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Paper 17
Date: October 26, 2020

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NRG ENERGY, INC. and
TALEN ENERGY CORPORATION,
Petitioner,

v.

MIDWEST ENERGY EMISSIONS CORP.,
Patent Owner.

IPR2020-00832
Patent 10,343,114 B2

Before KRISTINA M. KALAN, CHRISTOPHER M. KAISER, and AVELYN M. ROSS, *Administrative Patent Judges*.

KALAN, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314, 37 C.F.R. § 42.4

I. INTRODUCTION

NRG Energy, Inc., Talen Energy Corporation, and Vistra Corp. (formerly known as Vistra Energy Corp.) filed a Petition (Paper 3, "Pet.") requesting an *inter partes* review of claims 1–9 and 12–30 of U.S. Patent No. 10,343,114 B2 (Ex. 1001, "the '114 patent"). Subsequently, Vistra Corp. and Midwest Energy Emissions Corp. ("Patent Owner") filed a Joint Motion to Terminate Vistra Corp. as a petitioner pursuant to a settlement. Paper 10. That motion was granted. Paper 13. Therefore, NRG Energy, Inc. and Talen Energy Corporation (collectively, "Petitioner") remain as petitioners. *Id.* at 4. Patent Owner filed a Preliminary Response to the Petition (Paper 9, "Prelim. Resp."). Pursuant to our authorization, Petitioner filed a Reply (Paper 15, "Pet. Reply"), and Patent Owner filed a Sur-reply (Paper 16, "Sur-reply").

To institute an *inter partes* review, we must determine that the information presented in the Petition shows "there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314(a). For the reasons discussed below, after considering the parties' submissions and the evidence of record, we determine that Petitioner has demonstrated a reasonable likelihood of prevailing with respect to at least one claim of the '114 patent. Thus, we institute an *inter partes* review.

A. Related Proceedings

The parties identify *Midwest Energy Emissions Corp. v. Vistra Energy Corp.*, No. 1:19-cv-01334-RGA (D. Del.) as a related matter. Pet. 6–7; Paper 6, 2. Petitioner also identifies IPR2020-00834 as a second petition against the '114 patent. Pet. 8.

B. The '114 Patent

The '114 patent, titled "Sorbents for the Oxidation and Removal of Mercury," "relates to methods and materials for the removal of pollutants from flue gas or product gas from a gasification system," and "[i]n particular, mercury is removed from gas streams generated during the burning or gasification of fossil fuels by highly reactive regenerable sorbents." Ex. 1001, code (54), 1:27–31. The'114 patent discloses that the "combustion and gasification of fossil fuel such as coal generates flue gas that contains mercury and other trace elements that originate from the fuel" and "[s]everal types of mercury control methods for flue gas have been investigated, including injection of fine sorbent particles into a flue gas duct and passing the flue gas through a sorbent bed." *Id.* at 1:33–35, 1:56–59. However, the '114 patent explains that a "major problem with existing carbon injection systems is that the sorbent is relatively unreactive toward mercury" and therefore "these sorbents must be used in large amounts." *Id.* at 2:10–12. The '114 patent further describes other mercury sorbent approaches and their problems. *Id.* at 2:20–3:15.

The '114 patent describes a halogen/halide-promoted sorbent "that is highly effective for the removal of mercury from flue gas streams" and that the "sorbent comprises any activated carbon and/or non-carbon compound." *Id.* at 3:36–39. Further, "[o]ptional secondary components and alkali may be added to further increase reactivity and mercury capacity." *Id.* at 3:43–44. The '114 patent states that "the optional secondary component is selected from the group consisting of Group V halides, Group VI halides, HI, HBr, HCl, and combinations thereof." *Id.* at 4:52–55.

The '114 patent discloses in "an embodiment, the promoted sorbent is introduced by direct injection into the flue gas stream" and in "another

embodiment, the base sorbent is promoted within the flue gas stream." *Id.* at 5:41–43. The '114 patent describes that in "some embodiments, the carbon base sorbent and the promoter are introduced into the mercury-containing gas at the same location or at separate locations." *Id.* at 7:5–8. For instance, the '114 patent explains for one example that "the sorbent is injected into the flue gas after the boiler" and the "additive can be injected where desired (e.g., before, after, or within the boiler)." *Id.* at 30:1–4.

The '114 patent explains that when "a promoted or a non-promoted base sorbent reacts with elemental or oxidized mercury, a mercury/sorbent chemical composition is formed and, in the case of elemental mercury reacting with the promoted base sorbent, the mercury is oxidized." *Id.* at 3:53–57. The '114 patent further describes separating the promoted sorbent from the gas stream and adjusting "the rate at which the carbon base sorbent is introduced or the rate at which the promoter is introduced or combination thereof" according to a monitored mercury content of the cleaned gas "so that the mercury content of the cleaned gas is maintained at substantially the desired level with minimal operating cost." *Id.* at 7:10–16.

C. Illustrative Claim

1. A method of separating mercury from a mercury containing gas, the method comprising:
combusting coal in a combustion chamber, to provide the mercury-containing gas, wherein the mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br-, or a combination thereof, wherein
the coal comprises added Br_2, HBr, Br-, or a combination thereof, added to the coal upstream of the combustion chamber, or
the combustion chamber comprises added Br_2, HBr, Br-, or a combination thereof, or
a combination thereof;

injecting a sorbent material comprising activated carbon into the mercury-containing gas downstream of the combustion chamber;
contacting mercury in the mercury-containing gas with the sorbent, to form a mercury/sorbent composition;
separating the mercury/sorbent composition from the mercury-containing gas, to form a cleaned gas;
monitoring the mercury content of the cleaned gas; and
controlling, in response to the monitored mercury content of the cleaned gas, an injection rate of injecting the sorbent into the mercury-containing gas, the sorbent composition, or a combination thereof, so that the mercury content of the cleaned gas is maintained at or below a desired level.

Ex. 1001, 33:49–34:7.

D. The Asserted Grounds of Unpatentability

Petitioner contends claims 1–9 and 12–30 of the '114 patent are unpatentable on the following grounds. Pet. 10.

Reference(s)	Basis	Claim(s) Challenged
Sjostrom,[1] Eckberg[2]	§ 103	1, 2, 4–9, 12–28, 30
Sjostrom, Olson-646[3]	§ 103	1–9, 12–30[4]

[1] Sharon Sjostrom, "Full Scale Evaluations of Mercury Control Technologies with PRB Coals," Track A, Session A3 (Mercury – Control), Presentation A3b, EUEC: 8TH ELECTRIC UTILITIES ENVIRONMENTAL CONFERENCE (Tucson, Arizona: January 25, 2005) (Ex. 1010).
[2] Craig Eckberg *et al.*, "Mercury Control Evaluation of Halogen Injection into a Texas Lignite-Fired Boiler," Track A, Session A3 (Mercury – Control), Presentation A3c, EUEC: 8TH ELECTRIC UTILITIES ENVIRONMENTAL CONFERENCE (Tucson, Arizona: January 25, 2005) (Ex. 1011).
[3] US 2006/0048646 A1, published Mar. 9, 2006 (Ex. 1014).
[4] The Petition states that claims 1–9 and 12–30 are being challenged under this ground, but Petitioner's actual arguments for this ground appear to address only claims 1–4, 6–9, 14, 19–22, and 24–30. *Compare* Pet. 10, 69 (indicating that Ground 2 challenges claims 1–9 and 12–30) *with* Pet. 69–97

In support of its unpatentability arguments, Petitioner relies on the declaration of Dr. Stephen Niksa. Ex. 1002 ("Niksa Declaration").

II. ANALYSIS

A. Claim Construction

We apply the claim construction standard articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005); 37 C.F.R. § 42.100(b) (2019); *see also Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board*, 83 Fed. Reg. 51,340 (Oct. 11, 2018) (applicable to *inter partes* reviews filed on or after November 13, 2018). Under *Phillips*, claim terms are afforded "their ordinary and customary meaning." *Phillips*, 415 F.3d at 1312. "[T]he ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention." *Id.* at 1313. Only terms that are in controversy need to be construed, and then only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

Neither party asserts a claim construction for the challenged claims. *See* Pet. 10; *see generally* Prelim. Resp. On this record, we determine that no claim terms require express construction.

B. Principles of Law

"In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363

(addressing only claims 1–4, 6–9, 14, 19–22, and 24–30). Clarification is requested.

(Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")). This burden of persuasion never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

A claim is unpatentable under § 103(a) 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 the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *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 skill in the art; and (4) when in evidence, objective indicia of non-obviousness (i.e., secondary considerations). *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). "To satisfy its burden of proving obviousness, a petitioner cannot employ mere conclusory statements. The petitioner must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness." *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

We analyze the asserted grounds of unpatentability in accordance with these principles to determine whether Petitioner has met their burden to establish a reasonable likelihood of success at trial.

C. Level of Ordinary Skill in the Art

Petitioner argues:

> A person of ordinary skill in the art ("POSITA") would have at least a bachelor's degree in chemical engineering, mechanical engineering, or a related field of study with at least two years of experience with implementing pollution control in power generation plants for natural gas, coal, and/or industrial waste incineration.

Pet. 12 (citing Ex. 1002 ¶ 64). Patent Owner does not appear to dispute this proposed definition. *See generally* Prelim. Resp. Neither party argues that the outcome of this case would differ based on our adoption of any particular definition of one of ordinary skill in the art.

In light of the record before us, we adopt Petitioner's proposal regarding the level of one of ordinary skill in the art. The level of ordinary skill in the art is also reflected by the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

D. Real Parties-In-Interest

Petitioner identifies a number of real parties-in-interest and potential real parties-in-interest. Pet. 1–6.

Patent Owner argues that "35 U.S.C. § 312(a)(2) provides that a petition may only be considered if 'the petition identifies all real parties in interest.'" Prelim. Resp. 8. Patent Owner contends that Petitioner lists "dozens of 'potential real parties in interest,' without explanation as to their relationship to petitioners," that this "is not an identification of *all real parties in interest*," and that, if instituted, this proceeding would be under a cloud of uncertainty because the ambiguity in Petitioner's list "will likely lead to confusion and disputes as to which parties are real parties in interest and which are bound by the estoppel provisions of 35 U.S.C. § 315." *Id*. For instance, Patent Owner asserts that Petitioner identifies various vendors and suppliers as "potential real parties in interest" but states that "[n]one of

these companies or any unnamed entity is funding, controlling, or directing, or otherwise has an opportunity to control or direct this Petition or proceeding" and this implies that these entities are not actually real parties in interest. *Id.* In addition, Patent Owner argues that some entities are identified both as "potential real parties in interest" and "real parties in interest," which creates ambiguity and conflict in the listing of entities. *Id*. For these reasons, Patent Owner contends that Petitioner has "not met their burden of identifying all real parties in interest" and "the Board should deny institution for failure to comply with § 312(a)(2)." *Id.* at 8–9.

We are not made aware of any rule, statute, or case law that prohibits Petitioner from identifying multiple real parties-in-interest or multiple potential real parties-in-interest. Petitioner's identification of about a dozen real parties-in-interest does not appear problematic or overly burdensome. Pet. 1–2. Petitioner's identification of numerous potential real parties-in-interest, while unusual, also does not appear problematic. *Id.* at 2–6. To the extent Petitioner has identified an entity as both a real party-in-interest and a potential real party-in-interest, we interpret that to mean that party is identified as a real party-in-interest. Petitioner's reasons for identifying numerous potential real parties-in-interest appear plausible: Petitioner identifies these parties "out of an abundance of caution" because "they are vendors and suppliers" in the related litigation but have not "agreed to be listed as a real party-in-interest" in this Petition. Pet. 1–6. This provides the Board and Patent Owner notice that other potential entities may be indirectly involved, but also provides reasons for not committing those parties to the real party-in-interest category. Ordinarily, problems regarding identification of real parties-in-interest arise when a petitioner fails to identify a real party-in-interest. *See, e.g., Ventex Co., Ltd. v. Columbia Sportswear N. Am., Inc.*,

IPR2017-00651, Paper 152 (PTAB Jan. 24, 2019) (precedential) (terminating proceeding where Petition failed to name time-barred RPI and privy). Here, the alleged problem is over-identification of potential real parties-in-interest. Without express violation of a known rule, statute, or case law, however, this does not appear to be a problem warranting non-institution of *inter partes* review.

E. Discretion under 35 U.S.C. § 325(d)

Patent Owner argues that the Board should exercise its discretion to deny institution under 35 U.S.C. § 325(d). Prelim. Resp. 1–2. Patent Owner asserts:

> Petitioners contend that the challenged claims cannot claim priority to earlier applications because those applications fail to provide written description support for two limitations: (1) using HBr, Br_2, or Br^-/bromide as an additive (Pet. at VI.C.2); and (2) adding the additive to coal (Pet. at VI.C.3). They contend that this dispute is appropriate for *Inter Partes* Review because: "Examiners do not make findings of priority as a matter of course during prosecution." Pet. at 11-12. This assertion is misguided. Petitioners fail to mention that the examiner found written description support for the challenged claims based on material contained in, or equivalent to, the parent applications. Because Petitioners identify no material error in the examiner's conduct, the Board should deny institution under § 325(d).

Id. at 2.

> To evaluate whether to exercise discretion under 35 U.S.C. §325(d),
>
> the Board uses the following two-part framework: (1) whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office; and (2) if either condition of first part of the framework is satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims

Advanced Bionics LLC v. MED-EL Elektromedizinische Geräte GmbH, IPR2019-01469, Paper 6 at 8 (PTAB Feb. 13, 2020) (precedential). The factors set forth in *Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 (PTAB Dec. 15, 2017) (precedential as to § III.C.5, first paragraph) provide insight into how to apply the framework, because *Becton, Dickinson* factors (a), (b), and (d) relate to part (1) of the framework and factors (c), (e), and (f) relate to part (2).

1. Advanced Bionics Framework Part (1)

For part (1) of the *Advanced Bionics* framework (and factors (a), (b), and (d) of *Becton, Dickinson*), Patent Owner contends that, shortly after filing the '760 application, a new independent claim was added which recited, among other things, "combusting coal in a combustion chamber, to provide the mercury-containing gas, wherein the mercury-containing gas comprises a halogen or halide promoter comprising Br_2, HBr, Br^-, or a combination thereof" and "injecting a sorbent material comprising activated carbon into the mercury-containing gas downstream of the combustion chamber." *Id.* at 4–5 (citing Ex. 1026, 75–76). According to Patent Owner, "this claim encompasses all of the features that Petitioner alleges are absent from the various parent applications, i.e., the use of HBr, Br2, or Br-, and the addition of a bromine material to the coal." *Id.* at 5.

Patent Owner, however, acknowledges that the new claim "does not expressly recite providing bromine to the coal" but argues "its scope covers that embodiment because it covers combusting coal to obtain a mercury-containing gas that also contains those bromine species." *Id.* Patent Owner cites a subsequent interview with the Examiner to discuss support for the amended claims and argues that the Examiner found support for the claim

scope in Figure 6 of the '114 patent, which is reproduced below. *Id.* (citing Ex. 1026, 1535).

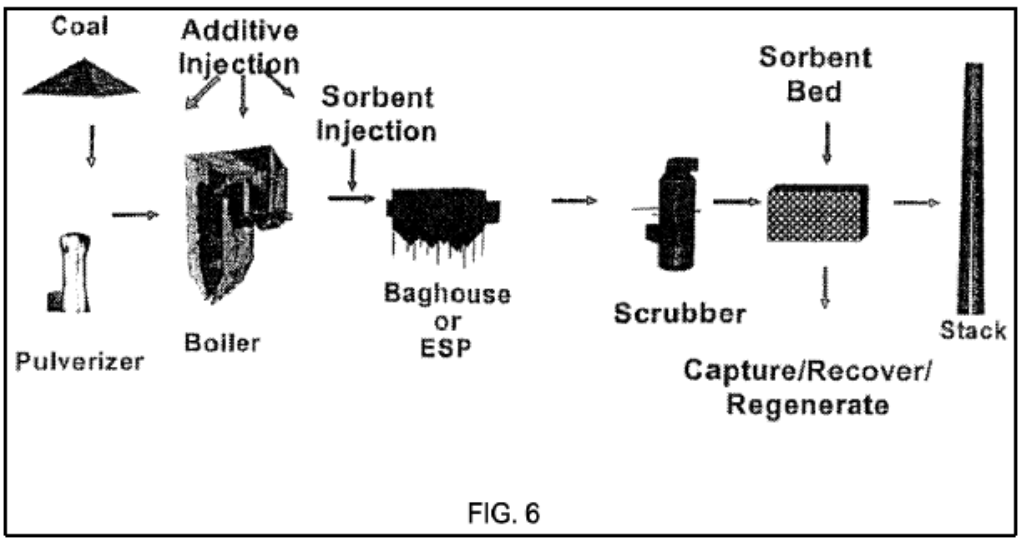


FIG. 6

Figure 6 of the '114 patent is "a block diagram illustrating the use of the invention in a coal fueled facility." Ex. 1001, 9:33–34. Patent Owner asserts that Figure 6 "is taken directly from the provisional application" and "the same written description issues that form the basis of the Petition were already considered by the examiner during prosecution." Prelim. Resp. 6.

Petitioner replies that the Examiner "at most considered whether the '114 Patent, *as filed*, included support for all claim limitations in the '114 Patent specification," but did not "address entitlement to benefit through each of the parent applications." Reply 4.

The independent claims of the '114 patent require that coal comprise added Br_2, HBr, Br- or a bromide compound, or a combination thereof, *or* the combustion chamber comprises added Br_2, HBr, Br- or a bromide compound, or a combination thereof. Ex. 1001, 33:55–60, 35:9–14, 35:29–34, 36:10–15. The scope of the claim added during prosecution of the '760 application may be viewed as encompassing various methods of adding the bromine species so coal is combusted and a mercury-containing gas is

provided that includes the bromine species. However, as acknowledged by Patent Owner, the claim added during prosecution of the '760 application "does not expressly recite providing bromine to the coal." Prelim. Resp. 5. Nor does the claim expressly recite that the bromine species are added to the combustion chamber.

Therefore, the Examiner did not necessarily consider whether the '760 application and its priority applications provided support for the two specific embodiments of adding the bromine species to coal and adding the bromine species to the combustion chamber. Analysis of the claim added during prosecution of the '760 application did not require analysis of whether there was written description support for these two specific embodiments, but rather, whether there was sufficient written description support for the claimed genus of adding the bromine species, which encompassed numerous ways of adding the bromine species. In other words, the analysis of support for the genus did not necessarily require analysis of support for the species. As a result, we do not agree with Patent Owner that the same or substantially the same arguments regarding the priority of the '114 patent previously were presented to the Office. Having reached this conclusion, we need not necessarily analyze the second part of the *Advanced Bionics* framework. Nevertheless, because Patent Owner argues that the Examiner implicitly considered priority issues during examination (Prelim. Resp. 6–8), we address this argument below.

2. Advanced Bionics Framework Part (2)

For part (2) of the *Advanced Bionics* framework (and factors (c), (e), (f) of *Becton, Dickinson*), Patent Owner contends that Petitioner "could have attempted to argue that the examiner's § 112/priority date analysis contained some material error, but they failed to do so," and, thus, factors (c), (e),

and (f) of *Becton, Dickinson* weigh against institution. Prelim. Resp. 6. In response to Petitioner's statement that "Examiners do not make findings of priority as a matter of course during prosecution, instead accepting applicant's asserted priority date" (Pet. 11–12), Patent Owner argues that although "examiners are not required to provide a priority date analysis for every application, such an analysis is required when considering references that post-date the earliest claimed filing date." Prelim. Resp. 6–7 (citing MPEP § 201.08). Patent Owner asserts that during prosecution, "the examiner considered several references with prior art dates in between the provisional filing date and the '114 filing date" but, nonetheless, "the fact that the examiner did not reject the claims based on this reference indicates that she did not accept Petitioners' assertion of a lapse in priority." *Id.* at 7. In view of this, Patent Owner argues that the Board should deny the petition. *Id.* at 8.

Petitioner argues "the Patent Office made no finding regarding priority of the '114 Patent to earlier filed applications." Pet. 21. Petitioner also asserts that although "the Patent Office did not make a determination regarding priority to earlier applications, applicants cited to the as-filed '760 Application for written-description support" when amending the pending claims of the '760 application to recite the addition of bromine-containing species (Br_2, HBr, Br^-, bromine compound) to coal upstream of a combustion chamber. *Id.* at 20–21, 23–24. However, Petitioner contends that some portions of the '760 application cited for written description support were not present in the '594 application, and earlier applications do not provide written description support for the independent claims of the '114 patent. *Id.* at 24–26. Petitioner further asserts that "the Examiner at most considered whether the '114 Patent, *as filed*, included support for all

claim limitations in the '114 Patent specification," the "Examiner did not address entitlement to benefit through each of the parent applications," and "[b]reaks in the priority chain occurred." Pet. Reply 4 (citing Ex. 1026, 1535; Pet. 26–33).

We find that Petitioner has demonstrated that the Office erred in a manner material to the patentability of the challenged claims. As discussed below with regard to the priority of the '114 patent, Petitioner demonstrates, on this record, a break in the priority chain of the '114 patent, and that the independent claims of the '114 patent lack written description support in each application of the priority chain. This is further illustrated by Patent Owner's arguments, which show that the Examiner cited Figure 6 of the '760 application for written description support when considering the claim amendments cited by Patent Owner. Prelim. Resp. 5–6 (citing Ex. 1026, 1535). Although Figure 2 of the provisional application corresponds to Figure 6 of the '760 application, Petitioner is correct that this drawing was removed from intervening applications, including the '163 and '595 applications, and was added to the specification when the '760 application was filed. Pet. Reply 5; *see* Ex. 1020, 16; Ex. 1021, 41–47; Ex. 1022, 40–46; Ex. 1026, 62.

For these reasons, we decline to exercise our discretion under § 325(d) to deny institution.

F. Discretion under 35 U.S.C. § 314(a)

Under § 314(a), we have discretion to deny institution of an *inter partes* review. *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2140 (2016); *SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1356 (2018); *Harmonic Inc.*, 815 F.3d at 1367 ("[T]he PTO is permitted, but never compelled, to institute an IPR proceeding."); *see also* 37 C.F.R. § 42.4(a) ("The Board institutes the

trial on behalf of the Director."). In deciding whether to institute an *inter partes* review, we consider the guidance in the Consolidated Trial Practice Guide, which states:

> Based on the Board's experience, one petition should be sufficient to challenge the claims of a patent in most situations. Two or more petitions filed against the same patent at or about the same time . . . may place a substantial and unnecessary burden on the Board and the patent owner and could raise fairness, timing, and efficiency concerns.

Patent Trial and Appeal Board Consolidated Trial Practice Guide ("CTPG") (Nov. 2019), https://www.uspto.gov/sites/default/files/documents/tpgnov.pdf, 59.

Here, Petitioner filed two petitions on the same day challenging claims 1–9 and 12–30 of the '114 patent. In IPR2020-00834, Petitioner presented two anticipation grounds, one based on Vosteen and one based on Downs-Boiler, and six obviousness grounds based on either Vosteen or Downs-Boiler and additional references. IPR2020-00834, Paper 3, 10. In this proceeding, Petitioner presented two obviousness challenges, the first based on Sjostrom and Eckberg and the other based on Sjostrom and Olson-646. Pet. 10.

Petitioner filed a Petitioner's Explanation Regarding the Necessity of Multiple Petitions. Paper 2 ("Explanation"). Arguing that "[g]iven the strength of the prior-art references on the merits, and noncumulative nature of the references, both petitions should be instituted," Petitioner nevertheless ranks the IPR2020-00834 petition above the IPR2020-00832 petition. Explanation 2.

Citing the CTPG's statement that "more than one petition may be necessary . . . when there is a dispute about priority date requiring arguments

under multiple prior art references," Petitioner also contends that the two petitions assert different priority dates and assert different references. *Id.* at 3 (citing CTPG 59). Petitioner further argues that the issues presented to the Board by the two Petitions are limited, because the Petition in IPR2020-00834 uses only two primary references and two secondary references whereas the Petition in this proceeding uses only one primary reference and two secondary references. *Id.* at 3–4. Petitioner also contends that Patent Owner may attack obviousness grounds for dependent claims in IPR2020-00834 via evidence of secondary considerations. *Id.* at 4. In view of this possibility, Petitioner requests that the Board also institute in this proceeding because Olson-646 discloses numerous limitations of the same dependent claims. *Id.* Petitioner also argues that, instead of each party individually filing separate petitions, the parties joined forces for reasons of efficiency. *Id.* at 4–5.

Petitioner's arguments are persuasive. As argued by Petitioner, the CTPG recognizes that more than one petition may be necessary when there is a priority date dispute that requires arguments under multiple prior art references. CTPG 59. We also agree with Petitioner that the second petition in this proceeding does not unduly burden the Board, due to its two grounds based on three references. Because the remaining grounds in IPR2020-00834 based on Downs-Boiler appear to challenge only claims 1–7 and 12–30 of the '114 patent, the petition in this proceeding potentially challenges claims (i.e., claims 8 and 9) in addition to those challenged by the ground based on Downs-Boiler in IPR2020-00834.

Patent Owner does not contest Petitioner's arguments that the simultaneous filing of two petitions does not unduly burden the Board. *See generally* Prelim. Resp.; Sur-reply. Nor does Patent Owner argue that two

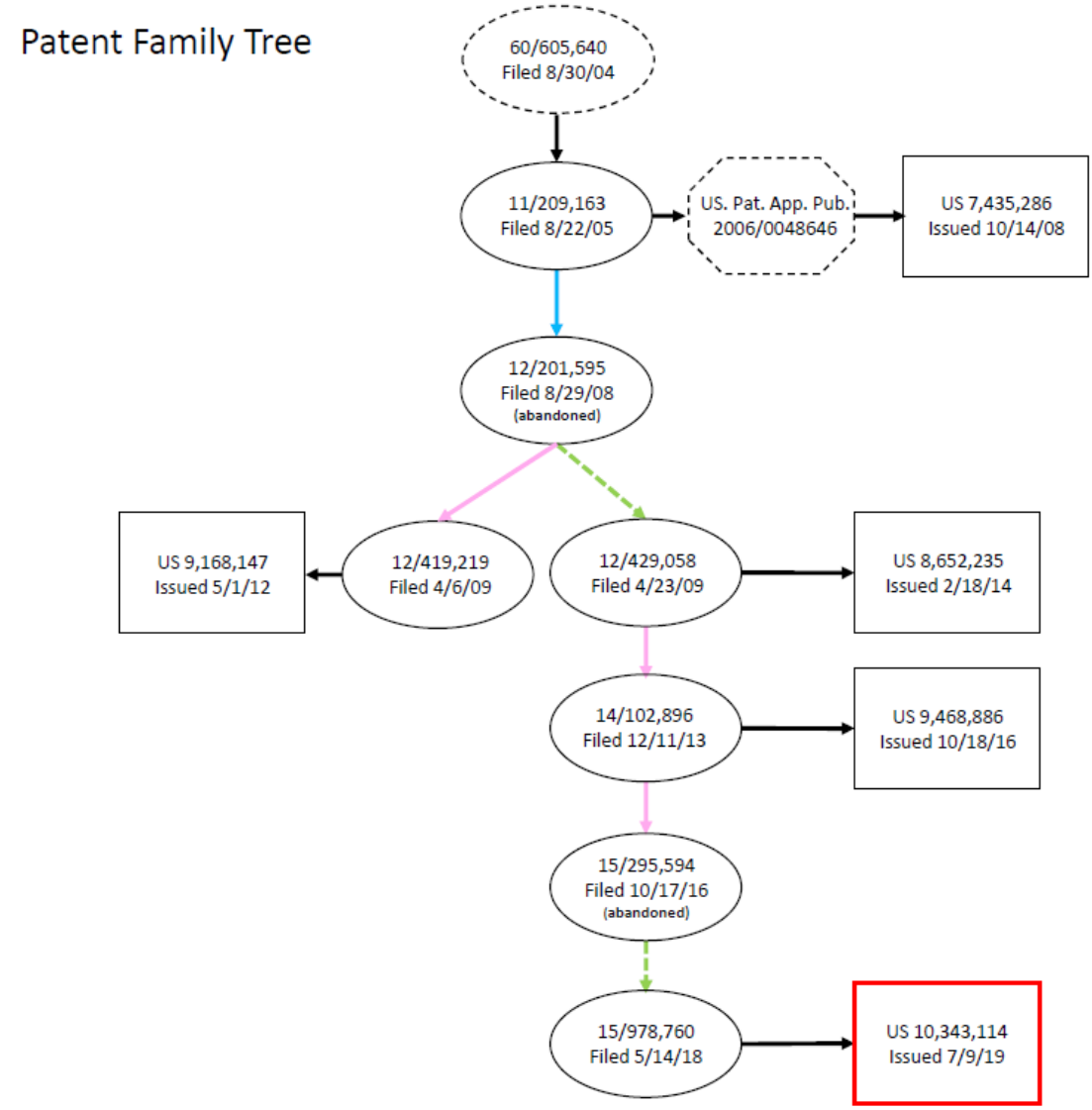
petitions prejudice Patent Owner or otherwise request us to exercise our discretion under § 314(a). *Id.* Given the unique circumstances in this proceeding, we find this to be a rare instance in which we should decline to exercise our discretion to deny the lower-ranked Petition.

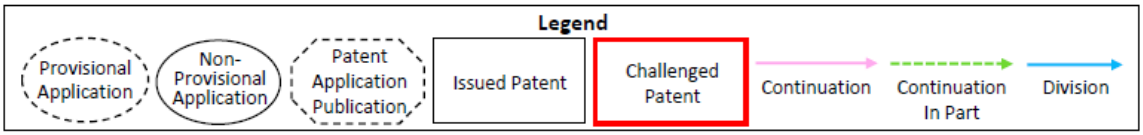
G. Priority of '114 Patent

Petitioner asserts that the priority date of the '114 patent is no earlier than its filing date of May 14, 2018. Pet. 20. Petitioner asserts it has demonstrated "the invalidity of the '114 Patent claims in the grounds below" and this places the burden on Patent Owner "to come forward with evidence 'to prove entitlement to claim priority to an earlier filing date.'" Pet. 21–22 (citing *PowerOasis, Inc. v. T-Mobile USA, Inc.*, 522 F.3d 1299, 1305–06 (Fed. Cir. 2008) (stating a patent owner has "to prove entitlement to claim priority to an earlier filing date").

Petitioner provides the following summary of the '114 patent's priority chain and family:

Patent Family Tree





Ex. 1017. This summary depicts the earliest filed application at the top and shows the latest filed application at the bottom. As illustrated above, the '114 patent has the following priority chain:

- Provisional Application 60/605,640, filed August 30, 2004, ("the provisional application");
- Non-provisional Application 11/209,163 ("the '163 application"), filed August 22, 2005, claiming priority to the Provisional Application;
- Non-provisional Application 12/201,595 ("the '595 application"), filed August 29, 2008, claiming priority to the '163 application as a divisional application;
- Non-provisional Application 12/429,058 ("the '058 application"), filed April 23, 2009, claiming priority to the '595 application as a continuation-in-part;
- Non-provisional Application 14/102,896 ("the '896 application"), filed December 11, 2013, claiming priority to the '058 application as a continuation;
- Non-provisional Application 15/295,594 ("the '594 application"), filed October 17, 2016, claiming priority to the '896 application as continuation; and
- Non-provisional Application 15/978,760 ("the '760 application"), filed May 14, 2018, claiming priority to the '594 application as a continuation-in-part.

Id.; Ex. 1001, code (21), (22), (60). The provisional application has an earlier date than when Sjostrom and Eckberg were publicly accessible (February 2005) and when Olson-646 was published (March 2006).

Reply 1. Therefore, if the '114 patent were entitled to the priority date of the provisional application, Sjostrom, Eckberg and Olson-646 would not qualify as prior art to the '114 patent.

Petitioner contends the priority date of the '114 patent is no earlier than its filing date of May 14, 2018, because:

> The earlier-filed applications in the priority chain fail to include sufficient written description of claim limitations that appear in each of the independent claims (Claims 1, 23–25), at least because there is no disclosure of adding any type of bromine-containing species (Br_2, HBr, Br^-, bromine compound) to the coal upstream of the combustion chamber, let alone the particular species recited in the claims.

Pet. 20. Petitioner asserts that the provisional application cannot be relied upon for support because the intervening applications do not include the relied-upon disclosure of the provisional application. *Id.* at 26 (citing *Lockwood v. American Airlines, Inc.*, 107 F.3d 1565 (Fed. Cir. 1997)).

Petitioner argues that "in the '760 Application and earlier applications, the Provisional is only 'incorporated by reference ***to the extent appropriate***,'" indicating that applicants did not intend to incorporate the entire document, but only parts of it, again without identifying the specific material to incorporate." *Id.* at 27 (citing Ex. 1001, 1:20–22). Petitioner asserts that "material from a provisional application incorporated by reference cannot be considered as providing written description support in a priority analysis, because such material would be deemed 'essential material.'" *Id.* at 27–28. "'[E]ssential material'—which includes 'material that is necessary to: provide a written description of the claimed invention'—'may be incorporated by reference, but ***only*** by way of incorporation by reference to a ***U.S. patent or U.S. patent application publication***.'" *Id.* (citing 37 C.F.R. § 1.57(d) (2020); 37 C.F.R. § 1.57(c)

(2005)). Petitioner further argues that the provisional application "fails to disclose adding to the coal or to the combustion chamber each of the particular bromine-containing species recited in the Newly Introduced Limitations, such as Br_2, Br^- and 'bromide compounds.'" *Id.* at 28–33 (citing Ex. 1002 ¶¶ 187, 192–196).

In addition, Petitioner contends there is a lack of support for the '114 patent claims in the intervening applications between the provisional application and the '114 patent because "[n]othing in the '595 Application filed 8/29/2008 describes adding the bromine promoter independently from the mercury sorbent, let alone to the coal or combustion chamber." *Id.* at 34 (citing Ex. 1022, 1–34). Petitioner also argues that the '058, '594, and '896 applications are deficient in their written description support. *Id.* at 34–36.

Patent Owner argues that a petitioner initially has the burden of persuasion and the burden of production on all issues, and if the petitioner provides *prima facie* evidence that its burden has been met, the burden of production shifts to patentee on some issues, such as the determination of a patent's priority date. Prelim. Resp. 13 (citing *Dynamic Drinkware*, 800 F.3d at 1379–80). According to Patent Owner, if "the patentee meets this burden by providing evidence of an earlier priority date, the Board must evaluate the petitioner's arguments in light of all the evidence to determine if the petitioner has met its burden of persuasion." *Id.* (citing *Dynamic Drinkware*, 800 F.3d at 1380; *Boart Longyear Ltd. v. Australian Mud Co. Pty Ltd.*, No. IPR2019-01129, 2019 WL 6442439, at *14 (PTAB Nov. 25, 2019)). Patent Owner contends that Petitioner confuses the burden of production with the burden of persuasion. *Id.* at 14.

In view of the above, Patent Owner asserts that Petitioner "must demonstrate that one or more of these applications lacks written description

support for the challenged claims of the '114 patent" but Petitioner has not met its burden. *Id.* at 14–15. Specifically, Patent Owner argues that the provisional application supports the claims of the '114 patent and the '594 application, the '896 application, and the '058 application collectively[5] support the claims of the '114 patent. *Id.* at 16–22, 24–31.

Patent Owner also addresses the '595 and '163 applications, stating that they "contain substantively identical disclosures," and therefore refers to the '595 application when arguing that those two applications support the claims of the '114 patent. *Id.* at 22. Specifically, Patent Owner asserts that the "'595 application discloses the same chemical model as the '594 application," "the use of a 'promoter' that supplies Br- such as HBr or Br_2," "and the practice of adding the promoter and sorbent at one or multiple locations." *Id.* (citing Ex. 1022 ¶¶ 52–53, 56, 64, Fig. 2, original claim 8).

Patent Owner acknowledges that "instead of the hypothetical example depicted in figure 5 of the ['594] patent, the ['595][6] patent describes an experimental test setup at an actual coal plant" in which "the promoter and sorbent were both injected downstream of the boiler" but argues "the inventors explained that these components could be added before, after, or within the boiler." *Id.* at 22–23 (citing Ex. 1022 ¶ 107). Patent Owner asserts that because "a halogen/halide promoted sorbent necessarily includes a halogen/halide such as Br_2, HBr, or Br-, a POSITA would recognize that adding this material before the boiler necessarily results in the limitations at

[5] Patent Owner states that the '595 application is representative of the '163 application and the '594 application is representative of the '058 and '896 applications. Prelim. Resp. 14.

[6] There appears to be a typographical error in this passage. It appears that the '594 application and the '595 application were inadvertently switched with one another.

issue in the '114 patent." *Id.* at 23. In response to Petitioner's arguments regarding lack of written description support in the intervening applications (including the '595 and '163 applications), Patent Owner contends that Petitioner offers "only brief, vague assertions as to why these applications fail to provide support for the challenged claims, or they criticize portions of the applications not relied upon above." *Id.* at 31.

Petitioner responds by arguing that it has shown Sjostrom and Eckberg to be printed publications, and that Olson-646 was published in March 2006, and this has shifted the burden to Patent Owner to show an earlier filing date. Pet. Reply 1 (citing *Mueller Sys., LLC v. Rein Tech, Inc.*, IPR2020-00100, 2020 WL 2478524, at *10 (PTAB May 12, 2020)). Petitioner asserts that "Patent Owner has not demonstrated written-description support through *each* of the parent applications" and that Patent Owner has not shown that all limitations are found in the provisional application. *Id.* at 1–4. Petitioner contends that Patent Owner does not dispute that a provisional application cannot be incorporated by reference for a priority analysis. *Id.* at 4. In addition, Petitioner disputes Patent Owner's analysis for support in the intervening applications, arguing that "[t]he '163 Application states that 'the ***inventive sorbent*** can be injected where desired (e.g., before, after, or within the boiler)" and "[t]he 'inventive sorbents' are those formed from '***chemically combin[ing] molecular bromine*** . . . ***with activated carbon***.'" *Id.* at 4–5 (citing Ex. 1021, 18, 29; Ex. 1022, 14, 25 (emphasis added)). Petitioner asserts that "the '114 Patent claims require ***separately*** injecting the promoter and sorbent (i.e., before they chemically combine)—the promoter must be added to the coal or to the boiler, and the sorbent must be injected downstream of the boiler." *Id.* at 5 (citing Ex. 1001, claims 1, 23–25). Petitioner further argues that Figure 2 of the

provisional application was removed from all intervening applications but added to the specification when the '114 patent was filed (i.e., as Figure 6 in the '760 application). *Id.*

Patent Owner argues that the provisional application supports the challenged claims. Sur-reply 1–4. In response to Petitioner's arguments regarding the '163 application and the separate injection of promoter and sorbent, Patent Owner argues that "[n]o such language appears in the claims," "[a]t best, Petitioners are raising a new argument based on a new claim construction position, but they fail to identify the claims affected, the claim language that they seek to construe, or any intrinsic or extrinsic evidence in support of their position", and "the claims do not merit such a construction" because the claim language "does not exclude adding bromine or sorbent at both locations." *Id.* at 4. Patent Owner further contends that claim 14 of the '114 patent recites "wherein the sorbent material injected into the mercury-containing gas is a promoted sorbent" and "[t]hus, the claims plainly do not exclude injection of bromine with sorbent so long as some bromine is provided upstream of the combustion chamber and some activated carbon is injected downstream of the combustion chamber." *Id.* at 5. In addition, Patent Owner asserts "the specification describes embodiments where multiple injection points are used to inject combined promoter and sorbent." *Id.* (citing Ex. 1001 at 14:10–16).

Having considered the parties' positions and evidence, we determine that Petitioner has demonstrated a reasonable likelihood that one or more of the applications in the priority chain for the '114 patent lacks written description support for the challenged claims. Conversely, Patent Owner's arguments are insufficient to establish that the applications in question provide written description support.

According to *Lockwood v. American Airlines, Inc.*,

> In order to gain the benefit of the filing date of an earlier application under 35 U.S.C. § 120, *each application in the chain leading back to the earlier application must comply with the written description requirement of 35 U.S.C. § 112*. *In re Hogan,* 559 F.2d 595, 609, 194 USPQ 527, 540 (CCPA 1977).

107 F.3d at 1571 (emphasis added). Even if the provisional application and/or the '760 application were found to provide support for the challenged claims of the '114 patent, at least the '163 application and the '595 application do not provide written description support for the challenged claims.

The independent claims of the '114 patent recite that coal comprises added Br_2, HBr, Br^-, or a combination thereof (claims 1, 23, and 24), or Br_2, HBr, a bromide compound or a combination thereof (collectively, the "promoter"), (claim 25), or the combustion chamber comprises the added promoter, and the sorbent material is injected into the mercury-containing gas downstream of the combustion chamber. Ex. 1001, 33:55–63, 35:9–17, 35:30–38, 36:10–18. Therefore, regardless of whether the independent claims of the '114 patent encompass injecting both promoter and sorbent material into the mercury-containing gas downstream of the combustion chamber and/or adding that combination to coal or the combustion chamber, the issue is whether there is written description support in each application of the '114 patent's priority chain for a method that includes both (1) adding the promoter to coal or to the combustion chamber and (2) injecting the sorbent material into the mercury-containing gas downstream of the combustion chamber, as claims 1 and 23–25 recite.

Patent Owner states that the '595 application is representative of the '163 application and "[t]he '595 and '163 applications contain

substantively identical disclosures." Prelim. Resp. 14, 22. Petitioner does not dispute these assertions. *See generally* Pet.; Pet. Reply. For expediency, we analyze the disclosure of the '595 application.

Although Figure 6 of the '760 application corresponds to Figure 2 of the provisional application, that drawing is absent from the '595 and '163 applications. Ex. 1026, 62; Ex. 1020, 16; Ex 1020, 41–47; Ex. 1022, 40–46.[7] The '595 application describes methods for "the removal of mercury from the gases produced in the utilization of fossil fuels." Ex. 1022, 2, ¶ 8. To achieve this, the '595 application describes a "halogen/halide promoted activated carbon sorbent" that "comprises a new halide-modified carbon form containing a reactive compound produced by the reaction of bromine (or halide or other halogen) with the carbon," although "[o]ptional secondary components and alkali may be added to further increase reactivity and mercury capacity." *Id.* at 3, ¶ 9. The promoter can be selected from a group that includes "molecular halogens" and the optional secondary component may be selected from a group that includes HBr. *Id.* at 3–4, ¶¶ 11, 15. In another embodiment, the promoter is selected from a group that includes Br_2. *Id.* at 4, ¶ 18. The '595 application also describes the reaction of "[m]olecular bromine or a bromine compound" with activated carbon and the role of "halide anions electrons" in the oxidation of mercury. *Id.* at 10, ¶¶ 52–53.

[7] It appears that material from the provisional application was added to the '760 application. Ex. 1026, 36. However, it does not appear that this practice was followed for the '595 and '163 applications. One example of this is the absence of a drawing corresponding to Figure 6 in the '760 application or Figure 2 in the provisional application.

The '595 application further describes an example that involves "Full-Scale Testing." *Id.* at 25, ¶ 107. For this example, the '595 application discloses "the halogen/halide promoted carbon sorbent was injected into the flue gas after the boiler." *Id.* Thus, this passage describes a combination of promoter and sorbent material being added at one single point: "into the flue gas after the boiler." The '595 application continues the description of this example by stating "[i]n general however, the inventive sorbent can be injected where desired (e.g., before, after, or within the boiler)." *Id.* Although this describes other injection points ("e.g., before, after, or within the boiler"), this disclosure regards the promoted sorbent material. As a result, it describes the addition of both the promoter and the sorbent material at a single point, not (1) the addition of the promoter with the coal or the combustion chamber and (2) the injection of the sorbent material into mercury-containing gas downstream of the combustion chamber, as claims 1 and 23–25 of the '114 patent recite. As a result, we do not agree with Patent Owner's arguments regarding paragraph 107 of the '595 application. *See* Prelim. Resp. 22–23; Sur-reply 4–5.

Patent Owner further argues that paragraph 56 of the '595 application describes "the practice of adding the promoter and sorbent at one or multiple locations." Prelim. Resp. 22. Paragraph 56 explains that "single injection points 116 or 119 are shown in Figure 3, although one skilled in the art will understand that multiple injection points are within the scope of the present invention." Ex. 1022, 11, ¶ 56. However, this refers to injection points in flue gas stream 15 described in paragraph 55 of the '595 application, not multiple injection points at different points in the process (e.g., in the flue gas stream, in the combustion chamber, or with coal). *Id.* at 10–11, ¶ 55. Further, to the extent Patent Owner argues there is written description

support in the ’595 and ’163 applications for adding the promoter to the coal or to the combustion chamber (in addition to injecting the sorbent material downstream of the combustion chamber) because this would have been an obvious variation of the ’595 application’s disclosure, rendering an invention obvious does not satisfy the written description requirement. *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1352 (Fed. Cir. 2010) (en banc) (citing *Lockwood*, 107 F.3d at 1571–72).

We further note that the ’595 and ’163 applications each incorporate by reference the provisional application in its entirety. Ex. 1021, 5, ¶ 1; Ex. 1022, 1, ¶ 1. Petitioner asserts that “material from a provisional application incorporated by reference cannot be considered as providing written support in a priority analysis, because such material would be deemed ‘essential material,’” and such essential material may only be incorporated by reference to a U.S. patent or U.S. patent application publication. Pet. 27–28 (citing 37 C.F.R. § 1.57(d) (2020); 37 C.F.R. § 1.57(c) (2005)). Petitioner is correct that 37 C.F.R. § 1.57(c) (2005) permitted the incorporation by reference of essential material, which included material necessary to provide a written description of the claimed invention, but it is critical to note that it limited such incorporations to U.S. patents and U.S. patent application publications. 37 C.F.R. § 1.57(c) (2005)). Patent Owner does not dispute this point. *See generally* Prelim. Resp.; Sur-reply; *cf. Ex parte Maziere,* 27 USPQ2d 1705, 1706–07 (Bd. Pat. App. & Inter. 1993) (holding that if “essential material” is included in the application at issue, incorporation by reference in the parent application was sufficient to claim priority and to satisfy the written description requirement, but not discussing provisional applications). Therefore, to the extent the provisional application provides support for the challenged claims, the

incorporation by reference of the provisional application by the '595 and '163 applications cannot cure the deficiencies discussed above.

Moreover, although we have only analyzed the '595 and '163 applications, we also look to the incorporation statements in the other applications in the chain leading to the '760 application. Reply 4. The incorporation statement in the '058 application provides: "The disclosures of US Patent Applications 12/201,595; 11/209,163; and 60/604,640 are hereby incorporated herein by reference to the extent appropriate." Ex. 1023, 7. The incorporation statement in the '896 application provides: "The disclosures of US Patent Application Serial Nos. 12/429,058; 12/201,595; 11/209,163; and 60/605,640 are hereby incorporated herein by reference to the extent appropriate." Ex. 1024, 8. The incorporation statement in the '594 application provides: "The disclosures of US Patent Application Serial Nos. 14/102,896; 12/429,058; 12/201,595; 11/209,163; and 60/605,640 are hereby incorporated herein by reference to the extent appropriate." Ex. 1025, 10. "To incorporate material by reference, the host document must identify with *detailed particularity* what specific material it incorporates and *clearly indicate where* that material is found in the various documents." *Zenon Envtl., Inc. v. U.S. Filter Corp*., 506 F.3d 1370, 1378, 1379 (Fed. Cir. 2007) (quoting *Cook Biotech Inc. v. Acell, Inc*., 460 F.3d 1365, 1376 (Fed. Cir. 2006)). It is unclear to us what the term "to the extent appropriate" means in this context. The incorporation statements in the '058 application, the '896 application, and the '594 application all fail to identify with detailed particularity the specific material incorporated "to the extent appropriate," and fail to clearly indicate where that material is found in the various documents. *See also* MPEP 211.02 ("In view of this requirement for a specific reference in the later-filed

application, the right to rely on a prior application may be waived by an applicant if a proper reference to the prior application is not included in the later-filed application."). This ambiguity creates an additional concern regarding the chain of priority of the '760 application.

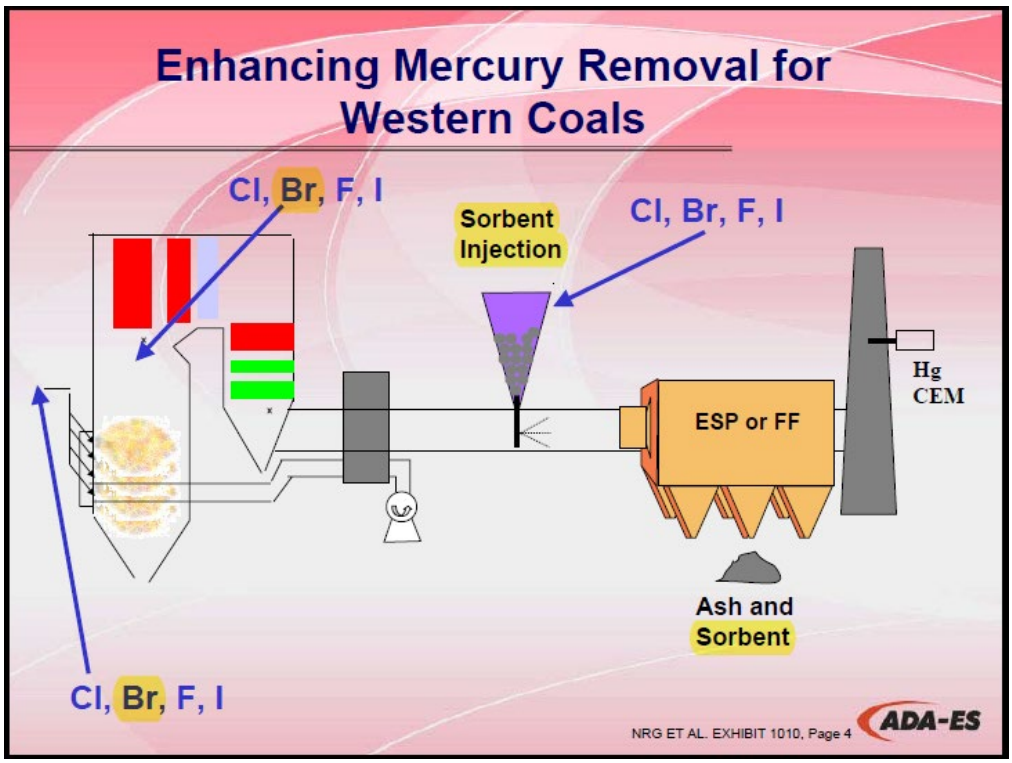
In view of the present record, Petitioner has demonstrated that one or more of the applications in the priority chain for the '114 patent lacks written description support for the challenged claims. Patent Owner, on this record, has not presented persuasive arguments or evidence that the '114 patent is entitled to a priority date earlier than the May 14, 2018 filing date of the '760 application.

H. Asserted Obviousness over Sjostrom and Eckberg (Ground 1)

Petitioner argues that claims 1, 2, 4–9, 12–28, and 30 are unpatentable over Sjostrom and Eckberg. Pet. 36–69.

1. Sjostrom

Sjostrom is a presentation titled "Full Scale Evaluations of Mercury Control Technologies with PRB Coals" that was made during the 2005 Electric Utilities Environment Conference ("EUEC"). Ex. 1010, 1; Ex 1030, 3, 23. Sjostrom includes the following drawing of a process:

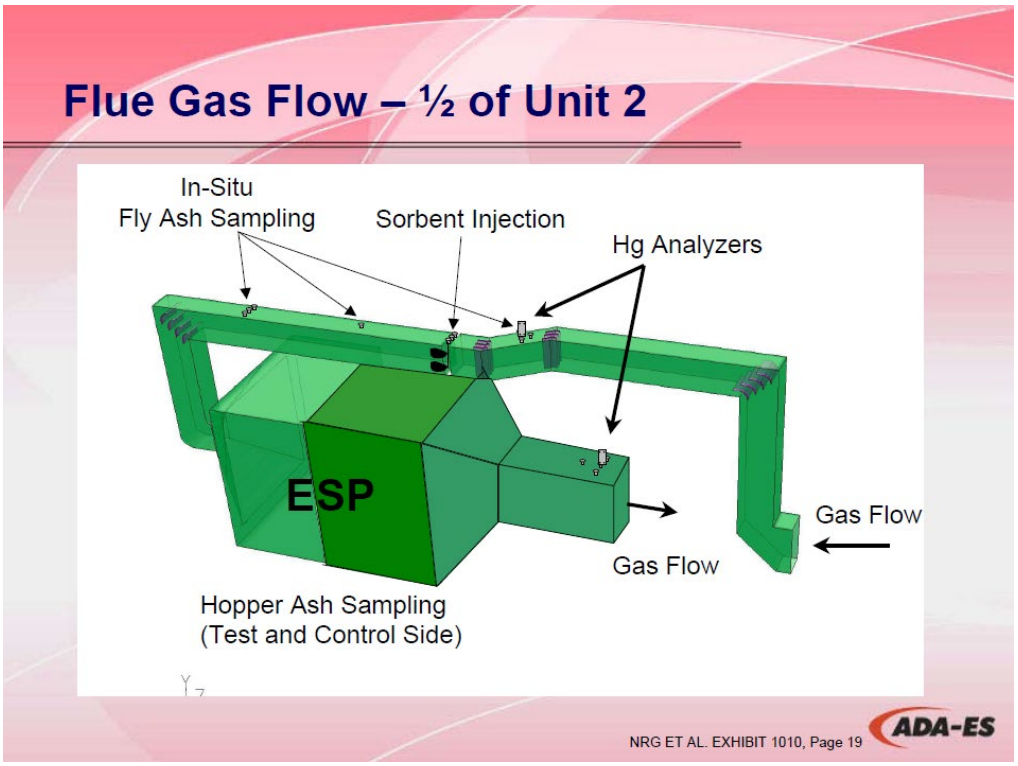


Sjostrom's Process Diagram

Ex. 1010, 4. Sjostrom's Process Diagram is captioned "Enhancing Mercury Removal for Western Coals." *Id.* The Figure includes a boiler (or combustion chamber) on the left and arrows pointing to what appears to be upstream of the boiler, into the boiler, and to a "Sorbent Injection" device, which appears to be located downstream of the boiler. *Id.* The arrows are labeled with chemical species, such as bromine. *Id.* An "ESP or FF" is located on the right side of the figure with "Ash and Sorbent" located below the "ESP or FF" device. *Id.*

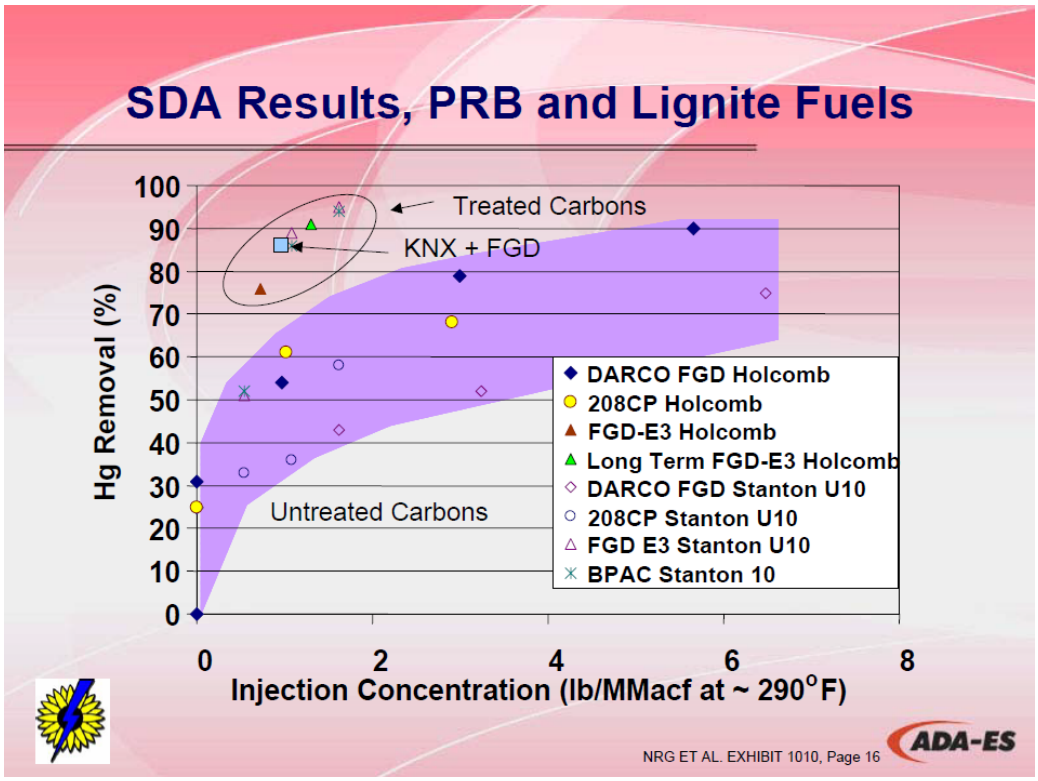
Sjostrom describes "KNX (Alstom Power)" when discussing "Coal Additives at Meramec" and describes "Activated Carbon Injection to Improve Mercury Control." *Id.* at 10, 23.

The far right side of Sjostrom's figure also has a "Hg CEM." *Id.* at 4. Sjostrom provides the following drawing when discussing "Flue Gas Flow – ½ of Unit 2:"

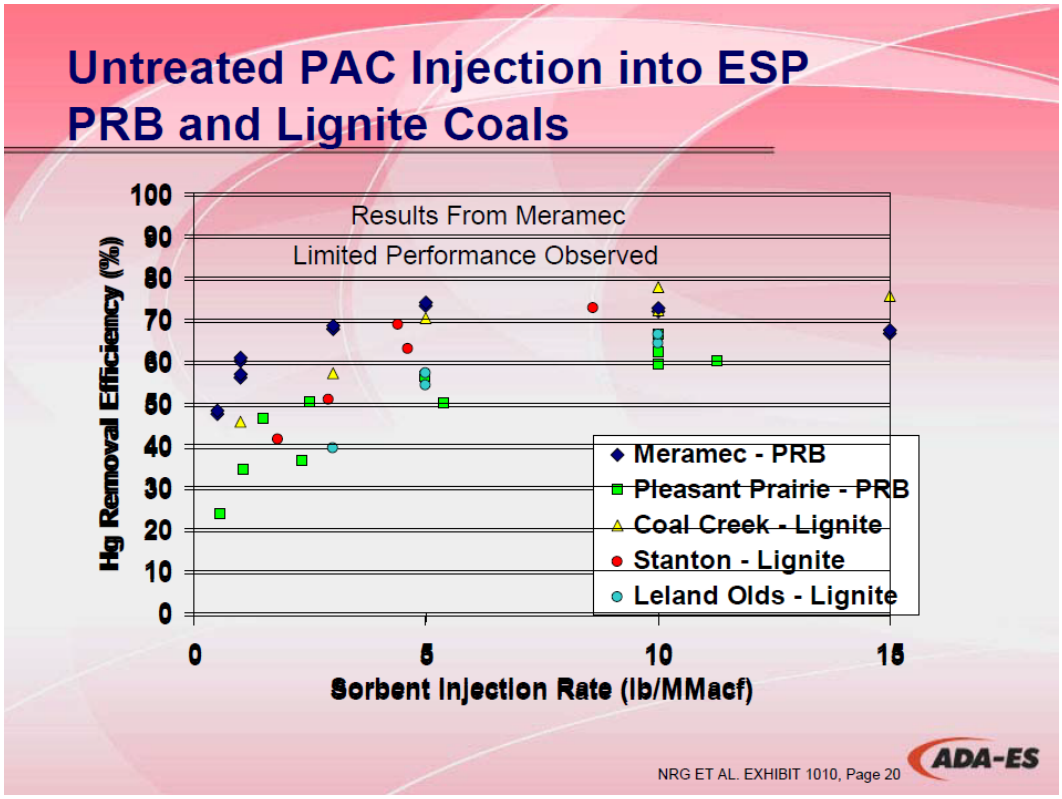


Sjostrom's Flue Gas Flow Figure

Id. at 19. Sjostrom's Flue Gas Flow figure includes "Hg Analyzers." *Id.* Sjostrom also includes the following graphs:



Sjostrom's "SDA Results" Graph

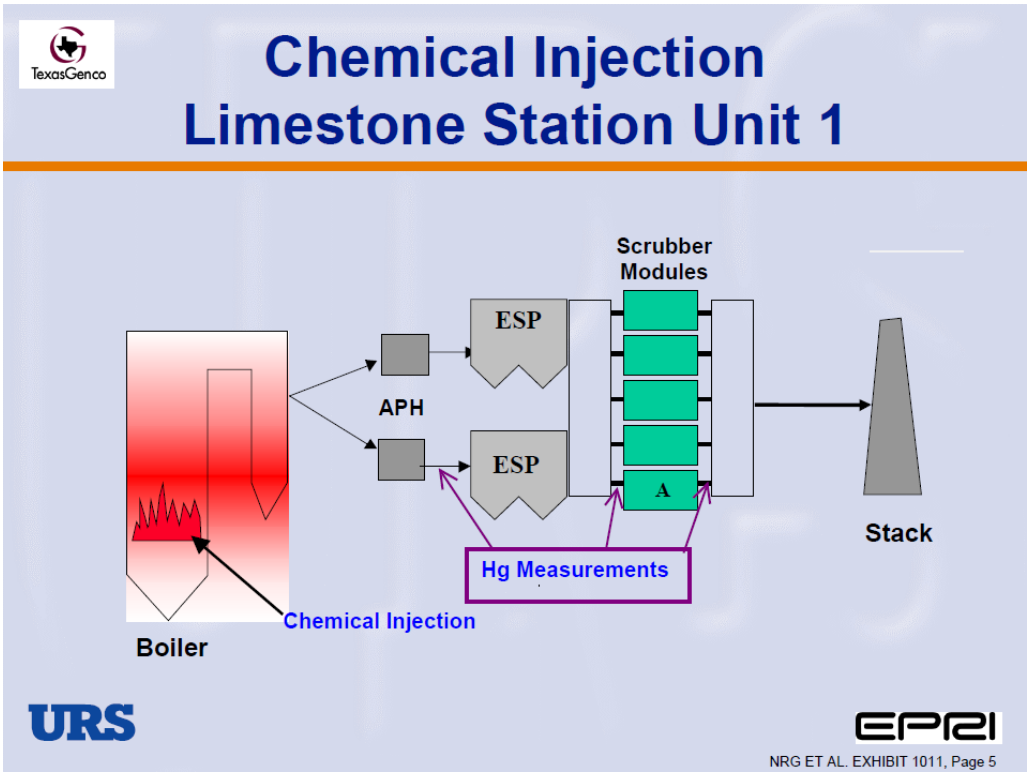


Sjostrom's "Untreated PAC Injection" Graph

Id. at 16, 20.

2. Eckberg

Eckberg is a presentation titled "Mercury Control Evaluation of Halogen Injection into a Texas Lignite-Fired Boiler" that, like Sjostrom, was made during the 2005 EUEC. Ex. 1011, 1; Ex 1030, 3, 23–24. Eckberg includes the following process figure:



Eckberg's Process Figure

Ex. 1011, 5. Eckberg's process figure includes a boiler on the left with an arrow pointing to the boiler that is labeled "Chemical Injection." *Id.* Eckberg further describes $CaBr_2$ as a chemical addition for its tests and refers to a "Salt Solution Tank" when depicting injection equipment. *Id.* at 3, 8–9.

3. Public Accessibility of Sjostrom and Eckberg

Petitioner asserts "Sjostrom and Eckberg are printed publications, available as prior art under 35 U.S.C. §§102(a) and (b) (pre-AIA) and §102(a)(1) (post-AIA)." Pet. 39. Petitioner argues that the "Sjostrom and Eckberg presentations, delivered consecutively at the Electric Utilities Environment Conference ("EUEC") in January 2005 and mailed on CD to conference participants within a few weeks" meet the standard for public accessibility set forth in *GoPro, Inc. v. Contour IP Holding LLC*, 908 F.3d 690, 693 (Fed. Cir. 2018). *Id.*

Patent Owner does not dispute whether Sjostrom and Eckberg were publicly accessible. *See generally* Prelim. Resp.

On this record, Petitioner has demonstrated a reasonable likelihood that Sjostrom and Eckberg were publicly available. *Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039 (PTAB Dec. 20, 2019) (Paper 29) (for purposes of institution, a petitioner must show a reasonable likelihood that an asserted reference qualifies as a printed publication). Petitioner provides evidence that Sjostrom and Eckberg were presented on January 25, 2005 at the 2005 EUEC and that there were over eight hundred attendees. Ex. 1002 ¶¶ 239, 245–250; Ex. 1030, 2–3, 23, 106–118. Petitioner's evidence does not indicate that attendance of the 2005 EUEC was restricted. *Id.* Petitioner also provides evidence of the CD that was mailed to the conference attendees and copies of the Sjostrom and Eckberg presentations from the CD, without any apparent restriction or expectation of confidentiality. Ex. 1002 ¶ 240; Ex. 1031; Ex. 1010; Ex. 1011; *GoPro*, 908 F.3d at 694–95. Therefore, on this record, Petitioner has met its burden of showing that Sjostrom and Eckberg qualify as printed publications.

4. Unpatentability Analysis

With respect to claim 1, Petitioner argues that Sjostrom and Eckberg disclose:

Preamble: "A method of separating mercury from a mercury-containing gas" (Pet. 44 (relying on Ex. 1010, 1, 8, 15–17, 20–21; Ex. 1002 ¶ 512));

Element 1(a): "combusting coal in a combustion chamber, to provide the mercury-containing gas," (Pet. 44–45 (relying on Ex. 1010, 3, 4, 12, 18; Ex. 1011, 5; Ex. 1002 ¶¶ 513–514));

Element 1(b): "the mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br^-, or a combination thereof, wherein the coal comprises added Br_2, HBr, Br^-, or a combination thereof, added to the coal upstream of the combustion chamber, or the combustion chamber comprises added Br_2, HBr, Br^-, or a combination thereof, or a combination thereof;" (Pet. 46–48 (relying on Ex. 1010, 4, 23; Ex. 1011, 5, 8–9; Ex. 1002 ¶¶ 515–520));

Element 1(c)(a): "injecting a sorbent material comprising activated carbon into the mercury-containing gas downstream of the combustion chamber" (Pet. 48 (relying on Ex. 1010, 4; Ex. 1011, 10–11, 16; Ex. 1002 ¶¶ 521–522));

Element 1(c)(b): "contacting mercury in the mercury-containing gas with the sorbent, to form a mercury/sorbent composition;" (Pet. 49 (relying on Ex. 1002 ¶¶ 523–524));

Element 1(d): "separating the mercury/sorbent composition from the mercury-containing gas, to form a cleaned gas;" (Pet. 49–50 (relying on Ex. 1010, 4; Ex. 1002 ¶ 525));

Element 1(e): "monitoring the mercury content of the cleaned gas"

(Pet. 50–52 (relying on Ex. 1010, 4, 19, 22; Ex. 1002 ¶ 526));

Element 1(f)(1): "controlling, in response to the monitored mercury content of the cleaned gas, an injection rate of injecting the sorbent into the mercury-containing gas, the sorbent composition, or a combination thereof," and element 1(f)(2): "so that the mercury content of the cleaned gas is maintained at or below a desired level." (Pet. 52–54 (relying on Ex. 1010, 16, 20, 22; Ex. 1002 ¶¶ 527–530)).

Relying on the Niksa Declaration, Petitioner argues that one of ordinary skill in the art would have been motivated to combine the teachings of Sjostrom and Eckberg, and would have had a reasonable expectation of success in doing so. Pet. 42–44 (citing Ex. 1010, 4, 15–16, 20–21; Ex. 1011, 5, 9, 14; Ex. 1002 ¶¶ 503–511; Ex. 1030, 23). For example, Petitioner argues that Sjostrom and Eckberg are both "directed to using bromine (in conjunction with activated carbon) for improving mercury removal." *Id.* at 42. Petitioner argues "Sjostrom states that 'Br' is used, but does not identify the specific chemical that contains that bromine or its injection rate." *Id.* (citing Ex. 1010, 4; Ex. 1002 ¶ 503). Petitioner asserts that "Eckberg describes a similar system, including injection of halogens into a coal-fired boiler for mercury removal" and "Eckberg informs a POSITA of the type of bromine to be used (calcium bromide), the bromine:coal ratio, the bromine feed rate, and the bromine concentration in the flue gas." *Id.* at 42–43 (citing Ex. 1011, 5, 9, 14; Ex. 1002 ¶ 504). Petitioner asserts that one of ordinary skill in the art would "have understood it was obvious that a calcium bromide in an aqueous solution would dissociate to form Br^- (bromide ions)." *Id.* at 47.

Petitioner also argues that further "motivation to combine existed because both references were presented consecutively during the 'A3'

session at the 2005 EUEC" and, thus, "a POSITA attending the conference, or reading the materials after receiving the mailed CD, would have understood that the two presentations included related material and would have complemented one another." *Id.* at 43 (citing Ex. 1030, 23; Ex. 1002 ¶ 505). In addition, Petitioner asserts that a "POSITA would have been motivated to apply the teachings of Eckberg to Sjostrom because it would have provided well-known chemical substances to use as the 'Cl' or 'Br' identified in the figures of Sjostrom" and a "POSITA would have found supplementing the system of Sjostrom with the teachings of Eckberg obvious to try." *Id.* According to Petitioner, there would have been a reasonable expectation of success in combining the teachings of Sjostrom and Eckberg "because they described nearly identical processes. Both references add bromine to coal-plants to remove mercury from flue gas," both "references include similar surrounding equipment—such as boilers, air pre-heaters, and ESPs or other particulate matter control devices" and in "combining Sjostrom with Eckberg, no modifications would need to be made to the overall process equipment, operating conditions, or activated carbon sorbent used in Sjostrom." *Id.* at 43–44 (citing Ex. 1010, 4; Ex. 1011, 5, 9; Ex. 1002 ¶¶ 506–511).

Petitioner also presents arguments and evidence that Sjostrom and Eckberg suggest the limitations of challenged dependent claims 2, 4–9, and 12–22, which depend from claim 1. Pet. 54–66.

Regarding claim 23, Petitioner asserts that "[c]laim 23 copies Elements 1(Pre)-1(d)" and, thus, "claim 23 is obvious over Sjostrom in view of Eckberg for the same reasons." *Id.* at 66 (citing Ex. 1002 ¶¶ 563–568).

Regarding claim 24, Petitioner contends that "[c]laim 24 is nearly identical to claim 1" and, thus, "claim 24 is obvious over Sjostrom in view

of Eckberg for the same reasons." *Id.* at 66 (citing Ex. 1002 ¶¶ 569–578). Petitioner further asserts that element 24(c) "adds that 'the activated carbon reacts with the halogen or halide promoter in the mercury-containing gas to form a promoted sorbent' and that the mercury is contacted with 'the promoted sorbent.'" *Id.* at 67 (citing Ex. 1001, claim 24). Petitioner contends that the "bromine added at Addition Location 1 or Addition Location 2 of Sjostrom would contact the sorbent in the flue gas at or downstream of the sorbent injection point" and at least "a quantity of promoted sorbent would have formed as a reaction between the sorbent and halogen upon contact." *Id.* (citing Ex. 1010, 4). Petitioner argues that it "was well-known in the art that halogens (including bromine) 'promoted' activated carbon sorbents because they improved mercury removal by increasing the ability of the activated carbon to bind with the mercury." *Id.* (citing Ex. 1002 ¶¶ 573–574).

In addition, Petitioner contends

> Claim 24 also differs in that Element 24(f)(1) requires "controlling, in response to the mercury content of the cleaned gas, an injection rate of injecting the sorbent into the mercury-containing gas, a rate of addition to the coal or the combustion chamber of the added Br_2, HBr, the bromide compound, or a combination thereof, or a combination thereof."

Id. (citing Ex. 1001, claim 24). Petitioner asserts that as "discussed for Element 1(f), Sjostrom discloses continuously controlling the rate of injecting the sorbent based on the continuous mercury content measurements." *Id.* (citing Ex. 1002 ¶ 577).

Regarding claim 25, Petitioner argues that "[c]laim 25 is nearly identical to Elements 1(Pre)-1(d)" and, thus, "claim 25 is obvious over Sjostrom in view of Eckberg for the same reasons." *Id.* at 68 (citing

Ex. 1002 ¶¶ 579–584). Petitioner further asserts that claim 25 "differs from Claim 1 in that it replaces 'Br$^-$' with 'a bromide compound'" but as "discussed above with respect to Claim 1, it would have been obvious that Sjostrom's 'Br' teaches a bromide compound, and Eckberg discloses using the specific bromide compound as an aqueous solution of calcium bromide." *Id.* (citing Ex. 1001, claim 25; Ex. 1002 ¶ 582).

Petitioner also presents arguments and evidence that Sjostrom and Eckberg suggest the limitations of challenged dependent claims 26–28 and 30. Pet. 68–69.

Patent Owner does not substantively address Petitioner's Ground 1 challenges, aside from arguing the priority of the '114 patent, as discussed herein. Based on the preliminary record before us, we find that Petitioner's arguments and evidence are sufficient to show a reasonable likelihood Petitioner would prevail in proving unpatentability of claims 1, 2, 4–9, 12–28, and 30.

I. Asserted Obviousness over Sjostrom and Olson-646

Petitioner argues that claims 1–9 and 12–30 are unpatentable over Sjostrom, Eckberg, and Olson-646. Pet. 69–97.[8]

1. Olson-646

Olson-646 is a patent publication titled "Sorbents for the Oxidation and Removal of Mercury." Ex. 1014, code (54). Petitioner acknowledges that Olson-646 is the patent publication of the '163 application, but argues that the earliest priority date for the challenged claims of the '114 patent is May 2018, which is the filing date of the '760 application, and thus that Olson-646 is available as prior art under 35 U.S.C. §§ 102(a) and 102(b)

[8] *See supra* n.4.

(pre-AIA) and §§ 102(a)(1) and 102(a)(2). Pet. 70–72 (citing Ex. 1017; Ex. 1002 § 264).

Olson-646 "relates to methods and materials for the removal of pollutants from flue gas or product gas from a gasification system. In particular, mercury is removed from gas streams generated during the burning or gasification of fossil fuels by highly reactive regenerable sorbents." Ex. 1014 ¶ 4. Olson-646 proposes a model for the oxidation of mercury in Figure 2, which is reproduced below.

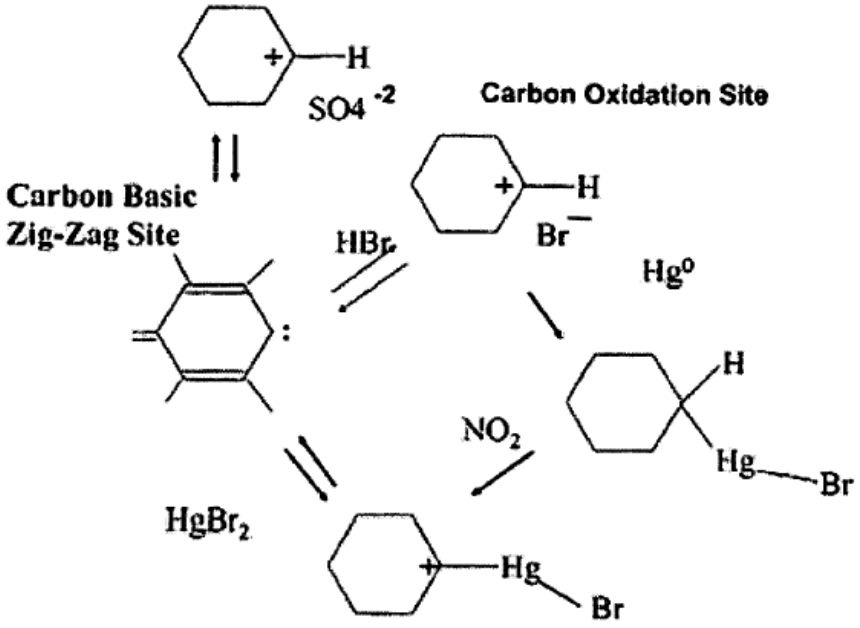


FIG. 2

Figure 2 is a proposed mechanistic model of the chemical reactions in the oxidation and capture of mercury. *Id.* ¶ 33. Olson-646 explains that "as illustrated in FIG. 2, hydrogen bromide reacts with the unsaturated structure of the activated carbon" and this "may be, by way of illustration only, a carbene species on the edge of the graphene sheet structures of the carbon." *Id.* ¶ 54. According to Olson-646, "[m]olecular bromine or a bromine

compound reacts to form a similar structure, with a positive carbon that is active for oxidizing the mercury with subsequent capture by the sorbent." *Id.* Olson-646's Figure 3 is reproduced below.

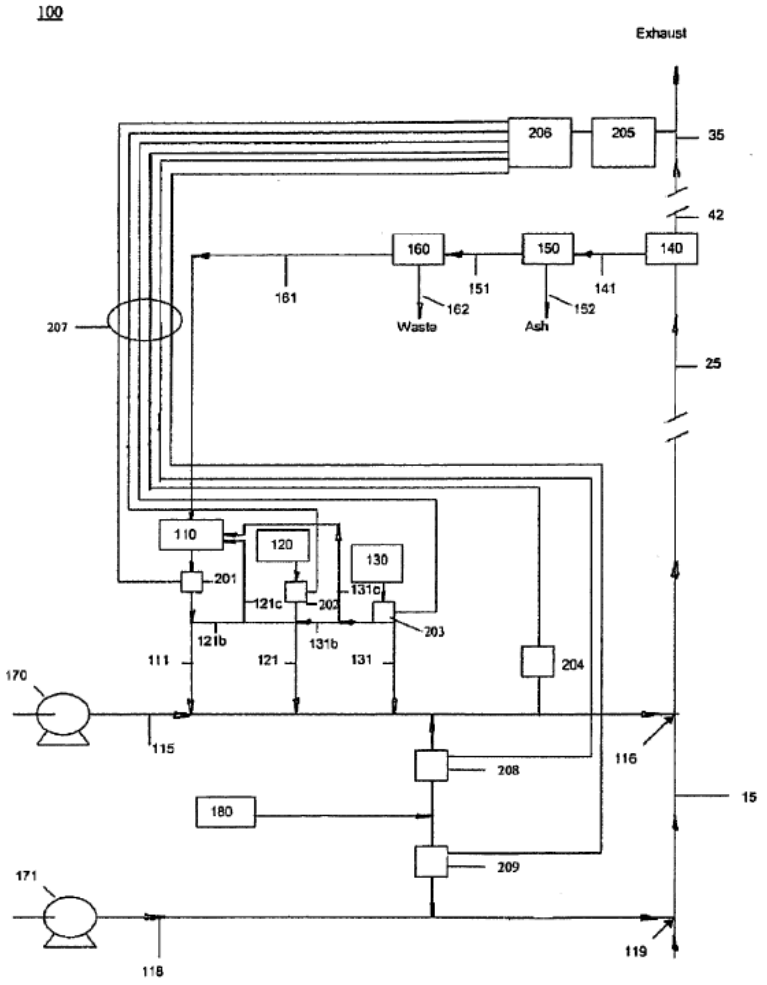


FIG. 3

Figure 3 is schematic for the preparation of promoted carbon sorbents and processes for flue gas mercury reduction in flue gases. *Id.* ¶ 34. Figure 3 depicts a schematic of a "mercury control system 100 comprising preparation of promoted carbon sorbents" that includes a "base activated carbon reservoir 110, an optional halogen/halide promoter reservoir 120, an optional secondary component reservoir 130, and an optional a[l]kali

component reservoir 180, each of which with corresponding flow control device(s) 201, 202, 203, and 208/209, respectively." *Id.* ¶ 56. Olson-646 further explains that in "operation, promoted carbon sorbent and/or an optional alkali component is injected into contaminated flue gas stream 15." *Id.* ¶ 61.

2. Unpatentability Analysis

Regarding reasons to combine the references, Petitioner argues that Sjostrom does not expressly state which specific "Br" compounds to use, or their specific injection rate. Pet. 74. One of ordinary skill in the art, however, would have been motivated to "use the 'HBr or Br_2' of Olson-646 as the bromine-containing species ('Br') of Sjostrom" with a reasonable expectation of success, because Olson-646 "describes the chemicals and associated reactions theorized to have been used in the system of Sjostrom" and "both references teach using the same conventional halogen to achieve the same results." *Id.* at 75 (citing Ex. 1014 ¶¶ 43, 66; Ex. 1002 ¶¶ 594–596).

Regarding its claim-specific arguments, Petitioner largely relies on its arguments for Ground 1 and Sjostrom. We discuss below Petitioner's additional reliance on Olson-646 for certain challenged claims. Regarding claim 1, Petitioner adds that "Olson-646 supplements the teachings of Sjostrom, describing specific 'Br' containing compounds that react with activated-carbon and improve mercury removal." *Id.* at 76–77. Petitioner also argues that "Figure 3 of Olson-646 shows the sorbent, along with the halide promoter, injected into the mercury-containing (flue) gas (item 15) at injection point 116." *Id*. at 78 (citing Ex. 1014, Fig. 3). For the "controlling" limitations of claim 1, Petitioner argues that one of ordinary skill in the art "would not have needed to remove anything from the system

of Sjostrom, they merely would have had to apply the teachings of Olson-646 to fill in the missing details, such as flow controllers and valves, to implement the desired control system." *Id.* at 82.

Regarding claims 2 and 3, Petitioner argues that "Olson-646 provides a method 'for reducing mercury in flue gas'" and "collecting greater than 70 wt-% of the mercury in the flue gas." *Id.* (citing Ex. 1014 ¶ 22).

Regarding claim 4, Petitioner argues that Olson-646 discloses that "the sorbent comprises from about 1 to about 30 grams promoter per 100 grams of base activated carbon." *Id.* at 83 (citing Ex. 1014 ¶¶ 14, 18, claims 3, 17).

Regarding claim 6, Petitioner argues that Olson-646 also discloses and identifies the effectiveness of HBr or Br_2. *Id.* at 84–85.

Regarding claim 7, Petitioner argues that Olson-646 also teaches embodiments "wherein the halogen/halide promoter is in gaseous or vapor form" that comprises "gaseous HBr or Br_2." *Id.* at 86 (citing Ex. 1014 ¶ 66).

Regarding claims 8 and 9, Petitioner argues that Olson-646 refers to a "secondary component," which is another term for "secondary material," and its introduction into the system of Olson-646. *Id.* at 86–88 (citing Ex. 1014 ¶¶ 11, 14, 15, 17, 56, 63).

Regarding claim 14, Petitioner argues that Olson-646 also uses Norit Darco FGD sorbent, and motivates one of ordinary skill in the art to add bromine to the sorbent before injecting at Addition Location 3. *Id.* at 88–90 (citing Ex. 1014, Fig. 1, ¶¶ 45–48; Ex. 1002 ¶¶ 633–635).

Regarding claims 19, 21, and 22, Petitioner argues that one of ordinary skill in in the art would understand that Olson-646 refers to HBr or Br_2 as sorbent enhancement additives. *Id.* at 90–91 (citing Ex. 1002 ¶¶ 640–645).

Regarding claim 20, Petitioner argues that one of ordinary skill in the art would have been motivated to look to Olson-646 to select HBr or Br_2 as the "Br." *Id.* at 91 (citing Ex. 1002 ¶¶ 640–641).

Regarding claim 24, Petitioner argues that Olson-646 clarifies the relationship between the halogen and the activated carbon disclosed by Sjostrom. *Id.* at 92 (citing Ex. 1002 ¶ 658).

Regarding claims 26–27, Petitioner argues that Olson-646 describes the effectiveness of HBr or Br_2 in promoting activated carbon. *Id.* at 93 (citing Ex. 1002 ¶¶ 669–674).

Regarding claim 29, Petitioner argues that Olson-646 discloses that "the promoter is added at from about 1 to about 30 grams per 100 grams of activated carbon." *Id.* at 94 (citing Ex. 1014 ¶¶ 23, 27, claims 3, 17, 37, 47).

Regarding claim 30, Petitioner argues that Olson-646 explains the reaction and relationship already occurring between the halogen, activated carbon, and mercury disclosed by Sjostrom. *Id.* at 97 (citing Ex. 1014, Fig. 2; Ex. 1002 ¶¶ 680–681).

Patent Owner does not substantively address Petitioner's Ground 2 challenges, aside from arguing the priority of the '114 patent, as discussed herein. Based on the preliminary record before us, we find that Petitioner's arguments and evidence are sufficient to show a reasonable likelihood Petitioner would prevail in proving unpatentability of claims 1–4, 6–9, 14, 19–22, and 24–30.[9]

III. CONCLUSION

For the reasons set forth above, we determine that Petitioner has demonstrated a reasonable likelihood of prevailing with respect to at least

[9] *See supra* n.4.

one challenged claim of the '114 patent. Thus, we institute an *inter partes* review on all challenged claims and on all grounds presented.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that an *inter partes* review is instituted on each of the grounds asserted in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial, which shall commence on the entry date of this decision.

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