

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

REG SYNTHETIC FUELS, LLC,
Petitioner,

v.

NESTE OIL, OYJ,
Patent Owner.

IPR2018-01375
Patent 8,859,832 B1

Before RAE LYNN P. GUEST, CHRISTOPHER L. CRUMBLY, and
AVELYN M. ROSS, *Administrative Patent Judges*.

ROSS, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Claims Unpatentable
Granting Patent Owner's Motion to Amend
35 U.S.C. § 318(a)

I. INTRODUCTION

REG Synthetic Fuels, LLC (“Petitioner” or “REG”) filed a Petition requesting *inter partes* review of claims 1–20 of U.S. Patent No. 8,859,832 B2 (Ex. 1001, “the ’832 patent”). Paper 2 (“Pet.”). Neste Oil, Oyj (“Patent Owner” or “Neste”) filed a Preliminary Response to the Petition. Paper 6 (“Prelim. Resp.”).

Upon consideration of the Petition, the Preliminary Response, and the parties’ evidence, we determined that Petitioner had demonstrated a reasonable likelihood that it would prevail with respect to at least one claim of the ’832 patent. Paper 11 (“Decision on Institution”). Thus, pursuant to the Supreme Court’s decision in *SAS Institute Inc. v. Iancu*, 138 S. Ct. 1348, 1355 (2018), and the USPTO Guidance¹, we instituted review of all challenged claims on all challenged grounds. *Id.*

Following institution of trial, Patent Owner filed a Patent Owner Response (Paper 17, “PO Resp.”), Petitioner filed a Reply (Paper 22, “Pet. Reply”), and Patent Owner filed a Surreply (Paper 26, “Surreply”). In support of their respective positions, Petitioner relies on the testimony of Dr. Edward L. Sughrue II (Ex. 1002, “Sughrue Decl.”; Ex. 1050, “2nd Sughrue Decl.”), and Patent Owner relies on the testimony of Dr. Michael T. Klein (Ex. 2002, “Klein Decl.”).

After institution, Patent Owner filed a contingent Motion to Amend, proposing substitute claims 21–24. Paper 19 (“Motion to Amend” or

¹ In accordance with USPTO Guidance, “if the PTAB institutes a trial, the PTAB will institute on all challenges raised in the petition.” See USPTO, Guidance on the Impact of SAS on AIA Trial Proceedings (April 26, 2018) (available at <https://www.uspto.gov/patents-application-process/patent-trial-and-appeal-board/trials/guidance-impact-sas-aia-trial>) (“USPTO Guidance”).

“MTA”). Subsequently, Petitioner filed an Opposition to Patent Owner’s Motion (Paper 23, “MTA Opp.”), Patent Owner filed a Reply in Support of its Motion (Paper 27, “MTA Reply”), and Petitioner filed a Surreply (Paper 30, “MTA Surreply”).

An oral hearing was held on November 26, 2019, and a transcript of the hearing is included in the record (Paper 35, “Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons discussed below, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–20 of the ’832 patent are unpatentable. We also grant Patent Owner’s Motion to Amend with respect to proposed substitute claims 21–24.

A. Related Proceedings

The Petitioner attests that “[t]he ’832 patent is not at present the subject of any other proceedings.” Pet. 3. Concurrently with the filing of this Petition, Petitioner also challenges US Patent No. 8,742,185 B2, which has been assigned case number IPR2018-01374.

B. The ’832 Patent (Ex. 1001)

The ’832 patent is titled “Process for the Manufacture of Diesel Range Hydrocarbons.” Ex. 1001, 1:1–2. The ’832 patent describes an improved process for the preparation of diesel range hydrocarbons from a biological feedstock that is first hydrotreated and then isomerized. *Id.* at 1:18–24, 5:23–40. By way of example, Figure 1 of the ’832 patent is reproduced below.

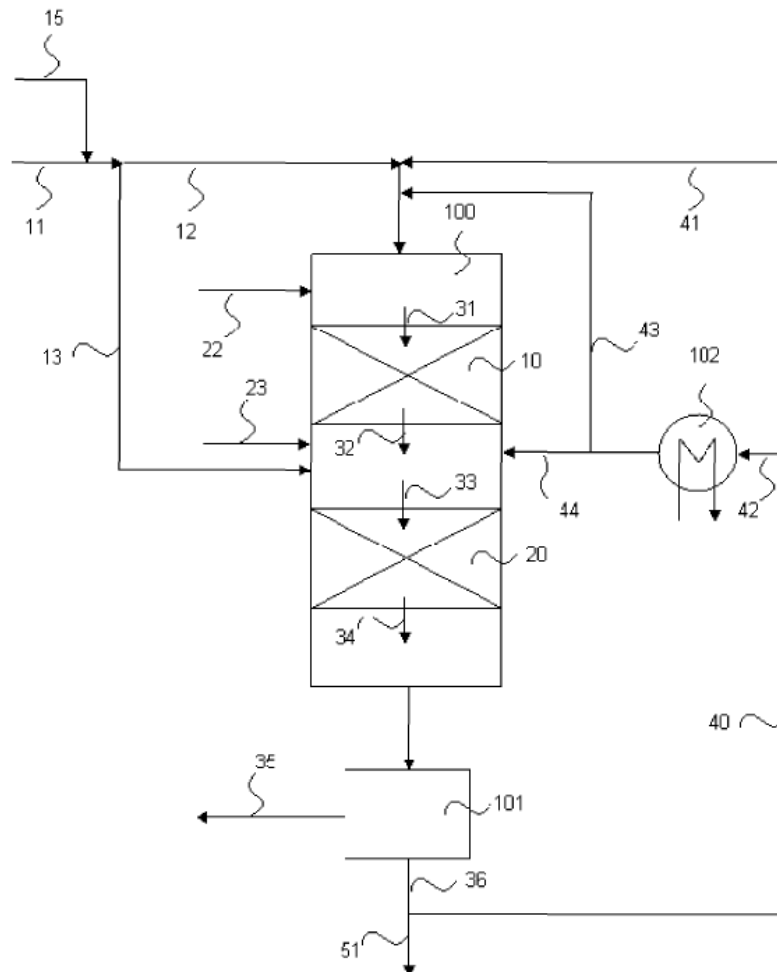


Fig. 1

Figure 1 “schematically shows the operation of the hydrotreatment process.”

Id. at 5:44–45. According to Figure 1, the hydrotreatment reactor 100 includes one or more catalyst beds 10 and 20 in series. *Id.* at 6:18–19. Biological feedstock 11, with sulfur concentration added at feed 15, is introduced as feed streams 12 and 13 onto catalyst beds 10 and 20. *Id.* at 6:19–28. The '832 patent explains that “the selectivity of decarb-reactions and the deoxygenation through decarb-reactions can be promoted during hydrotreating over the hydrotreatment catalyst, by using sulphur content of

50–20000 w-ppm.” *Id.* at 9:9–12. According to the ’832 patent, “[t]he specific sulphur content in the feed is able to double the extent of n-paraffins formed by removal of CO_x.” *Id.* at 9:14–16. After completion of the hydrotreatment step, the hydrotreated product 51 is subjected to an isomerization step using an isomerization catalyst. *Id.* at 7:20–21. An optional stripping step may occur after hydrotreatment and prior to isomerization of the hydrotreated product 51. *Id.* at 10:34–43. The isomerized product includes diesel range hydrocarbons. *Id.* at 10:57–62.

C. Illustrative Claim

Claim 1, the only independent claim subject to the instant *inter partes* review, is illustrative of the claimed subject matter and is reproduced below:

1. A process for the manufacture of diesel range hydrocarbons comprising the following steps:
introducing a feed comprising at least one organic or inorganic sulphur compound hydrogen, and a feedstock comprising bio oil and/or fat from renewable sources to a hydrotreatment step in which hydrocarbons are formed,
isomerizing the formed hydrocarbons in an isomerization step,
wherein gas phase impurities formed in the hydrotreatment step are removed from the stream comprising hydrocarbons prior to contacting the hydrocarbons with the isomerization catalyst.

Ex. 1001, 16:2–15.

D. Instituted Grounds of Unpatentability

We instituted trial to determine whether claims 1–20 of the ’832 patent would have been obvious in view of the following grounds of unpatentability (Decision on Institution 2, 24):

Claim(s) Challenged	35 U.S.C. §	References/Basis
1–20	103	Jakkula ² and Monnier ³ , as evidenced by Mag ⁴
8, 9	103	Jakkula, Monnier, and Craig ⁵ , as evidenced by Garrido ⁶
1–20	103	Jakkula and Oldrich ⁷ , as evidenced by EPA ⁸
1, 3–7, 10–13	103	Aalto ⁹ , Monnier, and Chou ¹⁰ , as evidenced by Gunstone ¹¹
2, 8, 9, 14–20	103	Aalto, Monnier, Chou, as evidenced by Gunstone, and further in view of Toeneboehn ¹² , and Reid ¹³

² EP 1 396 531 A2, to Juha Jakkula et al., published October 3, 2004 (Ex. 1005, “Jakkula”).

³ US 5,705,722, to Jacques Monnier et al., issued January 6, 1998 (Ex. 1006, “Monnier”).

⁴ TED MAG, CANOLA SEED AND OIL PROCESSING (Canola Counsel of Canada, 1994) (Ex. 1031, “Mag”).

⁵ US 4,992,605, to Wayne K. Craig et al., issued February 12, 1991 (Ex. 1022, “Craig”).

⁶ M.D. Garrido et al., *Concentrations of Metals in Vegetable Edible Oils*, 50 Food Chemistry 237 (1994) (Ex. 1023, “Garrido”).

⁷ CZ 285 575, to Svajgl Oldrich, issued May 3, 1998 (Ex. 1017, “Oldrich” English translation).

⁸ Environmental Protection Agency, *Regulatory Impact Analysis: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements*, December 2000 (Ex. 1034, “EPA”).

⁹ SE 520 633, to Pekka Aalto, issued August 5, 2003 (Ex. 1014, “Aalto” English translation).

¹⁰ US 5,906,729, to Tai-Sheng Chou, issued May 25, 1999 (Ex. 1015, “Chou”).

¹¹ F.D. GUNSTONE ET AL., *THE LIPID HANDBOOK* (Chapman & Hall 2 ed. 1994) (Ex. 1007, “Gunstone”).

¹² US 5,298,639, to Gabriella J. Toeneboehn et al., issued March 29, 1994 (Ex. 1008, “Toeneboehn”).

II. ANALYSIS

A. Principles of Law

In an *inter partes* review, the petitioner bears the burden of proving unpatentability of the challenged claims, and the burden of persuasion never shifts to the patent owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). To prevail in this proceeding, Petitioner must support its challenges by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). Accordingly, all of our findings and conclusions are based on a preponderance of the evidence.

Obviousness is a question of law based on underlying determinations of fact. *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966); *Richardson-Vicks, Inc. v. Upjohn Co.*, 122 F.3d 1476, 1479 (Fed. Cir. 1997). A claim is unpatentable as obvious, under 35 U.S.C. § 103, if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time of the invention to a person having ordinary skill in the art. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). Consideration of the Graham factors “helps inform the ultimate obviousness determination.” *Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1048 (Fed. Cir. 2016) (en banc), *cert. denied* (Nov. 6, 2017). To prevail in an

¹³ US 4,512,878, to Lloyd E. Reid et al., published April 23, 1985 (Ex. 1019, “Reid”).

inter partes review, Petitioner must explain how the proposed combinations of prior art would have rendered the challenged claims unpatentable.

Subsumed within the *Graham* factors are the requirements that all claim limitations be found in the prior art references and that the skilled artisan would have had a reasonable expectation of success in combining the prior art references to achieve the claimed invention. *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1361 (Fed. Cir. 2007). “Obviousness does not require absolute predictability of success . . . all that is required is a reasonable expectation of success.” *In re O’Farrell*, 853 F.2d 894, 903–04 (Fed. Cir. 1988) (citations omitted).

B. Level of Ordinary Skill in the Art

We review the grounds of unpatentability in view of the understanding of a person of ordinary skill in the art at the time of the invention. *Graham*, 383 U.S. at 17. Petitioner submits that the ordinarily skilled artisan would have possessed:

(i) a Ph.D. degree in Chemistry or Chemical Engineering or a related field, and about 3 years total of practical experience with refining, hydroprocessing, and biofuels; (ii) a Master’s degree in Chemistry or Chemical Engineering or a related field, and about 5 years total of practical experience with refining, hydroprocessing, and biofuels; (iii) a Bachelor’s degree in Chemistry or Chemical Engineering or a related field, and about 10 years total of practical experience with refining, hydroprocessing, and biofuels.

Pet. 11–12; *see also* Ex. 1002 ¶ 16 (same). Patent Owner contends Petitioner’s proposed level of ordinary skill in the art is “unreasonably high” and instead proffers that “a person of ordinary skill in the art at the time of the invention in July 2005 would have had a degree in chemical engineering or chemistry and at least two or three years of experience with processes for

manufacturing diesel-range hydrocarbons from biorenewable feed stocks.”
PO Resp. 4–5. Neither Petitioner nor Patent Owner indicates that the outcome of any arguments made in this case would change depending on the level of ordinary skill in the art. *See generally* Pet.; PO Resp. 5 (“Neste submits, however, that the ’832 patent claims are patentable over the prior art irrespective of the particular level of ordinary skill in the art.”).

We agree with the parties and determine that the ordinarily skilled artisan, in July 2005, would have had at least a degree in chemical engineering or chemistry and would have had several years of experience in processing and refining biofuels. We need not parse the particular amount of education or experience given that neither party asserts this determination would have had any effect on the arguments or analysis in this case. Indeed, the prior art itself demonstrates the level of skill in the art at the time of invention. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (explaining that specific findings on ordinary skill level are not required “where the prior art itself reflects an appropriate level and a need for testimony is not shown” (quoting *Litton Indus. Prods., Inc. v. Solid State Sys. Corp.*, 755 F.2d 158, 163 (Fed. Cir. 1985))).

C. Claim Construction

The Board interprets claims of an unexpired patent using the “broadest reasonable construction in light of the specification of the patent.” 37 C.F.R. § 42.100(b) (2016).¹⁴

¹⁴ The broadest reasonable construction standard applies to *inter partes* reviews filed before November 13, 2018. 77 Fed. Reg. 48727 (Aug. 14, 2012) (codified at 37 C.F.R. § 42.100(b)), as amended at 81 Fed. Reg. 18766 (Apr. 1, 2016); *see also* 83 Fed. Reg. 51340 (Oct. 11, 2018) (changing the

Petitioner provides proposed constructions for the terms “hydrocarbons,” “diesel range hydrocarbons,” “feedstock,” “renewable sources,” “hydrotreatment step,” “stripping,” “isomerization,” and “molecular sieve.” Pet. 8–11. Patent Owner does not dispute any proposed construction. *See generally* Prelim. Resp.; PO Resp. 5 (“[I]t is unnecessary for the Board to expressly construe any of the ’832 patent claim terms identified by REG.”). As Patent Owner notes, “REG does not apply its claim constructions in its proposed obviousness grounds, and Neste’s arguments in the Patent Owner Response do not depend on disputing any of REG’s proposed constructions.” PO Resp. 5; *see generally* Pet. and Pet. Reply.

We agree with Patent Owner that resolving the parties’ dispute does not depend on the constructions proffered by Petitioner. Therefore, we determine that it is not necessary to provide an express construction for any term of the ’832 patent. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (holding that only terms in controversy must be construed and only to the extent necessary to resolve the controversy) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng’g*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

D. Challenges based on the Combination of Jakkula and Monnier

Petitioner contends that the subject matter of claims 1–20 of the ’832 patent is rendered obvious by the combination of Jakkula and Monnier, as evidenced by Mag (claims 8 and 9). Pet. 13 (Ground I). Additionally, Petitioner contends that the subject matter of claims 8 and 9 is rendered

standard for interpreting claims in *inter partes* reviews filed on or after November 13, 2018).

obvious by the combination of Jakkula, Monnier, and Craig, as evidenced by Garrido. Pet. 28 (Ground II). For the reasons discussed below, we determine Petitioner has demonstrated by a preponderance of the evidence that claims 1–20 of the '832 patent are unpatentable under 35 U.S.C. § 103 as obvious over Jakkula in combination with Monier and/or one of Mag¹⁵, Craig¹⁶, or Garrido.¹⁷

1. Overview of the prior art

a. *Jakkula (Ex. 1005)*

Jakkula describes a process for producing a hydrocarbon product, useful in diesel fuels, from a biological material. Ex. 1005 ¶¶ 1, 13. Jakkula involves a two-step process—a hydrotreatment step (hydrodeoxygenation or HDO step) and an isomerization step. *Id.* ¶ 16. In the hydrotreatment step, the biological feedstock is fed, with hydrogen gas, over a catalyst bed system including one or more catalyst beds. *Id.* ¶ 20. Jakkula explains that “biological raw materials often contain nitrogen, sulphur, and phosphorus that are known catalyst poisons and inhibitors.” *Id.* ¶ 6. During the hydrotreatment step, gases including carbon monoxide, carbon dioxide, nitrogen, phosphorus, sulphur, and light hydrocarbons are removed. *Id.* ¶¶ 16, 23. The hydrotreatment step uses a nickel-molybdenum or cobalt-

¹⁵ Mag is used by Petitioner as evidence to provide support for “the purity of alkali-refined canola oil,” relevant to claims 8 and 9. *See e.g.*, Pet. 19, 25 (summary chart).

¹⁶ Petitioner relies on Craig to describe bio oils such as canola, rapeseed, sunflower, and soybean oils for HDO processes. Pet. 30, 31 (summary chart).

¹⁷ Petitioner relies on Garrido as evidentiary support to “confirm[] that edible canola oil has less than 30w-ppm phosphorus, less than 10 w-ppm alkali/alkaline earth metals, and less than 10 w-ppm other metals,” as claimed in claims 8 and 9. *See e.g.*, Pet. 30, 31 (summary chart).

molybdenum catalyst because “these catalysts hav[e] some resistance to catalyst poisons.” *Id.* ¶ 10. The product from the hydrotreatment step is then isomerized. *Id.* ¶ 26. An optional stripping step, to further remove gaseous impurities, may precede the isomerization step. *Id.*

b. Overview of Monnier (Ex. 1006)

Monnier similarly describes a process for producing additives for diesel fuels using a biomass feedstock. Ex. 1006, 1:11–13. According to Monnier, the feedstock (depitched tall oil) is “spiked” with sulfur “to avoid loss of the sulphided active sites on the catalyst surface and maintain catalyst activity.” *Id.* at 4:11–18. The feedstock is subjected to hydrotreatment with hydrogen in the presence of a cobalt-molybdenum catalyst. *Id.* at 2:44–55. The hydrotreated product is then separated into liquid and gas phases. *Id.* at 3:15–19. The gaseous phase is recycled into the hydrogen input and the liquid phase is fractionated. *Id.* at 3:19–25.

2. Petitioner’s Contentions (claim 1)

Petitioner asserts that the method recited by claim 1 of the ’832 patent is suggested by the combination of Jakkula and Monnier. Pet. 13. Petitioner contends that Jakkula describes a process for the production of a diesel range hydrocarbon using a biological feedstock that is hydrodeoxygenated, or hydrotreated, and then isomerized. *Id.* at 13–14. According to Petitioner, Jakkula explains that “oxygen, nitrogen, phosphorus and sulfur compounds and light hydrocarbons are removed as gas, including carbon monoxide and carbon dioxide,” during the hydrotreatment step. *Id.* at 14 (citing Ex. 1005 ¶¶ 16, 23). “Optionally, a stripping step before the isomerization” step may be implemented to remove gaseous impurities from the stream to avoid contact of these gases with the isomerization catalyst. *Id.* Petitioner

acknowledges that Jakkula “does not expressly disclose that the HDO feed includes at least one inorganic or sulfur compound,” but draws our attention to Monnier which “explicitly discloses adding sulfur compounds to a biological feedstock and hydrotreating the feedstock.” *Id.* at 15 (citing Ex. 1006, 2:51–55). Petitioner relies on Monnier’s disclosure that “both presulfiding the Ni-Mo catalyst and spiking the feed stream with 1000 ppm elemental sulfur . . . ‘avoid[s] loss of sulphided active sites on the catalyst surface and maintain[s] catalyst activity.’” *Id.* (citing Ex. 1006, 4:1–4–18). Therefore, Petitioner reasons that the person of ordinary skill in the art would have had reason to add elemental sulfur to the method of Jakkula “in order to avoid the loss of catalyst activity and would have reasonably expected such sulfiding to be successful.” *Id.* at 15–16 (relying on Ex. 1002 ¶ 104).

Patent Owner does not challenge Petitioner’s allegation that Jakkula and Monnier disclose all of the limitations in independent claim 1. Rather, Patent Owner asserts that the skilled artisan would not have had reason to combine Jakkula and Monnier to arrive at the claimed invention. Based on our review of the Petition and supporting evidence, we determine that Petitioner has established by a preponderance of the evidence that each of the limitations of claim 1 are present in Jakkula and Monnier. *See* Pet. 13–16, 22–23; Ex. 1005 ¶¶ 1, 8, 13, 16–17, 20, 23, 26, 32, 60; Ex. 1006, 2:51–55, 3:61–5:30; Ex. 1002 ¶¶ 38–49, 66, 102–104, 106–107. We address Patent Owner’s arguments below.

3. Patent Owner’s Arguments

Patent Owner argues that there is no reason to combine Jakkula with the teachings of Monnier to add an “organic or inorganic sulphur

compound” to a feedstock because such an addition violates the principle of operation of Jakkula. *See generally* PO Resp. 5–14. In particular, Patent Owner contends that Jakkula repeatedly removes sulfur from its process including in a prehydrogenation step, the hydrotreatment step, in a pre-isomerization purification step, and by utilizing a counter current operation in the isomerization step. *Id.* at 7–10 (citing Ex. 1005 ¶¶ 4, 6–7, 10, 20–22, 26, 37, 41–43, 51, 56, 60, 62, 73–74, Tables 2–3; Ex. 2002 ¶¶ 28–39; Ex. 1002 ¶ 105). Jakkula describes several advantages that are achieved through its processing of bio oil feedstock including improved catalyst performance through removal of catalyst poisons, improved low temperature performance, and improved diesel fuel yield. *Id.* at 11–12 (citing Ex. 1005 ¶¶ 62, 66, 73; Ex. 2002 ¶¶ 32, 40). As a result, Patent Owner contends that a person of ordinary skill in the art would not have had reason to add sulfur to the feedstock prior to hydrotreatment, especially where “the prior art did not recognize any such problems[, i.e., loss of sulphided active sites,] with Jakkula’s process.” *Id.* at 12. Patent Owner also asserts that Petitioner’s arguments “do not account for Jakkula’s repeated emphasis on removing sulphur,” rely on an “illusory unsupported alleged problem with sulphided active sites,” and arrives at the claimed invention using the combination of Jakkula and Monnier through improper hindsight.¹⁸ *Id.* at 13–14.

We are not persuaded that the combination of Jakkula and Monnier would be contrary to the principle of operation described in Jakkula. In considering whether a proposed modification would be obvious, we also

¹⁸ Patent Owner’s arguments with respect to Jakkula are similar to arguments previously raised and rejected by the Board in a different matter involving the same parties. *See REG Synthetic Fuels, LLC, v. Neste Oil Oyj*, IPR2014-00192, Paper 48, 11–18 (PTAB Jun. 5, 2015).

consider whether combining references would violate the principle of operation of the modified reference. *See In re Mouttet*, 686 F.3d 1322, 1332 (Fed. Cir. 2012). A principle of operation of a prior art reference is concerned with whether the apparatus or process described therein, once modified, will operate on the same principles as before, or said another way, whether it operates in or is capable of working in the same manner. *See id.* (affirming a Board decision that using electrical versus optical components “does not affect the operability of Mouttet’s broadly claimed device—a programmable arithmetic processor.”); *see also Univ. of Maryland Biology Inst. v. Presens Precision Sensing GmbH*, 711 Fed. Appx. 1007, 1011 (Fed. Cir. 2017) (unpublished) (finding that the proposed combination would not “require a substantial reconstruction and redesign of the elements shown . . . or change in its basic principles”); *Smartdoor Holdings, Inc. v. Edmit Indus., Inc.*, 707 Fed. Appx. 705, 709 (Fed. Cir. 2017) (unpublished) (affirming the PTAB where the asserted combination would operate in the same manner), *In re Holness*, 612, Fed. Appx. 999, 1007 (Fed. Cir. 2015) (unpublished) (affirming the PTAB where no evidence exists that “the bar code reader in Capuano is incapable of working for a rotational motion.”). What a reference teaches and how a proposed modification of a reference would change its principle of operation are underlying factual inquiries in an obviousness analysis. *See, e.g., Icon Health & Fitness, Inc. v. Strava, Inc.*, 849 F.3d 1034, 1046 (Fed. Cir. 2017) (addressing the Board’s factual findings with respect to a reference’s principle of operation). Importantly, “obviousness must be determined in light of *all the facts*, and . . . a given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine.” *Medichem, S.A. v.*

Rolabo, S.L., 437 F.3d 1157, 1165 (Fed. Cir. 2006) (emphasis added); see also *Winner Int’l Royalty Corp. v. Wang*, 202 F.3d 1340, 1349 n.8 (Fed. Cir. 2000) (“The fact that the motivating benefit comes at the expense of another benefit, however, should not nullify its use as a basis to modify the disclosure of one reference with the teachings of another. Instead, the benefits, both lost and gained, should be weighed against one another.”).

We find that Jakkula’s principle of operation for producing a hydrocarbon component using a biological raw material involves a two-step process—that is, a hydrodeoxygenation step followed by an isomerization step. Ex. 1005 ¶¶ 1, 7–8, 16 (stating that “[i]t was surprisingly found that the problems of the prior art processes may be avoided or at least substantially reduced by the process of the invention having at least two steps”). Jakkula’s disclosure as a whole supports our finding as to its principle of operation. *Id.* ¶¶ 1, 7–8, 16, 26, 42, Figs. 1–3.

Petitioner proposes to modify Jakkula to add sulfur to the feedstock prior to the hydrodeoxygenation step in order to improve catalytic activity of the hydrodeoxygenation catalyst, as taught by Monnier. Pet. 15–16.

Relevant to the HDO step, Jakkula explains:

HDO means removal of oxygen by means of hydrogen, that is, oxygen is removed while breaking the structure of the material. Olefinic double bonds are hydrogenated and any sulphur and nitrogen compounds are removed. Sulphur removal is called hydrodesulphurization (HDS). [Ex. 1005 ¶ 7].

In the first step of the process, i.e. in the hydrodeoxygenation step, hereinafter referred to as the HDO step, the structure of the biological component is decomposed, oxygen, nitrogen, phosphorus and sulphur compounds, and light hydrocarbons as gas are removed, and the olefinic bonds are hydrogenated. [*Id.* ¶ 16].

In addition, nitrogen, sulphur and phosphorus compounds reacted in the HDO step become part of the gaseous phase. [*Id.* ¶ 60].

Therefore, it is clear that Jakkula contemplates the presence of sulfur in the feedstock. *See also* Pet. 16 (citing Ex. 1005 ¶ 60; Ex. 1032, IV-27; Ex. 1002 ¶¶ 41–47, 106) (explaining the same). Further, the removal of impurities from the HDO feedstock prior to hydrodeoxygenation is characterized as “optional.”

Biological starting materials *may be pretreated* with suitable methods such as thermally, chemically and mechanically prior to the hydrodeoxygenation step that breaks the structure thereof, the step being referred to herein as the HDO step. [Ex. 1005 ¶ 7 (emphasis added)].

Prior to the HDO step, the biological raw material *may optionally* be treated by prehydrogenation under milder conditions thus avoiding side reactions of the double bonds. [*Id.* ¶ 21 (emphasis added)].

Optional prehydrogenation may be carried out in a separate pressure vessel or in the same pressure vessel as the HDO and isomerization steps. [*Id.* ¶ 29 (emphasis added)].

With the *optional prehydrogenation step*, side reactions of the double bonds such as polymerization, ring formation and aromatization may be reduced, such side reactions causing the catalyst to coke, and thus shortening the operation period. The yield of the final product (diesel) is also considerably improved by the prehydrogenation. [*Id.* ¶ 62 (emphasis added)].

As Jakkula explains, the catalysts employed in a hydrodeoxygenation step include NiMo or CoMo catalysts which are known to “hav[e] some resistance to catalyst poisons.” *Id.* ¶ 17. Furthermore, the catalyst “poisoning” Jakkula is concerned with in the HDO step is associated with

water because “[b]iological raw materials are known to contain high amounts of oxygen that is converted to water, carbon monoxide, and carbon dioxide.” *Id.* ¶ 6, *see also id.* ¶ 60 (“In the HDO step, the poisoning of the catalyst is accelerated by water, carbon monoxide and carbon dioxide.”). Therefore, the addition of sulfur to the hydrodeoxygenation feed of Jakkula, suggested by Monnier, is not inconsistent with the teachings of Jakkula and does not violate the principle of operation espoused by Jakkula.

While Jakkula is concerned about the presence of sulfur in the stream *prior to isomerization* because, unlike the HDO step, noble metal catalysts are utilized that are “very expensive and extremely sensitive to catalyst poisons and water,” there is no indication that sulfur removal in the hydrodeoxygenation step alone, or coupled with the optional stripping step, is inadequate to protect the isomerization catalyst from poisoning. *Id.* ¶ 10; *see id.* ¶¶ 26, (describing the optional stripping step), 63 (describing the optional stripping step as way to protect the “valuable noble metal catalyst”); *see also id.* ¶ 73 (describing the results of example 1—where an optional prehydrogenation or optional stripping step are not used—as “excellent” and “very suitable as a component in diesel fuels”). Moreover, that the skilled artisan, at the time of invention, would have been aware of the need to weigh the benefit achieved by spiking the hydrodeoxygenation feed with sulfur (per Monnier) against the risk of poisoning an isomerization catalyst downstream “should not nullify its use as a basis to modify the disclosure.” *Winner*, 202 F.3d at 1349 n.8.

We are also not persuaded by Patent Owner’s assertion that Petitioner’s combination was predicated on improper hindsight reconstruction. It is improper to base a conclusion of obviousness upon facts

gleaned only through hindsight. “The invention must be viewed not after the blueprint has been drawn by the inventor, but as it would have been perceived in the state of the art that existed at the time the invention was made.” *Sensonics, Inc. v. Aerosonic Corp.*, 81 F.3d 1566, 1570 (Fed. Cir. 1996) (citing *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1138 (Fed. Cir. 1985)). Therefore, “to establish a *prima facie* case of obviousness based on a combination of elements disclosed in the prior art, the [Petitioner] must articulate the basis on which it concludes that it would have been obvious to make the claimed invention.” *Id.* Impermissible hindsight is inferred when the specific understanding or principle within the knowledge of one of ordinary skill in the art that would motivate one (with no knowledge of the claimed invention) to make the proposed combination has not been explained. *In re Rouffet*, 149 F.3d 1350, 1358 (Fed. Cir. 1998).

Here, Petitioner has provided sufficient reasoning with rational underpinnings to explain why one of ordinary skill in the art would have modified the teachings of the applied references. *See KSR*, 550 U.S. at 418. The modifications proposed by Petitioner are supported by the record. Pet. 15–16 (citing Ex. 1006, 2:51–55, 3:61–5:30, Example 1; Ex. 1002 ¶ 104). Monnier expressly describes the addition of sulfur as advantageous for maintaining the activity of a NiMo catalyst, the same catalyst taught by Jakkula. Ex. 1005, ¶ 20 (“Typically, Ni-Mo/Al₂O₃ and CoMo/Al₂O₃ catalysts are used.”); Ex. 1006, 2:51–55 (“The catalysts suitable for the process of this invention . . . includ[e] cobalt-molybdenum (Co-Mo) catalysts, nickel-molybdenum (NiMo) catalysts, or other transition metal based catalysts used for hydroprocessing.”). For example, Monnier states:

The depitched tall oil was spiked with 1000 ppm sulphur using CS₂ to avoid loss of sulphided active sites on the catalyst surface and maintain catalyst activity. [Ex. 1006, 4:15–18].

[T]he tall oil feedstock has a sulphur compound added thereto prior to hydroprocessing, to avoid the loss of sulphided active sites on the catalyst surface and maintain catalyst activity. [*Id.* at 10:18–21].

Thus, we see no evidence of improper hindsight reconstruction and determine that Petitioner has established by a preponderance of the evidence that the skilled artisan would have had a reason to combine the teachings of Jakkula and Monnier and would have had a reasonable expectation of success in doing so.

4. Dependent claims

Patent Owner does not challenge Petitioner's allegations as to dependent claims 2–20. *See generally* PO Reply. Based on our independent review of the Petition and evidence cited therein (*see e.g.*, Pet. 16–32), we determine that Petitioner has demonstrated by a preponderance of the evidence that the subject matter of claims 2–20 was taught by the combination of Jakkula and Monnier, alone or in combination with Craig (as applied to claims 8 and 9), and as evidenced by Mag or Garrido prior to the application leading to the '832 patent. For example, Jakkula describes pretreatment of biological starting materials prior to the hydrodeoxygenation step to remove impurities as required by claim 2. *See* Pet. 16–17, 23 (citing Ex. 1005 ¶¶ 6–7, Examples 1–2, Ex. 1006, 3:26–43). Relevant to claims 3–6 and 14–17, Jakkula teaches removal of carbon monoxide, carbon dioxide, nitrogen, phosphorus, sulfur compounds and other impurities by stripping the gaseous stream from the hydrotreatment step with water vapor or other

suitable gas and where the stripping step is carried out in a counter-current manner. *Id.* at 17–18, 23–24 (citing Ex. 1005 ¶¶ 23, 26). Jakkula describes the biological feedstock from plants (including plant-based oils), animals (and animal-based fats), or fish and where the free fatty acids are greater than 10% (nearly 100%) as claimed in claims 7, 11, 12, and 18. *Id.* at 18, 21, 24–27 (citing Ex. 1005 ¶¶ 17, 68–69; *see also* Ex. 1002 ¶¶ 38–39 and 84). And lastly, relevant to claims 8 and 9, Jakkula teaches use of an alkali-refined rapeseed oil, and that canola oil is produced from rapeseed. *Id.* at 18–20, 25 (citing Ex. 1005 ¶ 17; *see* Ex. 1002 ¶¶ 81, 86–100). And as evidenced by Mag, alkali-refined canola oil meets the claimed levels of alkaline and alkaline earth metals, other metals, and phosphorus. *Id.* at 19–20, 25 (citing Ex. 1031 ¶ 3–4; Ex. 1002 ¶¶ 81–83, 87–88). Petitioner additionally relies on Craig as evidenced by Garrido to suggest the limitations of claims 8 and 9. Craig describes use of edible oils, such as canola oil, in hydrotreatment processes where the canola oil meets the claimed levels of alkaline and alkaline earth metals, other metals, and phosphorus, as evidenced by Garrido. *Id.* at 28–32 (citing Ex. 1022, 3:23–28, 6:47–48, 7:10; Ex. 1023, 239 (Table 3)).

E. Challenges based on the Combination of Aalto, Monnier, and Chou

Petitioner contends that the subject matter of claims 1, 3–7, and 10–13 of the '832 patent are rendered obvious by the combination of Aalto, Monnier, and Chou, as evidenced by Gunstone. Pet. 38 (Ground IV). Petitioner further alleges that the subject matter of claims 2, 8, 9, and 14–20 are rendered obvious by the combination of Aalto, Monnier, and Chou, as

evidenced by Gunstone, and further in view of Toeneboehn, and Reid. Pet. 48 (Ground V).

1. Overview of Prior Art

a. *Aalto (Ex. 1014)*

Aalto describes a process for the production of middle distillates containing diesel range hydrocarbons from vegetable oils. Ex. 1014, 1. According to Aalto, the fatty acid feed stock is hydrogenated, or hydrotreated, with a nickel/molybdenum or cobalt/molybdenum catalyst to provide n-paraffins. *Id.* at 2–3. The resulting n-paraffins are then isomerized using zeolite catalysts. *Id.* at 2, 4.

b. *Chou (Ex. 1015)*

Chou teaches a two-stage process like those discussed in Aalto and Monnier above. Ex. 1015, 2:48–51. Chou suggests that the hydrogen sulfide and ammonia can be stripped from the hydrotreated product prior to introducing it to the isomerization catalyst. *Id.* at 2:52–58. Chou, however, also describes a mode where gaseous poisons are not stripped and instead fed through to the isomerization catalyst. *Id.* at 5:40–6:67.

2. Petitioner’s Contentions (claim 1)

Petitioner argues that “Aalto discloses the same HDO [hydrodeoxygenation]/isomerization process as that claimed by the ’832 patent.” Pet. 38 (citing Ex. 1014, 2:21–24). In particular, Petitioner alleges that the process of Aalto produces diesel range hydrocarbons from biological oils via a two-step process involving the hydrotreatment of a vegetable oil feed stream followed by isomerization of the resulting n-paraffins. *Id.* (citing Ex. 1014, 2:8–19, Examples 1–2, Tables 3 and 4). According to Petitioner, Aalto also uses a nickel-molybdenum catalyst for the

hydrotreatment step. *Id.* at 39. Aalto differs from the instant claims in that Aalto “does not expressly disclose that the feed includes at least one inorganic or organic sulfur compound.” *Id.* However, Petitioner relies on Monnier to suggest adding sulfur compounds to a biological feed stock prior to hydrotreatment in order to maintain catalyst activity for nickel-molybdenum catalysts useful in hydrodeoxygenation/hydrotreatment steps. *Id.* (citing Ex. 1006, 3:61–5:30); *see also supra* Section II. D. 2. Petitioner further urges that Chou teaches a process where “H₂S and NH₃ is stripped from the HDS [hydrodesulfurization] effluent product (i.e., n-paraffins) before reaching the Pt/beta zeolite isomerization catalyst.” *Id.* at 41. Petitioner reasons that a person of ordinary skill in the art would have reason to include the stripping step of Chou to remove large amounts of gaseous impurities to protect the isomerization catalyst from catalyst poisoning. *Id.* at 41–42.

Patent Owner does not challenge Petitioner’s allegations that Aalto, Monnier, and Chou¹⁹ disclose each of the limitations in independent claim 1. Rather, Patent Owner asserts that the skilled artisan would not have had a reason to combine Aalto and Monnier to arrive at the claimed invention. We determine, after reviewing the Petition and evidence therein, that Petitioner has established by a preponderance of the evidence that that each of the limitations in claim 1 are present in one of Aalto, Monnier, and Chou. *See* Pet. 38–42, 44–45; Ex. 1014, 1:6–8, 2:8–13, 2:17–24, 3:1–18, 3:61–5:30, Examples 1–2, Tables 3–4; Ex. 1006, 1:58–67, 2:56–63, 3:5–4:4, 4:15–18,

¹⁹ Petitioner uses Gunstone, Toeneboehn, and Reid, as further evidence in support of dependent claims 2, 7–9, 11, and 12, to support the fatty acid and metal concentrations of certain bio oils and demonstrate why low metal concentrations are desirable. *See e.g.*, Pet. 42–43, 50–52.

7:4–6; Ex. 1015, 2:52–57, 3:52–54, 5:40–6:67, Table 2, Fig. 3C; Ex. 1002 ¶¶ 36–37, 43–46, 48–49, 64, 66, 120–125. We address Patent Owner’s arguments below.

3. Patent Owner’s Arguments

Patent Owner contends that a person of ordinary skill would not have had reason to combine the teachings of Aalto with Monnier because the skilled artisan “would not ignore the more recent developments [in Jakkula] and blindly follow an outdated or superseded disclosure” in Aalto. PO Resp. 14; *see* PO Surreply 16–17 (same). Patent Owner argues that because a person of ordinary skill in the art would have been aware of all relevant art, including both Aalto and Jakkula, and “would have recognized that these repetitive references provide substantially the same disclosures” even though “Aalto does not contain as many specific disclosures directed to extending catalyst life by removing impurities such as sulphur.” PO Resp. 15–16. According to Patent Owner, “[a] skilled artisan would not have tried to improve the Aalto/Jakkula process by modifying it in a way that was directly contrary to the updated understanding expressed in Jakkula . . . [but rather,] would have used the more up-to-date teachings of Jakkula as a guide.” *Id.* at 17. Because “the Aalto/Jakkula process was understood to require the removal of sulphur to protect catalyst activity and achieve improved diesel fuel product yield,” a person of ordinary skill in the art would have no reason to combine Aalto with Monnier, which seeks to add sulfur to the feedstock. *Id.*

In response, Petitioner asserts that “[i]nstead of dismissing Aalto in favor of Jakkula, a POSA would have understood Aalto describes an operable process for hydrotreatment and subsequent HI[, or

hydroisomerization,] of biological feedstocks; nothing in Jakkula disparages the operability of Aalto.” Pet. Reply 18. Therefore, Petitioner further argues that the person skilled in the art would have understood that adding sulfur to Aalto’s feedstock is not contrary to Aalto’s teachings. *Id.* at 19.

We are not persuaded by Patent Owner’s position. Petitioner argues that Monnier, disclosing the same hydrotreatment catalyst used in Aalto, describes adding sulfur to the biological feedstock in order to improve catalyst performance. Pet. 39 (citing Ex. 1006, 3:61–5:30, Example 1). According to Petitioner, Monnier describes both presulfiding the catalyst *and* spiking the feed with sulfur in an amount of 1000 ppm “to avoid loss of the sulphided active sites on the catalyst surface and maintain catalyst activity”—a well-known concept in the art. *Id.* (citing Ex. 1006, 4:1–4, 4:15–18; Ex. 1002 ¶ 122).

Patent Owner’s arguments do not respond to the asserted ground of unpatentability advanced by Petitioner. Rather, Patent Owner seeks to jettison the broad teachings of Aalto in favor of the narrower teachings of Jakkula (not part of the ground) without reason. Patent Owner fails to direct our attention to any teaching of Jakkula that expressly criticizes Aalto or suggests Aalto is inoperable. *See generally* PO Resp. and PO Surreply. In fact, Patent Owner does “not dispute that Aalto’s process was operable.” PO Surreply 16. Nor does Patent Owner cite to any legal authority permitting us to rewrite Petitioner’s ground of unpatentability to excise Aalto and include Jakkula as part of the combination. *See generally* PO Resp. and PO Surreply; *see also* Tr. 129–130, 142–143 (referring to *In re Dow Chem. Co.*, 837 F.2d 469, 473 (Fed. Cir. 1988) for the proposition that the person of ordinary skill in the art would have been aware of the all relevant art in the

area of the invention). Furthermore, we reject Patent Owner's contention (detailed above in Section II.D.3) that the addition of sulfur to the hydrotreatment feedstock would violate the principle of operation of Jakkula.

We have considered the record and determine that a person of ordinary skill in the art at the time of invention, seeking to improve the process of Aalto, would have reason to combine the teachings of Monnier to include spiking the HDO feedstock with sulfur to improve catalyst activity and would have had a reasonable expectation of doing so. Therefore, we conclude that claim 1 would have been obvious over the combined disclosures of Aalto, Monnier, and Chou.

4. Dependent claims

Patent Owner does not challenge Petitioner's allegations as to dependent claims 2–20. Based on our independent review of the Petition and accompanying evidence (*see e.g.*, Pet. 38–56), we further determine that Petitioner has demonstrated by a preponderance of the evidence that the subject matter of claims 2–20 was taught by the combination of Aalto, Monnier, and Chou, as evidenced by Gunstone, and further in view of Toeneboehn and Reid (claims 2, 8, 9, 14–20), prior to the application leading to the '832 patent. For example, and relevant to claims 3–6 and 14–17, Chou teaches removal of gaseous impurities, such as hydrogen sulfide and ammonia, by stripping hydrotreatment effluent using hydrogen and where the stripping step is carried out in a counter-current mode operation. Pet. 42, 45–46, 54–55 (citing Ex. 1015, 2:53–52, 4:47–52; Ex. 1014, 3:5–4:4, 7:4–6). Aalto describes conversion of vegetable oils to give a middle distillate feedstock comprised primarily of TOFA where the free fatty acids

are greater than 10% (nearly 100%) as claimed in claims 7, 11, 12, and 18. Pet. 42–43, 46–48, 55 (citing Ex. 1014, 5:20–22; Ex. 1002, ¶ 84). And, with respect to claims 8 and 9, Aalto teaches using biological plant oils as a feedstock for the hydrotreatment reaction that includes palm oil or tall oil—each meeting the claimed levels of alkaline and alkaline earth metals, other metals, and phosphorus. Pet. 49–52, 53–54 (citing Ex. 1014, 2:1–3, 3:1–3; Ex. 1007, 84; Ex. 1008, 1:9–42, 2:67–3:1; Ex. 1002, ¶¶ 36–37, 74–77, 84, 128–32; Ex. 1037, Table A; and Ex. 1038).

Based on the foregoing, we conclude that claims 2–20 would have been obvious over the combined disclosures of Aalto, Monnier, and Chou (as evidenced by Gunstone), Toenboehn, and Reid.

III. CONTINGENT MOTION TO AMEND

Patent Owner filed a contingent Motion to Amend to cancel original claims 1–20 and replace them with substitute claims 21–24. MTA 1–3. We have determined that original claims 1–20 of the '832 patent have been shown to be unpatentable by a preponderance of the evidence; therefore, we proceed to address Patent Owner's contingent Motion to Amend.

Before considering the patentability of any substitute claims, we first must determine whether the motion to amend meets the statutory and regulatory requirements set forth in 35 U.S.C. § 316(d) and 37 C.F.R. § 42.121. As part of this showing, Patent Owner must demonstrate: (1) the amendment responds to a ground of unpatentability involved in the trial; (2) the amendment does not seek to enlarge the scope of the claims of the patent or introduce new subject matter; (3) the amendment proposes a reasonable number of substitute claims; and (4) the proposed claims are supported in the original disclosure (and any earlier filed disclosure for

which the benefit of a filing date is sought). 37 C.F.R. § 42.121;
Lectrosonics, Inc. v. Zaxcom, Inc., IPR2018-01129, Paper 15 (PTAB Feb.
25, 2019) (precedential).

Although Patent Owner must demonstrate that the statutory and regulatory requirements for a motion to amend are met, Patent Owner “does not bear the burden of persuasion to demonstrate the patentability of [the proposed] substitute claims.” *Lectrosonics*, Paper 15 at 4 (citing *Aqua Prods. Inc. v. Matal*, 872 F.3d 1290 (Fed. Cir. 2017); *Bosch Auto. Serv. Sols. LLC v. Iancu*, 878 F.3d 1027 (Fed. Cir. 2017)). “Rather, as a result of the current state of the law and [U.S. Patent and Trademark Office] rules and guidance, the burden of persuasion will ordinarily lie with the petitioner to show that any proposed substitute claims are unpatentable by a preponderance of the evidence.” *Lectrosonics, Inc.*, Paper 15 at 4.

Patent Owner proposes *substantive* amendments to claims 1 and 10 by way of proposed substitute claims 21 and 24. MTA 2–3 (illustrating amendments to proposed claim language). For example, proposed substitute independent claim 21 is reproduced below with annotations showing amendments to original claim 1:

21. A process for the manufacture of diesel range hydrocarbons comprising the following steps:
introducing a feed consisting of: ~~comprising~~
(i) at least one organic or inorganic sulphur compound,
(ii) hydrogen, ~~and~~
(iii) a feedstock consisting of ~~comprising~~ bio oil and/or fat from renewable sources, and
(iv) at least one diluting agent of biological origin,
to a hydrotreatment step in which hydrocarbons are formed in the presence of a hydrogenation catalyst,
wherein the feed contains 50–570 w-ppm of sulphur,
calculated as elemental sulphur, and

isomerizing the formed hydrocarbons in an isomerization step in the presence of an isomerization catalyst, wherein gas phase impurities formed in the hydrotreatment step are removed from ~~a~~^{the} stream comprising hydrocarbons prior to contacting the hydrocarbons with the isomerization catalyst.

Id. Claim 24 further narrows the sulfur content in the feed to 50–100 w-ppm sulfur. *Id.* at 3. The remaining proposed substitute claims are amended to reflect proper dependency. *Id.* Accordingly, we limit our discussion below to proposed substitute claim 21.

A. Requirements Under 35 U.S.C. § 316 (d) and 37 C.F.R. § 42.121

Patent Owner proposes four substitute claims in place of twenty challenged claims. MTA 2–3. “There is a rebuttable presumption that a reasonable number of substitute claims per challenged claim is one (1) substitute claim.” *Lectrosonics*, Paper 15 at 4. Therefore, we determine that the amendments propose a reasonable number of substitute claims. *See* 37 C.F.R. § 42.121(a)(3).

Patent Owner asserts that the proposed substitute claims are patentable over the references at issue in this proceeding, and demonstrates how the additional proposed limitations are intended to address the obviousness grounds on which we instituted trial. MTA 1, 10–23. We determine that the amended language in the proposed substitute claims is responsive to the grounds of unpatentability involved in this trial.

Patent Owner further asserts that the proposed substitute claims do not present new matter or enlarge the scope of the originally issued claims. *Id.* at 4. Patent Owner proposes that proposed substitute claim 21 includes additional limitations not present in original claim 1. Specifically, Patent Owner’s proposed substitute claim 21 requires “at least one diluting agent of

biological origin” and that “the feed contain[] 50–570 w-ppm of sulfur, calculated as elemental sulfur.” *Id.* at 2. Patent Owner further limits the scope of the claims by requiring that the feed *consists of* the enumerated limitations and that the feedstock “*consist[s]* of bio oil and/or fat from renewable sources,” thereby removing the open-ended “comprising” language. *Id.* at 5. Therefore, we determine the proposed substitute claims narrow the scope, and do not enlarge the scope, of the original claims.

Patent Owner asserts that proposed substitute claims 21–24 are supported by the original disclosure. *Id.* at 4–8 (citing Ex. 2002, 2006, 2005, 2003). Petitioner does not dispute most of Patent Owner’s contentions regarding whether the Motion to Amend complies with the statutory and regulatory requirements nor does Petitioner dispute much of Patent Owner’s contentions on written description except that Petitioner disputes there is written description support for “an unbounded dilution range.” MTA Opp. 3–8. Thus, we determine that Patent Owner has shown compliance with the requirements for a motion to amend and also written descriptive support for each of the undisputed limitations of proposed substitute claims 21–24. *See* Ex. 2006 ¶¶ 37, 40, 42–70, 83, 87; Ex 2002 ¶¶ 68–79. We address Petitioner’s arguments below as to whether Patent Owner has shown written descriptive support for the “at least one diluting agent” language in the substitute claims.

Patent Owner argues that the modified language—adding “at least one diluting agent of biological origin”—finds support in the original application. MTA 5 (citing Ex. 2006 ¶¶ 37, 43, 62, 64; Ex. 2002 ¶ 73; Ex. 2005 ¶¶ 37, 43, 62, 64; Ex. 2004, 9:7–20, 11:16–32, 16:14–27, 17:5–14; Ex. 2003, 9:7–20, 11:16–32, 16:14–27, 17:5–14). These portions describe

addition of a dilution agent to control the temperature of the catalyst bed. *See, e.g.*, Ex. 2006 ¶¶ 43 (“The temperature at the end of the catalyst bed is controlled by net heat of reactions and to the extent of the dilution agent used.”).

Petitioner asserts that “[the] proposed claims 21–24 lack adequate written description support for the recited feed because the ’832 disclosure fails to evidence the inventors had possession of an unbounded dilution range.” MTA Opp. 3. According to Petitioner, “the ’832 disclosure repeatedly and explicitly teaches a particular ratio.” *Id.* at 3–4 (citing Ex. 2006 ¶¶ 38, 43, 55–56, 62, 64, 73, 83; Ex. 2003, 9:29–30, 11:30–2, 15:7–12, 16:19–21, 17:5–10, 19:22–27, claim 1; Ex. 1050 ¶ 88). Petitioner further contends that the newly claimed sulfur concentrations of 50–570 ppm (claim 21) and 50–100 ppm (claim 24) are disclosed in working examples that each include diluting ratios of 5:1. *Id.* at 4. Therefore, “the ’832 disclosure unambiguously sets forth what the dilution ratio is and never suggests other dilution ratios outside the stated range.” *Id.* As further support that any ratio of diluent is not permitted by the ’832 disclosure, Petitioner references the *inter partes* review of the parent application where “the Board ruled that [the] proposed claims omitting a minimum dilution ratio lacked written description support because a dilution ratio of 5:1 diluting agent:fresh feed was repeatedly taught as necessary to achieve the purported advantages of the ’832 disclosure.” *Id.* at 7 (citing *REG Synthetic Fuels, LLC, v. Neste Oil Oyj*, IPR2013-00178, Paper 63 at 8–11 (PTAB Aug. 29, 2014)).

A motion to amend “may not . . . introduce new matter.” 35 U.S.C. § 316(d)(3). New matter is any matter that lacks support in the original

application. *See TurboCare Div. of Demag Delaval Turbomach. v. Gen. Elec. Co.*, 264 F.3d 1111, 1118 (Fed. Cir. 2001) (“When [an] applicant adds a claim . . . the new claim[] . . . must find support in the original specification.”). A proposed claim that introduces new matter is properly rejected under 35 U.S.C. § 112 for lack of written descriptive support. *See, e.g., In re Rasmussen*, 650 F.2d 1212, 1214 (CCPA 1981) (“The proper basis for rejection of a claim amended to recite elements thought to be without support in the original disclosure, therefore, is § 112, first paragraph . . .”). A proposed new claim complies with 35 U.S.C. § 112, first paragraph, where the written description in the original application “reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date.” *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc). “It is not necessary that the application describe the claim limitations exactly, but only so clearly that persons of ordinary skill in the art will recognize from the disclosure that appellants invented processes including those limitations.” *In re Wertheim*, 541 F.2d 257, 262 (CCPA 1976) (citation omitted).

We find sufficient written description support for “at least one diluting agent of biological origin” as recited in proposed substitute claims 21–24. The ’182 Application²⁰ describes

²⁰ Patent Owner cites to U.S. Application 13/491,182 (Ex. 2006, “the ’182 Application” — ultimately issuing as the ’832 patent), U.S. Application 13/107,146 (Ex. 2005), and U.S. Application 11/477,922 (Ex. 2004). *See generally* MTA. Petitioner explains that “[b]ecause each of EX2004–2006 have the same disclosure (except for the priority claim paragraph [0001]) and have the same paragraph numbering, for ease of reference[,] citations to EX2006 are intended to encompass citations to the same disclosure in EX2004 and EX2005.” MTA Opp. 3, n1. Accordingly, we do the same.

A still further object of the invention is an improved process for the manufacture of diesel range hydrocarbons from bio oils and fats, wherein the hydrotreatment of triglyceride feedstock containing free fatty acids is carried out using dilution of fresh feed and reduced reaction temperature. [Ex. 2006 ¶ 24].

The feed (total feed) to the hydrotreating unit is here understood to comprise fresh feed and at least one dilution agent. [*Id.* ¶ 36].

The hydrotreating step is carried out contacting the feed comprising fresh feed and at least one diluting agent with a hydrotreatment catalyst under hydrotreatment conditions. [*Id.* ¶ 37].

It was surprisingly found that dilution of fresh feed in the hydrotreatment step, in combination with decreased reaction temperature reduces the undesired side reactions and improves reaction selectivity [*Id.* ¶ 38].

The fresh feed stream 12 is first mixed with the hydrotreated product recycle stream 41 and quench liquid stream 43 and the resulting mixture 31, diluted in the fresh feed concentration, is then introduced on the catalyst bed 10. [*Id.* ¶ 40].

The temperature at the end of the catalyst bed is controlled by net heat of reactions and to the extent of the dilution agent used. [*Id.* at ¶ 43].

The hydrotreatment section comprises one or more catalyst beds in series, dilution agent introduction on the top of the first catalyst bed and fresh feed, recycle liquid and hydrogen introduction on top of each catalyst beds. [*Id.* at ¶ 62].

See also Ex. 2002 ¶ 73 (citing, inter alia, Ex. 2006 ¶¶ 37, 43).

Petitioner's argument that only certain dilution ratios are supported by the original disclosure is unpersuasive. MTA Opp. 3 ("the '832 disclosure repeatedly and explicitly teaches [a] particular ratio"). The plain language

of the '182 Application overwhelmingly relates the use of certain dilution ratios to the *recycled* feed. For example, the '182 Application states:

The dilution agent can also be *recycled product* from the process (product recycle). The diluting agent/fresh feed-ratio is 5–30:1, preferably 10–30:1 and most preferably 12–25:1. [Ex. 2006 ¶ 38 (emphasis added)].

If the product recycle is used, product recycle/fresh feed ratio is 5–30:1, preferably 10–30:1, most preferably 12–25:1. [*Id.* ¶ 43 (emphasis added)].

If the dilution agent is product recycle, the product recycle/fresh oil-ratio is from 5–30:1, preferably 10–30:1 and most preferably 12–25:1. [*Id.* ¶ 62 (emphasis added)].

It was surprisingly observed in examples that *product recycle dilution* can prevent or remarkably decrease the reactions between free fatty acids and the formation of high molecular weight compounds during hydrotreating, when at least 5:1 (*product recycle*):(*fresh oil*)-ratio was used. [*Id.* ¶ 64 (emphasis added)].

In the examples it was be seen that the ratio of at least 5:1 (*recycle:fresh*) significantly decreased the formation of high molecular weight products, when the feedstock contains 10 wt-% of free fatty acids (calculated from fresh oil) is used. Using at least 5:1 *recycle ratio* and reduced reaction temperature, free fatty acids can be processed without the need for deacidification. [*Id.* ¶ 73 (emphasis added)].

See also *id.* ¶¶ 83, 87 (Examples 5 and 7).²¹

²¹ The lone description of a dilution ratio without reference to product recycle (Ex. 2006 ¶ 56), is overshadowed by statements in the written description correlating the particular dilution ratio to the conditional language “*if . . . product recycle . . .*” See *e.g.*, Ex. ¶¶ 43, 62.

We are also unpersuaded that a particular dilution ratio is mandated by the purported advantage of the invention. MTA Opp. 5. While adequate written description support is required for all claims, the converse is not true—that is, the claims need not recite everything contained in the written description. Further, the written description requirement does not impose upon an applicant a requirement to claim all advantages disclosed in the specification. *See ScriptPro LLC v. Innovation Associates, Inc.*, 833 F.3d 1336, 1342 (Fed. Cir. 2016) (“Not every claim must contain every limitation or achieve every disclosed purpose.”).

Further, neither the cases cited by Petitioner nor our prior decision in IPR2013-00178 compel a different result. Unlike the instant ’182 Application—describing use of either a diluting agent *or* a product recycle (Ex. 2006, ¶¶ 38, 43, 57, 72)—the specifications in *ICU Medical* and *Lizard Tech* described only a single embodiment. *See ICU Med., Inc. v. Alaris Med. Sys., Inc.*, 558 F.3d 1368, 1378 (Fed. Cir. 2009) (finding that “the specification describes only medical valves with spikes”); *LizardTech Inc. v. Earth Resource Mapping Inc.*, 424 F.3d 1336, 1345 (Fed. Cir. 2005) (finding that “the embodiment in LizardTech’s specification covers only one way of creating a seamless DWT”). And, in IPR2013-00178, the proposed substitute claims recited an HDO product having “less than 1 wt-% of high[er] molecular weight hydrocarbons” using “a stream of diluting agent.” IPR2013-00178, Paper 38, 6–7. There, we determined that “the formation of high molecular weight hydrocarbons, [is] directly tied to a dilution ratio of ‘at least 5:1.’” IPR2013-00178, Paper 63, 9. However, in this case, the proposed substitute claims do not require any particular product characteristics. Therefore, we find that the skilled artisan would have

understood the '832 patentee to have been in possession of the invention as described in the substitute claims.

Having determined that the contingent Motion to Amend meets the requirements of 35 U.S.C. § 316(d) and 37 C.F.R. § 42.121, we analyze whether proposed substitute claims 21–24 are unpatentable by a preponderance of the evidence based on the entirety of the record. For the reasons discussed below, we determine that Petitioner has not shown by a preponderance of the evidence that proposed claims 21–24 are unpatentable in view of Jakkula, Monnier, Monnier II, and Satterfield.

B. Obviousness of Proposed Substitute Independent Claim 21

As a substitute for independent claim 1, Patent Owner proposes claim 21. MTA 2. Relevant to the patentability over the prior art, proposed claim 21 adds the following limitations to original claim 1: (1) introducing a feed that *consists of* the enumerated limitations; (2) the feedstock *consists of* a “bio oil and/or fat from renewable sources”; (3) “at least one diluting agent of biological origin”; (4) a hydrotreatment step in the presence of a hydrogenation catalyst; (5) where the feed contains 50–570 w-ppm sulphur; and (6) and requiring the isomerization step to be performed in the presence of an isomerization catalyst. *Id.*

With respect to the limitations of substitute claim 21 present in original claim 1, Petitioner relies on the same arguments and evidentiary support we determined supported, by a preponderance of the evidence, a conclusion of obviousness. *Compare* Pet. 13–18, 20–21, *with* MTA Opp. 13–22. Petitioner contends that the additional limitations included in proposed substitute claim 21 do not avoid a conclusion of obviousness because each is disclosed or suggested by the prior art. MTA Opp. 8.

Petitioner argues that Jakkula describes “a feed that includes a biological raw material (*i.e.*, bio oil and/or fat) and hydrogen” and that “[b]iological feedstocks include tall oil and canola oil.” *Id.* at 14 (citing Ex. 1005 ¶¶ 1, 13–15, 17–20, 65, 68–74; Ex. 1002 ¶¶ 138–40; Ex. 1050 ¶¶ 59–60, 107). Petitioner also asserts that Jakkula describes a nickel-molybdenum catalyst as a suitable hydrogenation catalyst. *Id.* at 15 (citing Ex. 1005 ¶¶ 20, 70). Patent Owner does not dispute Petitioner’s additional allegations with respect to these noted additional limitations. *See generally* MTA Reply. We determine that the preponderance of the evidence supports Petitioner’s allegations regarding these limitations, which Patent Owner does not dispute, were taught or suggested by the prior art.²² We address Patent Owner’s arguments regarding “wherein the feed contains 50–570 w-ppm of sulphur,” below. Because we determine Patent Owner’s argument is persuasive, we need not reach the additional disputed limitations—*i.e.*, “at least one diluting agent of biological origin.”

Petitioner argues that both Monnier and Monnier II describe the addition of sulfur to a bio oil feedstock in a process nearly identical to Jakkula. MTA Opp. 15. Petitioner explains that the addition of sulfur is known to improve catalyst activity by avoiding loss of sulphided active sites. *Id.* (citing Ex. 1006, 3:61–5:30, claim 5; Ex. 1012, 7:31–8:1, 10:3–6;

²² We observe that Petitioner does not mention or identify “isomerizing in the formed hydrocarbons in an isomerization step *in the presence of an isomerization catalyst*,” as present in the prior art when challenging Patent Owner’s substitute claims. *See generally* MTA Opp. Patent Owner does not challenge this omission. *See generally* MTA Reply. Whether we would have granted Patent Owner’s motion in view of Petitioner’s omission is moot given that Petitioner’s arguments related to other aspects of the substitute claims are not persuasive.

Ex. 1005 ¶¶ 20, 70; Ex. 1050 ¶¶ 109–111, 113, 115). Petitioner asserts that “Monnier does not restrict the amount of sulfur that should be added to a feed” but “exemplifies such sulfur addition by adding 1000 ppm sulfur in working examples.” *Id.* at 15–16 (citing Ex. 1050 ¶ 111; Ex. 1006, 4:15–18); *see also id.* at 16 (“a POSA would understand that Monnier’s omission of an express range for the amount of sulfur additive is necessarily *broader* than the range of sulfur additive recited in Monnier II.”). According to Petitioner, “Monnier II teaches that ‘[t]he sulphur additive is typically used in a concentration in the range of 200 to 3,000 ppm of sulphur.’” *Id.* at 16 (citing Ex. 1012, 2:36–3:1; Ex. 1050 ¶ 113; Ex. 1002 ¶ 67). Petitioner asserts that Monnier describes using feeds of canola oil and depitched tall oil. *Id.* (citing Ex. 1006, 2:1–5, 2:33–37, example 8; Ex. 1050 ¶ 110). Petitioner asserts that “because both Jakkula and Monnier utilize canola oil that would be understood to contain from 0–15 ppm sulfur (depending on the type), addition of 200 ppm sulfur per Monnier II’s disclosed range would have been understood to provide a feed of 200–215 ppm sulfur, thus within the sulfur range of Neste’s claim 21.” *Id.* at 17 (citing Ex. 1050 ¶¶ 116–117).

Patent Owner argues that: (1) no motivation exists to add sulfur in the claimed ranges; (2) no overlapping ranges are taught by Monnier II, Monnier, or Satterfield; and (3) Monnier II is not prior art. MTA Reply 2–10.

First, Patent Owner contends that each of Petitioner’s reasons to add sulfur to the feedstock—to promote decarboxylation reactions and to maintain catalyst activity—fails to provide a reason to use the claimed ranges. *Id.* at 2. In particular, Patent Owner argues that “to promote

decarboxylation reactions, the prior art taught using at least 2000 ppm sulfur.” *Id.* (citing Ex. 2002 ¶¶ 97–102; Ex. 1009; Ex. 1010; Ex. 1011). According to Patent Owner, Petitioner’s expert “similarly testified that Ferrari²³ would have motivated a POSA to use sulphur concentrations of 3000–6000 ppm.” *Id.* at 2–3 (citing Ex. 1002 ¶ 70; Ex. 2013, 17:9–23). And, Patent Owner contends Petitioner’s secondary reason, i.e., to maintain catalyst activity, fares no better. *Id.* at 3. According to Patent Owner, “Monnier discloses adding 1000 ppm to ‘avoid loss of the sulphided active sites on the catalyst surface and maintain catalyst activity’” which is consistent with Criterion²⁴ “urg[ing] sulphiding with at least 1000 ppm.” *Id.* (citing Ex. 1006, 4:15–18; Ex. 1024, 4 (explaining that “[s]ulphur injection should be restarted immediately” where the concentration drops below 1000 ppm); Ex. 2002 ¶¶ 94–96; Ex. 2013, 9:18–10:9). Patent Owner asserts that even “Dr. Sughrue . . . testified that a POSA would have used 1000 ppm of sulphur, ‘as taught by Monnier.’” *Id.* (citing Ex. 1002 ¶¶ 104). Therefore, Patent Owner argues there is no reason offered by Petitioner to drop the sulfur level below 2000 ppm to the claimed ranges of 50–100 ppm and 50–570 ppm.

²³ Ferrari, et al., “Hydrotreatment and Hydrocracking of Oil Fractions,” 85–96 (B. Delmon et al., eds., Elsevier Science, 1999)(“Ferrari”). Petitioner relies on Ferrari as evidence to support its contention that sulfur promotes carboxylation reactions. Pet. 56–57.

²⁴ Criterion Catalysts, Technical Bulletin, “CRITERION Hydrotreating Catalyst In-Situ Presulphiding Guidelines – Liquid Phase (preferred method) – Gas Phase (alternative method),” August 1998 (“Criterion”). Petitioner relies Criterion as evidence to support its contention that it was known that nickel-molybdenum catalysts perform better in a sulfided state. Pet. 39.

We are persuaded by Patent Owner’s argument. As Patent Owner explains, the sulfur concentrations described in the prior art—and relied upon by Petitioner and Petitioner’s expert—as necessary for “avoiding loss of the sulphided active sites” and “to maintain catalytic activity” far exceeds the ranges appearing in the proposed substitute claims. For example, Petitioner’s expert testifies that Laurent I and Laurent II²⁵ each suggest certain levels of sulfur concentration lead to increased decarboxylation. Ex. 1002 ¶ 51. In particular, Dr. Sughrue testifies that “a POSA would readily appreciate that about 2000 wppm sulfur was used in the reactions of Laurent I” and “one of skill in the art would readily determine that the sulfur concentrations tested [in Laurent II] were about 2000 wppm, about 4000 wppm, and about 7900 wppm.” *Id.* ¶¶ 52 (citing Ex. 1009, 81, 87–89, 92–93, Tables 1, 5), 54 (citing Ex. 1010, 106–108, 114, Fig. 10, Table 4). Petitioner also relies on the teachings of Ferrari for the same proposition. *Id.* ¶ 56. Dr. Sughrue testifies that “Ferrari discloses at least a 45–50% increase in the decarboxylation product by increasing the sulfur content from about 1266 wppm sulfur to about 4431 wppm sulfur.” *Id.* ¶ 58 (citing Ex. 1011, 87, 90–91, Figs. 4, 5, Table 3). Each of these references suggests a sulfur concentration that far exceeds that of the substitute claims.

²⁵ Laurent, E. & Delmon, B., “Study of the Hydrodeoxygenation of Carbonyl, Carboxylic and Guaiacyl Groups over Sulfided CoMo/ γ -Al₂O₃ and NiMo/ γ -Al₂O₃ Catalysts,” 109 Applied Catalysis, 77–96, 1994 (“Laurent I”); Laurent, E. & Delmon, B., “Study of the Hydrodeoxygenation of Carbonyl, Carboxylic and Guaiacyl Groups over Sulfided CoMo/ γ -Al₂O₃ and NiMo/ γ -Al₂O₃ Catalysts II. Influence of water, ammonia and hydrogen sulfide,” 109 Applied Catalysis, 97–115, 1994 (“Laurent II”). Petitioner relies on Laurent I and Laurent II as evidence to support its contention that sulfur promotes carboxylation reactions. Pet. 56–57.

Petitioner also argues that “[a] POSA further would understand that at least about 30 ppm sulfur should be included in a feed to keep nickel-molybdenum catalysts in their sulfided state.” MTA Opp. 15 (citing Ex. 1051, 392; Ex. 1050 ¶¶ 106, 108). We are not persuaded. The teaching of 30 ppm sulfur originates from Satterfield which states that “non-noble metal catalysts must be kept in a sulfided state, so a minimum concentration of H₂S, e.g., of the order of 30 ppm, must be maintained in the reacting gases,” however, Satterfield describes hydrocracking petroleum-based feeds, *not* hydrotreating feeds of biological origin. Ex. 1051, 391; MTA Reply 5 (citing MTA Opp. 15, 18–19; Ex. 1051, 390–392; Ex. 1001, 4:48–59, 5:8–10). Indeed, Petitioner’s expert stresses that when hydrotreating petroleum-based feedstocks, keeping the hydrotreatment catalyst in a sulfided state “is not much of a concern,” because “typical petroleum-based feedstocks contain anywhere from 5,000 to 30,000 ppm sulfur.” Ex. 1002 ¶ 61. In contrast, “[h]owever, bio-based feedstocks present the *opposite problem* because they *do not contain enough sulfur* to keep the hydrotreating catalyst in its sulfide state.” *Id.* ¶ 62 (emphasis added). Therefore, the skilled artisan would have understood that low concentrations of sulfur, i.e., 30 ppm, would not have been appropriate for a biological-based feedstock but, instead, would have been useful in combination with *high-sulfur petroleum-based feeds*.

We are also not persuaded by Petitioner’s further argument that “Monnier *exemplifies* such sulfur addition by adding 1000 ppm sulfur in working examples,” and “does not restrict the amount of sulfur that should be added to a feed.” MTA Opp. 15–16 (emphasis added). The lone concentration described in Monnier is 1000 ppm sulfur. See Ex. 1006, 4:14–

17, Examples. The understanding that a concentration of 1000 ppm sulfur is a minimum concentration to maintain catalytic activity is further reinforced by Criterion, relating to the catalysts employed in Monnier. Ex. 1024; *see also* Ex. 1006 3:60–64 (explaining that tests were carried out using a “commercial nickel-molybdenum or alumina catalyst, available under the trade mark CRITERION 424, [that] was supplied in the form of extrudates.”). Criterion instructs the skilled artisan to “[m]aintain the reactor outlet H₂S concentration at 1000 ppm *minimum*” and cautions that “[i]f the H₂S level falls below 1000 ppm, keep the reactor temperature constant until 1000 ppm H₂S is re-established.” Ex. 1024, 4 (emphasis added). We also disagree that Monnier II can be read alone, or together with Monnier, to suggest that a person of ordinary skill in the art would have expected success using a lower concentration of sulfur than 1000 ppm. MTA Opp. 16. As discussed below, the disclosure in Monnier II is limited to processing depitched tall oil, known to have a high sulfur concentration of about 670 ppm, therefore, even without being combined with a “sulphur additive” in the range of 200–3000 ppm, the total sulfur concentration exceeds the concentration claimed in the substitute claims. Ex. 1012, 16; Ex. 2002 ¶¶ 15–117; Ex. 2013, 21:7–20. Therefore, Petitioner has failed to provide a reason to combine the teachings of the recited prior art references to achieve sulfur concentrations as claimed. Said another way, Petitioner has failed to provide a reason why the skilled artisan would optimize the total sulfur concentration below the minimum concentration taught in the prior art.

Next, Patent Owner argues that Monnier II does not teach an overlapping range. MTA Reply 4. Patent Owner explains that “Monnier II expressly ties its identification of 200 to 3000 ppm ‘sulphur additive’ to its

depitched tall oil feedstock” which is “known to have a relatively high sulphur content of 670.” *Id.* at 4–5 (citing Ex. 1012, 2:31–3:1, Table 4; Ex. 2002 ¶¶ 115–119); *see also id.* at 5 (tying a “sulphur additive” range of 200–3000 ppm to depitched tall oil)(citing Ex. 2002 ¶¶ 115–119; Ex. 1012, 1:1, 2:8–3:8, 4:32–5:27). Therefore, the sulfur content of the Monnier II feedstock alone exceeds the claimed range, and when combined with the “sulphur additive,” yields a range of 870–3670 ppm sulfur. *Id.* (citing Ex. 2002 ¶¶ 117). Patent Owner further contends that changes made in the disclosure of Monnier, filed after the disclosure of Monnier II, reinforces its position that Monnier II is limited to depitched tall oil feedstocks. *Id.* at 5 (citing Ex. 2002 ¶¶ 115–119; Ex. 1012, 1:1, 2:8–3:8, 4:32–5:27). According to Patent Owner, the Monnier disclosure “*deleted* the 200–3000 ppm sulphur additive range” for depitched tall oil and expanded the recitation of bio oil feedstocks “to include, e.g., canola oil, sunflower oil, yellow grease, and animal tallow.” *Id.* at 5–6 (citing Ex. 2002 ¶ 118; Ex. 1050, ¶ 99; Ex. 1006, 2:23–40). In Monnier, the only “sulphur additive” concentration disclosed is a concentration of 1000 ppm which is added to “*every* bio oil feedstock in its newly added Examples 2–8.” *Id.* (citing Ex. 1006, 4:15–18, 5:32–9:23; Ex. 2013, 12:3–16:6). Indeed, Patent Owner notes that “Monnier itself added *1000 ppm sulphur* to canola oil feedstock”—the exemplary feedstock purported to support the Petitioner’s overlapping range. *Id.* at 6 (citing Ex. 1006, 8:65–9:23; Ex. 2013, 15:22–16:6).

In addition, Patent Owner urges that Satterfield similarly fails to support Petitioner’s assertions because it is not properly combinable with Jakkula and it does not describe overlapping ranges. MTA Reply 7. In particular, Patent Owner explains that Satterfield’s discussion of using “on

the order of 30 ppm” sulfur relates to hydrocracking, i.e., breaking down of hydrocarbons, which the ’832 patent describes as “an unwanted side reaction.” *Id.* (citing Ex. 1051, 390–393; Ex. 1014, 2; Ex. 1071 ¶ 17; Ex. 1001, 2:7–8; Ex. 2013, 50:13–20). Patent Owner therefore argues that “[b]ecause hydrocracking would have been viewed as undesirable when performing Jakkula’s HDO and isomerization processes, REG provides no reasoning, absent hindsight, for modifying an HDO process to incorporate hydrocracking reaction parameters.” *Id.* at 8. Furthermore, Patent Owner contends that the feedstock in Satterfield’s hydrocracking process is *petroleum-based* and not a bio oil. *Id.* (citing Ex. 1051, 391). As discussed above, this is important because “petroleum-based feedstocks typically ‘contain anywhere from 5,000 to 30,000 ppm sulfur.’” *Id.* (citing Ex. 1002 ¶ 61; Ex. 2002 ¶¶ 109–112). Thus, Patent Owner asserts that because “Satterfield’s disclosure of a 30 ppm sulfur concentration for use in a *different* chemical reaction with *different* feedstocks than used in Jakkula, Monnier, and Monnier II,” it cannot support Petitioner’s obviousness case. *Id.*

We also agree with Patent Owner that there is no overlap in the ranges found in the prior art and the substitute claims and, therefore, the prior art ranges do not render the proposed substitute claims unpatentable. Monnier II does not merely exemplify depitched tall oil, rather it teaches use of depitched tall oil *alone*. See generally Ex. 1006. Depitched tall oil has a known sulfur concentration of 670 ppm. Ex. 2002 ¶¶ 115–116; see also Ex. 1012, 16; Ex. 2013, 21:7–20 (Dr. Sughrue conceding “the sulfur in the tall oil feed is 670 ppm.”). Therefore, as Patent Owner asserts (MTA Reply 5), when combined with a sulfur additive in amounts of 200–3000 ppm, a total

sulfur content of between 870 to 3670 ppm exists in the feed. The amendment history of the specification between Monnier II (the earlier disclosure) and Monnier (the later disclosure) confirms that Monnier II correlates its sulfur concentration of 200–3000 ppm sulfur to depitched tall oil. In particular, the sulfur range in Monnier II, of 200–3000 ppm, was removed and only a teaching of 1000 ppm sulfur remained in Monnier. *Compare* Ex. 1012, 2:37–3:1, 5:16–18, *with* Ex. 1006, 2:51–59 (removing the paragraph detailing a sulfur range of 200–3000 ppm), 4:16–18; Ex. 2002 ¶ 118; Ex. 1050 ¶ 99. At the same time, the feedstock of Monnier was expanded to include feedstock of bio oils with a lower sulfur content than the depitched tall oil solely taught by Monnier II. *Compare* Ex. 1012, 1:1, 2:8–3:8, 4:32–5:27, *with* Ex. 1006 2:23–40; Ex. 2002, ¶¶ 115–119. Even Petitioner’s example using canola oil (MTA Opp. 17–18) is erroneous in light of the examples in Monnier detailing use of 1000 ppm sulfur when processing canola oil. Ex. 1006, 8:34–38 (Example 7) (using the hydrotreatment process described in Examples 1 and 2). Furthermore, as discussed above, both the disclosure of Satterfield and testimony of Dr. Sughrue suggest Satterfield’s sulfur level of 30 ppm relates to petroleum-based feedstocks and provides little insight as to what sulfur concentration is necessary to ensure that the catalyst in processing a bio oil is sufficiently sulfided.

Lastly, Patent Owner contends that Monnier II is not prior art because Monnier II is an unpublished, abandoned patent application. MTA Reply 9. Patent Owner distinguishes *Lund*, relied upon by Petitioner, by explaining that “*Lund* evaluated an abandoned application only as potential ‘known or used by others’ prior art” and not as a printed publication as required by the

AIA. *Id.* (discussing *In re Lund*, 376 F.2d 982 (CCPA 1967); 35 U.S.C. § 311(b)). Patent Owner further argues that abandoned applications are not “prior art unless its disclosures were incorporated by reference into the later patent.” *Id.* 9–10 (citing *Ex parte MacDonald*, 113 U.S.P.Q. 262, *3 (BPAI July 6, 1956)). And, because Monnier does not incorporate Monnier II by reference, it is not a prior art printed publication. *Id.*

Petitioner asserts that Monnier II is prior art as of January 6, 1998, the date Monnier issued. MTA Opp. 9. Petitioner relies on *Lund*, as holding “that if a CIP issued before the filing date of the contested application, the unpublished, abandoned parent can be prior art via the USPTO rule.” *Id.* at 10 (citing *Lund*, 376 F.2d at 991); *see also id.* (citing 37 CFR 1.14(a)(3) (1998)).

Because we determine that, even assuming that Monnier II is prior art, Petitioner failed to show that substitute claim 21 is invalid as obvious, a determination of whether Monnier II is prior art is moot.

In view of the foregoing, we find Petitioner has not established, by a preponderance of the evidence, that the combination of Jakkula, Monnier, Monnier II, and Satterfield would have rendered proposed substitute claim 21 obvious.

C. Obviousness of Proposed Substitute Claims 22–24

Because substitute claims 22–24 depend from substitute claim 21 and therefore necessarily incorporate all limitations of claim 21, Petitioner has also not established, by a preponderance of the evidence, that the combination of Jakkula, Monnier, Monnier II, and Satterfield would have rendered proposed substitute claims 22–24 obvious.

IV. CONCLUSION

We conclude that Petitioner has satisfied its burden of demonstrating, by a preponderance of the evidence, that the subject matter of claims 1–20 of the '832 patent is unpatentable as follows:

Claims	35 U.S.C. §	Reference(s)	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–20	103	Jakkula, Monnier	1–20	
8 and 9	103	Jakkula, Monnier, Craig, Garrido	8 and 9	
1–20 ²⁶	103	Jakkula, Oldřich		
1, 3–7, 10–13	103	Aalto, Monnier, Chou	1, 3–7, 10–13	
2, 8, 9, 14–20		Aalto, Monnier, Chou, Gunstone, Toeneboehn, Reid	2, 8, 9, 14–20	
Overall Outcome			1–20	

²⁶ We need not reach the question of whether Petitioner has shown by a preponderance of the evidence that the combination of Jakkula and Oldřich render claims 1–20 unpatentable (Ground 3, Pet. 32–38) as Petitioner has met its burden of demonstrating by a preponderance of the evidence that claims 1–20 are unpatentable over the combination Jakkula and Monnier (among others) and separately over the combination of Aalto and Monnier (among others).

We further conclude that Petitioner has *not* demonstrated by a preponderance of the evidence that proposed substitute claims 21–24 are unpatentable as follows:

Motion to Amend Outcome	Claim(s)
Original Claims Cancelled by Amendment	1–20
Substitute Claims Proposed in Amendment	21–24
Substitute Claims: Motion to Amend Granted	21–24
Substitute Claims: Motion to Amend Denied	
Substitute Claims: Not Reached	

V. ORDER

Accordingly, it is:

ORDERED that Petitioner has established, by a preponderance of the evidence, that claims 1–20 of the '832 patent are unpatentable; and

FURTHER ORDERED that Patent Owner's Motion to Amend is *granted*; and

FURTHER ORDERED that because this is a final written decision, parties to the proceeding seeking judicial review must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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