

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

WEATHERFORD INTERNATIONAL, LLC, WEATHERFORD/LAMB, INC.,
WEATHERFORD US, LP, and WEATHERFORD ARTIFICIAL LIFT
SYSTEMS, LLC,
Petitioners

v.

PACKERS PLUS ENERGY SERVICES INC.,
Patent Owner

Case IPR2017-01232
Patent 9,303,501

EXCLUSIVE LICENSEE'S NOTICE OF APPEAL

Pursuant to 35 U.S.C. §§ 141 and 142 and 37 C.F.R. §§ 90.2(a), 90.3 and 104.2, Exclusive Licensee, Rapid Completions LLC, (“Rapid Completions”) hereby provides notice of its appeal to the United States Court of Appeals for the Federal Circuit for review of the Final Written Decision of the United States Patent and Trademark Office (“USPTO”) Patent Trial and Appeals Board (“PTAB”) in Inter Partes Review 2017-01232, concerning U.S. Patent 9,303,501 (“the ’501 patent”), entered on October 16, 2018, attached hereto as Appendix A.

ISSUES TO BE ADDRESSED ON APPEAL

- A. Whether the PTAB erred in concluding that claims 1–9 would have been obvious under 35 U.S.C. § 103 in view of Yost, Thomson, Ellsworth, and Halliburton?
- B. Whether the PTAB erred in concluding that Halliburton is a printed publication?
- C. Whether the PTAB erred in giving insufficient weight to Patent Owner’s secondary considerations of non-obviousness?
- D. Whether the PTAB erred in concluding that Patent Owner did not demonstrate commercial success?
- E. Whether the PTAB erred in concluding that Patent Owner did not demonstrate copying of the claimed invention?

- F. Whether the PTAB erred in concluding that Patent Owner did not show that the claimed invention was contrary to accepted wisdom and produced unexpected results?
- G. Whether the PTAB erred in concluding that a person of ordinary skill in the art would have been motivated to combine the teachings of the prior art and would have achieved the claimed invention with a reasonable expectation of success?
- H. Whether the Board erred in considering new evidence submitted for the first time in Petitioners' Reply?

Rapid Completions reserves the right to challenge any finding or determination supporting or related to the issues listed above, and to challenge any other issues decided adversely to Rapid Completions in the Final Written Decision and/or any orders, decisions or rulings underlying the Final Written Decision.

Simultaneous with submission of this Notice of Appeal to the Director of the United States Patent and Trademark Office, this Notice of Appeal is being filed with the Patent Trial and Appeal Board. In addition, this Notice of Appeal, along with the required docketing fees, is being filed with the United States Court of Appeals for the Federal Circuit.

Dated: December 14, 2018

Respectfully submitted,

/Gregory J. Gonsalves/

Dr. Gregory Gonsalves

Reg. No. 43,639

2216 Beacon Lane

Falls Church, Virginia 22043

(571) 419-7252

gonsalves@gonsalveslawfirm.com

CERTIFICATE OF SERVICE

The undersigned certifies that in addition to being filed electronically through the Patent Trial and Appeal Board's E2E system the foregoing NOTICE OF APPEAL was served on the Director of the United States Patent and Trademark Office, at the following address (in accordance with 37 C.F.R. §§ 90.2(a), 104.2):

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CERTIFICATE OF FILING

The undersigned certifies that on December 14, 2018, a true and correct copy of the foregoing NOTICE OF APPEAL was filed electronically with the Clerk's Office of the United States Court of Appeals for the Federal Circuit at the following address:

Clerk of Court
United States Court of Appeals for the Federal Circuit
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Washington, DC 20005

CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing NOTICE OF APPEAL was served on December 14, 2018, by filing this document through the PTAB's E2E system as well as by delivering a copy via electronic mail to the attorneys of record for the Petitioners as follows:

Lead Counsel

Jason Shapiro
Reg. No. 35,354
EDELL, SHAPIRO & FINNAN, LLC
9801 Washingtonian Blvd.
Suite 750
Gaithersburg, MD 20878
js@usiplaw.com
301-424-3640

Backup Counsel

Patrick Finnan
Reg. No. 39,189
EDELL, SHAPIRO & FINNAN, LLC
9801 Washingtonian Blvd.
Suite 750
Gaithersburg, MD 20878
pjf@usiplaw.com
301-424-3640

Dated: December 14, 2018

/Gregory J. Gonsalves/
Dr. Gregory Gonsalves
Reg. No. 43,639
2216 Beacon Lane
Falls Church, Virginia 22043
(571) 419-7252
gonsalves@gonsalveslawfirm.com

Appendix A

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WEATHERFORD INTERNATIONAL, LLC,
WEATHERFORD /LAMB, INC., WEATHERFORD US, LP, and
WEATHERFORD ARTIFICIAL LIFT SYSTEMS, LLC,
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v.

PACKERS PLUS ENERGY SERVICES, INC.,
Patent Owner.

Case IPR2017-01232
Patent 9,303,501 B2

Before SCOTT A. DANIELS, NEIL T. POWELL, and
CARL M. DEFRANCO, *Administrative Patent Judges*.

POWELL, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
Inter Partes Review
37 C.F.R. § 42.108

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I. INTRODUCTION

Packers Plus Energy Services Inc. (“Packers Plus”) is the owner of Patent No. 9,303,501 B2 (“the ’501 patent”). Weatherford International, LLC, Weatherford/Lamb, Inc., Weatherford US, LP, and Weatherford Artificial Lift Systems, LLC (“Petitioner”) filed a Petition (Paper 2, “Pet.”) challenging claims 1–9 of the ’501 patent. Rapid Completions LLC, the exclusive licensee of the ’501 patent, filed a Preliminary Response (Paper 9, “Prelim. Resp.”). In view of those submissions, we instituted an *inter partes* review of claims 1–9 of the ’501 patent. Paper 10 (“Institution Decision” or “Dec. on Inst.”). Subsequent filings include a Patent Owner Response (Papers 16, 17¹, “PO Resp.”), a Petitioner Reply (Paper 20, “Pet. Reply”), and a Patent Owner Surreply (Paper 33, “PO Surreply”).

We have jurisdiction over this proceeding under 35 U.S.C. § 6(b). After considering the evidence and arguments of the parties, we determine that Petitioner has proven by a preponderance of the evidence that claims 1–9 of the ’501 patent are unpatentable. *See* 35 U.S.C. § 316(e). We issue this Final Written Decision pursuant to 35 U.S.C. § 318(a).

II. BACKGROUND

A. *The ’501 Patent*

The ’501 patent describes a method of using a tubing string for treating a particular segment of a wellbore, while sealing off other segments. Ex. 1001, Abstract. Typically, a tubing string is run into a wellbore as a conduit for oil and gas products to flow to the surface. *Id.* at 1:36–42. But

¹ Paper 16 is a private, unredacted version of the Patent Owner Response, and Paper 17 is a public, redacted version of the Patent Owner Response.

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when natural formation pressure is insufficient, a well “stimulation” technique is employed, which involves injecting fracturing fluids into the formation to enlarge existing channels and thereby improve inflow into the wellbore. *Id.* at 1:43–47.

As described in the ’501 patent, the tubing string includes a series of ports along its length, with a ball-actuated sliding sleeve mounted over each port, for selectively permitting the release of fluid from certain segments of the tubing string. *Id.* at 2:46–3:6, 6:44–7:39. Special sealing devices, called “solid body packers,” are mounted along the length of the tubing string downhole and uphole of each port. *Id.* at 2:46–3:6, 6:11–43. The solid body packers are disposed about the tubing string and seal the annulus between the tubing string and the wellbore wall, thereby dividing the wellbore into a series of isolated segments. *Id.* at 6:25–31. When the sliding sleeve over a particular port is activated to an open position, fluid can pass into one segment of the wellbore but is prevented from passing into adjacent segments by the packers positioned on either side of the port. *Id.* at 6:49–64.

B. Related Matters

The ’501 patent is involved in a concurrent district court action, *Rapid Completions LLC v. Baker Hughes Incorporated*, No. 6:15-cv-00724 (E.D. Tex.). Paper 5, 1–2. The ’501 patent is also involved in instituted *inter partes* reviews in IPR2016-01380 and IPR2017-00247. *Id.* at 2. Additionally, the ’501 patent is the subject of a petition for *inter partes* review in IPR2016-01236.

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C. The Challenged Claims

Of the challenged claims, claim 1 is independent, and claims 2–9 depend from claim 1. Claim 1 is reproduced below.

1. A method for fracturing a hydrocarbon-containing formation accessible through a wellbore, the method comprising:

running a tubing string into an open hole and uncased, non-vertical section of the wellbore, the tubing string having a long axis and an inner bore and comprising:

a first port opened through a wall of the tubing string,

a second port opened through the tubing string wall, the second port downhole from the first port along the long axis of the tubing string,

a third port opened through the tubing string wall, the third port downhole from the second port along the long axis of the tubing string,

a first sliding sleeve having a seat with a first diameter, the first sliding sleeve positioned relative to the first port and moveable relative to the first port between (i) a closed port position wherein fluid can pass the seat of the first sliding sleeve and flow downhole of the first sliding sleeve and (ii) an open port position permitting fluid flow through the first port from the tubing string inner bore and sealing against fluid flow past the seat of the first sliding sleeve and downhole of the first sliding sleeve,

a second sliding sleeve having a seat with a second diameter smaller than the first diameter, the second sliding sleeve positioned relative to the second port and moveable relative to the second port between (i) a closed port position wherein fluid can pass the seat of the second sliding sleeve and flow downhole of the second sliding sleeve and (ii) an open port position permitting fluid flow through the second port from the tubing string inner bore and sealing against fluid flow past the seat of

the second sliding sleeve and downhole of the second sliding sleeve,

a first solid body packer mounted on the tubing string to act in a position uphole from the first port along the long axis of the tubing string, the first solid body packer operable to seal about the tubing string and against a wellbore wall in the open hole and uncased, non-vertical section of the wellbore,

a second solid body packer mounted on the tubing string to act in a position between the first port and the second port along the long axis of the tubing string, the second solid body packer operable to seal about the tubing string and against the wellbore wall in the open hole and uncased, non-vertical section of the wellbore,

a third solid body packer mounted on the tubing string to act in a position offset from the second port along the long axis of the tubing string and on a side of the second port opposite the second solid body packer, the third solid body packer operable to seal about the tubing string and against the wellbore wall in the open hole and uncased, non-vertical section of the wellbore, and

a hydraulically actuated sliding sleeve in a position offset from the third solid body packer along the long axis of the tubing string on a side of the third solid body packer opposite the second port, the hydraulically actuated sliding sleeve being positioned relative to the third port and moveable relative to the third port between (i) a closed port position in which the hydraulically actuated sliding sleeve covers the third port and (ii) an open port position in which the hydraulically actuated sliding sleeve exposes the third port to the tubing string inner bore to permit fluid flow through the third port from the tubing string inner bore,

wherein the tubing string is run into the wellbore with the first, second, and third solid body packers each in an unset position;

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expanding radially outward the first, second, and third solid body packers until each of the first, second, and third solid body packers sets and seals against the wellbore wall in the open hole and uncased, non-vertical section of the wellbore,

wherein the first, second, and third solid body packers, when expanded, secure the tubing string in place in the wellbore and create a first annular wellbore segment between the first and second solid body packers, a second annular wellbore segment between the second and third solid body packers, and a third annular wellbore segment downhole of the third solid body packer,

wherein the first annular wellbore segment is substantially isolated from fluid communication with the second annular wellbore segment by the second solid body packer,

wherein the second annular wellbore segment is substantially isolated from fluid communication with the third wellbore segment by the third solid body packer, and

wherein the first, second, and third annular wellbore segments provide access to the hydrocarbon-containing formation along the wellbore wall in the open hole and uncased, non-vertical section of the wellbore;

applying a first pressure within the tubing string inner bore such that the hydraulically actuated sliding sleeve moves from the closed port position to the open port position without the hydraulically actuated sliding sleeve engaging any fluid conveyed sealing device;

conveying a fluid conveyed sealing device through the tubing string to pass through the first sliding sleeve and to land in and seal against the seat of the second sliding sleeve thereby moving the second sliding sleeve to the open port position and permitting fluid flow through the second port; and

pumping fracturing fluid through the second port and into the second annular wellbore segment to fracture the hydrocarbon-containing formation.

Ex. 1001, 13:65–16:6.

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D. The Pending Ground

Claims 1–9 of the '501 patent are challenged as allegedly unpatentable under 35 U.S.C. § 103 based on the following pending ground (Dec. on Inst. 18):

Statutory Basis	References	Challenged Claims
§ 103	Yost, ² Thomson, ³ Ellsworth, ⁴ and Halliburton ⁵	1–9

As further support, Petitioner proffers the Declaration of Vikram Rao, Ph.D. (Exs. 1007, 1044). Patent Owner proffers Declarations of Harold E. McGowen III, PE. (Exs. 2051, 2081, 2084).

² A.B. Yost et al., *Production and Stimulation Analysis of Multiple Hydraulic Fracturing of a 2,000-ft Horizontal Well*, SPE 19090, Society of Petroleum Engineers, Gas and Technology Symposium, Dallas TX, (June 7–9, 1989) (Ex. 1002).

³ D.W. Thomson et al., *Design and Installation of a Cost-Effective Completion System for Horizontal Chalk Wells Where Multiple Zones Require Acid Stimulation*, SPE (Society for Petroleum Engineering) 37482 (1997) (Ex. 1003).

⁴ B. Ellsworth et al., *Production Control of Horizontal Wells in a Carbonate Reef Structure*, 1999 Canadian Institute of Mining, Metallurgy, and Petroleum Horizontal Well Conference (1999) (Ex. 1004).

⁵ Halliburton, *Completion Products, Second Edition* (Ex. 1028).

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III. MOTION TO EXCLUDE

Petitioner has filed a Motion to Exclude seeking exclusion of certain evidence submitted by Patent Owner. Paper 24 (“Motion” or “Mot.”). For the reasons explained below, we determine that Petitioner has demonstrated unpatentability of the claims over all of the evidence submitted by Patent Owner (including that evidence Petitioner seeks to exclude). Consequently, we dismiss Petitioner’ Motion to Exclude as moot.

IV. ANALYSIS

A. Claim Construction

Petitioner proposes a construction for the claim language “solid body packer.” Pet. 37–38. Patent Owner also addresses the meaning of the claim language “solid body packer,” as well as the claim language “second annular wellbore.” PO Resp. 4–6. For purposes of this decision, we need not construe explicitly any claim language to determine that Petitioner has demonstrated obviousness of claims 1–9 by a preponderance of the evidence. *See* 35 U.S.C. § 314(a); *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”).

B. Alleged Obviousness of Claims 1–9 over Yost, Thomson, Ellsworth, and Halliburton

Petitioner asserts that Yost teaches most of the limitations of independent claim 1. *E.g.*, Pet. 41–66. Petitioner explains that “Yost describes multi-stage fracturing of horizontal open hole wells using packers for zonal isolation and ported sliding sleeves for injecting fracturing fluid.” *Id.* at 15.

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Petitioner notes that Yost teaches using inflatable packers, not the “solid body packer[s]” recited in claim 1. *Id.* at 38. Petitioner also states that Yost teaches the use of “ported collar sliding sleeves” in lieu of “ball-actuated sliding sleeves.” *Id.* Petitioner argues that it would have been obvious to replace Yost’s packers and sliding sleeves with solid-body packers and Thomson’s ball-actuated sliding sleeves, respectively. *Id.* at 38–41.

Petitioner also indicates that Yost does not disclose the “hydraulically actuated sliding sleeve” recited in claim 1. *Id.* at 38. Petitioner asserts, however, that it would have been obvious in view of Thomson and Halliburton to use Halliburton’s pump-open plug at the lower end of Yost’s tubing string. *Id.*

Patent Owner argues that claims 1–9 would not have been obvious for a number of reasons related to the factors identified in *Graham v. John Deere Co.*, 383 U.S. 1, 148 (1966). Those factors include (1) the scope and content of the prior art, (2) differences between the prior art and the claims, (3) the level of ordinary skill in the art, and (4) secondary considerations, i.e., objective indicia of non-obviousness.

For the reasons discussed below, Petitioner’s evidence and arguments demonstrate unpatentability of claims 1–9 as obvious over Yost, Thomson, Ellsworth, and Halliburton. Pet. 38–71; Pet. Reply 6–23. We turn now to a discussion of the parties’ dispute over the prior art status of Halliburton, followed by a detailed discussions of the *Graham* factors and our conclusions regarding whether claims 1–9 would have been obvious.

1. Whether Halliburton Is Prior Art

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The parties dispute whether Halliburton was sufficiently publicly accessible to qualify as a printed publication. Petitioner’s evidence of public accessibility includes a declaration of Aileen Barr, who testifies that “I have been employed at Halliburton” (the company) “since 1980.” Ex. 1029¶ 2. Ms. Barr testifies that Halliburton (the reference) “is marketing material describing, among other things, completion products offered for sale by Halliburton” (the company). *Id.* at ¶ 4. Ms. Barr further testifies about the printing and distribution of Halliburton to customers. *Id.*

Patent Owner argues that Petitioner has not shown indexing or distribution of Halliburton sufficiently to establish public accessibility. PO Resp. 60–61. Patent Owner argues that the Barr Declaration does not indicate how Halliburton is stored or cataloged. *Id.* at 61. Patent Owner also asserts that the Barr Declaration does not provide sufficient evidence that Halliburton, as it appears in Petitioner’s exhibits, was “actually distributed and received by persons of ordinary skill in the art during the relevant time frame.” *Id.* Rather, Patent Owner argues, the Barr Declaration is “filled with vague statements.” *Id.* Petitioner responds that Patent Owner provides no evidence to counter the Barr Declaration, which Petitioner argues demonstrates public accessibility. Pet. Reply 6.

We find a preponderance of the evidence demonstrates public accessibility of Halliburton. Patent Owner’s arguments fail to acknowledge important aspects of the evidence, while attacking others individually, rather than as a whole. For example, Patent Owner does not acknowledge the fundamental nature of the document: a catalog of oilfield completion products offered for sale, the catalog bearing a copyright date of 1997, with

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no indication of confidentiality or other restraints on its dissemination. Ex. 1029 ¶ 4; Ex. 1028, 1, 6 (“Halliburton Energy Services has excelled in oilfield services for over 75 years.”), 152 (“© 1997 Halliburton Energy Services, Inc.”). In fact, Halliburton states that “[t]hese catalogs are available from your local Halliburton representative or on the Internet Website at the Web address www.halliburton.com.” Ex. 1028, 7. By its very nature, such a document is highly likely to have been distributed to persons interested and ordinarily skilled in the art. *See, e.g., Nobel Biocare Servs. AG vs. Instradent USA, Inc.*, 2018 WL 4354227, *7 (Fed. Cir. 2018) (Affirming public accessibility finding for type of document intended for public dissemination with no indication otherwise). Consistent with this, Ms. Barr testifies that Halliburton “was available to any customer or potential customer, as well as others, seeking a copy in 1997.” Ex. 1029 ¶ 4.

Indeed, Ms. Barr’s Declaration includes the un rebutted testimony that “Halliburton, as a regular practice and in the normal course of its business, prints these types of product catalogs every few years, including the 1997 Catalog, and disseminates them to customers and/or potential customers from the year they are printed until the next edition is printed.” *Id.* Ms. Barr further testifies regarding the details of the regular business practices that were used to disseminate Halliburton. *Id.* We find the evidence demonstrates that Halliburton was publicly accessible and disseminated to persons interested and ordinarily skilled in the art as part of the regular business practices of Halliburton (the company).

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2. Scope and Content of the Prior Art

a. Yost

Yost discloses a U.S. Department of Energy sponsored stimulation procedure for a horizontal wellbore in the Devonian shales of Wayne County, West Virginia. Ex. 1002, 2. In the procedure, a casing string with 14 sliding sleeve ported collars was inserted into a horizontal uncased, i.e. open hole, wellbore. *Id.* The casing string included eight external casing packers (“ECP’s”) providing eight separate open hole zones along the length of the casing string. *Id.* According to the report, only seven of the ECP’s properly inflated so that only seven zones were available for testing. *Id.* The casing string and zones 1–8 are illustrated in Yost’s Figure 2, titled “Completion & Testing Procedures,” reproduced below.

Completion & Testing Procedures

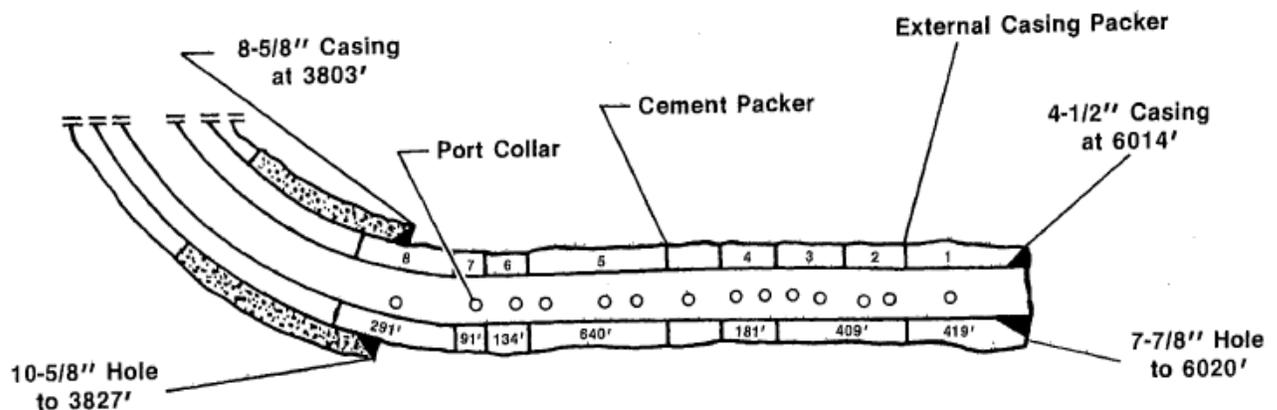


Fig. 2—Schematic diagram of completion configuration.

Figure 2 of Yost, above, depicts the casing string, ECP’s, and sliding sleeve openable ports within each of the eight zones. A “straddle tool” (not shown) was used to open and close the port collars in the individual zones. *Id.*

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The procedure included 24-hour pressure build-up in each of the seven isolated zones along a 2,221-foot length of the horizontal wellbore, and for each zone, data collection relating to various characteristics of the well including “average reservoir pressure values, skin values, and average permeability values for the various zones with the different stimulation jobs.” *Id.* at 2. For each zone, different “frac jobs” were undertaken to stimulate the Devonian shale formation using different pressurized fluids, e.g. nitrogen, liquid CO₂, and nitrogen-foam with proppants. *Id.* at 3. Yost concludes that “[a]s a result of the different frac jobs in the various zones, the production was enhanced in all zones. This improvement in production is reflected in the increase in flow rates and a decrease in skin factor values.” *Id.* at 5. Based on the foregoing, we find that Yost teaches open-hole multistage fracturing of a wellbore.

b. Thomson

Thomson discloses a “completion design that allows multiple acid fracs to be performed in horizontal subsea chalk-formation wells with a single trip into the wellbore.” Ex. 1003, 1. “The key element” of Thomson’s system “is a multi-stage acid frac tool (MSAF) that is similar to a sliding sleeve circulating device and is run in the closed position.” *Id.* Thomson’s Figure 5, below, depicts the MSAF tool in cross-section.

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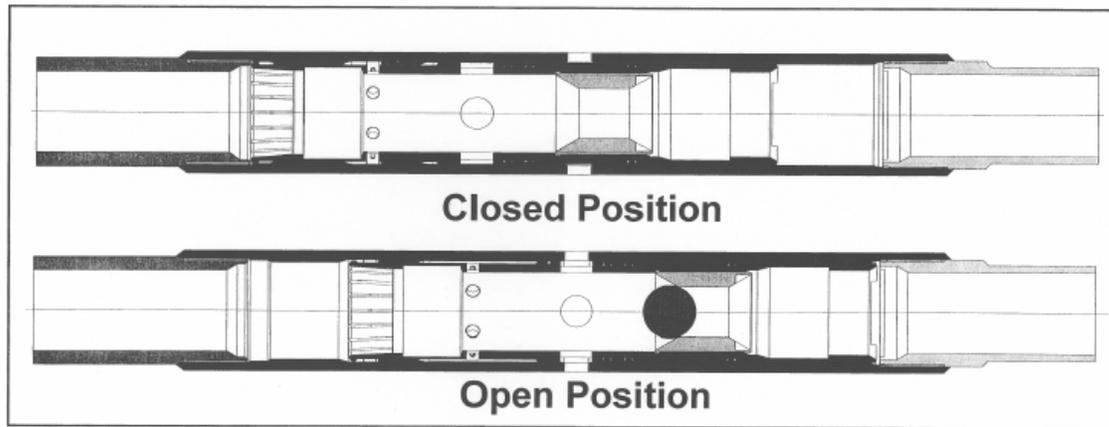


Figure 5
MSAF Tool in the Closed and Open Positions

Thomson’s Figure 5, reproduced above, depicts in the upper illustration labeled “Closed Position,” the MSAF tool having a sliding sleeve covering fluid ports in the closed position, and in the lower illustration, labeled “Open Position,” the sliding sleeve having been motivated by a ball into an open position uncovering the fluid ports. *Id.* at 2, 12.

Thomson discloses that hydraulic-set retrievable packers may be positioned on each side of an MSAF tool. *Id.* at 1. Thomson shows an MSAF tool disposed between two packers in Figure 3, which is reproduced below.

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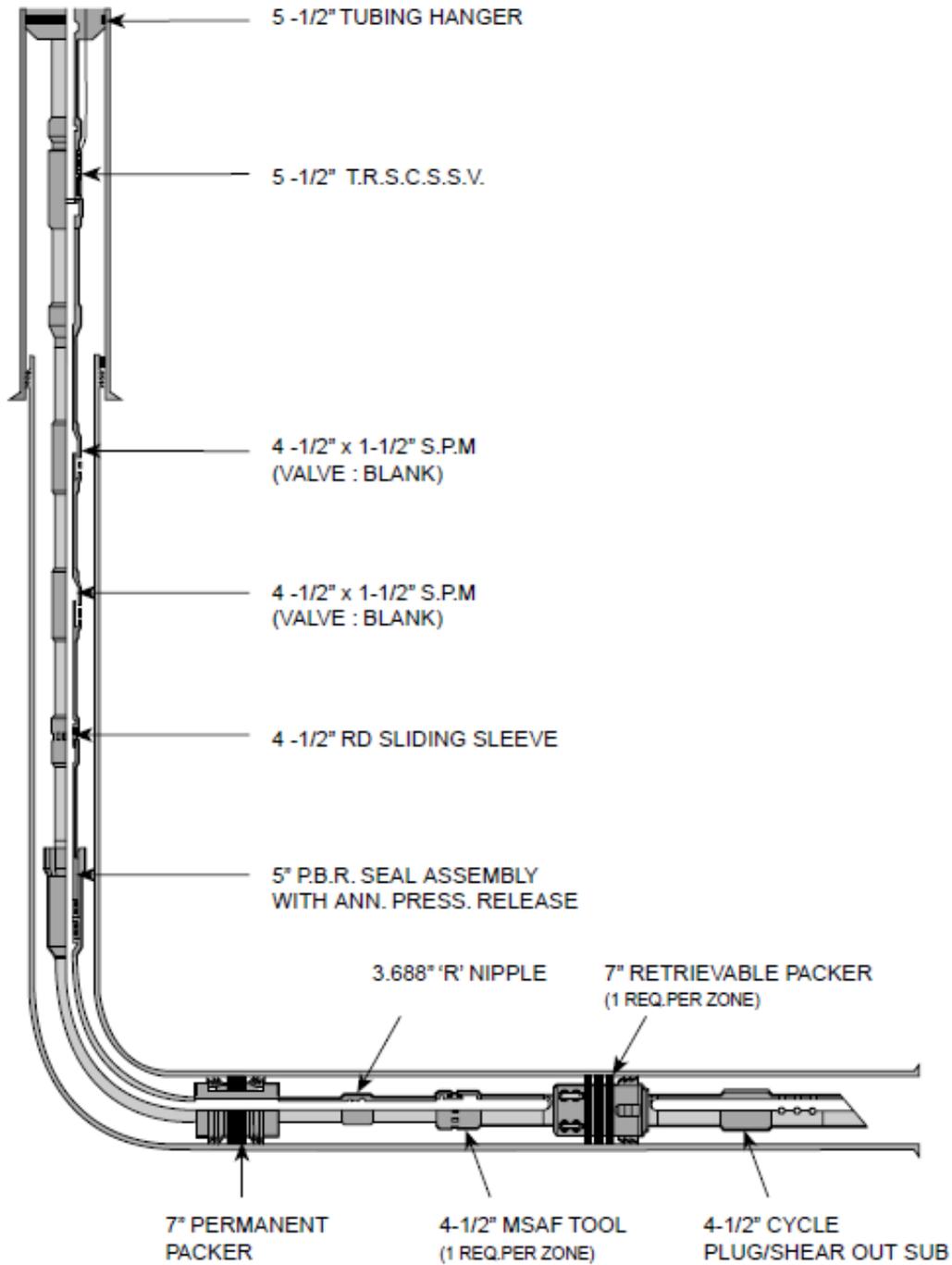
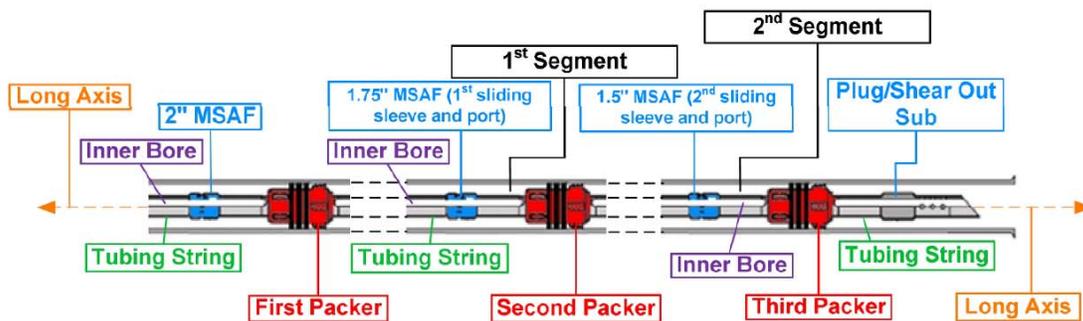


Fig. 3 — Schematic of a Typical Joanne Completion

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Thomson’s Figure 3 shows “a schematic of a typical Joanne completion.” *Id.* at 2. Figure 3 shows one MSAF tool disposed between two packers. *Id.* at 2, Fig. 3. Thomson discloses that more MSAF tools can be used, stating that “[u]p to 9 MSAF tools can be run in the completion with isolation of each zone being achieved by hydraulic-set retrievable packers that are positioned on each side of an MSAF tool.” *Id.* at 1. To illustrate an example of Thomson’s disclosure of using multiple MSAF tools, each isolated in a zone by adjacent hydraulic-set retrievable packers, Petitioner provides the following modified, annotated version of Thomson’s Figure 3. Pet. 9.



Petitioner’s modified, annotated version of Figure 3 shows three MSAF tools and three packers mounted in alternating positions along a tubing string. *Id.* Based on table 1 of Thomson, the annotated, modified Figure 3 identifies the first (leftmost) MSAF tool as having a 2” dimension, the next MSAF tool as having a 1.75” dimension, and the next MSAF tool as having a 1.5” dimension. *Id.* at 9, n.2. This also comports with Thomson’s disclosure that “[e]ach sleeve contains a threaded ball seat with the smallest ball seat in the lowest sleeve and the largest ball seat in the highest sleeve.” *Id.* at 1. Thomson discloses that:

With this system, stimulation of 10 separate zones is accomplished in 12–18 hours by a unique procedure that

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lubricates varying sized low-specific gravity balls into the tubing and then pumps them to a mating seat in the appropriate MSAF, thus sealing off the stimulated zone and allowing stimulation of the next zone which is made accessible by the open sleeve.

Id. Based on the foregoing disclosures, we find that Thomson teaches multistage fracturing of a wellbore.

c. Ellsworth

Ellsworth discloses that “[m]ore recently, solid body packers (SBP’s) (see Figure 4) have been used to establish open hole isolation.” Ex. 1004, 3. Ellsworth’s Figure 4 is reproduced below.

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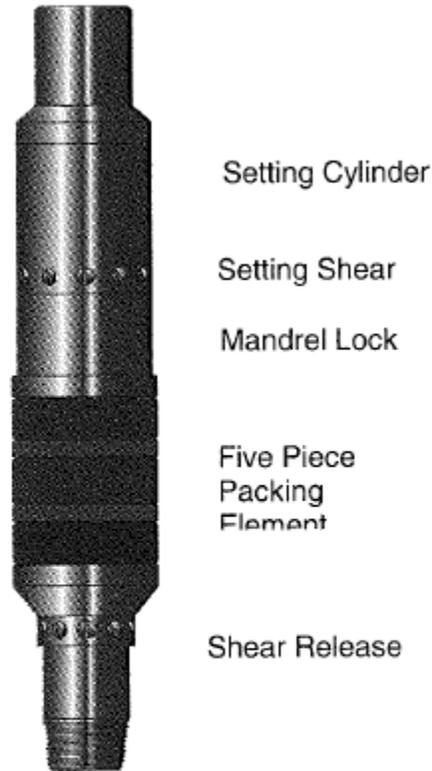


Figure 4 - The solid body packer is hydraulic set instead of inflatable (Guiberson / Halliburton Wizard II packer shown)

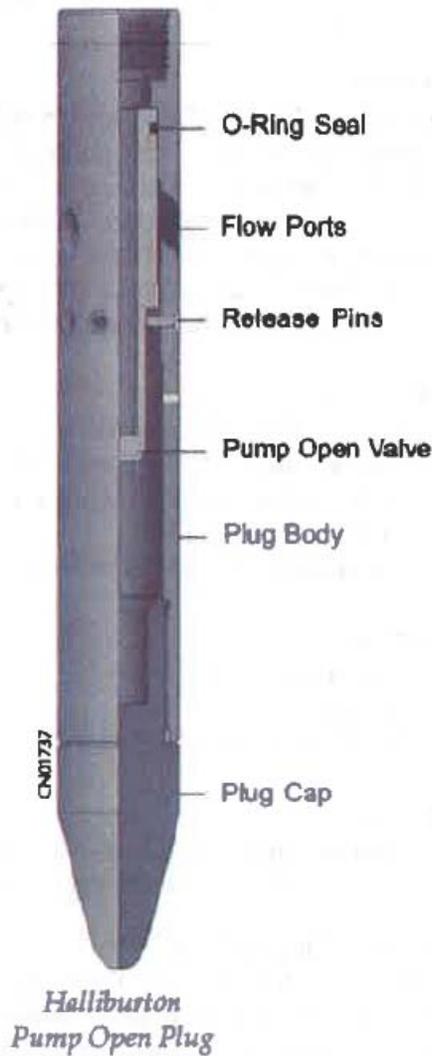
Figure 4, above, shows a solid body packer, including a setting cylinder, a setting shear, a mandrel lock, a five piece packing element, and a sheer release. *Id.* at Fig. 4. Ellsworth teaches that a solid body packer provides a hydraulically actuated mechanical packing element. *Id.* at 3. Ellsworth explains that “[t]he objective of using this type of tool is to provide a long-term solution to open hole isolation without the aid of cemented liners.” *Id.*

d. Halliburton

Halliburton discloses a pump open plug that “is a positive plug that holds pressure from either direction but can be pumped open by applying

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excess surface pressure.” Ex. 1028, 93. Halliburton shows this in a drawing labeled “Halliburton Pump Open Plug,” reproduced below. *Id.*



Halliburton’s “Pump Open Plug” drawing shows various features of the pump open plug, including a plug body, a plug cap, a pump open valve, flow ports, a pump open valve, release pins, and an o-ring seal. *Id.*

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3. *Differences Between the Prior Art and the Claimed Invention*

As noted above in Section IV.B, Petitioner notes that Yost teaches most of the limitations of the challenged claims, but notes (1) that Yost teaches using inflatable packers, not the claimed “solid body packer[s],” (2) that Yost teaches the use of “ported collar sliding sleeves” in lieu of “ball-actuated sliding sleeves,” and (3) that Yost does not disclose the “hydraulically actuated sliding sleeve” recited in claim 1. Pet. 38.

Patent Owner does not dispute Petitioner’s characterization of the differences between Yost and the challenged claims. *See* PO Resp., generally. We are persuaded that the disclosure of Yost differs from the challenged claims in only the ways identified by Petitioner. *See, e.g.,* Pet. 38–71.

Petitioner cites Thomson, Ellsworth, and Halliburton as teaching the claim limitations that Yost does not. For example, regarding difference (1), Petitioner relies on Thomson and Ellsworth as teaching solid body packers for isolating multiple segments of a wellbore. Pet. 17–22, 38–41, 51–56. More specifically, Petitioner cites Ellsworth as teaching the use of solid body packers for isolating in an open hole wellbore.⁶ *Id.* at 17–19, 38–41, 51–56. Regarding difference (2), Petitioner cites Thomson as teaching ball-actuated sliding sleeves. *Id.* at 19–22, 43–51. Regarding difference (3), Petitioner cites Halliburton as teaching a hydraulically actuated sliding sleeve consistent with the challenged claims. *Id.* at 22–24, 56–58, 64.

⁶ Petitioner also cites alleged Patent Owner admissions regarding the suitability of solid body packers for isolating in open hole wellbores. Pet. 26–31.

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Patent Owner argues that Thomson differs from the challenged claims in the way it discloses using its apparatus. Specifically, Patent Owner argues that Thomson does not disclose “running a tubing string into an open hole and uncased, non-vertical section of the wellbore,” or certain similar limitations of claim 1. PO Resp. 56–57. Patent Owner’s assertion appears to be correct. *See, e.g.*, Ex. 1002, 3 (“Before running the completion, each well was perforated with tubing-conveyed perforating (TCP) guns.”), 4 (“The well in general and liner in particular needs to be properly cleaned and conditioned”), Fig. 3. We note, however, that Petitioner relies on Yost, not Thomson, as teaching stimulation in an open hole wellbore.

Patent Owner indicates that Ellsworth differs from the claimed invention in that Ellsworth teaches water shutoff, rather than fracturing. PO Resp. 57. Without disputing this assertion, Petitioner asserts “it is irrelevant as . . . Ellsworth has not been relied upon for fracturing.” Pet. Reply 15. We agree with Petitioner.

Patent Owner also argues that “Halliburton and Thomson” do not teach the hydraulically actuated sleeve of the claims. PO Resp. 57–59. In support of this assertion, Patent Owner suggests that it would not have been obvious to combine the teachings of the references because there is no express disclosure in the references to use Halliburton’s pump-open plug for open hole multi-stage fracturing. *See id.* Contrary to Patent Owner’s indication, this argument does not go to the differences between the claims

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and the prior art, but to whether it would have been obvious to combine the teachings of the references.⁷

Having reviewed each of the references and the associated evidence provided by the parties pertaining to the respective disclosure of each reference, we find that although Yost, Thomson, Ellsworth, and Halliburton do not individually disclose all the limitations of claims 1–9, each of the limitations of claims 1–9 is taught by at least one of Thomson, Ellsworth, and Halliburton. Additionally, we find that the claimed invention would have resulted from combining the teachings of the references in the manner that Petitioner asserts would have been obvious. *See, e.g.*, Pet Pet. 17–24, 38–71. Indeed, Patent Owner does not dispute Petitioner’s contention that the proffered combination of the teachings of the references would have produced the claimed invention. *See* PO Resp., generally. Because we find it persuasive, we adopt as our own Petitioner’s explanation of the differences between the references and the claims, as well as its explanation of how the combination of the references’ teachings would have produced the claimed invention.

4. *Level of Ordinary Skill in the Art*

“Section 103(a) forbids issuance of a patent when ‘the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

⁷ Moreover, we find Patent Owner’s particular arguments as to why it allegedly would have been unobvious to combine the teachings of the references unpersuasive because the arguments conflict with the Supreme Court’s instruction that an obviousness analysis “need not seek out precise teachings directed to the specific subject matter of the challenged claim.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007).

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invention was made to a person having ordinary skill in the art to which said subject matter pertains.” *KSR*, 550 U.S. at 405.

Petitioner asserts that a person of ordinary skill in the art as of November 19, 2001

would have had at least a Bachelor of Science degree in mechanical or petroleum engineering or a similar technical discipline, such as metallurgy or material science and engineering and at least 3 years of experience with oil or gas well drilling and completion operations or in technical support of such operations.

Pet. 25 (citing Ex. 1007 ¶ 38). In addition, Petitioner relies upon its Declarant, Dr. Rao, to establish also that a person of ordinary skill in the art was aware that fracturing could be accomplished in both horizontal open hole and cased wells, with either inflatable or solid body packers being used for zonal isolation. *Id.* at 25–26. Dr. Rao testifies that “by the late 1990s, before the purported invention of the subject matter of the ’501 Patent, it was well understood that fracturing in horizontal open hole or cased wells can be successfully performed with both zonal isolation and some form of sleeve or port for injection into the isolated zones.” Ex. 1007 ¶ 70.

Referring to the prior art, Dr. Rao explains further that “[a] selection of tools was available for performing zonal isolation including inflatable and solid body packers, . . . and ball-drop actuated sliding sleeves like the MSAF tool of Thomson.” *Id.* Petitioner also asserts that “Patent Owner, through its named inventor (Mr. Themig) and its technical experts from a prior litigation (Messrs. Britton and Trahan), has made repeated admissions” (Pet. 27) “that many tools (*e.g.*, packers and sliding sleeves) and systems (*e.g.*, completion systems) initially designed for or used with cemented casing could also be

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used in open and that such use in open hole is not a patentable advancement” (*id.* at 26–27).

Patent Owner does not expressly disagree with Petitioner’s asserted level of ordinary skill in the art. Nor does Patent Owner dispute that a person of ordinary skill in the art would have been aware of different completion techniques, such as open hole and cased well completions. *See* PO Resp. 7–11. Patent Owner, however, makes the argument that, “[p]reparing a wellbore for oil or gas production is significantly more complicated than simply drilling a hole in the ground.” *Id.* at 7. Patent Owner contends specifically that a person of ordinary skill in the art would have *only* considered cemented casing completion when planning to use multi-stage hydraulic fracturing, such as that disclosed in Thomson, to stimulate oil and gas production. *Id.* at 11–18. Patent Owner relies upon its Declarant, Mr. McGowen, to support its position that cemented casing, and the use of “plug and perf” fracturing was the conventional way to create efficient and productive multi-stage fracture horizontal wells. *Id.* at 13–18 (citing Ex. 2051, 14, 19, 23–25; Ex. 2016, 30:6–31:3; Ex. 2085, 89:11–22). Mr. McGowen testifies that:

[a]s of 2001, the industry accepted method for constructing a hydraulically fractured horizontal well consisted of drilling a horizontal borehole, running casing into that horizontal borehole, cementing the casing in place, perforating a section of the horizontal borehole that the operator desired to hydraulically fracture, hydraulically fracturing that perforated interval, and then repeating the plug/perforate/fracture cycle for each section that the operator desired to hydraulically fracture (the “Plug and Perf” method).

Ex. 2051, 22.

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Patent Owner’s position is that based, on conventional wisdom, a person of ordinary skill in the art would not have contemplated using the known tools and multi-stage fracturing techniques in an open hole at least because “cemented casing is necessary to avoid the formation of these undesirable fractures.” PO Resp. 16–17.

Petitioner argues that Patent Owner’s evidence of conventional use of Plug and Perf “merely show[s] that some people preferred cemented casing.” Pet. Reply 21. Petitioner contends that other prior art references, in addition to Yost, expressly describe that horizontal open hole completions were known and had been done prior to the filing of the ’501 patent. *Id.* Petitioner alleges that technical papers by McClellen (Ex. 1042) and Kim and Abass (Ex. 1043) describe successful horizontal open hole completions prior to the effective filing date of the ’501 patent. *Id.*

After reviewing the evidence, we give some credit to the testimony of both parties’ Declarants in this proceeding. For instance, we determine that one of ordinary skill in the art would have known that Plug and Perf using a cemented casing was a conventionally accepted method in the oil and gas industry for completing a hydraulically fractured horizontal well. *See* Ex. 2051, 22, (Mr. McGowen testified that “[a]s of 2001, Plug and Perf was the industry standard because it had been economically successful, rigorously tested, and widely accepted amongst industry experts.”). Various papers cited by Patent Owner lend credence to the assertion that in the industry cemented casings were commonly used and characterized by some as “a prerequisite to ensure adequate zonal isolation for multiple fracture treatments in horizontal wells.” Ex. 2079, 1, *see also* Ex. 2078, 2 (“Austin

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et al. emphasized the importance of casing and cementing the horizontal section to allow for fracture initiation points to place multiple fractures along the horizontal well.”). We also give certain credit, as well, to Dr. Rao who testifies that “Yost specifically describes multi-stage open hole fracturing of horizontal wells using packers for zonal isolation” (Ex. 1007 ¶ 46), and that those of ordinary skill in the art understood that such multi-stage open hole fracturing was a viable option (Ex. 1044 ¶¶ 6–9). We also credit Dr. Rao’s testimony that those of ordinary skill in the art “could readily discern when it was advisable to use a cased hole tool in open hole and when it was not.” *Id.* at ¶ 71.

We find that such knowledge is not mutually exclusive. For example, both parties’ Declarants provide reasoning and exemplary prior art references detailing why one of ordinary skill in the art might consider a cased well and an uncased well in different circumstances. *Compare* Ex. 1007 ¶ 46, (Dr. Rao discussing Yost’s multi-stage hydraulic fracturing in horizontal open-hole completion to “avoid the problems of formation damage associated with cementing.”), *with* Ex. 2051, 22–23 (Mr. McGowen explains that the problem of “multiple complex fractures being initiated near the wellbore, could be better controlled through the precise placement of perforations, which requires cementing, perforating and the Plug and Perf method.”). Consistent with our finding, Mr. McGowen testified during his deposition that openhole completions would have been an option:

Q. So going without cemented casing would have been an option to consider[?]

A. It would have been an option to consider. But it’s something that had been -- in the early days of horizontal, there was

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hydraulic fracturing done in open holes and that was a more primitive completion system where they had no control over where the frac fluids were going, and then the industry progressed and became more sophisticated and developed methods to try to control where the fracture initiated.

Ex. 1045, 75:25–76:9.

Therefore, in addition to the education and experience of one of ordinary skill in the art as discussed above, upon which the parties essentially agree, we determine that a person of ordinary skill in the art would have known that cementing and lining a wellbore with a cemented casing for a multi-stage fracturing completion was well-known. *See* Ex. 1034, 48 (“Options considered for isolating the individual zones included conventional cementing of the casing with perforations to access the individual zones.”). A person of ordinary skill in the art also would have known that there existed circumstances in which open hole multi-stage fracturing might also be successful. *See* Ex. 1002, 5 (Yost describing successful production increase from using multistage fracturing to achieve “zone isolation” in an “open hole” so as to “avoid the problems of formation damage associated with cementing and to eliminate the need for tubing-conveyed perforating of numerous treatment intervals”); Ex. 1042, 3 (“The horizontal section for the first well Shell Midale horizontal C9-3-6-11Wd was completed in a conventional manner with a cemented and perforated liner. Openhole completions were used in the next two horizontal wells.”); *see also id.* (noting “potential for selective acid stimulation of horizontal wells completed openhole, provided that good zonal isolation is maintained.”).

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The level of knowledge attributed to one of skill in the art by Mr. McGowen, Dr. Rao, and the prior art illustrates, albeit in different ways, certain problems encountered in wellbore completion and how the industry addressed and overcame such problems prior to the filing of the '501 patent. For instance, knowledge of conventional fracturing through perforations in cemented casing completions as described by Mr. McGowen, and fracturing in open hole completions in Yost and McClellan, is consistent with the Federal Circuit's admonition that the hypothetical person of ordinary skill in the art is attributed with knowledge "of all prior art in the field of the inventor's endeavor and of prior art solutions for a common problem even if outside that field." *In re Nilssen*, 851 F.2d 1401, 1403 (Fed. Cir. 1988).

What we do not attribute to one of ordinary skill in the art, based on the testimonial and prior art evidence in this proceeding, is Patent Owner's contention that one of ordinary skill in the art would have understood that multi-stage fracturing *required* cemented casing completion. *See* PO Resp. 16–17 ("Thus, prior to 2001, a [person of ordinary skill in the art] would also expect that cemented casing is necessary to avoid the formation of these undesirable fractures."). This position appears as mostly unsupported attorney argument. Although in his declaration Mr. McGowen opined that "Plug and Perf was deemed necessary partly because of the type of hydraulic fracturing treatments being pumped and partly because of the then current theories about the behavior of hydraulic fractures," nowhere does Patent Owner point us to persuasive evidence that cased hole Plug and Perf completions were the sole option one of skill in the art would have considered for successful wellbore completions. Ex. 2051, 23; *see also id.* at

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17 (Mr. McGowen states that “[t]he POSITA would consider many different well configurations, reservoir types, stimulation methods, downhole operations, and other factors.”).

Additionally, Petitioner provides persuasive evidence that, consistent with Ellsworth’s disclosure, a person of ordinary skill in the art knew that cased hole tools, such as solid body packers, could be used successfully in open holes. Petitioner relies on alleged prior admissions by Patent Owner’s current COO, Kevin Trahan, that use of cased hole completion tools in open hole completions was well known and even “common place” in the industry. Pet. 29–30 (citing Ex. 1012, 10–11). In his expert report in a separate case, *Halliburton Energy Services, Inc. and Halliburton Group Canada v. Packers Plus Energy Services, Inc., et al.*, Case No. CV-44,964 238th Judicial District Court of Midland Count, Texas, involving trade secret issues, Mr. Trahan stated that:

[c]ased hole tools, including packers, have been used in open hole applications for many years. In my opinion use of a tool with Rockseal type features in open hole does not pass the patentability standard of novelty or nonobviousness. The open hole application of tools that were originally designed for cased hole has been common place in the industry since I began working in the industry in 1992. There is nothing novel or nonobvious about such an application.

Ex. 1012, 10–11. In the same case, in his supplemental expert report responding to plaintiff’s expert, Mr. Trahan stated further:

Mr. Berryman has expended significant effort in attempting to show that tools that were initially designed for cased hole would not be applicable for use in open hole. This point could be construed as intentionally misleading.

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Ex. 1013, 4. Farther along in his supplemental expert report, Mr. Trahan explained that “my intention is to convey the fact that downhole tools which were initially designed for cased hole can be, and have been, utilized in open hole. I have personal experience of such installations and look forward to testifying as such at trial.” *Id.* at 6.

Patent Owner does not dispute that cased hole tools can be used in open holes. PO Resp. 20. Patent Owner argues, however, that Mr. Trahan’s alleged admissions, “do not support a finding that it would have been obvious to use solid body packers for the specific purpose of multi-stage open hole fracturing.” *Id.* Petitioner does not, however, rely on Mr. Trahan’s testimony for teaching use of solid body packers in multi-stage open hole fracturing. Petitioner relies on the teachings in Ellsworth showing successful use of solid body packers in a multi-stage zonal isolation of a horizontal open hole well bore, in combination with Yost’s and Thomson’s disclosures of multi-stage stimulations. Pet. 2–5, 38–41. Petitioner argues that “Ellsworth disclosed that Wizard ‘solid body packers’ were a known alternative to inflatable packers for zonal isolation and stimulation in horizontal open hole wells.” *Id.* at 39. That the combination of Ellsworth and Thomson with Yost would have been possible and a straightforward task for a person of ordinary skill in the art is further established by Petitioner’s use of Mr. Trahan’s prior admissions showing persuasively that it was within the realm of experience and skill in the art to use completion tools for cased holes, such as solid body packers, in open hole fracturing applications. Ex. 1012, 10–11. Mr. Trahan’s admissions are reasonably understood to confirm Dr. Rao’s testimony that “persons of ordinary skill in the art readily

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understood the considerations of using a cased hole tool in an open hole well and could readily discern when it was advisable to use a cased hole tool in open hole and when it was not.” Ex. 1007 ¶ 71.

5. *Whether It Would Have Been Obvious to Combine Prior Art*

The Supreme Court instructs an expansive and flexible approach in determining whether a patented invention was obvious at the time it was made. *See KSR*, 550 U.S. at 415. The existence of a reason for a person of ordinary skill in the art to modify a prior art reference is a question of fact. *See In re Constr. Equip. Co.*, 665 F.3d 1254, 1255 (Fed. Cir. 2011). In an obviousness analysis, some kind of reason must be shown as to why a person of ordinary skill would have thought of combining or modifying the prior art to achieve the patented invention. *See Innogenetics, N.V. v. Abbott Labs.*, 512 F.3d 1363, 1374 (Fed. Cir. 2008). A reason to combine or modify the prior art may be found explicitly or implicitly in market forces; design incentives; the “interrelated teachings of multiple patents”; “any need or problem known in the field of endeavor at the time of invention and addressed by the patent”; and the background knowledge, creativity, and common sense of the person of ordinary skill. *Perfect Web Techs., Inc. v. InfoUSA, Inc.*, 587 F.3d 1324, 1328–29 (Fed. Cir. 2009) (quoting *KSR*, 550 U.S. at 418–21).

The parties have two disputes regarding Petitioner’s proposed combination of the references’ teachings. First, the parties dispute whether motivation and a reasonable expectation of success existed for using the proposed combination of components for open hole multi-stage fracturing. Pet. 38–41; PO Resp. 63–66; Pet. Reply 6–14. Second, the parties dispute

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whether Petitioner provides rational underpinning for its assertion that a person of ordinary skill in the art would have combined Halliburton's disclosure of a pump-open plug with the disclosures of the other references. Pet. 38–41; PO Resp. 66. We discuss these disputes in detail below in Sections IV.B.5.a and IV.B.5.b.

On the whole, Petitioner's evidence and arguments provide rational underpinning for its contentions, demonstrating that there would have been a motivation and a reasonable expectation of success for a person of ordinary skill in the art to combine the references' teachings in the proposed manner. Because we find it persuasive, we adopt as our own Petitioner's explanation of the reasons that a person of ordinary skill in the art would have had motivation and a reasonable expectation of success. Pet. 1–6, 12–31, 38–41. a wellbore.

a. The Dispute About Using the Proposed Combination of Components for Open Hole Multi-Stage Fracturing

Asserting that Yost discloses open hole multi-stage fracturing (Pet. 15), Petitioner argues that it would have been obvious to modify Yost's apparatus to use certain components disclosed in Thomson, Ellsworth, and Halliburton (*id.* at 38–41). Petitioner argues that it would have been obvious to substitute solid body packers, as disclosed in Thomson and Ellsworth, for Yost's inflatable packers. *Id.* Petitioner also asserts that it would have been obvious to substitute Thomson's ball-activated sliding sleeves (MSAF tools). *Id.* Petitioner contends that a person of ordinary skill in the art would have been motivated to use solid-body packers to avert known problems with inflatable packers. *Id.* at 38. Petitioner asserts that a person of ordinary skill in the art would have been motivated to use ball-actuated

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sliding sleeves “to fracture in a single trip with no through tubing intervention.” *Id.* Petitioner asserts that solid body packers and ball-actuated sliding sleeves represented known alternatives also known to provide predictable results. *Id.* at 39. Petitioner further asserts that it would have been obvious to try, that known work in the field would prompt these variations, and that it was known to successfully use cased hole tools in an open hole. *Id.* at 40–41. Petitioner summarizes that “[t]hus, there existed in the art a teaching, suggestion, and motivation to use Thomson’s hydraulic-set packers and ball-drop actuated sliding sleeves for the same purposes and to achieve the same results as the comparable inflatable packers and ported collar sliding sleeves in Yost.” *Id.* at 41.

Patent Owner argues that a person of ordinary skill in the art would not have had motivation or a reasonable expectation of success for performing multi-stage fracturing in in an open hole wellbore. PO Resp. 63–66. Patent Owner contends that Yost was not a commercially viable enterprise, but simply a DOE experiment and “Yost confirms the fears raised by the conventional wisdom prior to 2001. The DOE reported fluid communication between multiple zones and it doubted whether the process actually induced new fractures.” *Id.* at 65. Patent Owner contends that “Yost’s reports of fluid communication between zones (i.e., failed zonal isolation) would strongly encourage a [person of ordinary skill in the art] to employ cemented casing to avoid that problem. Indeed, that is the teaching Mr. Yost himself endorsed in subsequent work.” *Id.* (citing Ex. 2100, 211). Additionally, Patent Owner again argues that a person of ordinary skill in the

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art would have thought that the only way to perform open hole multi-stage fracturing would have been using a cemented casing. *Id.* at 65.

We find that Petitioner has demonstrated a person of ordinary skill in the art would have had motivation to use Thomson’s apparatus in an open hole wellbore, and a reasonable expectation of success in doing so. We find that a person of ordinary skill in the art would have recognized the possibility of minimizing completion time and expense by performing multi-stage fracturing in an open hole wellbore. From Yost, it was known to use alternating packers and port collars to achieve zonal isolation in an “open hole” wellbore “to avoid the problems of formation damage associated with cementing and to eliminate the need for tubing-conveyed perforating of numerous treatment intervals.” Ex. 1002, 1. Indeed, Ellsworth recognizes that using solid body packers in an open hole wellbore provides the advantage that “[c]ost effective use of horizontal can be enhanced with the ability to segment, and control production without the need to run and cement liners.” Ex. 1004, 10.

Patent Owner does not dispute that a person of ordinary skill in the art would have had reason to perform multi-stage fracturing in an open hole wellbore. Instead, Patent Owner emphasizes uncertainty about whether the modification could have been implemented successfully in a commercially viable way. In particular, Patent Owner asserts that Yost does not show sufficient *economic* benefits, e.g. increasing profitability of a well, such that one of ordinary skill in the art would have used open hole completions for multi-stage fracturing. PO Resp. 64–65 (citing Ex. 2081 § 9.2; Ex. 2084 § 9.2). We disagree.

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Reviewing the record evidence through the lens of one of ordinary skill in the art, it is clear that while cased wellbores were conventional, open hole completions were an option that was known to those of ordinary skill in the art. *See* Section IV.B.4. For example, Yost details an open hole completion of a horizontal well including seven zones, and states that compared to cemented casings “[a]n alternative approach is zone isolation accomplished by the installation of external casing packers and port collars as an integral part of a casing string in the horizontal section.” Ex. 1002, 1. A reasonable reading of Yost clearly discloses specific considerations of open hole completion for a multi-stage fracture operation, and expressly recognizes the success of such a completion in the following conclusions:

1. This 2000 foot horizontal well in fractured Devonian shale has successfully demonstrated numerous folds of increase in production as compared to vertical wells in a pressure-depleted producing field.
2. Productivity improvements were successfully evaluated by actual flow rates, build-up analysis, and skin factor calculations.
3. This project represents the most extensively documented zone-to-zone production and stimulation testing of a long horizontal well in a naturally-fractured gas reservoir.
4. Both long horizontal drilling and multiple stimulations are required to achieve high folds of increase in production.

Ex. 1002, 5. Patent Owner makes much of the fact that Yost is an experiment, and not a commercial implementation of open hole multi-stage fracture completion. In connection with this, Patent Owner contends that the characteristics of the field in Yost differed from those that would be used for commercial production. *See* PO Resp. 44–51 (citing Ex. 2081 § 9.5; Ex. 2084 § 9.5). Yet, Patent Owner has not pointed to any case law or precedent

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that stands for the proposition that distinguishing prior art as a test, or experiment, as compared to a commercial embodiment, has any particular relevance with respect to a determination of obviousness. Moreover, there is no necessity that prior art disclose a commercial system as opposed to a non-commercial system. Pet. Reply 7–8 (citing *Galderma Labs., L.P. v. Tolmar Inc.*, 737 F.3d 731, 737 (Fed. Cir. 2013) (“Nothing in the statute or our case law required Tolmar to prove obviousness by starting with a prior art commercial embodiment and then providing motivation to alter that commercial embodiment.”)).

Citing Mr. McGowen’s testimony, Patent Owner also argues that “the modest production boost described in Yost ‘represents performance that is about the same as would be expected from an unfrac’ced horizontal well in this are drilled into normally pressured naturally fractured section of the reservoir.’” PO Resp. 64–65 (citing Ex. 2081 § 9.2; Ex. 2084 § 9.2). Because Mr. McGowen cites no supporting evidence for this testimony on this point (*see* Ex. 2081 § 9.2; Ex. 2084 § 9.2), we find Patent Owner’s argument on this point unpersuasive.

Moreover, Patent Owner’s suggestion that a wellbore completion technique must have some proven level of profitability seems to require almost an “absolute predictability,” which is “an incorrect legal standard for obviousness.” *Soft Gel Techs. v. Jarrow Formulas, Inc.*, 864 F.3d 1334, 1341 (Fed. Cir. 2017) (citing *Noelle v. Lederman*, 355 F.3d 1343, 1352 (Fed. Cir. 2004)); *see also Hoffman-La Roche Inc. v. Apotex, Inc.*, 748 F.3d 1326, 1331 (Fed. Cir. 2014) (“Conclusive proof of efficacy is not necessary to

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show obviousness. All that is required is a reasonable expectation of success.”).

We find persuasive Dr. Rao’s rebuttal testimony on these points and give weight to Dr. Rao’s testimony that one of ordinary skill in the art, in 2001, understood that “certain formations, such as the very consolidated shale formations of the Bakken, lent themselves to being completed as open holes.” Ex. 1044 ¶ 7. Dr. Rao testifies that “[a] person of ordinary skill in the art in the 1990s understood that open hole, multistage fracturing was a viable option in appropriate, competent boreholes and formations,” and buttresses his testimony by reference to C.M. Kim & H.H. Abass, “Hydraulic Fracture Initiation From Horizontal Wellbores: Laboratory Experiments,” *Rock Mechanics As A Multidisciplinary Science* (1991) (“Kim & Abass”). *Id.* ¶¶ 7–8. Discussing experimental results of fracture initiation in horizontal wellbores, Kim & Abass wrote, “[i]t appears that the type of wellbore completion is not a critical factor. However, an openhole completion would be preferred if the formation rock is competent enough to maintain the wellbore in stable condition during the life of the well.” Ex. 1043, 15. In view of Dr. Rao’s testimony and the teachings and evidence from Yost, Kim & Abass, and McClellan, we are persuaded that although certain evidence may show that cemented and perforated cased wellbore completions were “conventional,” this would not have posed an insurmountable problem, discouraged or failed to show a reasonable expectation of success to a person of ordinary skill in the art seeking to combine the teachings of Thomson and Ellsworth by using Thomson’s apparatus in an open hole wellbore. *See In re Icon Health and Fitness, Inc.*,

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496 F.3d 1374, 1382 (Fed. Cir. 2007) (“we do not ignore the modifications that one skilled in the art would make to a device borrowed from the prior art”).

b. The Dispute About Combining Halliburton’s Pump-Open Plug With the Teachings of Yost, Thomson, and Ellsworth

Petitioner also argues that it would have been obvious, in view of Thomson and Halliburton, to use Halliburton’s pump-open plug at the end of the tubing string. Pet. 38–39. Petitioner argues that a person of ordinary skill in the art would have been motivated to do so because the closed state of the plug would allow 1) pressurization of the tubing string to set packers, and 2) fluid flow through the tubing string for stimulation operations. *Id.* Additionally, Petitioner asserts that a person of ordinary skill in the art “would have also known that Halliburton’s pump-open plug was an obvious alternative to Thomson’s plugs because of the plug failure problems noted by Thomson and the disadvantages associated with having to expel a Thomson-type plug in order to open the lower end of the tubing string.” *Id.* at 39. Petitioner asserts that the evidence confirms that a person of ordinary skill in the art seeking to optimize Yost’s system would “readily modify” it to use a ball-actuated sliding sleeve, as well as a hydraulically actuated sliding sleeve (like Halliburton’s pump-open plug) at the toe of the well. *Id.*

Patent Owner argues that Petitioner does not show that a person of ordinary skill in the art would modify Thomson’s system to use Halliburton’s pump open plug as the tailpipe plug. PO Resp. 66. Patent Owner reasons that Thomson suggests using a disappearing plug in lieu of a pump out plug or a cycle plug. *Id.* Patent Owner similarly argues that Halliburton “teaches that the disappearing plug, not the hydraulic sleeve,

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solve[s] the problems identified in Thomson.” *Id.* at 59. Patent Owner further argues that Halliburton “advertises [its hydraulic sleeve] for a completely different purpose.” *Id.* at 66. In particular, Patent Owner argues that “Halliburton does not teach that [its hydraulic sleeve] could be used for open hole multi-stage fracturing, it describes it as a tool for production.” *Id.* at 59. Patent Owner criticizes Petitioner as providing “no evidence that a [person of ordinary skill in the art] would follow the portions of Thomson that they like, and then disregard the teachings in Thomson that contradict their theory.” *Id.*

Petitioner responds that Halliburton describes its pump open plug as configured for the very purpose needed in Thomson’s system. Pet. Reply 5. Petitioner also argues that Patent Owner’s argument that Thomson suggests using a disappearing plug shows that it also would have been obvious to use this plug, not that it would have been unobvious to use Halliburton’s pump open plug. Pet. Reply 5–6.

We find Petitioner’s evidence and arguments more persuasive than Patent Owner’s. We agree with Petitioner that Thomson’s indication of a desire to use a tailpipe plug different from a pump out or cycle plug provides express motivation to use a different type of tailpipe plug. *See, e.g.*, Ex. 1003, 4–5; Ex. 1007 ¶¶ 65–66, 69; Pet. 38–39. Furthermore, we find persuasive Petitioner’s evidence that a person of ordinary skill in the art would have viewed Halliburton’s pump open plug as a good option for a tailpipe plug. A tailpipe plug serves the purpose of holding pressure inside the tubing string to allow setting packers, followed by opening when needed to allow fluid flow out of the tubing string. *See, e.g.*, Ex. 1003, 3 (“Once all

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the lower half of the completion was on depth, pressure was applied down the tubing against the pump-out plug . . . to set all seven packers simultaneously.”), 4 (“If the plug expends early, the packers cannot be set, and the completion cannot be tested. If it does not expend, there is no flow path to enable balls to be pumped to their mating seat.”); Ex. 1007 ¶¶ 42, 60–61. Thus, Halliburton’s disclosure that its pump open plug “holds pressure from either direction but can be pumped open by applying excess surface pressure” (Ex. 1028, 93) would commend it as well-suited for a tailpipe plug. Pet. Reply 5–6; Ex. 1007 ¶ 68. Moreover, we find Petitioner’s evidence demonstrates that a person of ordinary skill in the art would have had a reasonable expectation of success in using Halliburton’s plug for this purpose. *See, e.g.*, Ex. 1007 ¶¶ 44, 69.

We find unpersuasive Patent Owner’s attorney argument that the prior art does not expressly disclose the exact combination Petitioner proposes. *See KSR*, 550 U.S. at 418 (“[T]he analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.”); *id.* at 421 (“A person of ordinary skill is also a person of ordinary creativity, not an automaton.”). Notwithstanding Patent Owner’s observation that Halliburton does not disclose using its plug for open hole multi-stage fracturing, Petitioner’s evidence persuades us it would have been apparent to a person of ordinary skill in the art that the configuration of Halliburton’s plug lends itself to the very function Thomson’s tailpipe plug needs to provide. Additionally, our finding that a person of ordinary skill in the art would have had reason to use

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a pump open plug is not negated by Thomson’s discussion of possibly using a disappearing plug. Moreover, we do not agree with Patent Owner’s suggestion that a person of ordinary skill in the art would have concluded from any of the cited portions of Halliburton to use a disappearing plug to the exclusion of the pump open plug. Nor do we agree with Patent Owner’s suggestion that because Halliburton teaches using its pump open plug for production, a person of ordinary skill in the art would not have reason to use it for open hole multi-stage fracturing. *See, e.g., KSR*, 550 U.S. at 417 (“When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one.”).

6. *Objective Indicia of Non-Obviousness*

Patent Owner presents evidence of objective indicia of non-obviousness, including proceeding contrary to accepted wisdom, nexus, copying, commercial success, and industry praise. Evidence of objective indicia of non-obviousness, when present, must always be considered en route to a determination of obviousness. *See In re Cyclobenzaprine Hydrochloride Extended-Release Capsule Patent Litig.*, 676 F.3d 1063, 1075–76 (Fed. Cir. 2012).

a. *Nexus*

Patent Owner’s evidence of nexus shows that the structural limitations in the claims read on the apparatus sold by Packers Plus, and that these features are not a subcomponent of, but rather the entirety of the product sold. Ex. 2051, 7, 43, Exhibit A; *see also* Ex. 2056 (describing “StackFRAC systems use RockSEAL hydraulically set mechanical packers to isolate

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zones together with ball-actuated hydraulically activated PracPORT sleeves”); Ex. 2057; Ex. 2017 (explaining that the “StackFRAC system is designed to provide open hole fracturing”); *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317 (Fed. Cir. 2016) (“[T]here is a presumption of nexus . . . when the patentee shows that the asserted objective evidence is tied to a specific product and that product ‘is the invention disclosed and claimed.’”); *Demaco Corp. v. F. Von Langsdorff Licensing Ltd.*, 851 F.2d 1387, 1392 (Fed. Cir. 1988) (presumption does not apply if the claimed invention is merely a subcomponent of the product).

We agree with Petitioner that the challenged claims are method claims, and that some of the evidence simply of commensurate tools and hardware between StackFRAC and the claimed invention may not necessarily express each claimed method step. *See* Pet. Reply, 17–19. However, Patent Owner’s evidence of objective indicia includes information and evidence that expresses the use of these tools and hardware in highly similar, if not the same, steps as claimed. For example, where claim 1 recites “running a tubing string into an open hole and uncased, non-vertical section of the wellbore” (Ex. 1001, 14:1–2), a Packers Plus advertisement states “StackFRAC HD technology allows you to increase your production by running longer laterals with shorter stage lengths . . . open hole systems provide an excellent opportunity to complete two or more laterals off of one vertical wellbore” (Ex. 2017, 1).

In view of the evidence of record, we are persuaded that at least some of the StackFRAC systems sold by Patent Owner are ultimately used in accordance with the challenged method claims. In those instances where the

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StackFRAC system is used in accordance with the challenged claims, we determine that there is a nexus between StackFRAC and the merits of the claimed invention.

b. *Commercial Success*

Packers Plus’s Chief Financial Officer, J.J. Girardi, states in his declaration that “Packers Plus has sold tools for or performed fracture treatments for tens of thousands of StackFRAC stages in the United States. That work accounts for the vast majority of Packers Plus’s overall revenue and profits.” Exs. 2048, 2049. Mr. Girardi states further that Packers Plus is “generating ██████████ in annual U.S. revenue,” and that “[t]he StackFRAC system has been critical to that success.” *Id.* We note that Patent Owner does not specifically define the market, asserting that “there is no requirement that a patentee define the market share of a product to demonstrate commercial success.” PO Resp. 39. Patent Owner does indicate that the relevant market, as of 2011, can be understood from the following Figure 1, in a third party research and survey report by Qittitut Consulting, LLC. Ex. 2010.

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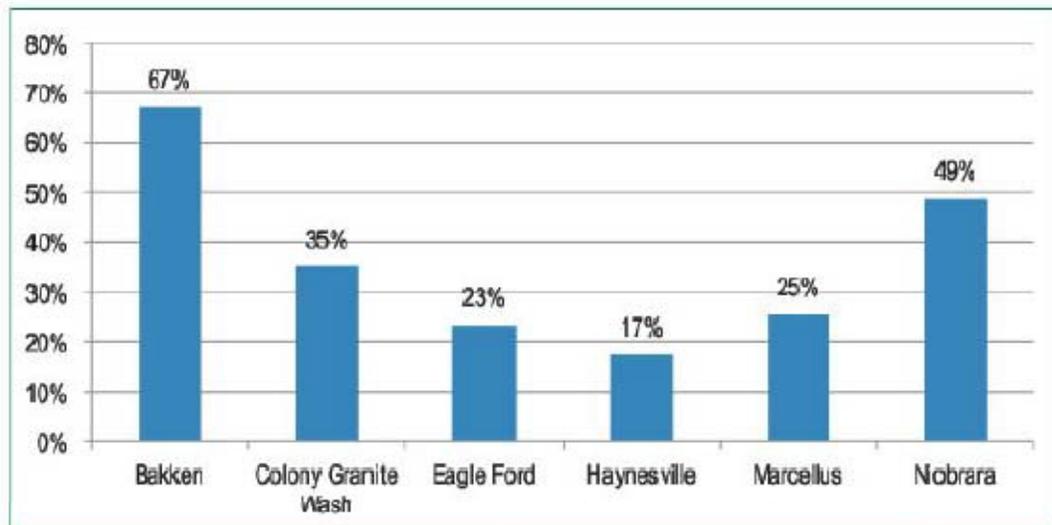


Figure 1. The OHMS technique for frac treatments is used in the Bakken play more than in other plays.

Ex. 2010, 4, Fig 1. Figure 1 reproduced above is from a report titled: Sleeves vs. Shots – The Debate Rages, by Qittitut Consulting, LLC, and shows a graph illustrating the percentage of open hole multi-stage (“OHMS”) well completions in different sites or “plays.”

Patent Owner argues that this graph is indicative of commercial success because OHMS “has overtaken competing fracturing methods such as plug and perf in the Bakken formation and its market share has grown in other formations as well.” PO Resp. 41. The first problem with this argument is that the graph does not show data in any time domain, so we are not persuaded that this is evidence of any particular annual market growth of OHMS. Second, it is not clear that these “plays” are the entire market for oil and gas well completions, or what part of the overall market they represent. See Pet. Reply, 17 n.1 (With respect to this play data, Petitioner argues that

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“PO cherry-picked six oil fields to create an illusion of market context.”). Further, Patent Owner does not point to any information or evidence that StackFRAC is the only method to perform OHMS, or discloses what part of these OHMS percentages for each play are due to Packers Plus’s StackFRAC system or systems that allegedly infringe, such as Weatherford’s ZoneSelect, or Baker Hughes Iso-Frac and FracPoint system.⁸

Patent Owner argues also that commercial success is shown by essentially the overall U.S. revenue generated by its StackFRAC system and allegedly infringing systems such as Weatherford’s ZoneSelect and Baker Hughes’s FracPoint systems. PO Resp. 39–42. Listed below are sales and revenue figures for Packers Plus, Weatherford, and Baker Hughes:

- a) Packers Plus – [REDACTED] annually (Exs. 2048, 2049);
- b) ZoneSelect by Weatherford – 12% of fracture system sales (Ex. 2074, 2);
- c) FracPoint by Baker Hughes – \$1 billion from 2008 and 2015 (Ex. 2051, 42; Ex. 2081, 25–27; Ex. 2084, 22–24).⁹

This evidence does not establish market share or commercial success of the claimed inventions for several reasons.

First, the foregoing evidence does not contain clear information about what portion of each company’s sales infringe the claimed methods. For example, Packers Plus’s CFO, Mr. Juan Jose Pena Giraldi, testifies that Packers Plus’s annual revenue is [REDACTED], but fails to state what part of

⁸ Patent Owner explains that both Iso-Frac and FracPoint are names used by Baker Hughes at different times to refer to the Baker Hughes’s horizontal open hole ball-drop well completion system. PO Resp. 35.

⁹ Patent Owners declarant, Mr. McGowen concedes that his estimate of Baker Hughes’s revenue from its FracPoint system is “a rough estimate.” Ex. 2081, 24; Ex. 2084, 24.

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that annual revenue is due to StackFRAC. *See* Ex. 2048 (Mr. Giraldi testifies only that StackFRAC “accounts for the vast majority of Packers Plus’ overall revenue and profits.”); Ex. 2049. Thus, the evidence of record does not show how much revenue Packers Plus generated from sales of the StackFRAC components.

Furthermore, the StackFRAC components, by themselves, do not embody the claimed invention, which relates to a method that includes “running a tubing string into an open hole and uncased, non-vertical section of the wellbore.” Ex. 1001, 14:1–2. Thus, only those StackFRAC systems that are actually installed in an open hole wellbore embody the claimed invention. And we do not have reliable information regarding what portion of StackFRAC systems are so installed. *See* Pet. Reply 17–19.

Accordingly, we do not have reliable information regarding Packers Plus’s revenues associated with the patented invention sufficient to support a finding of commercial success.

Regarding the alleged commercial success of Baker Hughes’s FracPoint system, we have only an uncorroborated estimate of FracPoint revenue. *See* Exs. 2048; 2049; 2081, 25–27; 2084, 25–27. Furthermore, as with StackFRAC, the FracPoint components themselves cannot embody the claimed method invention. And we also lack reliable information regarding what portion of speculated Baker Hughes revenue is associated with installations that embody the patented invention. *See* Pet. Reply 17–19.

From the foregoing information, we can reasonably understand that there is a market for multistage fracturing tools and systems, and sales of goods, and perhaps services, with some portion arguably having nexus to the

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claimed invention. The fact that there are sales however, does not define the market, nor tell us what portion of the market these sales account for, nor evidence any growth in market share.

To an extent, we find some objective evidence in an industry paper for the Society of Petroleum Engineers prepared by Weatherford (“Weatherford’s paper” Ex. 2074), which provides some insight into the potential relative market of completion and fracture systems in unconventional formations. *See* Ex. 2074, 1 (“There is a lot of debate about how best to complete and fracture unconventional formations regarding the effectiveness and efficiency differences between frac sleeve and P-n-P methods.”). Figure 1 from Weatherford’s paper illustrates certain completion techniques used by Weatherford.

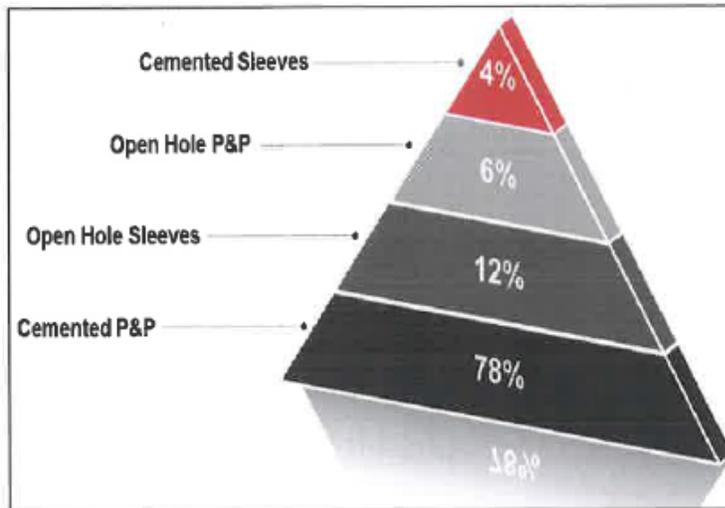


Figure 1—Percentages for different frac methods at Weatherford.

Weatherford’s paper at Figure 1, reproduced above, indicates that OHMS accounts for 12% of Weatherford’s fracturing completions. *Id.* at 2. Even if Weatherford’s Figure 1 is representative of the market for open hole multi-stage fracturing, we still have no cogent evidence of how much of the

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overall market for open hole multistage fracturing (all companies performing fracturing completions) involves the use of tools consistent with those recited in the claims. Thus, the Weatherford paper’s vague snapshot of fracturing distributions does not demonstrate commercial success of the claimed invention, particularly when Weatherford’s paper notes that “[Plug and Perf] is still the number one stimulation technique being used in unconventional horizontal wells in North America and globally.” Ex. 2074, 2. Indeed, the Weatherford paper indicates that Plug and Perf accounts for 78% of Weatherford’s fracturing, vastly outstripping the 12% attributed to open hole with sleeves. *Id.* at Fig. 1.

We find unavailing Patent Owner’s reliance on *Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034 (Fed. Cir. 2016). *See* PO Resp. 39–40. *Apple* addressed the issue of whether a nexus existed, not whether commercial success existed. *See* 839 F.3d at 1054–1055. (“We look to the record to ascertain whether there is substantial evidence for the jury’s fact finding that Apple established a nexus between commercial success and the invention in claim 8.”). *Apple* determined that a nexus had been shown, stating that “[t]his record overall contains substantial evidence of a nexus between the slide to unlock feature and the iPhone’s commercial success.” *Id.* at 1056. Contrary to Patent Owner’s suggestion, *Apple* did not involve a dispute regarding the existence of commercial success, much less discuss whether the iPhone dominated the market. *See id.* at 1054–1056. Here, we have resolved the *Apple* issue in Patent Owner’s favor—we find that a nexus exists for those instances of StackFRAC apparatus used in accordance with the challenged method claims. Patent Owner’s citation of *Apple* does not

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persuade us that we should also find commercial success in spite of the lack of persuasive evidence that use of StackFRAC in accordance with the challenged method claims has been significant in the relevant market.

The evidence does not show commercial success. Despite a showing of nexus between the claimed invention and some installations of Packers Plus’s StackFRAC system, Patent Owner’s evidence of commercial success is lacking in detail that links such ambiguous revenue and sales to any significant market growth in completions embodying the claimed invention. Accordingly, this factor does not weigh towards a finding of non-obviousness.

c. Industry Praise

Asserting that the StackFRAC system accounts for “the vast majority of Packers Plus” [REDACTED] annual U.S. revenue, Patent Owner argues that a variety of media sources, technical journals, and industry analysts have praised the StackFRAC system. PO Resp. 30–34. Patent Owner argues that the praise and notoriety is for the StackFRAC system specifically, “as embodied in claim 1, i.e., the overall combination of claimed elements.” *Id.* at 31.

Patent Owner argues, for example, that a confidential industry report by [REDACTED], obtained from a competitor, Baker Hughes, [REDACTED] [REDACTED] and a 2013 technical paper by BP America “identified a Packers Plus article as describing ‘the first commercial OHMS [Open Hole Multi-Stage] systems [that] were developed and deployed in 2001.’” *Id.* at 33–34 (citing Exs. 2013, 2047). Patent Owner argues further that

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Schlumberger negotiated for and credited Packers Plus’s technologies as facilitating the development of Schlumberger’s StageFRAC multistage fracturing service for horizontal wells. *Id.* at 34 (citing Ex. 2054 (“Packers Plus has established an industry leading reputation with their systems, which when combined with our services, offers a powerful solution.”)). Patent Owner contends that “[t]his high praise from a major competitor, and its desire to obtain rights to the technology is highly compelling evidence of non-obviousness.” *Id.*

Petitioner argues that Patent Owner’s evidence “is flawed because the praise is not ‘professional’ (i.e., from experts or industry players) and there is no nexus to the claims.” Pet. Reply 22 (citing *Power-One, Inc. v. Artesyn Techs., Inc.*, 599 F.3d 1343, 1352 (Fed. Cir. 2010)). We agree that certain evidence is attributable to entities that are not experts or companies in the oil and gas industry, such as the Financial Post Magazine. *See* Ex. 2006. Petitioner’s arguments, however, do not negate that Patent Owner’s evidence shows some industry praise. First, as discussed above, much of the recognition and praise evidence is attributable to competitors in the oil and gas industry such as Schlumberger and Baker Hughes, as well as oil and gas industry reporting such as Oil Patch Report. *See* Ex. 2008 (“After 10 years of marketing their innovative StackFRAC system, Packers Plus has become the darling of the oil and gas sector, not just in North America, but worldwide.”). Second, we do not find Petitioner’s reliance on *Power-One* to be entirely valid. In *Power-One*, the Federal Circuit found that evidence of industry praise “demonstrate[s] the unobviousness of the invention disclosed in the ’125 patent” and that “praise in the industry for a patented invention,

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and specifically praise from a competitor tends to ‘indicat[e] that the invention was not obvious.’” *Power-One, Inc.*, 599 F.3d at 1352. *Power-One* indicates that it may be suitable to credit evidence of praise and recognition from Packers Plus’s competitors. But we are not persuaded that this case stands for the proposition that other evidence, such as national media recognition of inventor, Dan Themig, as Ernst & Young’s entrepreneur of the year, which also notes his development of Packers Plus’s StackFRAC product, is flawed or irrelevant, or that all the media evidence provided by Patent Owner in this regard should be discounted.

Industry praise for an invention may provide evidence of nonobviousness where the industry praise is linked to the claimed invention. *See Geo. M. Martin Co. v. Alliance Mach. Sys. Intern. LLC*, 618 F.3d 1294, 1305 (Fed. Cir. 2010); *Asyst Tech’n, Inc., v. Emtrak, Inc.*, 544 F.3d 1310, 1316 (Fed. Cir. 2008). Patent Owner has supplied credible evidence that use of the StackFRAC system in open holes was praised and recognized in the oil and gas industry. For example, calling StackFRAC an “innovation,” Alberta Oil Magazine stated that “StackFRAC, the company’s prize product and primary innovation, is an open hole ball drop completion system that’s widely credited with unlocking old resource plays that were thought to be too expensive or too technically challenging to tap.” Ex. 2004. Such evidence supports Patent Owner’s position.

Other evidence advanced by Patent Owner provides less convincing support for Patent Owner’s assertions of industry praise. An example of such evidence comes from the Canadian OilPatch Technology Guidebook (Ex. 2005), which “profiled Packers Plus and its StackFRAC technology.”

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PO Resp. 28. This article describes Packers Plus as a “[m]ultistage fracking pioneer” that “revolutionized the completions sector.” Ex. 2005. This provides some support for Patent Owner’s assertion of industry praise. At the same time, the article includes portions suggesting that the desirable feature of StackFRAC consists of facilitating the performance of a number of fracturing stages. *Id.* (“When we started you could do five fracs,” he said. “Our StackFRAC brought that up to 20 and now we have technology that can do 60.”). Given Petitioner’s evidence that Thomson provides the same advantage of facilitating the performance of a number of fracturing stages, the persuasive value of Patent Owner’s evidence industry praise is somewhat diminished. *See, e.g.*, Ex. 1035 ¶¶ 28–29.

Thus, the exhibits presented by Patent Owner provide some evidence of industry praise. Certain of the exhibits appear to provide praise specifically for the claimed invention as a whole, as asserted by Patent Owner. Others of the exhibits are less convincing for Patent Owner’s position. Although the persuasive value of Patent Owner’s evidence does not appear commensurate with the number of exhibits allegedly showing industry praise, we give some weight to industry publications that highlight the specific technical aspects and elements corresponding to the claims in the ’501 patent.

d. *Copying*

We turn to Patent Owner’s allegations of copying. PO Resp. 34–39. Patent Owner offers two technical documents, one document is labeled “Packers Plus” and details the well completion tooling for what is apparently the StackFRAC tooling, as it is intended for open hole horizontal fracture

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well completion. Ex. 2053. The other is labeled “Iso-Frac System,” apparently the name for Baker Hughes’s competing system. Ex. 2052, 13. Patent Owner contends that Baker Hughes simply “replaced the Packers Plus logo and slogan with the Baker Hughes internal name for their ‘equivalent’ system.” PO Resp. 35. Patent Owner argues further that Baker Hughes’s FracPoint system employs the same components as used in Packers Plus’s StackFRAC system. PO Resp. 37–39.

Petitioner argues that “there is no evidence that shows that Ex. 2053 embodies any challenged claim.” Pet. Reply 23. Specifically, Petitioner argues that Exhibit 2053 does not show a “hydraulically actuated sliding sleeve” (Ex. 1001, 14:55) that is moved by “applying a first pressure within the tubing string inner bore such that the hydraulically actuated sliding sleeve moves from the closed port position to the open port position without the hydraulically actuated sliding sleeve engaging any fluid conveyed sealing device” (*id.* at 15:29–33). Pet. Reply 23.

Instead, Petitioner argues, Ex. 2053 shows at the end of the tubing string a “Hydraulic Closing Circulating Sleeve.” Ex. 2053, 1; Pet Reply 23. Petitioner asserts that there is no evidence that the Hydraulic Closing Circulating Sleeve constitutes a “hydraulically actuated sliding sleeve.” Pet. Reply 23. Petitioner further argues that Exhibit 2053 “points out that the sleeve uses ‘1 1/2" Ball for 1 1/4" Ball Seat’ and that the sleeve is ‘Set to close at 5-6 MPA.’” Pet Reply 23. Petitioner asserts that these features do not meet the claim requirement that the hydraulically actuated sliding sleeve moves to the open position “without the hydraulically actuated sliding sleeve engaging any fluid conveyed sealing device.” *Id.* In support of this,

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Petitioner suggests that the drawing's reference to a ball indicates that the Hydraulic Closing Circulating Sleeve is moved by engagement of a ball acting as a fluid conveyed sealing device. *Id.* Moreover, Petitioner argues, the drawing's statement "Set to close at 5-6 MPA" means that applying pressure moves the Hydraulic Closing Circulating Sleeve to a closed position, not to an open position, as required by the claims. *Id.*

We are persuaded that the preponderance of the evidence demonstrates that Exhibit 2053 does not show an apparatus meeting claim 1's limitations associated with the "hydraulically actuated sliding sleeve." Regarding the contents of Exhibits 2052 and 2053, Patent Owner argues that they show identical components. PO Resp. 35. Patent Owner relies on the drawings in Exhibits 2052 and 2053 themselves as evidence of what components they show, citing no independent evidence regarding the components shown by the drawings. *See id.* Thus, we look to the drawing in Exhibit 2053 to determine, as best we can, how the Hydraulic Closing Circulating Sleeve functions. Doing so, we agree with Petitioner's explanation that the evidence in the drawing weighs against finding that it show a hydraulically actuated sliding sleeve that functions consistent with the limitations of the claims. *See Pet. Reply 23.* Consequently, Exhibit 2053, the cornerstone of Patent Owner's copying argument, may show Baker Hughes copied something, but it does not show Baker Hughes copied the invention claimed in the '501 patent. We therefore find that the alleged copying does not weigh in Patent Owner's favor.

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e. *The Invention is Contrary to Accepted Wisdom and Produced Unexpected Results*

Patent Owner argues, as it does with respect to the level of ordinary skill, that a POSITA would have believed that the manner in which to achieve the most efficient and profitable horizontal fracturing well completions was by casing and cementing the wellbore and using the Plug and Perf method to achieve productive fracturing. *See* PO Resp. 24. Pointing to a Halliburton paper published in 1988 by the Society of Petroleum Engineers (Ex. 2098, 1), Patent Owner asserts that “[c]asing and cementing the horizontal section allows fracture initiation points to be controlled in placing multiple fractures.” PO Resp. 24. For example, in the Halliburton paper, it was described that “[t]o be effectively fracture stimulated, a horizontally drilled well must be cased and cemented through the horizontal producing section of the well.” Ex. 2098, 1. Patent Owner relies on multiple references that expressly state that cemented casing and the Plug and Perf technique were conventional and provided a successful method for multi-stage fracture stimulation of a well. *See* PO Resp. 23–27.

Petitioner contends that references such as the Halliburton paper merely show that cemented casing was preferred, and points, again, to Yost, to show that open hole completions had been successful, and were also known to those of ordinary skill in the art. Pet. Reply 20–22. Petitioner contends that multi-stage open hole completions might not have been the most prevalent method, but that this technique was known to those of ordinary skill in wellbore fracturing, as illustrated by a paper authored by McLellan. *Id.* at 21 (citing Ex. 1042, 3).

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As noted above, a person of ordinary skill in the art would have known that it was conventional to cement and line a wellbore with a cemented casing for a multi-stage fracturing completion, and a person of ordinary skill in the art also would have known that there existed circumstances in which open hole multi-stage fracturing would also be successful. *See* Section IV.B.4. The level of ordinary skill speaks initially to the question of whether it was contrary to accepted wisdom to perform a multi-stage open hole completion. Although cemented casings were, and still appear to be, a commonly used method of performing multi-stage fracture completions in the industry, the evidence nonetheless shows that open hole multi-stage completions were known and preferred under certain circumstances. *See* Ex. 1043, 15 (A 1991 Halliburton paper by C.M. Kim and H.H. Abass (“Kim and Abass paper”) discussing fracture initiation in horizontal wellbores and stating that “[a]n openhole completion would be preferred if the formation rock is competent enough to maintain the wellbore in stable condition for the life of the well.”). Thus, we are persuaded that using such open hole methods was not contrary to the wisdom and skill of a person of ordinary skill in the art.

Additionally, we are not persuaded by Patent Owner’s evidence of unexpected or surprising results. Arguing that open hole multi-stage completions unexpectedly outperformed cemented and cased wells, Patent Owner points to a paper titled Comparative Study of Cemented Versus Uncemented Multi-Stage Fractured Wells in the Barnett Shale published in 2010 by the Society of Petroleum Engineers. PO Resp. 29 (citing Ex. 2015 (“The Barnett Shale Paper”)). The Barnett Shale paper explains that OHMS

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completions in the Barnett shale formation in Texas apparently outperformed cemented liner completions based on cost savings, improved fracture stimulation, and well production. Ex. 2015, 3. The conclusion reached by the authors was that “it is clear that beyond the production benefits, the simplified operations intrinsic to the OHMS method also result in numerous time and cost savings.” *Id.* at 5. This evidence shows a benefit of OHMS in a particular region, i.e., the Barnett shale, but does not necessarily show that such results were unexpected or surprising. One of ordinary skill in the art would have known, from the Kim and Abass paper, that where the formation can support open hole completions, such open hole completions were preferred. Ex. 1043, 15.

Additionally, Yost and Thomson recognized many of the positive results espoused by the Barnett Shale paper. Yost recognized that open hole, multistage fracturing “eliminate[d] the need for tubing-conveyed perforating of numerous treatment intervals.” Ex. 1002, 1. Thomson recognized that multistage fracturing using its tool “reduces operational time normally required to stimulate multiple zones,” such that “cost savings are realized from the time reduction. As more experience is obtained with the system, increased efficiency will undoubtedly be generated, allowing additional time reduction and even greater cost savings when compared to traditional stimulation procedures.” Ex. 1003, 5.

Patent Owner also cites a declaration of Alfred R. Powell (Ex. 2103) in support of the contentions of surprising results. PO Resp. 28. Patent Owner argues that Mr. Powell viewed Packers Plus’s work as experimental. *Id.* (citing Ex. 2103 ¶ 6). Patent Owner also argues that “when Mr. Powell

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approached companies like Halliburton and Schlumberger to design a fracture treatment for his wells, they told him ‘it would not be possible.’” *Id.* (citing Ex. 2103 ¶ 3). We find these arguments unpersuasive for a number of reasons. First, Patent Owner does not provide persuasive evidence that the project Mr. Powell discusses practiced the claimed invention. For at least this reason, we are unpersuaded that Halliburton or Schlumberger thought that the claimed invention would not be possible, or that Packers Plus ultimately performed the claimed invention for Mr. Powell. Moreover, the other evidence of record, including Yost, McLellan, and Kim & Abass demonstrates that a person of ordinary skill in the art would have understood that it would be possible to perform open hole multi-stage fracturing.

7. *Conclusion on Obviousness*

Having considered each of the *Graham* factors individually, we now weigh them collectively. The scope and content of the prior art, as well as the differences between the prior art and the challenged claims, weigh heavily in favor of Petitioner’s contention that claims 1–9 would have been obvious. As explained above in Section IV.B.4, the only differences between Yost and the claims are (1) that Yost teaches using inflatable packers, not the claimed “solid body packer[s],” (2) that Yost teaches the use of “ported collar sliding sleeves” in lieu of “ball-actuated sliding sleeves,” and (3) that Yost does not disclose the “hydraulically actuated sliding sleeve” recited in claim 1.

Petitioner persuades us that Thomson, Ellsworth, and Halliburton contain teachings that bridge these differences between the claims and Yost.

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Regarding difference (1), Petitioner persuades us that Thomson and Ellsworth teach solid body packers, and that a person of ordinary skill in the art would have had reason to substitute solid body packers for Yost's inflatable packers, as well as a reasonable expectation of success in doing so. *See, e.g.*, Pet. 3–5, 17–22, 25–31, 38–41. A person of ordinary skill in the art would have had reason to use solid body packers, for example, because of the knowledge in the art that solid body packers would have been well-suited to sealing in open-hole well bores. *See, e.g., id.*

Regarding difference (2), Petitioner persuades us that Thomson discloses ball-activated sliding sleeves (MSAF) tools, and that a person of ordinary skill in the art would have had reason to use them in lieu of the sliding sleeves taught by Yost, as well as a reasonable expectation of success in doing so. *See, e.g., id.* at 3–4, 19–22, 25–26, 38–41. A person of ordinary skill in the art would have had reason to use ball-activated sliding sleeves like Thomson's to, for example, reduce expense and time of well completion.

Regarding difference (3), Halliburton's pump open plug meets the limitations of the claims associated with the "hydraulically actuated sliding sleeve." And Petitioner persuades us that a person of ordinary skill in the art would have had motivation and a reasonable expectation of success for using Halliburton's pump open plug the cycle plug at the end of Thomson's tubing string. *See, e.g.*, Pet. 5–6, 13–15, 22–26, 38–41. A person of ordinary skill in the art would have had reason to use Halliburton's pump-open plug as a tailpipe plug, for example, because (as explained above in Section IV.B.4.b) a person of ordinary skill in the art would have expected Halliburton's

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pump-open plug to provide successfully the functions needed of a tailpipe plug.

The level of ordinary skill in the art also weighs in favor of Petitioner’s assertion that claims 1–9 would have been obvious. We are persuaded that it would have been within the skill of a person of ordinary skill in the art to recognize that the packers and sleeves disclosed by Thomson, Ellsworth and Halliburton would work well in Yost’s system, and to successfully implement Yost’s system with those components added. *See, e.g.,* Pet. 2–6, 12–31, 38–41. Additionally, in view of the teachings of the prior art, we are persuaded that a person of ordinary skill in the art would have viewed it as desirable to perform multi-stage fracturing in an open hole, as taught by Yost and reinforced by Ellsworth (teaching desirability of open hole completion) and the knowledge in the art (as reflected, *e.g.,* by McLellan and Kim and Abass) . And although a person of ordinary skill in the art may have viewed cased hole completions as a conventional way to perform multistage fracturing, a person of ordinary skill in the art would have also understood that open hole multistage fracturing could be performed to advantage in at least some circumstances.¹⁰ *See* Sections IV.B.2, IV.B.6.e. Additionally, for the reasons explained in Section IV.B.5.a, we find that a person of ordinary skill in the art would have had a reasonable expectation of success in performing multi-stage fracturing in an

¹⁰ Consistent with this, the ’501 patent does not indicate any prior concerns about performing multi-stage fracturing in an open hole wellbore, stating instead that “[t]he apparatus and methods of the present invention can be used in various borehole conditions including open holes, cased holes, vertical holes, horizontal holes, straight holes or deviated holes.” Ex. 1001, 2:42–46.

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open hole wellbore. That it might not have been thought appropriate to perform open hole multi-stage fracturing in all circumstances is not determinative. *See KSR*, 550 U.S. at 416 (“If the claim extends to what is obvious, it is invalid under § 103.”).

Some of the objective indicia of non-obviousness advanced by Patent Owner weigh in favor of non-obviousness. In particular, Patent Owner’s evidence of industry praise weighs somewhat in favor of non-obviousness. The other evidence of objective indicia of non-obviousness does not weigh in favor of Patent Owner.

On the whole, because they weigh heavily in favor of obviousness, we determine that the first three *Graham* factors outweigh the evidence of copying and industry praise. Accordingly, we conclude that Petitioner has demonstrated by a preponderance of the evidence that claims 1–9 would have been obvious.

8. *Collateral Estoppel*

In view of our decision in IPR2016-01509, Petitioner argues that collateral estoppel precludes Patent Owner from arguing in favor of patentability. Pet. Reply 3–6. Because we determine that Petitioner has demonstrated unpatentability by a preponderance of the evidence, we need not address Petitioner’s contentions regarding collateral estoppel.

V. CONCLUSION

For the reasons expressed above, we determine that Petitioner has demonstrated by a preponderance of the evidence that the subject matter of claims 1–9 would have been obvious in view of Yost, Thomson, Ellsworth, and Halliburton.

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VI. ORDERS

After due consideration of the record before us, it is:
ORDERED that claims 1–9 have been shown to be unpatentable;
FURTHER ORDERED that Petitioner’s Motion to Exclude is
dismissed as moot; 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.

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FOR PETITIONER:

Jason Shapiro
js@usiplaw.com

Patrick Finnan
pjf@usiplaw.com

FOR PATENT OWNER:

Hamad Hamad
hhamad@caldwellcc.com

Gregory Gonsalves
gonsalves@gonsalveslawfirm.com