate Claim 24. As described in Paper 34, 2007 IFA does not disclose a “fuel fraction...feeds a steam production and/or superheating furnace” recited in Claim 24, nor does 2007 IFA disclose “fuel fraction is fed as fuel to at least one furnace” as recited in original Claim 1, which Claim 24 depends from. Thus, 2007 IFA does not recite all the recited limitations of Claim 24 and does not anticipate Claim 24.

Petitioner further alleges Claim 24 is obvious over 2007 IFA because the substitution of the hydrogen fuel “to the auxiliary or package steam boiler uses a known technique on a known device for its intended purpose, with predictable results.” Opp. at 10. First, Petitioner ignores differences between the slides shown

on the bottom of page 8 and the bottom of page 9, respectively. EX2007 ¶¶67-71. The order of the slides and the labels of the components contained therein reflect that 2007 IFA discloses distinct processes. *Id.* Petitioner’s expert agrees that “the presentation’s labeling is deliberate,” EX1068 ¶24, and the slides use different terms to mean different things. There is no “auxiliary or package steam boiler” contemplated on the second slide of page 9. EX1006 at 9. Further, “H₂ fuel” is introduced for the first (and only) time on the second slide of page 9, and it is expressly feeding a **gas turbine**, not any “steam system.” Opp. at 10. A POSA would not “route the H₂ fuel [to the unidentified “steam system”] as a matter of course” because the slide already shows the H₂ fuel expressly “routed” to the gas turbine for the production of electricity (the “power cycle”). Opp. at 10; EX1006 at 9.

Second, Petitioner fails to recognize that the purpose of 2007 IFA is not only to reduce CO₂ emissions, but also to “[i]mprove efficiency of... power generation unit in the complex.” EX1006 at 8. The design in 2007 IFA improves power generation by integrating a gas turbine driver, which the H₂ fuel feeds. *Id.* Substituting the flow of the H₂ fuel to the auxiliary or package steam boiler instead of the gas turbine driver would interfere with the intended purpose of improving power generation, as neither the auxiliary or package steam boiler provide power generation alone. *Id.* Thus, the substitution would render 2007 IFA inoperable for its intended purpose. Second, the substitution does not yield predictable results as

alleged. As described above, the substitution provided by the Petitioner would interfere with the design provided in 2007 IFA. At best, the substitution would require extensive undue experimentation and redesign, and the Petitioner does not provide any evidence to the contrary.

2. Claim 24 is not anticipated or obvious over Rytter

Claim 24 is neither anticipated nor obvious over Rytter. As described in Paper 34, Rytter does not disclose a “fuel fraction . . . feeds a steam production and/or superheating furnace” recited in Claim 24, and Rytter does not disclose “fuel fraction is fed as fuel to at least one furnace” as recited in original Claim 1, which Claim 24 depends from. *See* EX1066 at 309:21-323:20 (“The hydrogen power station is where electricity is produced. That requires a turbine. This patent explicitly and only describes the use of a gas turbine. So anyone, I think, would conclude that the gas turbine is in 7.”). Thus, Rytter does not recite all the recited limitations of Claim 24 and cannot anticipate Claim 24. Further, the modification could not be obvious as replacing the power generator, the sole recipient of a CO₂ depleted syngas in Rytter, with a steam production furnace and/or a superheating furnace would deprive Rytter of electrical energy used to power the air separator, the hydrogen and carbon dioxide separator, and compressor for carbon dioxide, rendering Rytter inoperable. *See* EX2017 at 48:3-10; EX1008 at Fig. 1, 6:16-20.

3. Claim 24 is not obvious over Fjellhaug in view of Rytter

As described above in § IV(A)(2), Rytter cannot cure the deficiency of Fjellhaug, and Claim 24 is not obvious over Fjellhaug in view of Rytter for at least that reason alone, in addition to the reasons presented in the MTA. MTA at 22-24.

4. Claim 24 is not obvious over Terrien in view of Rytter

As described in Paper 34 and above, Rytter does not disclose a furnace. Therefore, Rytter cannot cure the deficiencies of Terrien (see below) and Claim 24 is not obvious over Terrien in view of Rytter for at least that reason alone.

B. Proposed Substitute Claim 25 is Patentable

1. Claim 25 is not obvious over 2007 IFA in view of the '058 Patent and further in view of KAP 2004

The Petitioner alleges “[t]he '058 Patent and KAP 2004 supply a core factual predicate for both Claims 25 and 26: a single, integrated fired heater.” Opp. at 14. The Petitioner then alleges the combination of 2007 IFA with '058 Patent and KAP 2004 render Claim 25 obvious. *Id.*

Petitioner has merely cherry picked a “heater” from the '058 patent to allege that KAP 2004 and 2007 IFA could be modified to include the claimed heater. This combination is based solely on hindsight and has no expectation of success and is not a legally supported combination. For example, Petitioner admits that even the heater from the '058 patent does not combust the same CO₂-depleted syngas fraction as claimed and would still require further modification, including fuel selection,

which is a non-trivial element for a heater. Specifically, Petitioner alleges that modifying 2007 IFA with the gas heater 210 of the '058 patent would succeed because the gas heater 210 is “a standard fired heater... and firing it with hydrogen-rich fuel required only routine burner selection.” *Id.* at 17-18.

Even if “burner selection” for a heater were “routine,” there is no disclosure in 2007 IFA that would support using a heater such as the gas heater 210 in the '058 patent. In the '058 Patent, the heater does not receive the same fuel fraction used in the 2007 IFA system. Instead, the gas heater 210 receives an off gas comprising 6.82% methane, 47.6% hydrogen, 1.87% carbon monoxide, 43.2% nitrogen, and 0.6% argon. '058 Patent, Table 1.² There is no evidence the heater of the '058 patent could even be modified to accept the H₂ fuel 2007 IFA sends to a gas turbine. Moreover, 2007 IFA further requires the production of 1350 tons of ammonia per day. 2007 IFA at 9, top slide. In the alleged combination, the heater from the '058 Patent would have to supplant the heat provided by combusting natural gas used in the 2007 IFA system to provide the heat required to produce 1350 tons of ammonia per day using the elements from 2007 IFA. Such an output is hardly “routine.” For

² The '168 Patent explicitly discloses using “purge flow obtained...from a PSA unit” as fuel under “Prior Art.” '168 Patent at 1:63-2:2. Petitioner’s expert admits that the '058 Patent merely discloses the same concept. EX2017 at 33:9-13.

example, the '058 Patent discloses the “small fuel-fired heater 210” can support the production of about 84 kilograms of ammonia per hour, whereas 2007 IFA discloses production of 56.25 tons of ammonia per hour. *See* EX1064, Table 1 (calculating the maximum amount of ammonia production from the reported from 7406.1 moles/hr of H₂ and 2990.7 moles/hr of N₂ and converting to kg/hr), *see also* EX1006 at 9.

Petitioner has not provided any evidence supporting any likelihood of success that the gas heater 210 from the '058 patent can even be modified to support the suggested combination (even if burner selection is “routine”). Success is unlikely because using the heater of the '058 patent with the system of 2007 IFA would render 2007 IFA inoperable for its intended purpose. The Petitioner alleges the disclosure in 2007 IFA only leaves one design question: “which fired equipment receives the fuel.” *Opp.* at 17. However, the Petitioner fails to consider the totality of 2007 IFA design. 2007 IFA emphasizes the integration of a gas turbine driver in the ammonia process. 2007 IFA at 8-9. The gas turbine provides *electrical* energy needed in the integrated design of 2007 IFA to produce ammonia. *Id.* at 9. On the other hand, the heater of the '058 Patent only combusts fuel to heat methane and does not provide any electrical energy. If, as argued by the Petitioner, the alleged fuel fraction feeds the gas heater 210 from the '058 Patent, there is nothing left in the design of 2007 IFA to supply the rest of the plant with sufficient electrical energy other than resorting to the use of natural gas to feed the gas turbine—either the plant would fail

to produce ammonia or combust natural gas and produce CO₂ emissions. Therefore, the combination as argued by the Petitioner would render the ammonia plant described in 2007 IFA unsatisfactory for its intended purpose.

2. Claim 25 is not obvious over Terrien in view of the knowledge of a POSA, the '058 Patent, and KAP 2004

Petitioner alleges Claim 25 is “obvious over Terrien³ combined with ordinary knowledge documented by the 058 Patent and KAP 2004.” Opp. at 19.

Claim 1, which Claim 25 depends from, recites “a conversion section including an autothermal reformer downstream from a pre-reformer and without a primary reformer therebetween.” Claim 25 also recites “said fuel fraction... feeds... said furnace for pre-heating the charge of the autothermal reformer.”

Terrien does not disclose all the limitations of Claim 1, as Petitioner alleges. For example, Petitioner alleges ¶ 74 of Terrien recites the recited arrangement of the pre-reformer and the ATR as recited in Claim 1. *Id.* at 24. But ¶ 74 of Terrien actually describes a pre-reformer 21 used to feed a steam methane reformer, not an ATR.

³ Petitioner previously identified Terrien in a second petition for IPR, IPR2025-01455, which was discretionarily denied. Petitioner appears to be using its Opposition (and accompanying new 56-page declaration) as an improper backdoor to introduce the same arguments. *See, e.g.*, Opp. at § X (“The Terrien-Based Grounds Independently Establish the Claim 1 Limitations”).

EX1007 ¶¶ [0074] – [0075]. For example, Terrien teaches a “pre-reformer (21) to form a pre-reformed gas stream (22)” and “reforming the pre-reformed gas stream (22)... in a stream [sic] methane reformer unit (23).” *Id.* As described throughout Terrien, part (23) corresponds to a steam methane reformer unit, which requires external heat to produce syngas as opposed to an ATR which instead uses partial oxidation to generate the heat to produce syngas. *See* EX1008, Col. 6, lines 22 – 46; EX1027, pg. 74. A steam methane reformer is a primary reformer. Thus, Terrien’s conversion section is just like that of Licht, which was expressly considered during Supplemental Examination. EX2007 ¶¶ 55-58, 131-135; EX1009. In any case, Terrien does not disclose “a conversion section including an autothermal reformer downstream from a pre-reformer and without a primary reformer therebetween.” At best, Terrien teaches only a conversion section with a standalone ATR, but not the recited arrangement in Claim 1 or Claim 25. *See* EX1007 at FIGs. 1, 5 – 7.⁴

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. The Petitioner appears to rely on impermissible hindsight to reach

⁴ Further, the ’058 Patent does not disclose a pre-reformer, and Petitioner’s expert admits the ammonia plant disclosed in KAP 2004 “is not the ATR-without-primary-reformer configuration that claim 1 requires.” EX1064 at FIG. 1; EX1063 ¶ 27.

ammonia synthesis. Opp. at 24 (“ammonia synthesis is a canonical downstream use of Terrien’s hydrogen”). The only reference to “ammonia” in Terrien is for use as “an external coolant” for cooling a carbon dioxide rich stream. EX1007 at [0039]. Because Terrien is directed specifically to the production of hydrogen and carbon dioxide as opposed to ammonia production or the Fischer—Tropsch process, which uses carbon monoxide, Terrien would not be combined with the ’058 Patent or the cited portion of KAP 2004, as they are specifically designed for ammonia synthesis and gas-to-liquids production via the Fischer—Tropsch process. EX1064, Col. 1, lines 5-9, *see* EX1065, pg. 45. Further, Petitioner does not explain why a POSA would specifically take “Terrien’s hydrogen” and use it with the so-called “ATR-to-ammonia” route of the ’058 Patent or KAP 2004 when Terrien never contemplates ammonia synthesis. Why use *this* hydrogen?

3. Claim 25 is not obvious over Rytter or Fjellhaug in view of the ’058 Patent and KAP 2004

Similarly to 2007 IFA, the combination of the ’058 Patent with Rytter or Fjellhaug would render both references inoperable for their intended purpose. Rytter is directed to the co-generation of methanol and electrical power. EX1008, Title. Rytter discloses hydrogen can be fed to a hydrogen power station 7. *Id.* at Col 6, lines 9-10. Rytter further describes the “energy from the hydrogen power station 7 may be used in the air separator 3, the separator 6... and for the compression of carbon dioxide from the separator 6.” *Id.* at Col 6, lines 16-19. In contrast, the gas

heater 210 from the '058 Patent does not produce electrical power. If the gas heater 210 is fed hydrogen in lieu of the hydrogen power station 7, the air separator 3, the separator 6, and the compression unit would lose their only power source or would have no other power generator (nor fuel for such power generator) and the system of Rytter would be unable to co-generate electrical power and methanol, or at best require extensive undue experimentation and redesign to operate. Therefore, one of ordinary skill would not combine the gas heater 210 from the '058 Patent with the teachings of Rytter.

Fjellhaug also teaches a combustng hydrogen gas “in a combined cycle gas turbine for production of electric energy.” EX1010 at Abstract. To produce electrical power, Fjellhaug teaches hydrogen gas stream 17 is “used as fuel for a combined cycle gas turbine 24.” *Id.* at Col. 4, lines 34-35. The exhaust from the turbine 24 “is supplied to a power generator 32.” *Id.* at Col. 4, lines 44-45. By feeding hydrogen stream 17 to the gas heater 210 instead of the turbine 24, the system as taught in Fjellhaug would similarly lose the ability to produce electrical power, rendering the system inoperable as with Rytter require substantial undue experimentation and redesign to be able to operate, no solutions of which have been proposed by Petitioner. Therefore, one of ordinary skill in the art would not combine the gas heater 210 from the '058 Patent with the teachings of Fjellhaug.

C. Proposed Substitute Claim 26 is Patentable

Petitioner alleges the same combinations described in §IV(B) render Claim 26 obvious. Opp. at 21-22. Claim 26 recites “fuel fraction...feeds said at least one furnace of a natural gas desulphurization section.” Like Claim 25, Claim 26 recites a furnace for preheating and includes the claim 1 limitations. Thus, the cited art does not render Claim 26 unpatentable for the same reasons described above in § IV(B).

The Petitioner also alleges Claim 26 lacks written support. *Id.* at 22-23. For at least the reasons stated in Paper 34 § VIII(C), Claim 26 is supported by the disclosure of EP '305.2. Moreover, implicit support also satisfies the requirements of 35 U.S.C. § 112(a) for amended claims. *See* MPEP § 2163(I)(B). Support may also be found in the claims. “[I]t is now well accepted that a satisfactory description may be found in originally-filed claims.” *Id.* Claim 7 of the originally filed application recites a process “wherein said fuel fraction (14) of the synthesis gas feeds one or more of the following apparatuses: ...one or more furnaces for pre-heating the charge of... natural-gas desulphurization section.” Contrary to the Petitioner’s assertion, Patent Owner clearly had possession of the subject matter of Claim 26 at the time of filing.

D. Proposed Substitute Claim 27 is Patentable

Claim 27 is patentable for the same reasons presented in §IV(B) and the MTA.

V. CONCLUSION

For the reasons above and those in the MTA, if the Board finds that Claim 1 and original Claim 10 are unpatentable, the Board should grant this MTA.

Respectfully submitted on September 8, 2026, by:

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CERTIFICATE OF COMPLIANCE WITH PAGE LIMITS

Pursuant to 37 C.F.R. § 42.24(d), I certify that this Reply complies with the page limit requirements of 37 C.F.R. §§ 42.24(c)(3) because it contains 12 pages, excluding the parts of that are exempted.

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e)(4), the undersigned certifies that on September 8, 2026, a complete and entire copy of this PATENT OWNER'S REPLY IN SUPPORT OF CONTINGENT MOTION TO AMEND UNDER 37 C.F.R. § 42.121 INCLUDING REQUEST FOR PRELIMINARY GUIDANCE was served on the Petitioner via electronic mail at the following addresses:

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