

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HALLIBURTON ENERGY SERVICES, INC.,
Petitioner,

v.

U.S. WELL SERVICES, LLC,
Patent Owner.

IPR2021-01033
Patent 8,789,601 B2

Before LYNNE H. BROWNE, GEORGE R. HOSKINS, and
SEAN P. O'HANLON, *Administrative Patent Judges*.

O'HANLON, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining Some Challenged Claims Unpatentable
35 U.S.C. § 318(a)

Granting Patent Owner's Motion to Seal
37 C.F.R. § 42.14

I. INTRODUCTION

A. Background

Halliburton Energy Services, Inc. (“Petitioner”) filed a Petition for *inter partes* review of claims 1–12 and 15–22 (“the challenged claims”) of U.S. Patent No. 8,789,601 (Ex. 1001, “the ’601 patent”). Paper 2 (“Pet.”), 3. U.S. Well Services, LLC (“Patent Owner”) filed a Preliminary Response. Paper 6. On January 11, 2022, we instituted an *inter partes* review of the challenged claims on all grounds raised in the Petition. Paper 12 (“Institution Decision” or “Inst. Dec.”), 60–61.

Subsequent to institution, Patent Owner filed a Patent Owner Response (Paper 17, “PO Resp.”), Petitioner filed a Reply to the Patent Owner Response (Paper 27, “Pet. Reply”), and Patent Owner filed a Sur-reply to Petitioner’s Reply (Paper 30, “PO Sur-reply”). An oral hearing was held on October 20, 2022. A transcript of the hearing has been entered into the record. Paper 39 (“Tr.”).

In our Scheduling Order, we notified the parties that “any arguments for patentability not raised in the [Patent Owner] response may be deemed waived.” *See* Paper 13, 8; *see also* Patent Trial and Appeal Board Consolidated Trial Practice Guide (“CTPG”) 66 (Nov. 2019) (“The patent owner response . . . should identify all the involved claims that are believed to be patentable and state the basis for that belief.”).¹

For the reasons that follow, we conclude that Petitioner has proven by a preponderance of the evidence that claims 1–12, 15, and 17–22 of the

¹ Available at <https://www.uspto.gov/TrialPracticeGuideConsolidated>.

'601 patent are unpatentable. It, however, has failed to meet its burden of proof regarding the unpatentability of claim 16.

B. Real Parties in Interest

Petitioner identifies itself, Halliburton Co., and Halliburton Holdings LLC as the real parties in interest. Pet. 1.

Patent Owner identifies itself and ProFrac Holding Corporation as real parties in interest. Paper 4, 1; Paper 40, 1.

C. Related Matters

The parties indicate that the '601 patent is the subject of the following district court proceedings:

US Well Services, Inc. v. Halliburton Co., No. 6-21-cv-00367 (W.D. Tex. filed Apr. 15, 2021) (“the Texas litigation”),

US Well Services, LLC v. Tops Well Services, LLC, No. 3-19-cv-00237 (S.D. Tex. filed July 22, 2019), and

US Well Services, Inc. v. Tops Well Services, LLC, No. 3-19-cv-00225 (S.D. Tex. filed July 3, 2019).

Pet. 1; Paper 4, 1. The parties also note other petitions for *inter partes* review filed by Petitioner and challenging patents owned by Patent Owner. Pet. 1–2; Paper 4, 2.

D. The Challenged Patent

The '601 patent relates to hydraulic fracturing in oil and gas wells, which entails pumping fluid into underground formations at high pressure. Ex. 1001, 1:17–30. Typically, this pumping is performed by large diesel-powered pumps. *Id.* at 1:31–34. The '601 patent purports to improve upon

known fracturing systems and methods by using electric motors to drive the pumps. *Id.* at 1:51–64. The '601 patent purports that electric motors and generators can be loaded directly on a truck or trailer, increasing efficiency and lowering cost. *Id.* at 7:30–60. Figure 3 illustrates a portion of the system and is reproduced below.

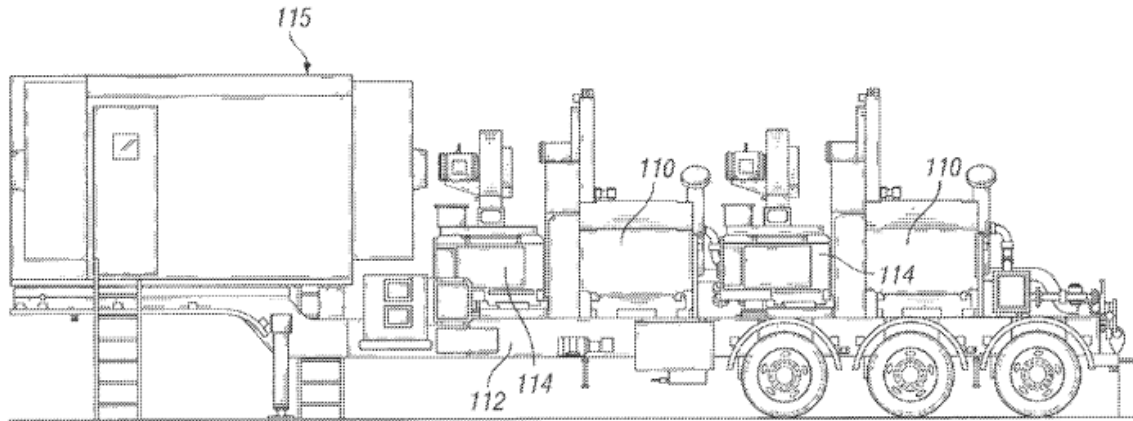


FIG. 3

Figure 3 is a left side view of the fracturing equipment mounted on a vehicle, showing trailer 112 carrying pumps 110, electric motors 114, and variable frequency drive (“VFD”) 115. Ex. 1001, 3:18–20; 7:61–67. The VFD controls the speed of the electric motors and connected pumps. *Id.* at 4:4–11. Multiple vehicles, including trailers or trucks, may be combined as a fleet at one wellbore. *See id.* at 4:8–18, Fig. 1. However, the VFDs can be discrete to each vehicle or pump, allowing independent control, so that if one pump or motor becomes incapacitated the remaining pumps and motors on the vehicle or in the fleet can continue to function. *Id.* The VFDs can also provide “monitoring and protection of drive internal operations while communicating with an operator via one or more user interfaces. For example, motor diagnostics can be performed frequently (e.g., on the

application of power, or with each start), to prevent damage to a grounded or shorted electric motor.” *Id.* at 4:40–45.

The ’601 patent claims priority as a continuation-in-part of U.S. Patent Application No. 13/679,689 (Ex. 1001, code (63); Ex. 1004, 5), which issued as U.S. Patent No. 9,410,410 B2 (Ex. 1002, “the ’410 patent”).

E. The Challenged Claims

Petitioner challenges claims 1–12 and 15–22 of the ’601 patent. Pet. 3, 14–15. Claims 1, 8, and 22 are independent. Claim 1 is illustrative of the challenged claims and is reproduced below.

1. A system for hydraulically fracturing an underground formation in an oil or gas well to extract oil or gas from the formation, the oil or gas well having a wellbore that permits passage of fluid from the wellbore into the formation, the system comprising:
 - a plurality of pumps mounted on a trailer or truck and powered by electric motors and fluidly connected to the well, the pumps configured to pump fluid into the wellbore at high pressure so that the fluid passes from the wellbore into the formation, and fractures the formation;
 - at least one variable frequency drive connected to the electric motors to control the speed of the motors, the at least one variable frequency drive frequently performing electric motor diagnostics to prevent damage to the electric motors if they become grounded or shorted; and
 - a plurality of generators electrically connected to the plurality of pumps to provide electrical power to the pumps.

Ex. 1001, 8:67–9:15.

F. Instituted Grounds of Unpatentability

The Petition relies on the following prior art references:

Name	Reference	Exhibit
Coli	US 2012/0255734 A1, published October 11, 2012	1009
Horikoshi	US 2011/0241590 A1, published October 6, 2011	1010
Vliet ²	US 2011/0197988 A1, published August 18, 2011	1011
API Standard	American Petroleum Institute, <i>Form-wound Squirrel-Cage Induction Motors—500 Horsepower and Larger</i> , ANSI/API Standard 541-2003 Fourth Edition, June 2004	1012
Gardner	Gardner Denver, <i>GD-2500Q Quintuplex Well Servicing Pump Operating and Service Manual</i> , 300FW996 Rev C, August 2005	1013
Stark	US 6,116,040, issued September 12, 2000	1014
Amrine	US 2011/0175397 A1, published July 21, 2011	1015
Nadeau	US 2009/0315297 A1, published December 24, 2009	1016
Stratton	US 5,293,947, issued March 15, 1994	1017

We instituted trial based on all asserted claims and grounds of unpatentability as follows:

Claim(s) Challenged	35 U.S.C. §	Reference(s)
1–7, 22	103	Coli, Horikoshi

² Although the first-named inventor is “J. Todd Van Vliet” (Ex. 1011, code (75)), the parties refer to Exhibit 1011 as “Vliet” (*see, e.g.*, Pet. 7; PO Resp. 54). We adopt the Parties’ nomenclature for consistency and ease of reference.

Claim(s) Challenged	35 U.S.C. §	Reference(s)
6	103	Coli, Horikoshi, Vliet
8–12, 15, 17, 18	103	Coli, Horikoshi, API Standard
10	103	Coli, Horikoshi, API Standard, Gardner
16	103	Coli, Horikoshi, API Standard, Stark
19	103	Coli, Horikoshi, API Standard, Amrine
20	103	Coli, Horikoshi, API Standard, Nadeau
21	103	Coli, Horikoshi, API Standard, Stratton

Pet. 14–15; Inst. Dec. 60. Petitioner submits a declaration of Robert A. Durham, Ph.D. (Ex. 1007, “Durham Declaration”) in support of its contentions. Patent Owner submitted a declaration of Mr. Robert Schaaf (Ex. 2005, “Schaaf Declaration”) in support of its preliminary responses. Patent Owner also submits a second declaration of Mr. Schaaf (Ex. 2034) and a declaration of Joel N. Broussard (Ex. 2016) in support of its Response.

II. ANALYSIS

A. Principles of Law

1. Inter Partes Review

“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 (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”). Petitioner bears the burden of persuasion to prove unpatentability of each challenged claim by a preponderance of the evidence. 35 U.S.C. § 316(e). This burden never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

2. Obviousness

A patent claim is unpatentable 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 the invention was made to a person having ordinary skill in the art to which the 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, any objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). “While the sequence of these questions might be reordered in any particular case” (*KSR*, 550 U.S. at 407), the Federal Circuit has explained that an obviousness determination can be made only after consideration of all of the *Graham* factors. *See, e.g., Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1360 (Fed. Cir. 2012).

B. Level of Ordinary Skill in the Art

The level of ordinary skill in the art is “a prism or lens” through which we view the prior art and the claimed invention. *Okajima v. Bourdeau*, 261

F.3d 1350, 1355 (Fed. Cir. 2001). The person of ordinary skill in the art is a hypothetical person presumed to have known the relevant art at the time of the invention. *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). In determining the level of ordinary skill in the art, we may consider certain factors, including: “(1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field.” *Best Med. Int’l, Inc. v. Elekta Inc.*, 46 F.4th 1346, 1353 (Fed. Cir. 2022) (citations omitted). “The patent’s purpose can also be informative.” *Id.* (citation omitted).

Petitioner contends that a person having ordinary skill in the art at the time of the invention (“POSITA”) would have either “a Bachelor of Science in Mechanical Engineering, Electrical Engineering, Petroleum Engineering or an equivalent field as well as at least two years of academic or industry experience in the oil and gas industry, including well drilling, completion, or production,” or “at least four years of industry experience in the oil and gas industry, including well drilling, completion, or production. Pet. 17.

Patent Owner asserts that it “has used Petitioner’s proposed definition of [a person of ordinary skill in the art].” PO Resp. 64. Patent Owner further asserts that the same definition was used in the Texas litigation. *Id.*

Based on the arguments presented and the cited references, we find Petitioner’s definition of the level of ordinary skill reasonable and, for purposes of this Decision, adopt it as our own.

C. Claim Construction

In an *inter partes* review, claims are construed using the same claim construction standard that would be used to construe the claims in a civil action under 35 U.S.C. § 282(b), including construing the claims in accordance with the ordinary and customary meaning of such claims as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. 37 C.F.R. § 42.100(b). “[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” and “after reading the entire patent.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313, 1321 (Fed. Cir. 2005) (en banc). In addition to the specification and prosecution history, we also consider use of the terms in other claims and extrinsic evidence including expert and inventor testimony, dictionaries, and learned treatises, although extrinsic evidence is less significant than the intrinsic record. *Id.* at 1312–17. Usually, the specification is dispositive, and it is the single best guide to the meaning of a disputed term. *Id.* at 1315.

“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’” *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (alteration in original) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

1. “A/C console”

Petitioner asserts that, in a litigation with a third party, Patent Owner argued that “A/C console” as used in claim 4 “refers to a structure that can

modify the A/C waveform of the alternating current supplied to the electric motor.” Pet. 18 (citing Ex. 1022, 18–19, 19 n.11; Ex. 1023, 20). Petitioner contends that it applied the same definition in the Petition. *Id.*

Patent Owner “does not dispute Petitioner’s construction.” PO Resp. 4.

We interpret “A/C console,” as agreed by the parties, to mean a structure that can modify the A/C waveform of the alternating current supplied to the electric motor.

2. “*high pressure*”

Patent Owner acknowledges that the court in the Texas litigation found “high pressure” to be indefinite, but argues that the term would be understood by those of ordinary skill in the art. PO Resp. 5–6 (citing Ex. 2028); *see also* Ex. 2045, 1 (WD Tex. Claim Construction Order). Patent Owner argues that “[h]ydraulic fracturing . . . involves pumping hydraulic fracturing fluid into a wellbore at various pressures—which includes pumping fluids into a wellbore at a high pressure or at a medium pressure and a high rate.” PO Resp. 5 (citing Ex. 1009 ¶ 35). Patent Owner argues that, based on “the claim language surrounding the ‘high pressure’ term in each of the independent claims,” an ordinarily skilled artisan would understand that “‘high pressure’ is referring to the pressure of a fracturing fluid used during the ‘stimulation’ phase of a hydraulic fracturing operation.” *Id.* at 5–6; *see also* PO Sur-reply 3–4.

Petitioner argues that “[Patent Owner] does not seek to construe ‘high pressure,’ but instead adds limitations ‘referring to the pressure of a fracturing fluid used during the “stimulation” phase of a hydraulic fracturing

operation.” Pet. Reply 3 (citing PO Resp. 6). Continuing, Petitioner asserts that “[Patent Owner] provides no intrinsic support for this construction.” *Id.* Petitioner also notes that the independent claims recite that the pumps are “configured to pump” or are “capable of pumping” at high pressure and argues that “high pressure” is functional language. *Id.* at 2–3.

Patent Owner replies by arguing that its declarant, Mr. Schaaf, testified in other proceedings before the Board that an ordinarily skilled artisan would consider 8000 to 12,000 psi to be “high pressure.” PO Sur-reply 2–3 (quoting Ex. 1061, 43:17–19).

We agree with Patent Owner that, as used in the challenged claims, “high pressure” refers to the pressure of the fracturing fluid used during the stimulation phase of a hydraulic fracturing operation. *See* PO Resp. 6. However, Patent Owner acknowledges that hydraulic fracturing also can be carried out at “medium pressure” (*id.* at 5) but does not explain the difference between “high” pressure and “medium” pressure; Patent Owner does not identify any disclosure in the ’601 patent setting forth any values for the recited “high pressure.”

For the purposes of this Decision, we interpret “high pressure” as suggested by Patent Owner to mean a pressure at which the fluid pumped into the wellbore will fracture the underground formation. *See* PO Resp. 5–6. We take no position on the definiteness of this term, and we note that indefiniteness under § 112 is not a basis on which claims may be determined unpatentable in an *inter partes* review. 35 U.S.C. § 311(b).

3. “*electric motor diagnostics*”

Patent Owner argues that an ordinarily skilled artisan would understand “electric motor diagnostics” to mean “tests performed on an electric motor to detect problems.” PO Resp. 6; PO Sur-reply 7. Patent Owner argues that an ordinarily skilled artisan would understand the specification to “indicate[] that the VFD can be used perform ‘diagnostics’ on electric motors mechanical systems.” PO Resp. 7 (citing Ex. 1001, claims 1, 8, and 22). Thus, Patent Owner concludes, we should interpret “performing electric motor diagnostics” broadly to “mean[] that ‘motor diagnostics can be performed . . . to prevent damage to a grounded or shorted electric motor’ not that the VFD specifically ‘detects a grounding or a short.’” *Id.* at 8 (second alteration in original).

Petitioner argues that “[Patent Owner] does not explain what it considers to be ‘mechanical’ systems in an electric motor (e.g., as compared to ‘electrical systems’).” Pet. Reply 9–10. Petitioner notes that “[t]he term ‘mechanical’ is not even used in the ’601 Patent.” *Id.* at 10.

The ’601 patent states that, “with respect to control capabilities,” its variable frequency drive “can provide complete monitoring and protection of drive internal operations.” Ex. 1001, 4:39–43. We agree with Patent Owner that, as used in the ’601 patent, “electric motor diagnostics” is a broad term that is not limited to detecting a grounding or short circuit. However, the ’601 patent does not include the word “test,” nor does Patent Owner or Mr. Schaaf define “test” or explain persuasively why “electric motor diagnostics” necessarily requires that a “test” be performed. *See* PO Resp. 6–8; Ex. 2034 ¶ 52. Thus, we decline to interpret “electric motor diagnostics” as suggested by Patent Owner. Rather, for the reasons set forth

in § II.E.1.c below, we interpret “electric motor diagnostics” to include (but not be limited to) detecting a grounding or short circuit. No further construction is necessary for this Decision. *See Realtime Data, LLC*, 912 F.3d at 1375.

4. “ported”

Patent Owner asserts that, in the Texas litigation, the parties “agreed that the phrase ‘can be ported from one well to another’” as used in claims 5 and 6 “should be afforded its plain and ordinary meaning, which is ‘transported / moved between wells.’” PO Resp. 8 (citing Ex. 2044).

Petitioner does not address this term. *See generally* Pet. Reply.

Patent Owner does not actually argue that we should interpret the term in any specific manner. Nor does Patent Owner rely on its claim construction to attempt to distinguish the prior art at issue in this proceeding from claims 5 and 6. Accordingly, we decline to construe “ported.”

D. Overview of the Asserted Prior Art

1. *Coli*

Coli relates to hydraulic fracturing in hydrocarbon-bearing wells. Ex. 1009 ¶ 3. *Coli* recognizes drawbacks of the diesel motors typically used in such drilling. *Id.* ¶¶ 5, 8. *Coli* purports to improve upon known fracturing systems by using electric motors and generators powered by natural gas to drive the pumps. *Id.* ¶¶ 9–11, 38. *Coli* purports that this use of electric components beneficially reduces the amount of infrastructure, makes control safer and easier, facilitates syncing the equipment within the system, and reduces costs. *Id.* ¶¶ 39, 66–71, 73.

Figure 3 is a schematic plan view of Coli's fracturing trailer and is reproduced below.

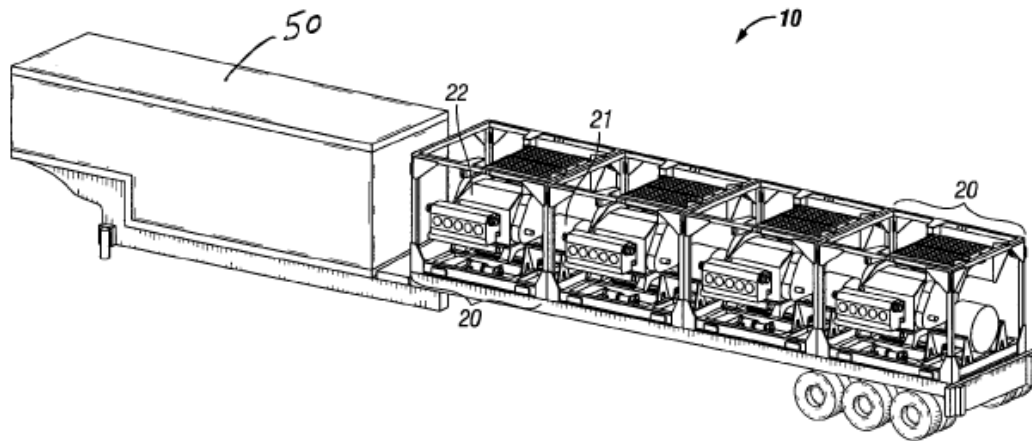


FIG. 3

Figure 3 is a schematic diagram of trailer 10 housing four fracturing modules 20. Ex. 1009 ¶ 40. Each fracturing module 20 includes electric motor 21 coupled directly to fluid pump 22. *Id.* ¶¶ 40, 52. The trailer housing also includes electrical transformer and drive unit 50 to step down the power voltage from turbine generator 30 (not shown) to electric motor 21. *Id.* ¶ 47. The “[f]racturing modules 20 utilize electric power from turbine generator 30 to pump the fracturing fluid directly to the wellbore.” *Id.* ¶ 40. Multiple natural gas-powered turbine generators may provide a dedicated source of electric power on-site. *Id.* ¶ 38.

2. Horikoshi

Horikoshi “relates to a motor driving apparatus having a fault diagnostic function.” Ex. 1010 ¶ 2. Horikoshi recognizes that typical driving apparatus include a DC/AC converter having only two current sensors to reduce cost, resulting in circumstances where an overcurrent due to a ground fault cannot be detected and, if an overcurrent is detected, it

cannot be determined whether the cause is a ground fault or a short circuit. *Id.* ¶¶ 4–5.

Horikoshi purports to improve upon known driving apparatus by including a fault diagnostic function capable of detecting a ground fault and a short circuit. Ex. 1010 ¶ 11. The motor driving apparatus includes an AC/DC converter that converts supplied three-phase AC power into DC power output into a DC/AC converter that converts the DC power into frequency variable three-phase AC power. *Id.* ¶ 27. The driving apparatus includes a zero phase current detector at the supply input of the AC/DC converter and current sensors to detect two of the three-phase AC currents output from the DC/AC converter. *Id.* ¶ 28. A determining unit uses signals input from these components to determine whether a detected overcurrent is a short circuit or a ground fault. *Id.* ¶ 29.

3. *Vliet*

Vliet discloses a fuel delivery system for use in a fracturing operation that is portable and transportable to various well sites. Ex. 1011 ¶ 14. For example, the fuel delivery system may be contained on a single wheeled or skidded trailer. *See id.* The trailer may also include pumps and electrical equipment that are supplied with power from conventional generators, which may conveniently be mounted on the same trailer. *Id.* ¶ 27.

4. *API Standard*

API Standard is an American National Standards Institute (“ANSI”) standard published by the American Petroleum Institute (“API”) that “covers the minimum requirements for form-wound squirrel-cage induction motors 500 horsepower (hp) and larger for use in petroleum industry services.”

Ex. 1012, 3, 7. API Standard is typically utilized for machines that use an adjustable speed drive as a source of power. *Id.* API Standard discloses that heat-treated forged steel shafts shall be used for machines driving reciprocating loads. *Id.* at 17. More specifically, “[h]eat-treated forged steel shafts shall be A4000 series and comply with ASTM A 668.” *Id.*

5. *Gardner*

Gardner is an operating and service manual published by Gardner Denver. Ex. 1013, 1. The manual is for a well servicing pump, model GD-2500Q Quintuplex. *Id.* The GD-2500Q is a quintuplex pump with a stroke length of 8.0 inches and a variety of plunger diameters, including 4.5 inches. *Id.* at 20. The GD-2500Q has an input power of 2200 or 2500 bhp and a rated brake horsepower of 2500 bhp. *Id.*

6. *Stark*

Stark discloses a system for cooling the variable frequency drive of a refrigeration system compressor. *E.g.*, Ex. 1014, 1:44–46, 1:52–55. Stark recognizes that variable frequency drives contain heat-producing power electronic components that require cooling. *Id.* at 1:13–17, 1:65–2:1, 2:56–60. Stark further recognizes that it is known to use heat sinks to draw heat away from these components. *Id.* at 1:17–20. Stark purports to improve upon known cooling methods by mounting these power electronic components directly upon a heat sink to draw heat away from the components. *Id.* at 2:1–5, 3:1–8. The heat sink contains flow channels through which refrigerant flows. *Id.* at 3:8–12. A control valve controls the flow of refrigerant through the heat sink. *Id.* at 3:17–22. The valve includes a sensor probe embedded within the heat sink that provides temperature

information to the valve. *Id.* at 3:24–31. In one embodiment, the temperature sensor provides temperature information to a microprocessor that is programmed to process data and control cooling of the power electronics. *Id.* at 4:21–29.

7. *Amrine*

Amrine discloses a heavy duty utility trailer for use in supporting and transporting cargo. Ex. 1015 ¶ 7. The trailer includes a frame with several cross-members extending laterally substantially perpendicular to the trailer longitudinal axis. *Id.* ¶ 37. Amrine purports that use of first and second cross-members, in conjunction with other structural components at the ends of the trailer, allows a support beam of shorter height to be used while improving the load bearing capacity and torsional robustness of the trailer. *Id.* ¶ 41. According to Amrine, shorter support beam heights provide greater ground clearance, which could be significant in non-highway use. *Id.*

8. *Nadeau*

Nadeau discloses a trailer comprising a floor and an elongated shell attached to the floor to define a chamber therebetween. Ex. 1016 ¶ 27, Fig. 1. The chamber imparts increased resistance to torsion and bending forces as compared to a conventional trailer having a similar size and load capacity. *Id.* ¶¶ 28–29. The chamber includes a neck portion at the front of the trailer to accommodate a fifth wheel or landing gear. *Id.* ¶¶ 28, 33. Supporting ribs may be positioned in the neck to ensure torsional resistance is maintained. *Id.* ¶ 34.

9. *Stratton*

Stratton discloses electric vehicles powered from an external source of electricity. Ex. 1017, 1:7–9. These vehicles typically draw power from an alternating current that powers an AC motor or may be rectified to power a DC motor. *Id.* at 1:16–23. Stratton states that “[p]reviously existing AC controllers were unavailable or unsuitable for use on mobile vehicles due to their size, complexity, and environmental sensitivity, particularly to acceleration and mechanical shock.” *Id.* at 1:25–30. Stratton purports to improve upon known vehicles by providing a vehicle with a variable speed AC electric drive motor. *Id.* at 2:4–6, 2:18–21. The motor is connected to a variable speed controller that varies the AC frequency of its output. *Id.* at 2:21–25, 3:11–14, 3:26–31. “For materials handling vehicle applications, the motor controller should be shock mounted to the vehicle to prevent damage from vibrations.” *Id.* at 3:22–25.

E. Asserted Obviousness Based on Coli and Horikoshi

Petitioner argues that claims 1–7 and 22 would have been obvious over Coli and Horikoshi. Pet. 18–34. In support of its showing, Petitioner relies upon the Durham Declaration. *Id.* (citing Ex. 1007). We have reviewed the parties’ briefs and the evidence of record and determine that, for the reasons explained below, Petitioner has shown, by a preponderance of the evidence, that the limitations of claims 1–7 and 22 are disclosed by the combination of Coli and Horikoshi and that Petitioner has set forth reasoning with rational underpinning why it would have been obvious to

combine the teachings of these references to arrive at the claimed subject matter.³

1. Independent Claim 1

Petitioner relies on Coli to disclose a system for hydraulically fracturing an underground formation substantially as recited in claim 1, including a variable frequency drive, and relies on Horikoshi to teach a variable frequency drive that frequently performs electric motor diagnostics. Pet. 18–26.

a. The Preamble

Claim 1 recites “[a] system for hydraulically fracturing an underground formation in an oil or gas well to extract oil or gas from the formation, the oil or gas well having a wellbore that permits passage of fluid from the wellbore into the formation.” Ex. 1001, 8:66–9:2. Petitioner argues that Coli discloses such a system. Pet. 21 (citing Ex. 1009 ¶¶ 6, 9, 13; Ex. 1007 ¶ 139).

Patent Owner does not contest this aspect of the Petition. *See generally* PO Resp.

Coli discloses “a system and method for hydraulic stimulation of underground hydrocarbon-bearing formations” by “delivering fracturing fluid to a wellbore.” Ex. 1009 ¶ 9.

³ For convenience, we address the alleged objective evidence of nonobviousness in a single section (§ II.M) below. To be clear, no ultimate conclusion of obviousness was reached prior to weighing all the pertinent evidence (including the asserted objective indicia), consistent with *Graham*.

Accordingly, for the foregoing reasons, to the extent the preamble is limiting, Coli supports Petitioner's contentions.

b. The Pumps and Motors Recitation

Claim 1 recites “a plurality of pumps mounted on a trailer or truck and powered by electric motors and fluidly connected to the well, the pumps configured to pump fluid into the wellbore at high pressure so that the fluid passes from the wellbore into the formation, and fractures the formation.” Ex. 1001, 9:4–8. Petitioner maps this recitation to Coli's fracturing modules 20. Pet. 21–22 (citing Ex. 1009 ¶¶ 5–6, 35, 40, 46, 77, 83, Fig. 3; Ex. 1007 ¶¶ 140–141).

Patent Owner argues that Coli does not disclose a pump configured to pump fluid into a wellbore at high pressure because “*Coli* is silent regarding the pressure at which the fluid is pumped into the wellbore.” PO Resp. 10; *see also id.* at 11 (“*Coli* is silent regarding the pressure at which the fluid is pumped into the wellbore (*i.e.*, high pressure)” (citing Ex. 2034, 25–27)); *id.* at 51–52 (presenting substantially similar arguments). According to Patent Owner, Coli only discloses “transferring a slurry (*i.e.*, fluid) into a formation at ‘medium pressure and a high rate.’” *Id.* at 10 (citing Ex. 1009 ¶ 35). According to Patent Owner, “merely using ‘high pressure discharging equipment’ is not injecting fluid into the wellbore at high pressure.” *Id.* at 11.

Petitioner argues that “[i]t is undisputed the fluid in *Coli* is pumped with sufficient pressure to enter the wellbore and fracture a formation.” Pet. Reply 3 (citing Pet. 21–23). Petitioner argues that Gardner confirms that Coli's pump can operate in a high-pressure setup. *Id.* at 4–5 (citing Ex. 1009

¶ 46; Ex. 1013, 8, 14; Ex. 1007 ¶¶ 72, 90–99). Petitioner also argues that Coli explicitly discloses pumping at high pressure. *Id.* at 6 (citing Ex. 1009 ¶¶ 77, 83).

Patent Owner concedes that “*Coli* does teach ‘high rate and pressure pumping equipment,’ and specifically a SWGS-2500 well service pump,” but argues that “*Coli* does not teach pumps powered by electric motors that are connected to a wellbore and pump the fluid at a ‘high pressure’ to enter and fracture the formation, as claimed in the ’601 Patent.” PO Sur-reply 4–5.

Claim 1 is an apparatus claim that recites pumps that are “configured to pump . . . at high pressure.” Ex. 1001, 9:6–7. Thus, the ’601 patent does not recite pumping the fluid at high pressure as suggested by Patent Owner. *See, e.g.*, PO Sur-reply 5. We agree with Petitioner that Coli’s pumps are configured to pump and are capable of pumping fracturing fluid at high pressure as recited in the ’601 patent. Coli discloses that the pump may be a “a quintiplex or triplex plunger style pump, for example, the SWGS-2500 Well Service Pump sold by Gardner Denver, Inc.” (Ex. 1009 ¶ 46), and Patent Owner concedes that this pump meets the recitations of the challenged claims. PO Sur-reply 4–5 (“*Coli* does teach ‘high rate and pressure pumping equipment’”).

Additionally, Coli discloses that its system includes “trailer 10 for housing one or more fracturing modules 20.” Ex. 1009 ¶ 40, Fig. 3. “Each fracturing module 20 can include an electric motor 21 and a fluid pump 22 coupled thereto. . . . Fracturing modules 20 utilize electric power from turbine generator 30 to pump the fracturing fluid directly to the wellbore.” *Id.* ¶ 40. And “[e]ach fracturing module 20 sits on trailer 10 which houses

the necessary mounts and manifold systems for low pressure suction and high pressure discharges.” *Id.* ¶ 77.

Accordingly, for the foregoing reasons, Coli supports Petitioner’s contentions.

c. The Variable Frequency Drive Recitation

Claim 1 recites “at least one variable frequency drive connected to the electric motors to control the speed of the motors, the at least one variable frequency drive frequently performing electric motor diagnostics to prevent damage to the electric motors if they become grounded or shorted.”

Ex. 1001, 9:9–13. Petitioner argues that Coli discloses a variable frequency drive that controls a variable speed motor, the motor being a component of fracturing module 20. Pet. 23 (citing Ex. 1009 ¶¶ 11, 65; Ex. 1007 ¶ 142).

Petitioner argues that Horikoshi discloses a “motor driving apparatus” that an ordinarily skilled artisan would understand to be a variable frequency drive. *Id.* at 23–24 (citing Ex. 1010 ¶¶ 12, 27; Ex. 1007 ¶¶ 143–144).

Petitioner argues that the Horikoshi system includes current sensors to detect overcurrent and an ordinarily skilled artisan would understand “that ‘overcurrent’ is a potential source of damage to an electric motor, and detecting overcurrent associated with ‘a ground fault or a phase-to-phase short circuit’ is a way to protect the electric motor from damage.” *Id.* at 24 (citing Ex. 1007 ¶ 145). Petitioner maps Horikoshi’s detection of overcurrent, and determination of it being caused by a ground fault or short circuit, to the recited electric motor diagnostics. *Id.* at 24–25 (citing Ex. 1007 ¶ 146).

Petitioner argues that the teachings of *Coli* and *Horikoshi* can be combined in two alternative ways. Pet. 20–21, 25–26. First, Petitioner argues that it would have been obvious to modify *Coli*’s VFD to include *Horikoshi*’s diagnostic functionality because the modification “would have been obvious to try and would have yielded predictable results.” *Id.* at 25–26 (citing Ex. 1007 ¶¶ 146–148); *see also id.* at 20–21 (citing *KSR*, 550 U.S. at 416–18;⁴ Ex. 1007 ¶¶ 125–138) (arguing that the modification would have been obvious “because such an improvement represents the use of a known technique (i.e., the fault detection of *Horikoshi*) to predictably improve a similar system (i.e., the VFD of *Coli*) in the same way”). Second, Petitioner argues that it would have been obvious to replace *Coli*’s VFD with *Horikoshi*’s motor driving apparatus “to take advantage of the overcurrent protection provided by *Horikoshi*.” *Id.* at 26 (citing Ex. 1007 ¶¶ 146–148) *see also id.* at 20 (citing Ex. 1007 ¶¶ 136–138; *Agrizap, Inc. v. Woodstream Corp.*, 520 F.3d 1337, 1344 (Fed. Cir. 2008)) (arguing that the modification would have been obvious “to detect a ground fault or a phase-to-phase short circuit, without affecting the other functionalities in *Coli*”).

Patent Owner argues that “*Horikoshi* does not disclose the use of anything other than an ‘overcurrent detector 28’ in a ‘motor driving apparatus’ to detect ‘overcurrent occurring in the DC/AC converter’ of the motor driving apparatus.” PO Resp. 14 (citing Ex. 2034, 27–30). According to Patent Owner, “*Horikoshi* does not disclose and is not concerned with diagnostic tests performed on an electric motor.” *Id.* (citing Ex. 2034, 27–30); *see also id.* at 16–17 (presenting substantially similar arguments).

⁴ Petitioner cites to West’s Supreme Court Reporter (“127 S.Ct. 1727, 1740”) rather than the official United States Reports. Pet. 21.

Patent Owner faults the Petition as attempting to narrow the meaning of “electric motor diagnostics.” *Id.* at 14–15. Patent Owner argues that an ordinarily skilled artisan “reviewing ‘electric motor diagnostics,’ as recited in the ’601 Patent would understand that the VFD is monitoring the electrical components and the mechanical components of the electric motor.” *Id.* at 14–15 (citing Ex. 2034, 27–30); *see also* PO Sur-reply 8.

Petitioner argues that, by detecting ground faults and short circuit faults in the motor, Horikoshi’s motor driving apparatus performs electric motor diagnostics. Pet. Reply 8 (citing Pet. 23–26; Ex. 1010 ¶¶ 11–12, 27; Ex. 1007 ¶¶ 142–148). Petitioner argues that, contrary to Patent Owner’s contention, Petitioner agrees that “electric motor diagnostics” is a broad term. *Id.* at 9.

Patent Owner replies that “[t]he phrase ‘electric motor damage’ connotes a structural limitation of the electric motor.” PO Sur-reply 8.

We disagree with Patent Owner’s contention that “electric motor diagnostics,” as used in the ’601 patent, requires monitoring both electrical and mechanical components of the electric motor. *See* PO Resp. 14–15. The ’601 patent discusses “electric motor diagnostics” on two occasions, neither of which specifies the nature of the “diagnostics” or on what motor components the diagnostics are performed. Ex. 1001, 2:33–35, 4:39–48. Rather, the ’601 patent states that, “with respect to control capabilities,” its variable frequency drive “can provide complete monitoring and protection of drive internal operations.” *Id.* at 4:39–43. Although “drive internal operations” may include both electrical and mechanical components, we fail to discern, and Patent Owner fails to identify, any suggestion in the ’601 patent that “electric motor diagnostics” requires monitoring *both*

electrical and mechanical components. To the contrary, the '601 patent, at best, appears to suggest that the “electric motor diagnostics” can be performed on any motor component affecting “drive internal operations.” *Id.*

As noted above, Patent Owner cites to pages 27–30 of Mr. Schaaf’s second Declaration (Exhibit 2034), but we fail to see support for Patent Owner’s interpretation, as Mr. Schaff does not appear to define “electric motor diagnostics” or provide substantial discussion regarding the same in the cited portions of his second Declaration. Rather, Mr. Schaaf opines that Horikoshi does not meet the claim language because, although Horikoshi discloses diagnostic capabilities of detecting a ground fault and short circuit during operation, “*Horikoshi* does not teach or disclose that ‘overcurrent’ is a potential source of damage to an electric motor.” Ex. 2034 ¶ 68. Thus, Mr. Schaaf appears to fault Horikoshi’s alleged failure to state that sending overcurrent to a motor can damage the motor.

The Petition sets forth disclosure in Horikoshi regarding the detection of overcurrent and determining the cause thereof (either ground fault or short circuit). We do not interpret the Petition as attempting to narrow the meaning of “electric motor diagnostics” as asserted by Patent Owner. *See* PO Resp. 14. Patent Owner does not persuasively identify fault in Petitioner’s mapping of this term to Horikoshi’s fault diagnostic function, which Patent Owner concedes detects an overcurrent condition. Notably, Patent Owner acknowledges that “electric motor diagnostics” includes monitoring the motor’s electrical components. *Id.* at 14–15. Additionally, Patent Owner’s declarant, Mr. Schaaf, testified that sensing the current in an electric motor is an example of electric motor diagnostics. Ex. 1062,

97:8–17. Moreover, Patent Owner’s arguments here are at odds with its proposed interpretation of “electric motor diagnostics,” which is not specifically directed to electrical or mechanical systems but, instead, broadly states “tests performed on an electric motor to detect problems.” PO Resp. 6.

Horikoshi discloses “a motor driving apparatus having a fault diagnostic function” in the form of a unit that uses signals received from a zero phase current detector and current sensors to determine whether a detected overcurrent is a short circuit or a ground fault. Ex. 1010 ¶¶ 2, 28–29. Horikoshi expressly teaches that it is desirable to detect and identify such sources of overcurrent (*id.* ¶ 11) and that it is known in the art to use fault detection to “provide[] protection against ground faults” (*id.* ¶ 8). Notably, the ’601 patent acknowledges that grounding and shorting are two causes of motor damage. Ex. 1001, 2:33–35.

Patent Owner also argues that Petitioner fails to set forth adequate motivation to combine the teachings of Coli and Horikoshi. PO Resp. 15–27. First, Patent Owner argues that an ordinarily skilled artisan would not have combined the teachings of Coli and Horikoshi because “*Coli* has an outward focus on overall system efficiency and performance, whereas *Horikoshi* is directed to the identification of a specific internal motor fault, once it has occurred.” *Id.* at 16.

As explained above, Petitioner argues that it would have been obvious to combine the reference teachings to add the diagnostic functionality of Horikoshi’s driving apparatus, which Petitioner argues is a variable frequency drive, to Coli’s variable frequency drive. *E.g.*, Pet. 20–21. Patent Owner’s arguments regarding the “focus” of the asserted references fails to

apprise us of error in Petitioner’s reasoning to combine the teachings of the asserted references.

Next, Patent Owner argues neither *Coli* nor Horikoshi “makes any mention of ‘preventing electric motor damage,’ or ‘performing electric motor diagnostics.’” PO Resp. 18 (citing Ex. 2034, 31–38). Instead, Patent Owner argues, the Petition relies on the conclusory assertions of Dr. Durham and hindsight. *Id.* at 18–21.

For the reasons explained above, Petitioner persuasively argues that Horikoshi’s detection and classification of an overcurrent condition is the performance of electric motor diagnostics as recited in the claims.

Finally, Patent Owner asserts that Petitioner’s challenges are based on hindsight reasoning. PO Resp. 21–27; PO Sur-reply 11–12. Patent Owner argues that neither Petitioner nor Dr. Durham “identif[ies] *why* a POSITA looking at *Coli* would have identified the problem or would have focused on that problem to then combine the references in the specific manner relied on in the” Petition. PO Resp. 22. Patent Owner faults Petitioner’s arguments for combining the reference teachings for failing to cite to the references themselves. *Id.* Patent Owner also characterizes Petitioner’s reasoning for combining the references as improper “generic motivation[.]” *See, e.g.*, PO Sur-reply 10.

We disagree with Patent Owner’s assertion that, in an obviousness combination, the rationale to combine references must be based on a problem identified in the primary reference. Patent Owner’s arguments appear to require that a teaching, suggestion, or motivation (“TSM”) be disclosed expressly by the references. However, the Supreme Court has “reject[ed] th[is] rigid approach.” *KSR*, 550 U.S. at 415; *see also id.* at 419

(“There is no necessary inconsistency between the idea underlying the TSM test and the *Graham* analysis. But when a court transforms the general principle into a rigid rule that limits the obviousness inquiry, . . . it errs.”). Although TSM is one manner in which rationale supporting obviousness can be established, it is not the only manner. Rather, the rationale for modifying or combining reference teachings may arise from a number of sources, including the interrelated teachings of multiple prior art references. *See id.* at 415–21. As discussed above, the Petition sufficiently sets forth how Horikoshi suggests preventing damage to electric motors by detecting ground faults and short circuits. For the same reason, we also disagree with Patent Owner’s assertion that Petitioner relies on impermissible hindsight reasoning or “generic motivations” in challenging the claims of the ’601 patent. To the contrary, as discussed above, Petitioner relies on Horikoshi to identify a problem and solution and argues that it would have been obvious to incorporate the solution (overcurrent detection and classification) in Coli’s system.

Accordingly, for the foregoing reasons and on this record, Coli and Horikoshi support Petitioner’s contentions. We further determine that Petitioner has set forth reasoning with rational underpinning explaining why it would have been obvious to combine the teachings of Coli and Horikoshi. *See, e.g.*, Pet. 20–21 (arguing that the modification to include Horikoshi’s overcurrent detection in Coli’s variable frequency drive would be obvious “because such an improvement represents the use of a known technique (i.e., the fault detection of *Horikoshi*) to predictably improve a similar system (i.e., the VFD of *Coli*) in the same way”).

d. The Generators Recitation

Claim 1 recites “a plurality of generators electrically connected to the plurality of pumps to provide electrical power to the pumps.” Ex. 1001, 9:14–15. Petitioner maps Coli’s turbine generators 30 to the recited generators. Pet. 26 (citing Ex. 1009 ¶¶ 38, 40; Ex. 1007 ¶ 149).

Patent Owner does not contest this aspect of the Petition. *See generally* PO Resp.

As noted above, each of Coli’s fracturing modules 20 includes electric motor 21 coupled directly to fluid pump 22. Ex. 1009 ¶¶ 40, 52. Coli discloses that “[f]racturing modules 20 utilize electric power from turbine generator 30 to pump the fracturing fluid directly to the wellbore.” *Id.* ¶ 40; *see also id.* ¶ 38 (referring to “[o]ne or more natural-gas powered turbine generators 30”).

Accordingly, for the foregoing reasons, Coli supports Petitioner’s contentions.

e. Conclusion

For the foregoing reasons, we conclude that Petitioner has shown, by a preponderance of the evidence, that the limitations of claim 1 are disclosed by the combination of Coli and Horikoshi, and Petitioner has set forth reasoning with rational underpinning why it would have been obvious to combine the teachings of these references to arrive at the claimed subject matter.

2. *Dependent Claims 2–7*

Claim 2 depends directly from claim 1 and further recites “wherein at least some of the plurality of generators are powered by a fuel selected from

the group consisting of natural gas, liquefied natural gas, and diesel.”
Ex. 1001, 9:16–19. Claim 3 depends directly from claim 1 and further recites “wherein at least some of the plurality of generators are turbine generators.” *Id.* at 9:20–21. Petitioner argues that Coli teaches the use of turbine generators powered by natural gas. Pet. 26–27 (citing Ex. 1009 ¶ 38; Ex. 1007 ¶¶ 150–151).

Patent Owner does not contest this aspect of the Petition. *See generally* PO Resp.

Coli discloses “[o]ne or more natural gas-powered turbine generators 30” that “provide a dedicated source of electric power on-site.” Ex. 1009 ¶ 38.

Accordingly, on this record, Coli supports Petitioner’s contentions.

Claim 4 depends directly from claim 1 and further recites “an A/C console.” Ex. 1001, 9:22–23. Petitioner maps Coli’s electrical transformer and drive unit 50 to the recited A/C console. Pet. 27 (citing Ex. 1009 ¶ 47; Ex. 1007 ¶ 152). Petitioner argues that an ordinarily skilled artisan would understand that this component modifies the A/C waveform by stepping down the voltage. *Id.* (citing Ex. 1007 ¶¶ 152–155).

Patent Owner does not contest this aspect of the Petition. *See generally* PO Resp.

Coli discloses that electrical transformer and drive unit 50 “step[s] down the voltage of the power from turbine generator 30 to a voltage appropriate for electric motor 21.” Ex. 1009 ¶ 47. This comports with the agreed upon interpretation of “A/C console.”

Accordingly, on this record, Coli supports Petitioner’s contentions.

Claim 5 depends directly from claim 1 and further recites “wherein the plurality of pumps are mounted on a trailer, and can be ported from one well to another.” Ex. 1001, 9:24–26. Petitioner argues that Coli’s pumps can be ported because they are mounted on trailer 10. Pet. 28 (citing Ex. 1009 ¶ 40; Ex. 1007 ¶ 156).

Patent Owner does not contest this aspect of the Petition. *See generally* PO Resp.

Coli discloses that trailer 10 houses one or more fracturing modules 20, each fracturing module including electric motor 21 and fluid pump 22 coupled thereto. Ex. 1009 ¶ 40. Coli further discloses that “a plurality of electric motors 21 and pumps 22 can be transported on a single trailer 10.” *Id.*

Accordingly, on this record, Coli supports Petitioner’s contentions.

Claim 6 depends directly from claim 1 and further recites “wherein the generators are mounted on the trailer or truck, and can be ported from one well to another.” Ex. 1001, 9:27–29. Petitioner argues that Coli teaches that turbine generators 30 “power trailer-mounted fracturing modules” and “are intended to ‘replace the diesel prime movers’ of the prior art.” Pet. 28 (citing Ex. 1009 ¶¶ 38, 40). Petitioner argues, “[b]ased on *Coli*’s disclosure, a POSITA would have understood that the prime movers in the prior art are trailer-mounted.” *Id.* at 29 (citing Ex. 1007 ¶ 157).

Patent Owner argues that “*Coli* does not disclose or suggest ‘generators are mounted on the trailer or truck, and can be ported from one well to another.’” PO Resp. 12 (citing Ex. 2034, 25–27); *see also id.* at 53–54 (presenting similar arguments); PO Sur-reply 12–14 (presenting similar arguments).

We agree with Petitioner that it would have been obvious to provide trailer-mounted turbine generators in Coli's system. Coli describes typical drilling systems as using diesel engines mounted on trailers. *E.g.*, Ex. 1009 ¶ 5. Coli purports to improve upon such known fracturing systems by using electric motors and generators powered by natural gas, rather than diesel engines, to drive the pumps. *E.g.*, *id.* ¶¶ 9–11. By replacing the trailer-mounted diesel engines with electric motors and generators, Coli strongly suggests that its components are also mounted on trailers. Furthermore, Coli discloses that its system includes “one or more trailers 10, each housing one or more fracturing modules 20,” each fracturing module including an electric motor 21 and a fluid pump 22, and each fracturing module being operatively associated with a turbine generator 30. *Id.* ¶¶ 38, 40, Fig. 3. Additionally, Coli is titled “*Mobile, Modular, Electrically Powered System for Use in Fracturing Underground Formations*” (*id.* at code (54) (emphasis added)), further suggesting that Coli's drilling system, including its turbine generators, are mounted on trailers.

Accordingly, on this record, Coli supports Petitioner's contentions.

Claim 7 depends directly from claim 1 and further recites “further comprising a plurality of variable frequency drives attached to the plurality of pumps, wherein each variable frequency drive discretely controls a single pump.” Ex. 1001, 9:30–33. Petitioner argues that Coli teaches a plurality of variable frequency drives and an ordinarily skilled artisan would have understood that each variable frequency drive may be associated with a single pump. Pet. 30 (citing Ex. 1009 ¶¶ 40, 47, 65; Ex. 1007 ¶¶ 160–161).

Patent Owner does not contest this aspect of the Petition. *See generally* PO Resp.

Coli discloses that “electric motors are controlled by variable frequency drives” and the “[v]ariable frequency drives essentially ‘tell’ the motors what they are allowed to do.” Ex. 1009 ¶ 65. Coli further discloses that, “[t]ypically, each fracturing module 20 will be associated with a drive housing for controlling electric motor 21 and pumps 22.” *Id.* ¶ 47.

Accordingly, on this record, Coli supports Petitioner’s contentions.

For the foregoing reasons, we conclude that Petitioner has shown, by a preponderance of the evidence, that the limitations of claims 2–7 are disclosed by the combination of Coli and Horikoshi, and Petitioner has set forth reasoning with rational underpinning why it would have been obvious to combine the teachings of these references to arrive at the claimed subject matter.

3. Independent Claim 22

Claim 22 recites a system similar to the system recited in claim 1 and specifies that the pumps and motors are connected to a trailer without skids. Ex. 1001, 10:31–53. In large part, Petitioner refers to its contentions regarding claim 1 in arguing that claim 22 would have been obvious over the combination of Coli and Horikoshi. *See* Pet. 31–34 (citations omitted). Petitioner relies on Coli to disclose attaching the pumps and motors directly to a trailer without using skids. *Id.* at 32–33 (citing Ex. 1009 ¶¶ 5, 14, 37, 40, 77–78; Ex. 1007 ¶¶ 164–167).

Patent Owner relies on the arguments advanced for claim 1 regarding claim 22. *See* PO Resp. 51–52.

For the reasons as set forth in § II.E.1 above, we conclude that Petitioner has shown, by a preponderance of the evidence, that the

limitations of claim 22 are disclosed by the combination of Coli and Horikoshi, and Petitioner has set forth reasoning with rational underpinning why it would have been obvious to combine the teachings of these references to arrive at the claimed subject matter.

F. Asserted Obviousness Based on Coli, Horikoshi, and Vliet

Petitioner argues that claim 6 would have been obvious over Coli, Horikoshi, and Vliet. Pet. 34–37. In support of its showing, Petitioner relies upon the Durham Declaration. *Id.* (citing Ex. 1007). We have reviewed the parties’ briefs and the evidence of record and determine that, for the reasons explained below, Petitioner has shown, by a preponderance of the evidence, that the limitations of claim 6 are disclosed by the combination of Coli, Horikoshi, and Vliet, and that Petitioner has set forth reasoning with rational underpinning why it would have been obvious to combine the teachings of these references to arrive at the claimed subject matter.

Claim 6 depends directly from claim 1 and recites “wherein the generators are mounted on the trailer or truck, and can be ported from one well to another.” Ex. 1001, 9:27–29. Petitioner relies on Coli and Horikoshi as set forth in § II.E above and relies on Vliet to teach mounting a generator on the same trailer on which the pump is mounted. Pet. 36–37 (citing Ex. 1011 ¶¶ 14, 27, 33; Ex. 1007 ¶ 177). Petitioner argues that it would have been obvious to mount Coli’s turbine generators 30 and pumps 22 on the same trailer “to improve the convenience, efficiency and portability of *Coli*’s pumping system.” *Id.* at 34 (citing Ex. 1007 ¶¶ 172–175); *see also id.* at 35–36 (arguing that it would have been obvious to mount the generator

“on the same trailer as the pumps and motors for convenience, efficiency and portability” (citing Ex. 1007 ¶¶ 172–175)).

Patent Owner reiterates its contention that Coli does not disclose generators mounted on a trailer and argues, therefore, that “there is no disclosure of any ‘generator mounted on a trailer’ for *Vliet* to allegedly improve on in *Coli* or *Horikoshi*.” PO Resp. 55; *see also* PO Sur-reply 12–14.

For the reasons discussed in § II.E.2 above, we agree with Petitioner that it would have been obvious to provide trailer-mounted turbine generators in Coli’s system. Vliet discloses such a generator. Vliet discloses a system for a fracturing operation at a well site. Ex. 1011 ¶¶ 2, 14. Vliet discloses that drilling components, including fuel tanks, pumps, and generators, are positioned on trailers. *E.g., id.* ¶ 27. Vliet discloses that this equipment “may conveniently be mounted on the [same] trailer.” *Id.* Thus, Vliet supports Petitioner’s contentions. We further determine that Petitioner has set forth reasoning with rational underpinning explaining why it would have been obvious to combine the teachings of Coli, Horikoshi, and Vliet. *See, e.g.,* Pet. 34–36.

For the foregoing reasons, we conclude that Petitioner has shown, by a preponderance of the evidence, that the limitations of claim 6 are disclosed by the combination of Coli, Horikoshi, and Vliet, and Petitioner has set forth reasoning with rational underpinning why it would have been obvious to combine the teachings of these references to arrive at the claimed subject matter.

G. Asserted Obviousness Based on Coli, Horikoshi, and API Standard

Petitioner argues that claims 8–12, 15, 17, and 18 would have been obvious over Coli, Horikoshi, and API Standard. Pet. 37–47. In support of its showing, Petitioner relies upon the Durham Declaration. *Id.* (citing Ex. 1007). We have reviewed the parties’ briefs and the evidence of record and determine that, for the reasons explained below, Petitioner has shown, by a preponderance of the evidence, that the limitations of claims 8–12, 15, 17, and 18 are disclosed by the combination of Coli, Horikoshi, and API Standard, and that Petitioner has set forth reasoning with rational underpinning why it would have been obvious to combine the teachings of these references to arrive at the claimed subject matter.

1. Independent Claim 8

Claim 8 recites a system similar to the system recited in claim 1 and specifies that the motor has a high-strength steel or steel alloy drive shaft attached to and configured to drive the pump. Ex. 1001, 9:34–51. Petitioner relies on Coli and Horikoshi in substantially the same manner as discussed in § II.E.1 above with respect to claim 1. *See* Pet. 40–43 (citations omitted). Petitioner argues that an ordinarily skilled artisan would understand Coli’s motor to have a drive shaft coupled directly to the pump shaft “because it is through the coupling of the motor shaft to the pump shaft that power is transferred from the motor to the pump.” *Id.* at 41 (citing Ex. 1007 ¶ 188). Petitioner notes that Coli discloses its pumps can be “quintiplex or triplex plunger style pump[s], for example, the SWGS-2500 Well Service Pump sold by Gardner Denver, Inc.” and relies on API Standard to teach that the shaft driving such a pump should be formed of an A400 series heat-treated

forged steel. *Id.* at 41–42 (citing Ex. 1009 ¶¶ 40, 46, 52; Ex. 1012, 17; Ex. 1007 ¶ 188). Specifically, Petitioner argues that it would have been obvious to form Coli’s motor drive shaft of 4340 steel alloy, “one of the grades of the A400 series.” *Id.* at 42 (citing Ex. 1007 ¶ 189; Ex. 1022); *see also id.* at 38–39 (citations omitted).

Patent Owner contends that Petitioner’s reasoning for combining the teachings of Coli, Horikoshi, and API Standard is flawed, arguing that because Coli and Horikoshi “do not disclose ‘designing motors’ . . . , there is no disclosure for *API Standard* to allegedly improve on.” PO Resp. 56 (citing Ex. 2034, 78–98).

Petitioner argues that Patent Owner improperly insists on a teaching, suggestion, or motivation rationale for combining the teachings of asserted references. Pet. Reply 18.

Patent Owner replies that Petitioner relies on improper hindsight reasoning and “generic motivations.” PO Sur-reply 14–16.

As noted by Petitioner, Coli discloses “[a] suitable pump is a quintiplex or triplex plunger style pump, for example, the SWGS-2500 Well Service Pump sold by Gardner Denver, Inc.” Ex. 1009 ¶ 46. Dr. Durham testifies that “[a] vast majority of the motors used in oil and gas fracturing pumps are form-wound squirrel-cage induction motors that are 500 horsepower and larger.” Ex. 1007 ¶ 182. API Standard “covers the minimum requirements for form-wound squirrel-cage induction motors 500 horsepower (hp) and larger for use in petroleum industry services.” Ex. 1012, 7. API Standard specifies that “[h]eat-treated forged steel shafts shall be used for machines . . . [d]riving reciprocating loads,” and that “[h]eat-treated forged steel shafts shall be A4000 series.” *Id.* at 17.

Dr. Durham testifies that an ordinarily skilled artisan “would have understood that 4340 alloy steel is one of the grades of steel in the 4000 series” (Ex. 1007 ¶ 182 (citing Ex. 1024, 5)) and would have used 4340 alloy steel for Coli’s motor shaft because “the [artisan] would have simply chosen from a finite number of identified (as members of the A4000 series), predictable solutions” (*id.* ¶ 185).

Dr. Durham testifies that “American Petroleum Institute (API) has been a cornerstone in establishing and maintaining standards for the worldwide oil and natural gas industry since 1919.” Ex. 1007 ¶ 85. Petitioner submits a declaration of Sylvia D. Hall-Ellis, Ph.D., who testifies that “prior to June 2004, API would have been known to persons at least of ordinary skill in the art as the largest trade association in the world for the oil and natural gas industry.” *Id.* ¶ 61 (citing <https://www.api.org/about>).

Accordingly, for the foregoing reasons, API Standard supports Petitioner’s contentions. We further determine that Petitioner has set forth reasoning with rational underpinning explaining why it would have been obvious to combine the teachings of Coli, Horikoshi, and API Standard. *See, e.g.*, Pet. 38–40.

For the foregoing reasons, we conclude that Petitioner has shown, by a preponderance of the evidence, that the limitations of claim 8 are disclosed by the combination of Coli, Horikoshi, and API Standard, and Petitioner has set forth reasoning with rational underpinning why it would have been obvious to combine the teachings of these references to arrive at the claimed subject matter.

2. Dependent Claims 9–12, 15, 17, and 18

Claim 9 depends directly from claim 8 and further recites “wherein the pump is a triplex or a quintuplex pump rated at about 2250 horsepower or more.” Ex. 1001, 9:52–53. Petitioner notes that Coli discloses its pumps can be “quintiplex or triplex plunger style pump[s], for example, the SWGS-2500 Well Service Pump sold by Gardner Denver, Inc.” Pet. 43–44 (citing Ex. 1009 ¶ 46). Petitioner argues that this pump “is rated at 2500 bhp (brake horsepower).” *Id.* Petitioner further notes that Coli discloses that its system “can deliver a true 2500 hp directly to each pump 22 because pump 22 is directly coupled to electric motor 21.” *Id.* at 44 (emphasis omitted) (quoting Ex. 1009 ¶ 49).

Patent Owner does not contest this aspect of the Petition. *See generally* PO Resp.

As noted by Petitioner, Coli discloses its pump to be a triplex or a quintiplex pump rated at more than 2250 horsepower. Ex. 1009 ¶¶ 46, 49.

Accordingly, on this record, Coli supports Petitioner’s contentions.

Claim 10 depends from claim 8 through claim 9 and further recites “wherein the pump has 4.5 inch diameter plungers with an eight inch stroke.” Ex. 1001, 9:54–55. Petitioner argues that the operating manual of the Gardner Denver pump disclosed by Coli discloses that the pump “can have 4.5 in. plunger size with an 8 in. stroke length.” Pet. 44–45 (citing Ex. 1013, 20).

Patent Owner does not contest this aspect of the Petition. *See generally* PO Resp.

As noted by Petitioner, Coli discloses “[a] suitable pump is a quintiplex or triplex plunger style pump, for example, the SWGS-2500 Well

Service Pump sold by Gardner Denver, Inc.” Ex. 1009 ¶ 46. Dr. Durham testifies that an ordinarily skilled artisan “would have understood that the ‘SWGS-2500 quintuplex pump’ disclosed by *Coli* refers to a Gardner Denver GD-2500Q power end (or pump end) coupled with a Gardner Denver SGWS fluid end.” Ex. 1007 ¶ 91. Gardner discloses that the GD-2500Q quintuplex pump has a stroke length of 8.0 inches and a variety of plunger diameters, including 4.5 inches. Ex. 1013, 20.

Accordingly, on this record, *Coli* supports Petitioner’s contentions.

Claim 11 depends directly from claim 8 and further recites “wherein the electric motor has a maximum continuous power output of about 1500 horsepower or more.” Ex. 1001, 10:1–3. Petitioner argues that, because *Coli* discloses that its motors can deliver a true 2500 hp directly to each pump 22, an ordinarily skilled artisan would understand that *Coli*’s motors have a maximum continuous power output of about 1500 horsepower or more. Pet. 45 (citing Ex. 1009 ¶ 49; Ex. 1007 ¶ 195).

Patent Owner does not contest this aspect of the Petition. *See generally* PO Resp.

As noted by Petitioner, *Coli* discloses its motor to deliver “a true 2500 hp directly to each pump 22.” Ex. 1009 ¶ 49.

Accordingly, on this record, *Coli* supports Petitioner’s contentions.

Claim 12 depends from claim 8 through claim 11 and further recites “wherein the electric motor has a maximum continuous torque of about 8750 ft-lb or more.” Ex. 1001, 10:4–5. Petitioner notes that *Coli* discloses that its “electric motor can be capable of operation in the range of up to 1500 rpms and up to 20,000 ft/lbs of torque” and argues that an ordinarily skilled

artisan would understand this to meet the recitations of claim 12. Pet. 46 (citing Ex. 1009 ¶ 11; Ex. 1007 ¶ 196).

Patent Owner does not contest this aspect of the Petition. *See generally* PO Resp.

As noted by Petitioner, Coli discloses its motor to provide “up to 20,000 ft/lbs of torque.” Ex. 1009 ¶ 11.

Accordingly, on this record, Coli supports Petitioner’s contentions.

Claim 15 depends directly from claim 8 and further recites “wherein the generator is a turbine generator.” Ex. 1001, 10:10–11. Petitioner relies on its showing regarding claim 3. Pet. 46.

Patent Owner does not contest this aspect of the Petition. *See generally* PO Resp.

As noted in § II.E.2 above regarding claims 2 and 3, Coli discloses “[o]ne or more natural gas-powered turbine generators 30” that “provide a dedicated source of electric power on-site.” Ex. 1009 ¶ 38.

Accordingly, on this record, Coli supports Petitioner’s contentions.

Claim 17 depends directly from claim 8 and further recites “wherein the variable frequency drive is mounted to the trailer or truck.” Ex. 1001, 10:17–18. Petitioner notes that Coli discloses variable frequency drives that control the fracturing modules. Pet. 46 (citing Ex. 1009 ¶ 65). Petitioner argues that “*Coli* also teaches that the drive functionality is incorporated into a unit that is ‘permanently fixed to the trailer 10’ with the fracturing modules.” *Id.* (quoting Ex. 1009 ¶ 47) (citing Ex. 1009 ¶ 65, Fig. 3). According to Petitioner, an ordinarily skilled artisan “would have understood the drive functionality in the ‘independent unit’ to include a

variable frequency drive that ‘is mounted to the trailer or truck’ with the fracturing modules.” *Id.* at 46–47 (citing Ex. 1007 ¶ 198).

Patent Owner does not contest this aspect of the Petition. *See generally* PO Resp.

As noted by Petitioner, Coli discloses its transformer, drive unit, transformer, and pump all being located on the same trailer. Ex. 1009 ¶¶ 47, 65, Fig. 3.

Accordingly, on this record, Coli supports Petitioner’s contentions.

Claim 18 depends directly from claim 8 and further recites “wherein the trailer has three axles.” Ex. 1001, 10:19–20. Petitioner argues that Coli depicts its trailer 10 having three axles. Pet. 47 (citing Ex. 1009, Fig. 3; Ex. 1007 ¶ 199).

Patent Owner does not contest this aspect of the Petition. *See generally* PO Resp.

As noted by Petitioner, Coli illustrates its fracturing trailer 10 as having three axles. Ex. 1009, Fig. 3.

Accordingly, on this record, Coli supports Petitioner’s contentions.

For the foregoing reasons, we conclude that Petitioner has shown, by a preponderance of the evidence, that the limitations of claims 9–12, 15, 17, and 18 are disclosed by the combination of Coli, Horikoshi, and API Standard, and Petitioner has set forth reasoning with rational underpinning why it would have been obvious to combine the teachings of these references to arrive at the claimed subject matter.

H. Asserted Obviousness Based on Coli, Horikoshi, API Standard, and Gardner

Petitioner argues that claim 10 would have been obvious over Coli, Horikoshi, API Standard, and Gardner. Pet. 47–49. In support of its showing, Petitioner relies upon the Durham Declaration. *Id.* (citing Ex. 1007). We have reviewed the parties’ briefs and the evidence of record and determine that, for the reasons explained below, Petitioner has shown, by a preponderance of the evidence, that the limitations of claim 10 are disclosed by the combination of Coli, Horikoshi, API Standard, and Gardner, and that Petitioner has set forth reasoning with rational underpinning why it would have been obvious to combine the teachings of these references to arrive at the claimed subject matter.

Claim 10 depends from claim 8 through claim 9 and recites “wherein the pump has 4.5 inch diameter plungers with an eight inch stroke.” Ex. 1001, 9:54–55. Petitioner relies on Coli, Horikoshi, and API Standard as set forth in § II.G above and relies on Gardner to disclose attributes of the pump disclosed in Coli. Pet. 49 (citing Ex. 1009 ¶ 46; Ex. 1013, 20; Ex. 1007 ¶ 204).

Patent Owner does not contest Petitioner’s challenge other than by referencing its arguments advanced for Coli and Horikoshi, which we find unavailing for the reasons set forth above. *See* PO Resp. 57; PO Sur-reply 16.

Accordingly, for the reasons provided in § II.G.2 above and on this record, Coli supports Petitioner’s contentions.

For the foregoing reasons, we conclude that Petitioner has shown, by a preponderance of the evidence, that the limitations of claim 10 are

disclosed by the combination of Coli, Horikoshi, API Standard, and Gardner, and Petitioner has set forth reasoning with rational underpinning why it would have been obvious to combine the teachings of these references to arrive at the claimed subject matter.

I. Asserted Obviousness Based on Coli, Horikoshi, API Standard, and Stark

Petitioner argues that claim 16 would have been obvious over Coli, Horikoshi, API Standard, and Stark. Pet. 49–54. In support of its showing, Petitioner relies upon the Durham Declaration. *Id.* (citing Ex. 1007). We have reviewed the parties’ briefs and the evidence of record and determine that, for the reasons explained below, Petitioner has failed to show, by a preponderance of the evidence, that the limitations of claim 16 are disclosed by the combination of Coli, Horikoshi, API Standard, and Stark.

Claim 16 depends directly from claim 8 and recites “wherein the variable frequency drive includes power semiconductor heat sinks having one or more thermal sensors monitored by a microprocessor to prevent semiconductor damage caused by excessive heat.” Ex. 1001, 10:12–15. Petitioner relies on Coli, Horikoshi, and API Standard as set forth in § II.G above and relies on Stark to teach transferring heat away from variable frequency drives. Pet. 49–54 (citations omitted). Specifically, Petitioner argues that it would have been obvious to include Stark’s “heat sink and associated hardware/functionality of the variable frequency drive” into the variable frequency drive of Coli as modified by Horikoshi or the variable frequency drive of Horikoshi, and substitute this modified variable frequency drive in place of Coli’s variable frequency drive. *Id.* at 51–53 (citations omitted). Petitioner identifies Stark’s “temperature sensor” that is

“embedded in the heat sink” and “microprocessor 50” as the associated hardware. *Id.* at 54 (citing Ex. 1014, 2:5–11, 4:21–29).

Patent Owner contests Petitioner’s reasoning for combining the teachings of Coli, Horikoshi, API Standard, and Stark. PO Resp. 57–61. Patent Owner argues that Petitioner does not identify why an ordinarily skilled artisan reviewing the teachings of Coli would have identified a problem for the teachings of Stark to solve. *Id.* at 57. Patent Owner argues that Petitioner does not explain how Stark’s variable frequency drive heat sink would be incorporated into the Coli/Horikoshi/API Standard variable frequency drive. *Id.* at 58. Continuing, Patent Owner argues that the references are not combinable because Stark discloses a refrigeration system that uses a refrigerant to remove heat from the variable frequency device and Petitioner has not explained how flow channels for the refrigerant would be incorporated into the Coli/Horikoshi/API Standard variable frequency device. *Id.* at 58–61. For the same reasons, Patent Owner argues that the combination proposed by Petitioner would not merely have been the combination of known components yielding predictable results. *Id.* at 61.

Petitioner argues that Patent Owner applies an improper “bodily incorporation” test for obviousness. Pet. Reply 19. Rather than requiring refrigerant flow channels to be added to Coli’s variable frequency drive, Petitioner argues that the modification proposed in the Petition “simply provides adding power semiconductor heat sinks with thermal monitoring to the VFD already present in Coli.” *Id.* Petitioner argues that “[t]hese components and their uses were well-known in the art.” *Id.* (citing Pet. 49–54; Ex. 1007 ¶¶ 205–214).

Patent Owner replies that Petitioner relies on improper “generic, conclusory statements.” PO Sur-reply 17.

Regarding Patent Owner’s contention that Petitioner has not identified a problem in Coli, Patent Owner again appears to argue that an explicit teaching, suggestion, or motivation must be disclosed expressly by the references. As noted above, however, the rationale for modifying or combining reference teachings need not be disclosed or suggested by the references, but may instead arise from a number of sources, including the interrelated teachings of multiple prior art references. *See KSR*, 550 U.S. at 415–21.

Stark notes that variable frequency drives contain heat-producing power electronic components that require cooling. Ex. 1014, 1:13–17, 1:65–2:1, 2:56–60. Such components are mounted on a heat sink having an internal flow channel through which refrigerant is cycled to remove heat from the variable frequency drive. *Id.* at 1:17–27, 3:1–4, 3:45–53. Stark discloses a refrigeration cycle that includes condenser 13, compressor 15, evaporator 17, and expansion device 20. *Id.* at 2:32–53. Flow lines 36, 39 allow a portion of the refrigerant to flow from the condenser, through the heat sink internal flow channel, to the evaporator. *Id.* at 3:14–22. A control valve throttles this refrigerant flow to control the amount of cooling provided to the heat sink. *Id.* at 3:14–22, 3:40–42. In the embodiment relied upon by Petitioner, “temperature sensor 42 is . . . embedded in the heat sink 30 and provides temperature related information to a microprocessor 50 that is programmed to process the data and send a control signal to the [control] valve.” *Id.* at 4:21–25.

By referring to Stark’s “‘temperature sensor’ ‘embedded in the heat sink’” and microprocessor 50” (*see* Pet. 54), we understand the Petition to argue that these components would be incorporated into the modified Coli variable frequency drive.⁵ As explained above, inclusion of these components necessitates inclusion of the remaining refrigeration cycle equipment and a refrigerant flowing through flow channels formed in the heat sink—there would otherwise be no purpose for the added temperature sensor and microprocessor. However, neither Petitioner nor Dr. Durham explains how this equipment would be incorporated into Coli’s modified variable frequency drive. *See id.* at 49–54; Ex. 1007 ¶¶ 205–214. We note that Stark’s variable frequency drive is part of a compressor used in a refrigeration system (Ex. 1014, 1:6–16) and the refrigeration system provides the source of the refrigerant that flows through the heat sink internal flow channels and cools the heat sink and variable frequency drive (*id.* at 3:14–22). Neither Petitioner nor Dr. Durham identify the refrigerant source in Coli’s modified system. Although Dr. Durham acknowledges Stark’s use of a refrigerant to cool its heat sink, he does not explain how such refrigerant would be provided in the modified Coli variable frequency drive. Ex. 1007 ¶ 214. And although Petitioner notes in its Reply that Coli’s blenders may include coolers (*see* Pet. Reply 19 n.4), Petitioner does not explain how such coolers necessarily include the use of a refrigerant or how any such refrigerant would be used with the variable frequency drives.

⁵ To the extent Petitioner argues in the Reply that only Stark’s heat sink would be incorporated into modified Coli variable frequency drive (*see* Pet. Reply 19), this argument is incompatible with the arguments presented in the Petition.

For the foregoing reasons, we conclude that Petitioner has not shown, by a preponderance of the evidence, that the limitations of claim 16 are disclosed by the combination of Coli, Horikoshi, API Standard and Stark. Accordingly, we determine that Petitioner has not shown, by a preponderance of the evidence, that claim 16 would have been obvious in view of Coli, Horikoshi, API Standard, and Stark.

J. Asserted Obviousness Based on Coli, Horikoshi, API Standard, and Amrine

Petitioner argues that claim 19 would have been obvious over Coli, Horikoshi, API Standard, and Amrine. Pet. 57. In support of its showing, Petitioner relies upon the Durham Declaration. *Id.* (citing Ex. 1007). We have reviewed the parties' briefs and the evidence of record and determine that, for the reasons explained below, Petitioner has shown, by a preponderance of the evidence, that the limitations of claim 19 are disclosed by the combination of Coli, Horikoshi, API Standard, and Amrine, and that Petitioner has set forth reasoning with rational underpinning why it would have been obvious to combine the teachings of these references to arrive at the claimed subject matter.

Claim 19 depends from claim 8 through claim 18 and recites "wherein the motor is attached to the trailer, and the trailer has cross-members that support the torque of the motor." Ex. 1001, 10:21–23. Petitioner relies on Coli, Horikoshi, and API Standard as set forth in § II.G above and relies on Amrine to disclose the use of cross-members. Pet. 57 (citations omitted). Specifically, Petitioner argues that it would have been obvious to incorporate Amrine's first cross-members 120 and second cross-members 124 into

Coli's trailer to resist torsional strains imposed by the motor. *Id.* (citing Ex. 1015 ¶¶ 37, 41, Fig. 5; Ex. 1007 ¶¶ 222–223).

Patent Owner argues that Petitioner's reasoning for combining the teachings of Coli, Horikoshi, API Standard, and Amrine is flawed because "*Coli* is not concerned with enhancing trailers or with providing support against torque torsional forces." PO Resp. 62. Patent Owner also argues that Petitioner relies on improper "generic, conclusory statements." PO Sur-reply 18–19.

Patent Owner again improperly appears to argue that an explicit teaching, suggestion, or motivation must be disclosed expressly by the references. This reasoning is erroneous for the reasons explained previously.

Amrine discloses a heavy duty utility trailer for hauling heavy machinery. Ex. 1015 ¶¶ 3–4, 7. The frame of the trailer includes first cross-members 120 and second cross-members 124 positioned laterally to the trailer's longitudinal axis through apertures in support beam 78 and side rails 112. *Id.* ¶ 37, Fig. 3. This arrangement improves the torsional robustness of the trailer. *Id.* ¶ 41. Thus, Amrine supports Petitioner's contentions. We further determine that Petitioner has set forth reasoning with rational underpinning explaining why it would have been obvious to include cross-members with Coli's trailer. *See, e.g.,* Pet. 57.

For the foregoing reasons, we conclude that Petitioner has shown, by a preponderance of the evidence, that the limitations of claim 19 are disclosed by the combination of Coli, Horikoshi, API Standard, and Amrine, and Petitioner has set forth reasoning with rational underpinning why it

would have been obvious to combine the teachings of these references to arrive at the claimed subject matter.

K. Asserted Obviousness Based on Coli, Horikoshi, API Standard, and Nadeau

Petitioner argues that claim 20 would have been obvious over Coli, Horikoshi, API Standard, and Nadeau. Pet. 59–60. In support of its showing, Petitioner relies upon the Durham Declaration. *Id.* (citing Ex. 1007). We have reviewed the parties’ briefs and the evidence of record and determine that, for the reasons explained below, Petitioner has shown, by a preponderance of the evidence, that the limitations of claim 20 are disclosed by the combination of Coli, Horikoshi, API Standard, and Nadeau, and that Petitioner has set forth reasoning with rational underpinning why it would have been obvious to combine the teachings of these references to arrive at the claimed subject matter.

Claim 20 depends from claim 8 through claim 18 and recites “wherein the trailer has a neck that includes a strengthening outer rib.” Ex. 1001, 10:24–25. Petitioner relies on Coli, Horikoshi, and API Standard as set forth in § II.G above and relies on Nadeau to teach use of a neck portion with supporting ribs. Pet. 59–60 (citations omitted).

Patent Owner argues that Petitioner’s reasoning for combining the teachings of Coli, Horikoshi, API Standard, and Nadeau is flawed because “[n]one of these references disclose or teach the supposed motivation to combine.” PO Resp. 63. Patent Owner also argues that there would not have been a need to strengthen the neck of Coli’s trailer because “*Coli* teaches that the fracturing modules placed on the trailer are ‘smaller and lighter.’” *Id.* (citing Ex. 1009; Ex. 2034). Patent Owner also argues that

Petitioner relies on improper “generic, conclusory statements.” PO Sur-reply 18–19.

Nadeau discloses an elongated shell attached to the floor of a trailer to impart increased resistance to torsion and bending forces. Ex. 1016 ¶¶ 27–29, Fig. 1. As connected to the trailer floor, the shell defines a chamber that has a tapered neck to accommodate a fifth wheel or landing gear. *Id.* ¶¶ 28, 33. Supporting ribs may be positioned in the neck to ensure torsional resistance is maintained. *Id.* ¶ 34. We understand Petitioner to argue that it would have been obvious to include Nadeau’s shell, including its neck portion, in Coli’s trailer. *See* Pet. 59–60 (discussing “neck portion N” of Nadeau’s elongated shell 120). Accordingly, Nadeau supports Petitioner’s contentions. We further determine that Petitioner has set forth reasoning with rational underpinning explaining why it would have been obvious to include Nadeau’s shell, including its neck portion, with Coli’s trailer. *See, e.g., id.* at 59 (arguing that incorporating Nadeau’s supporting ribs into Coli’s trailer would be the use of a known technique to predictably improve a similar system in the same way).

Patent Owner’s contention that the asserted references do not explicitly disclose Petitioner’s stated reason for modifying the Coli trailer is another improper interpretation that an explicit teaching, suggestion, or motivation must be disclosed expressly by the references. This reasoning is erroneous for the reasons explained previously. Moreover, as described above, Nadeau provides such reasoning.

Additionally, Patent Owner’s observation that Coli teaches fracturing modules that are smaller and lighter than convention equipment (*see* Ex. 1009 ¶ 81) fails to address persuasively Petitioner’s contention that an

ordinarily skilled artisan would seek to provide increased resistance to torsion and bending forces to the trailer carrying such equipment.

For the foregoing reasons, we conclude that Petitioner has shown, by a preponderance of the evidence, that the limitations of claim 20 are disclosed by the combination of Coli, Horikoshi, API Standard, and Nadeau, and Petitioner has set forth reasoning with rational underpinning why it would have been obvious to combine the teachings of these references to arrive at the claimed subject matter.

L. Asserted Obviousness Based on Coli, Horikoshi, API Standard, and Stratton

Petitioner argues that claim 21 would have been obvious over Coli, Horikoshi, API Standard, and Stratton. Pet. 62–63. In support of its showing, Petitioner relies upon the Durham Declaration. *Id.* (citing Ex. 1007). We have reviewed the parties’ briefs and the evidence of record and determine that, for the reasons explained below, Petitioner has shown, by a preponderance of the evidence, that the limitations of claim 21 are disclosed by the combination of Coli, Horikoshi, API Standard, and Stratton, and that Petitioner has set forth reasoning with rational underpinning why it would have been obvious to combine the teachings of these references to arrive at the claimed subject matter.

Claim 21 depends from claim 8 through claim 18 and recites “wherein the trailer has mounts attaching the variable frequency drive to the trailer, the mounts composed of a material that allows the trailer to move independently of the variable frequency drive to reduce vibration of the variable frequency drive.” Ex. 1001, 10:26–30. Petitioner relies on Coli, Horikoshi, and API Standard as set forth in § II.G above and relies on

Stratton to teach shock-mounting a variable frequency drive. Pet. 62–63 (citations omitted).

Patent Owner argues that Petitioner’s reasoning for combining the teachings of Coli, Horikoshi, API Standard, and Stratton is flawed because “[n]one of these references disclose or teach the supposed motivation to combine.” PO Resp. 64. Patent Owner also argues that Petitioner relies on improper “generic, conclusory statements.” PO Sur-reply 18–19.

Patent Owner’s contention that the asserted references do not explicitly disclose Petitioner’s stated reason for modifying the Coli trailer is another improper interpretation that an explicit teaching, suggestion, or motivation must be disclosed expressly by the references. This reasoning is erroneous for the reasons explained previously. Moreover, as described below, Stratton provides such reasoning.

Stratton discloses an electric vehicle with a variable speed AC electric drive motor and a variable speed controller that varies the AC frequency of its output. Ex. 1017, 2:18–25, 3:11–14. Dr. Durham testifies that an ordinarily skilled artisan would understand Stratton’s controller to be a variable frequency drive. Ex. 1007 ¶ 234. Stratton discloses that, “[f]or materials handling vehicle applications, the motor controller should be shock mounted to the vehicle to prevent damage from vibrations.” Ex. 1017, 3:22–25. Dr. Durham testifies that an ordinarily skilled artisan “would have understood that a ‘shock mount[]’ for a ‘variable frequency drive’ ‘to prevent damage from vibrations’ would be ‘composed of a material’ that allows the ‘variable frequency drive’ ‘to move independently of’ the vehicle on which it is attached.” Ex. 1007 ¶ 238 (alteration in original); *see also* Pet. 63 (citing same). Thus, Stratton supports Petitioner’s contentions. We

further determine that Petitioner has set forth reasoning with rational underpinning explaining why it would have been obvious to mount Coli's variable frequency drive on the trailer so as to prevent damage from vibrations. *See, e.g.*, Pet. 62 (arguing that incorporating Stratton's shock mounting into Coli's trailer would be "the application of a known technique (i.e., the use of mounts) to a known device (e.g., *Coli*'s vehicle-mounted VFD) ready for improvement to yield predictable results (i.e., to reduce vibrations to the VFD)").

For the foregoing reasons, we conclude that Petitioner has shown, by a preponderance of the evidence, that the limitations of claim 21 are disclosed by the combination of Coli, Horikoshi, API Standard, and Stratton, and Petitioner has set forth reasoning with rational underpinning why it would have been obvious to combine the teachings of these references to arrive at the claimed subject matter.

M. Alleged Objective Evidence of Nonobviousness

Notwithstanding what the teachings of the prior art would have suggested to one skilled in the art, objective evidence of nonobviousness (so called "secondary considerations") may lead to a conclusion that the challenged claims would not have been obvious. *In re Piasecki*, 745 F.2d 1468, 1471–72 (Fed. Cir. 1984). Objective evidence of nonobviousness "may often be the most probative and cogent evidence in the record" and "may often establish that an invention appearing to have been obvious in light of the prior art was not." *Transocean Offshore Deepwater Drilling, Inc. v. Maersk Drilling USA, Inc.*, 699 F.3d 1340, 1349 (Fed. Cir. 2012)

(citing *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538 (Fed. Cir. 1983)).

1. Petitioner's Asserted Failure to Address Evidence of Nonobviousness in the Petition

Patent Owner argues that it presented objective evidence of nonobviousness during prosecution of the related '410 patent. PO Resp. 28. Patent Owner argues that Petitioner was aware of this evidence, but “failed to consider or discuss all of the known evidence presented during the prosecution of the '410 Patent.” *Id.*; PO Sur-reply 19. According to Patent Owner, “[t]here is no credible justification for Petitioner’s failure to address known evidence of secondary considerations.” PO Resp. 28. Patent Owner argues that “Petitioner’s failure to address all of known evidence of secondary considerations . . . at the time of filing its Petition is an error that cannot be cured. Thus, Petitioner has failed to state a *prima facie* case of obviousness for all of the Challenged Claims.” *Id.* at 29.

We disagree with Patent Owner’s description of the Petition. Contrary to Patent Owner’s arguments, the Petition addresses the arguments made during prosecution of the '410 patent. *See* Pet. 63–65. For example, Petitioner argues that there is no nexus between that evidence and the claims of the '601 patent. *Id.* at 63–64.

Moreover, in this proceeding we determined there was good cause to allow additional pre-institution briefing to address Patent Owner’s asserted objective indicia of nonobviousness. *See* Paper 8 (Order granting additional preliminary briefing); Paper 7, 8–12 (Petitioner presenting additional arguments regarding a lack of nexus); Paper 9, 8–11 (Patent Owner presenting additional arguments regarding objective evidence of

nonobviousness). To the extent that Patent Owner requests that we reconsider our determination that good cause existed to allow the additional briefing, we decline to consider such an untimely request. *See* 37 C.F.R. § 42.71(d) (setting a request for rehearing time limit of 14 days after entry of a non-final decision or a decision to institute a trial).

Furthermore, to the extent Patent Owner argues for a per se rule that a Petitioner's failure to address known secondary considerations in a petition is unconditionally fatal to the petition (*see* PO Resp. 28–29), we decline to adopt such a rule. Patent Owner has cited no authority supporting such an interpretation. *See id.* at 29 (citing *ClassCo, Inc. v. Apple, Inc.*, 838 F.3d 1214, 1220 (Fed. Cir. 2016); *In re Kao*, 639 F.3d 1057, 1067–68 (Fed. Cir. 2011)). In *ClassCo*, the Federal Circuit determined that “the Board erred in giving [the patentee's] evidence of nonobviousness no weight,” but it “nonetheless agree[d] that the value this evidence possesses in establishing nonobviousness is not strong in comparison to the findings and evidence regarding the prior art under the first three *Graham* factors.” *ClassCo*, 838 F.3d at 1223. Thus, rather than applying the per se rule advocated by Patent Owner, the court held the error to be harmless and affirmed the Board's decision that the subject claims were unpatentable. *Id.* at 1222–23. Similarly, in *In re Kao*, the court determined that “the Board erred by failing to consider [the applicant's] evidence of secondary considerations,” but explained that this error was harmless because “[the applicant's] evidence of secondary considerations was insufficient to overcome [the] strong showing of primary considerations that rendered the claims at issue invalid.” *In re Kao*, 639 F.3d at 1071–72; *see also id.* at 1073 (“this error was harmless because there was no nexus between the secondary considerations presented

and the claimed invention”). Thus, the cases cited by Patent Owner contradict its per se argument. To the extent Petitioner erred by failing to address objective evidence of nonobviousness in the Petition, such error is harmless because, as discussed below, Patent Owner’s asserted evidence of nonobviousness is not persuasive to overcome Petitioner’s showings of obviousness.

Additionally, as noted below, objective evidence is only relevant to the obviousness inquiry if there is a nexus between it and the claimed invention, and Patent Owner bears the burden on the nexus inquiry. This suggests that it is not necessarily true that a petition is defective for not preempting argument on matters not yet made of record in the proceeding by Patent Owner.

2. Nexus

“In order to accord substantial weight to secondary considerations in an obviousness analysis, ‘the evidence of secondary considerations must have a “nexus” to the claims, i.e., there must be “a legally and factually sufficient connection” between the evidence and the patented invention.’” *Fox Factory, Inc. v. SRAM, LLC*, 944 F.3d 1366, 1373 (Fed. Cir. 2019) (citing *Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1332 (Fed. Cir. 2019)). “The patentee bears the burden of showing that a nexus exists” *WMS Gaming Inc. v. Int’l Game Tech.*, 184 F.3d 1339, 1359 (Fed. Cir. 1999). Nexus is a legally and factually sufficient connection between the objective evidence and the claimed invention, such that the objective evidence should be considered in determining nonobviousness. *Demaco Corp. v. F. Von Langsdorff Licensing Ltd.*, 851 F.2d 1387, 1392

(Fed. Cir. 1988). A nexus is presumed when “the patentee shows that the asserted objective evidence is tied to a specific product and that product ‘embodies the claimed features, and is coextensive with them.’” *Fox Factory*, 944 F.3d at 1373 (quoting *Polaris Indus., Inc. v. Arctic Cat, Inc.*, 882 F.3d 1056, 1072 (Fed. Cir. 2018)). “A finding that a presumption of nexus is inappropriate does not end the inquiry into secondary considerations,” as “the patent owner is still afforded an opportunity to prove nexus by showing that the evidence of secondary considerations is the ‘direct result of the unique characteristics of the claimed invention.’” *Id.* at 1373–74 (citing *In re Huang*, 100 F.3d 135, 140 (Fed. Cir. 1996)).

Patent Owner argues that its Clean Fleet Generation I product embodies the system recited in independent claim 1. PO Resp. 29–32. Patent Owner asserts that the Clean Fleet Generation I product has “two electric powered ‘frac’ pumps mounted on a trailer and two electric motors each capable of delivering 1750 BHP” and “[t]he trailer also has two VFDs to control and power each electric motor, and the pumps are rated for 14,500 psi.” *Id.* at 31 (citing Ex. 2034, 38–78; Ex. 2041, 2). Patent Owner asserts that the Clean Fleet Generation I product is powered by turbine generators. *Id.* at 32 (citing Ex. 2041, 9; Ex. 2034, 38–78). Patent Owner argues that its Clean Fleet Generation I product embodies independent claims 8 and 22 for the same reasons advanced for claim 1 and, with respect to claim 8, also because the Clean Fleet product includes a motor having a shaft made of steel grade 4340 HT. *Id.* at 34 (citing Ex. 2039, 35; Ex. 2034, 38–78), 37 (citing Ex. 2034, 38–78).

Petitioner argues that Patent Owner has not shown that the Clean Fleet product embodies the claims of the ’601 patent because Patent Owner and

Mr. Schaaf “provide no analysis for whether or how Clean Fleet practices” the “‘high pressure’ limitation or ‘frequently performing electric motor diagnostics.’” Pet. Reply 23 (citing PO Resp. 6; Ex. 2034, 39–41).

Petitioner also notes that “[Patent Owner] points to the same Clean Fleet product for non-obviousness across sixteen patents” and argues that Patent Owner’s reliance on the same evidence for all of these patents is improper because the patents recite “dozens of features” not recited in the ’601 patent, including a heater, a pump down pump, a combustible fuel vaporization system, a gas compression system, switchgear units, a tiebreaker, and a weight monitoring system. *Id.* at 23–25 (emphasis omitted). Petitioner also argues that Patent Owner has not established a nexus between its Clean Fleet Generation I product and the claims of the ’601 patent because Patent Owner has not tied the evidence of secondary considerations to the ’601 patent. *Id.* at 25–26. Rather, Petitioner asserts, Patent Owner’s evidence is tied to features known in the prior art. *Id.*

Patent Owner replies that “multiple patents can share a presumption of nexus with the same product [when] the claims of each of the patents covered essentially the same invention.” PO Sur-reply 20 (alteration in original) (quoting *Fox Factory*, 944 F.3d at 1377).⁶

Patent Owner has not established persuasively that it is entitled to a presumption of nexus. As we noted in the Institution Decision,

⁶ In our quotation here, we have modified Patent Owner’s quotation to *Fox Factory* to correct an inaccuracy. Rather than referring to “essentially the same *inventions*” as stated by Patent Owner (PO Sur-reply 20 (emphasis added)), *Fox Factory* refers to the singular “essentially the same *invention*.” *Fox Factory*, 944 F.3d at 1377 (emphasis added).

During prosecution of the '410 patent, the Applicant touted the “electric motors . . . powered by natural gas” or “a power grid” as being the reason for the asserted commercial success of the “Clean Fleet” product. Ex. 1005, 151–53. The claims of the '601 patent do not include this limitation. Indeed, claim 2 recites that the generators can be powered by diesel fuel. Ex. 1001, 9:16–19. Thus, on this record, Patent Owner has not sufficiently show[n] that the claims of the '601 patent are coextensive with the Clean Fleet product and, thus, has not sufficiently shown that it is entitled to a presumption of nexus.

Inst. Dec. 42–43. Patent Owner did not, in its post-institution briefing, address that preliminary conclusion, and we maintain it here. Patent Owner also fails to establish that the Clean Fleet Generation I product had variable frequency drives performing electric motor diagnostics, as discussed further below. Moreover, to the extent Patent Owner asserts that it is simply the use of VFD-controlled electric motors in hydraulic fracturing that corresponds to objective indicia of nonobviousness, the evidence of record establishes that the prior art disclosed such use of electric motors. *See* Ex. 1009 ¶¶ 9–11, 38, 65–66; *In re Kao*, 639 F.3d at 1069 (“there must be a nexus to some aspect of the claim not already in the prior art”).

Patent Owner also has not satisfied its burden to establish a nexus, absent a presumption, between the claims of the '601 patent and the asserted evidence of nonobviousness. Patent Owner and Mr. Schaaf rely heavily on Exhibit 2041. *See* PO Resp. 31–32; Ex. 2034, 39–42. However, Patent Owner identifies this Exhibit only as “USWS0037345” (PO Resp. viii) or as “USWS0037334 (AEO)” (in the Board’s P-TACTS filing system), and Patent Owner does not otherwise explain exactly what this Exhibit is. Thus, we question the appropriateness of Patent Owner’s reliance on Exhibit 2041 as *objective* evidence to establish nonobviousness. Nonetheless, even

considering Exhibit 2041, we are not apprised of a nexus between Patent Owner's Clean Fleet Generation I product and the claims of the '601 patent. For example, the independent claims require the variable frequency drive to perform electric motor diagnostics. Ex. 1001, 9:9–13, 9:45–49, 10:46–50. Patent Owner does not address this recitation. *See* PO Resp. 31–32. Patent Owner's broad citations to the entirety of its declarant's discussion regarding Petitioner's Clean Fleet product (*e.g., id.* at 31 (citing Ex. 2034, 38–78)) is not helpful in considering Patent Owner's arguments. Our review of Mr. Schaaf's Declaration reveals that he does mention electric motor diagnostics, but he does not explain how the variable frequency drive of the Clean Fleet Generation I product performs such diagnostics. Ex. 2034, 40–41.

Furthermore, the Clean Fleet Generation I product appears to contain several components that are not recited in the claims of the '601 patent. For example, the Clean Fleet Generation I product appears to include a data van, blenders, a hydration unit, a proppant delivery system, an auxiliary unit, transformers, switch gear, fuel gas heaters, and compressors. *See* Ex. 2041, 1, 3–8, 10–11. However, none of these components are required by the claims of the '601 patent.

Nor has Patent Owner addressed meaningfully the fact that it asserts that the same Clean Fleet product is embodied by several of its patents. *See Fox Factory*, 944 F.3d at 1378 (“The same evidence of secondary considerations cannot be presumed to be attributable to two different combinations of features.”). Although Patent Owner acknowledges the requirement that, in such a case, all of the patents must cover essentially the same invention (*see* PO Sur-reply 20), Patent Owner does not address in any

manner the other patents for which it asserts its Clean Fleet product embodies the claims. Notably, Patent Owner does not address the components noted by Petitioner as being claimed in others of Patent Owner's patents that are not recited in the '601 patent. *See* Pet. Reply 24. We additionally note that, in other proceedings, Patent Owner ascribed commercial success to features unrecited in the '601 patent. *See, e.g.*, IPR2021-01238, Paper 22 at 48–49 (touting “[Patent Owner’s] PowerPath® features” and the “use of switchgear on both sides of the high voltage highline cables”); IPR2021-01316, Paper 19 at 25 (touting “the electric blenders of the '724 Patent”).

Thus, for at least the foregoing reasons, Patent Owner fails to establish a nexus between its Clean Fleet Generation I product and the claims of the '601 patent.

3. Patent Owner's Asserted Evidence

Even if we were to find that Patent Owner has proven nexus, we find that Patent Owner's evidence of objective indicia is entitled to little weight, as discussed below.

a. Commercial Success

“When a patentee can demonstrate commercial success, usually shown by significant sales in a relevant market, and that the successful product is the invention disclosed and claimed in the patent, it is presumed that the commercial success is due to the patented invention.” *J.T. Eaton & Co. v. Atl. Paste & Glue Co.*, 106 F.3d 1563, 1571 (Fed. Cir. 1997) (citing *Demaco Corp. v. F. Von Langsdorff Licensing Ltd.*, 851 F.2d 1387, 1392–93 (Fed. Cir. 1988)). However, “the asserted commercial success of the

product must be due to the merits of the claimed invention beyond what was readily available in the prior art.” *Id.* (citing *Richdel, Inc. v. Sunspool Corp.*, 714 F.2d 1573, 1580, (Fed. Cir. 1983)).

Patent Owner argues that its Clean Fleet products have achieved commercial success. PO Resp. 37–39. Patent Owner relies predominantly on the declaration of Joel N. Broussard (Ex. 2016) in support of its contention that the Clean Fleet product drove a 22% growth in its business and on a Yahoo News article (Ex. 2011) in support of its contention that it entered a license agreement for its Clean Fleet products. *Id.* at 38 (citing Ex. 2016, 4; Ex. 2011).

Petitioner notes that Patent Owner relies on the second Declaration of Mr. Schaaf (Ex. 2034) in support of its assertions of commercial success and argues that Mr. Schaaf merely relied upon Mr. Broussard’s declaration and the prosecution history of the ’410 patent, but “did not do any independent analysis to verify any of the facts.” Pet. Reply 27 (citing Ex. 1062, 11:21–13:2, 14:9–15).

Mr. Broussard is Patent Owner’s President and Chief Executive Officer. Ex. 2016 ¶ 2. Thus, Mr. Broussard is not an unbiased declarant, and it is not clear that his declaration qualifies as *objective* evidence. *See In re Huang*, 100 F.3d at 140 (“[The inventor’s affidavit] merely represents the inventor’s opinion as to the purchaser’s reason for buying the product, and, alone, is insufficient. Instead, the applicant must submit some factual evidence that demonstrates the nexus between the sales and the claimed invention—for example, an affidavit from the purchaser explaining that the product was purchased due to the claimed features.”). For the contentions relied upon by Patent Owner, Mr. Broussard cites to the prosecution history

of the '410 patent for support. Ex. 2016, 4 (citing Ex. 1005, 143–99). The arguments regarding objective indicia of nonobviousness presented during prosecution of the '410 patent consist mainly of conclusory assertions. For example, regarding the contention regarding 22% growth, the applicant cites to “Exhibit A at ¶ 9.” Ex. 1005, 150–51. Exhibit A is the declaration of Jared Oehring, Patent Owner’s Vice President of Technology. *Id.* at 166. Thus, the declarant is not unbiased and, therefore, his declaration is not objective. Moreover, Mr. Oehring does not discuss “22% growth” in paragraph nine or elsewhere in his declaration. *See id.* at 166–68. We do not find such evidence to be objective or persuasive of nonobviousness of the challenged claims.

Exhibit 2011 is a Yahoo News press release that purports that Patent Owner sold PIK Notes that ProFrac converted into licenses. Ex. 2011, 1–2. However, Patent Owner has not entered the asserted license(s) into the record in this proceeding. Therefore, we are unable to evaluate the veracity of Exhibit 2011 or determine if the '601 patent is included in the asserted license. Moreover, Patent Owner’s attempt to establish that the purported license includes the '601 patent without making the license of record in this proceeding violates the best evidence rule. *See* Fed. R. Evid. 1002 (“An original writing, recording, or photograph is required in order to prove its content unless these rules or a federal statute provides otherwise.”); 37 C.F.R. § 41.152(a) (“Except as otherwise provided in this subpart, the Federal Rules of Evidence shall apply to contested cases.”). For at least these reasons, we do not find Exhibit 2011 persuasive of commercial success.

We additionally note that Patent Owner does not define the relevant market or present sales figures in support of its assertions of commercial success. *See J.T. Eaton & Co.*, 106 F.3d at 1571 (noting that commercial success is “usually shown by significant sales in a relevant market, and that the successful product is the invention disclosed and claimed in the patent”).

Finally, we note that the use of electric motors in place of diesel engines in hydraulic fracturing systems was known prior to the ’601 patent. *See, e.g.*, Ex. 1009 ¶¶ 9–11, 38–39, 66–71. For this additional reason, Patent Owner’s assertions of commercial success are unpersuasive. *See Ormco Corp. v. Align Tech., Inc.*, 463 F.3d 1299, 1312 (Fed. Cir. 2006) (“if the feature that creates the commercial success was known in the prior art, the success is not pertinent”); *In re Kao*, 639 F.3d at 1070 (requiring a determination of “whether the commercial success of the embodying product resulted from the merits of the claimed invention as opposed to the prior art or other extrinsic factors”).

Accordingly, for at least the foregoing reasons, we find Patent Owner’s evidence of commercial success to be weak.

b. Industry Praise

“Evidence that the industry praised a claimed invention or a product that embodies the patent claims weighs against an assertion that the same claimed invention would have been obvious. Industry participants, especially competitors, are not likely to praise an obvious advance over the known art.” *Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1053 (Fed. Cir. 2016) (en banc).

Patent Owner argues that its Clean Fleet products have been praised by the industry. PO Resp. 39–43. Patent Owner argues that its Clean Fleet products have received praise from professionals in the industry, recognition from industry publications, and industry awards. *Id.* at 39.

Petitioner argues that, in large part, Patent Owner’s arguments “relies solely on a string-cite from its CEO Broussard, absent further explanation of the awards.” Pet. Reply 28 (citing PO Resp. 40–41). Petitioner argues that Mr. Schaaf “did not review the awards, know who else received them, or know the criteria for the awards.” *Id.* (citing Ex. 1062, 18:20–19:20).

Patent Owner again relies predominantly on Mr. Broussard’s declaration and arguments made during prosecution of the ’410 patent. *See* PO Resp. 40–41 (citing Ex. 2016, 8)⁷; Ex. 2016 ¶¶ 18–19 (citing Ex. 1005, 143–99). As explained above, however, Patent Owner has failed to establish that these documents are objective evidence. Additionally, several of the exhibits cited by Patent Owner in support of its contention of industry praise consist mainly of quotations by Patent Owner employees. *See* PO Resp. 42 (citing, *inter alia*, Exs. 2009, 2017, 2018, 2020). Finally, although Patent Owner touts several awards (*see, e.g.*, PO Resp. 39–40), Patent Owner presents no evidence regarding the basis on which such awards are granted. We do not find such evidence persuasive to establish that the industry praised the system claimed in the ’601 patent.

Accordingly, for at least the foregoing reasons, we find Patent Owner’s evidence of industry praise to be weak.

⁷ Although Patent Owner cites to “Ex. 2016, 8, 9” (PO Resp. 41), Exhibit 2016 includes only eight pages.

c. Copying

“Copying may indeed be another form of flattering praise for inventive features.” *Crocs, Inc. v. ITC*, 598 F.3d 1294, 1311 (Fed. Cir. 2010). Copying “requires evidence of efforts to replicate a specific product.” *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1246 (Fed. Cir. 2010). “This may be demonstrated either through internal documents; direct evidence such as disassembling a patented prototype, photographing its features, and using the photograph as a blueprint to build a virtually identical replica; or access to, and substantial similarity to, the patented product (as opposed to the patent).” *Iron Grip Barbell Co. v. USA Sports, Inc.*, 392 F.3d 1317, 1325 (Fed. Cir. 2004) (internal citations omitted). “We note, however, that a showing of copying is only equivocal evidence of nonobviousness in the absence of more compelling objective indicia of other secondary considerations.” *Ecolochem, Inc. v. S. Cal. Edison Co.*, 227 F.3d 1361, 1380 (Fed. Cir. 2000); *see also In re GPAC*, 57 F.3d at 1580 (“[M]ore than the mere fact of copying by an accused infringer is needed to make that action significant to a determination of the obviousness issue.” (quoting *Cable Elec. Prods. v. Genmark, Inc.*, 770 F.2d 1015, 1028 (Fed. Cir. 1985))).

Patent Owner argues that it disclosed its Clean Fleet product at various events and that certain of its competitors, including Petitioner, copied the product. PO Resp. 43–48.

Petitioner notes that Patent Owner relies on the second Declaration of Mr. Schaaf in support of its assertions of copying and argues that Mr. Schaaf “did not know any of the brands, models, ratings, number of units, or other specifics of the alleged copiers.” Pet. Reply 26.

Patent Owner again relies predominantly on Mr. Broussard's declaration and arguments made during prosecution of the '410 patent. *See* PO Resp. 43–44 (citing Ex. 2016, 1–3; Ex. 1005, 143–99). As explained above, however, Patent Owner has failed to establish that these documents are objective evidence. Additionally, Patent Owner cites to page 158 of Exhibit 1005 in support of its assertion of copying by “an employee of one of [Patent Owner's] competitor's partners.” *Id.* at 44. Page 158, however, fails to cite to any evidence and, thus, amounts to unsupported attorney assertions rather than evidence. *See Icon Health & Fitness, Inc. v. Strava, Inc.*, 849 F.3d 1034, 1043 (Fed. Cir. 2017) (“Attorney argument is not evidence.”).

The additional exhibits cited by Patent Owner in support of its assertions of copying are also inadequate evidence. For example, Patent Owner cites Exhibit 2026 in support of its assertion that TOPS and Honghua (“T&H”) “copied the claimed invention.” PO Resp. 44–45 (citing Ex. 2026, 6–7). Exhibit 2026 is the original complaint filed by Patent Owner in its district court litigation with T&H. Thus, this exhibit contains Patent Owner's assertions, but it is not evidence of copying.

Finally, in arguing that Petitioner copied its Clean Fleet system, Patent Owner asserts that Petitioner had access to its system because Patent Owner's “product had been in the market since 2014.” PO Resp. 46. Patent Owner does not identify any evidence that Petitioner actually did have access to Patent Owner's Clean Fleet product. Rather, Patent Owner merely surmises that Petitioner had access because Patent Owner's product had been used in public. Such a mere assertion is not evidence of copying. *See Iron Grip Barbell Co.*, 392 F.3d at 1325.

Accordingly, for at least the foregoing reasons, we find Patent Owner's evidence of copying to be weak.

d. Long-Felt Need and Failure of Others

"The existence of a long-felt but unsolved need that is met by the claimed invention is . . . objective evidence of non-obviousness."

Millennium Pharms., Inc. v. Sandoz Inc., 862 F.3d 1356, 1369 (Fed. Cir. 2017) (citing *In re Cyclobenzaprine Hydrochloride Extended-Release Capsule Patent Litig.*, 676 F.3d 1063, 1081–83 (Fed. Cir. 2012)).

"Long[-]felt need is closely related to the failure of others. Evidence is particularly probative of obviousness when it demonstrates both that a demand existed for the patented invention, and that others tried but failed to satisfy that demand." *In re Cyclobenzaprine*, 676 F.3d at 1082.

Patent Owner argues that, prior to the '601 patent, "there was a long-felt need to power equipment in the hydraulic fracturing industry without using diesel engines and to improve operational efficiency." PO Resp. 49 (citing Ex. 1005, 155; Ex. 2034, 38–78). Patent Owner argues that others tried but failed to satisfy this need. *Id.* at 49–50 (citing Ex. 1005, 155–56, 170; Ex. 2016, 4).

Petitioner argues that Coli identified and solved the same need identified by Patent Owner. Pet. Reply 26.

In support of its assertion of a long-felt need, Patent Owner cites to page 155 of Exhibit 1005 (PO Resp. 49), which cites only the declaration of Mr. Oehring, and pages 38–78 of Mr. Schaaf's second Declaration, the relevant portion of which (Ex. 2034 ¶ 120) cites to the aforementioned prosecution history of the '410 patent and Mr. Broussard's declaration. As

explained above, however, Patent Owner has failed to establish that these documents are objective evidence. Patent Owner's arguments fail to apprise us of a long-felt need in the relevant industry.

Patent Owner also relies on the prosecution history of the '410 patent and the declaration of Patent Owner's Chief Executive Officer to support its assertion that others tried but failed to develop an electric hydraulic fracturing system. PO Resp. 49–50 (citing Ex. 1005, 155–56, 170; Ex. 2016, 4). As explained above, however, Patent Owner has failed to establish that these documents are objective evidence and, therefore, Patent Owner fails to apprise us of the failure of others.

Moreover, as noted by Petitioner (*see* Pet. Reply 26), Coli discloses an electrically-powered fracturing system for delivering fracturing fluid to a wellbore at a fracturing operation that uses electric motors and generators powered by natural gas to drive the pumps. Ex. 1009 ¶¶ 9–11, 34, 38. Thus, Patent Owner has not persuasively established the existence of an *unsolved* need.

Accordingly, for at least the foregoing reasons, we find Patent Owner's evidence of a long-felt but unsolved need to be weak.

4. Conclusion

For at least the reasons explained above, Patent Owner's asserted objective evidence of nonobviousness is weak and lacks a nexus to the claims of the '601 patent.

N. Ultimate Conclusion of Obviousness

Petitioner has shown that the individual limitations of claims 1–12, 15, and 17–22 of the '601 patent are disclosed by various combinations of

prior art references, and Petitioner provides persuasive arguments regarding why a person of ordinary skill in the art would have combined those teachings. Patent Owner's objective indicia is comparatively weak. When considering all of the evidence of obviousness and nonobviousness together (*see In re Cyclobenzaprine Hydrochloride Extended-Release Capsule Patent Litig.*, 676 F.3d 1063, 1079 (Fed. Cir. 2012)), we conclude Petitioner has demonstrated by a preponderance of the evidence that these challenged claims would have been obvious over the prior art in each of the Petition's challenges.

Petitioner has not shown, by a preponderance of the evidence, that claim 16 of the '601 patent would have been obvious.

III. PATENT OWNER'S MOTION TO SEAL

On April 5, 2022, Patent Owner filed a motion to file certain documents under seal. Paper 16. Petitioner did not oppose this motion. Because Patent Owner did not explain adequately why the subject documents contained confidential information, we denied Patent Owner's motion without prejudice, expressly authorizing Patent Owner to file a renewed motion to seal. Paper 34.

On October 17, 2022, Patent Owner filed a renewed motion to file certain documents under seal. Paper 36 ("Motion" or "Mot."). Petitioner did not oppose the Motion. For the reasons discussed below, Patent Owner's Motion is *granted*.

A. Motion to Seal

There is a strong public policy in favor of making information filed in an *inter partes* review open to the public, especially because the proceeding determines the patentability of claims in an issued patent and, therefore, affects the rights of the public. Under 35 U.S.C. § 316(a)(1) and 37 C.F.R. § 42.14, the default rule is that all papers filed in an *inter partes* review are open and available for access by the public; a party, however, may file a concurrent motion to seal and the information at issue is sealed pending the outcome of the motion. It is only “confidential information” that is protected from disclosure. 35 U.S.C. § 316(a)(7) (2018). In that regard, the Consolidated Trial Practice Guide provides:

The rules aim to strike a balance between the public’s interest in maintaining a complete and understandable file history and the parties’ interest in protecting truly sensitive information.

....

2. Confidential information: The rules identify confidential information in a manner consistent with Federal Rule of Civil Procedure 26(c)(1)(G), which provides for protective orders for trade secret or other confidential research, development, or commercial information. 37 C.F.R. § 42.54.

CTPG 19. The Consolidated Trial Practice Guide, in the default protective order, further provides that, “[w]here confidentiality is alleged as to some but not all of the information submitted to the Board, the submitting party shall file confidential and non-confidential versions of its submission.” *Id.* at 111.

The standard for granting a motion to seal is “for good cause.” 37 C.F.R. § 42.54(a). The filing party bears the burden of proof in showing entitlement to the relief requested in a motion to seal. *Id.* § 42.20(c).

1. Exhibit 2043

Patent Owner seeks to seal Exhibit 2043 in its entirety. Mot. 1. Patent Owner asserts that this exhibit “is a proposal that contains confidential, non-public, technical specification, commercial, and trade secret information that show and describe information that [Patent Owner] maintains as confidential commercial information.” *Id.* at 2. Patent Owner asserts that this exhibit includes “[Patent Owner’s] own design, cost, engineering, and manufacturing data and criteria.” *Id.* Patent Owner argues that “[s]uch information could be improperly used by competitors to gain unfair business and competitive advantage with customers in the marketplace, including using details of [Patent Owner’s] precise costs, dimensions and measurements for developing and manufacturing competitive commercial products.” *Id.* at 2–3. Patent Owner indicates that it produced Exhibit 2034 in the Texas litigation with the designation “CONFIDENTIAL – OUTSIDE ATTORNEY’S EYES ONLY.” *Id.* at 3.

We are persuaded that Exhibit 2043 contains information that is confidential and, therefore, that good cause exists to maintain this exhibit under seal. Accordingly, Patent Owner’s motion to seal Exhibit 2043 is *granted*.

As a reminder, confidential information that is subject to a protective order ordinarily becomes public forty-five days after final judgment in a trial. CTPG 21–22. After final judgment in a trial, a party may file a motion to expunge confidential information from the record prior to the information becoming public in accordance with 37 C.F.R. § 42.56.

2. Paper 17 and Exhibits 2032, 2033, 2034, 2039, and 2041

In its original motion, Patent Owner sought to seal Exhibits 2032, 2033, 2039, and 2041 and the portions of the Patent Owner Response (Paper 17) and the second declaration of Mr. Schaaf (Ex. 2034) that discuss these exhibits. Paper 16, 1. In accordance with our rules, we provisionally sealed these documents. In its renewed Motion, Patent Owner does not seek to seal these documents. Therefore, Paper 17 and Exhibits 2032, 2033, 2034, 2039, and 2041 will be made publicly available.

B. Protective Order

As noted in the Scheduling Order, “[n]o protective order shall apply to this proceeding until the Board enters one.” Paper 13, 2. Although Patent Owner does not request that we enter a protective order in this case, the Motion contains a “proposed protective order” as an attachment thereto. Mot. 5–9. However, Patent Owner does not state whether its proposed order is the Board’s default protective order. In our order regarding the original motion to seal, we provided Patent Owner with instructions regarding proposed protective orders:

Should Patent Owner file a renewed motion to seal, Patent Owner should also request that a protective order be entered and identify whether it wishes the Board’s default protective order or a protective order deviating therefrom be entered. Patent Owner is reminded that, should it choose to propose a protective order deviating from the default protective order, the parties “must submit the proposed protective order jointly along with a marked-up comparison of the proposed and default protective orders showing the differences between the two and explain why good cause exists to deviate from the default protective order.” Paper 13, 3.

Paper 34, 6. Although Patent Owner did not comply with our instruction, we nonetheless enter the Board’s default protective order in this case. We note that the “proposed protective order” attached to the Motion appears to be the Board’s default protective order.

We also provided Patent Owner with instructions regarding the confidentiality designation on Exhibit 2043:

[W]e note that certain ones of the Subject Exhibits contain confidentiality designations that are not provided for by the default protective order. *See, e.g.*, Exs. 2032, 2033, 2041, and 2043; *see also* Mot. 2. Patent Owner should file replacement copies of the exhibits containing the confidentiality designation set forth in the default protective order, along with an assertion that no changes other than to the confidentiality designation have been made. Alternatively, Patent Owner should propose a protective order defining the current confidentiality designations. Patent Owner is cautioned that the Board encourages use of the default protective order and any order deviating therefrom will only be entered upon a showing of good cause. *See* Paper 13, 3.

Paper 34, 6–7 (footnote omitted). Patent Owner did not comply with our instruction to file another version of Exhibit 2043 without the “CONFIDENTIAL – OUTSIDE ATTORNEY’S EYES ONLY” designation, nor did Patent Owner request that we enter a modified protective order defining such designation. In this proceeding, we assign no heightened level of confidentiality to Exhibit 2043 and, instead, Exhibit 2043 is to be treated in accordance with the Board’s default protective order.

IV. CONCLUSION⁸

Based on the evidence presented with the Petition, the evidence introduced during the trial, and the parties' respective arguments, Petitioner has shown, by a preponderance of the evidence, that claims 1–12, 15, and 17–22 of the '601 patent are unpatentable, but has failed to make such a showing regarding claim 16. In summary,

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–7, 22	103	Coli, Horikoshi	1–7, 22	
6	103	Coli, Horikoshi, Vliet	6	
8–12, 15, 17, 18	103	Coli, Horikoshi, API Standard	8–12, 15, 17, 18	
10	103	Coli, Horikoshi, API Standard, Gardner	10	

⁸ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. §§ 42.8(a)(3), (b)(2).

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
16	103	Coli, Horikoshi, API Standard, Stark		16
19	103	Coli, Horikoshi, API Standard, Amrine	19	
20	103	Coli, Horikoshi, API Standard, Nadeau	20	
21	103	Coli, Horikoshi, API Standard, Stratton	21	
Overall Outcome			1–12, 15, 17–22	16

V. ORDER

Accordingly, it is

ORDERED that claims 1–12, 15, and 17–22 of the '601 patent have been shown to be unpatentable;

FURTHER ORDERED that claim 16 of the '601 patent has not been shown to be unpatentable;

FURTHER ORDERED that Owner's Motion to seal Exhibit 2043 is *granted*;

FURTHER ORDERED that the Board's default protective order is entered and shall govern the treatment of confidential information in this proceeding;

FURTHER ORDERED that Paper 17 and Exhibits 2032, 2033, 2034, 2039, and 2041 will be unsealed; and

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

IPR2021-01033
Patent 8,789,601 B2

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