UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BAKER HUGHES INCORPORATED
and
BAKER HUGHES OILFIELD OPERATIONS, INC,
Petitioners

v.

PACKERS PLUS ENERGY SERVICES INC.,
Patent Owner

Case IPR2016-00596[1]
Patent 7,134,505 B2

EXCLUSIVE LICENSEE'S NOTICE OF APPEAL

[1] IPR2016-01496 was joined to IPR2016-00596.

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 2016-00596, concerning U.S. Patent 7,134,505 B2 ("the '505 patent"), entered on September 26, 2018, attached hereto as Appendix A.

ISSUES TO BE ADDRESSED ON APPEAL

A. Whether the PTAB erred in finding that claims 1–7, 14–22, and 24–26 are unpatentable as anticipated by Thomson;

B. Whether the PTAB erred in concluding that claim 15 is unpatentable as obvious over Thomson and Hartley;

C. Whether the PTAB erred in concluding that claims 23 and 27 are unpatentable as obvious over Thomson and Ellsworth;

D. Whether the PTAB erred in concluding that claims 1–7, 14–22, and 24–26 are unpatentable as obvious over Thomson and Brown;

E. Whether the PTAB erred in concluding that claim 15 is unpatentable as obvious over Thomson, Hartley, and Brown;

F. Whether the PTAB erred in concluding that claims 23 and 27 are

unpatentable as obvious over Thomson, Ellsworth, and Brown;

G. Whether the PTAB erred in concluding that claims 1–7 and 14–27 are unpatentable as obvious over Lane-Wells and Ellsworth;

H. Whether the PTAB erred in concluding that claim 15 is unpatentable as obvious over Lane-Wells, Ellsworth, and Hartley;

I. Whether the PTAB erred in concluding that claim 11 is unpatentable as obvious over Lane-Wells, Ellsworth, and Echols?

J. Whether the PTAB erred in giving insufficient weight to Patent Owner's secondary considerations of non-obviousness?

K. 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 inveniton with a reasonable expectation of success?

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.

Respectfully submitted,

Dated: November 26, 2018

/Gregory J. Gonsalves/

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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):

Director of the United States Patent and Trademark Office

c/o Office of the General Counsel

United States Patent and Trademark Office

P.O. Box 1450 Alexandria, Virginia 22313-1450

CERTIFICATE OF FILING

The undersigned certifies that on November 26, 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

717 Madison Place NW

Washington, DC 20005

CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing NOTICE OF APPEAL was served on November 26, 2018, by filing this document though 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:

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Appendix A

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Paper 89
Entered: November 13, 2018

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BAKER HUGHES INCORPORATED
and
BAKER HUGHES OILFIELD OPERATIONS, INC.,
Petitioner,

v.

PACKERS PLUS ENERGY SERVICES, INC.,
Patent Owner.

Case IPR2016-00596[1]
Patent 7,134,505 B2

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

POWELL, *Administrative Patent Judge.*

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

[1] IPR2016-01496 has been joined with IPR2016-00596.

I. INTRODUCTION

Packers Plus Energy Services Inc. ("Patent Owner") is the owner of Patent No. 7,134,505 B2 ("the '505 patent"). Baker Hughes Incorporated and Baker Hughes Oilfield Operations, Inc. (collectively, "Petitioner") filed a Petition challenging claims 1–7, 11, and 14–27 of the '505 patent. IPR2016-00596, Paper 10 ("596 Pet."). Rapid Completions LLC, the exclusive licensee of the '505 patent, filed a Preliminary Response. IPR2016-00596, Paper 12 ("596 Prelim. Resp."). In view of those submissions, we instituted an *inter partes* review of claims 1–7, 11, and 14–27 of the '505 patent. IPR2016-00596, Paper 12 ("596 Dec. on Inst."). Subsequent filings related to the grounds presented in the IPR2016-00596 Petition include a Patent Owner Response (IPR2016-00596, Papers 31, 32[2], "596 PO Resp."), a Petitioner Reply (IPR2016-00596, Paper 38, "596 Pet. Reply"), a Patent Owner Surreply (IPR2016-00596, Paper 45, "596 PO Surreply"), and a Petitioner Sur-surreply (IPR2016-00596, Paper 47, "596 Sur-surreply").

In IPR2016-01496, Petitioner asserted different grounds of unpatentability of claims 1–7, 11, and 14–27 of the '505 patent in another Petition. IPR2016-01496, Paper 1 ("1496 Pet."). Rapid Completions LLC filed a Preliminary Response. IPR2016-01496, Paper 17 ("1496 Prelim. Resp."). In view of those submissions, we instituted an *inter partes* review of claims 1–7, 11, and 14–27 of the '505 patent. IPR2016-01496, Paper 19 ("1496 Dec. on Inst."). Additionally, we granted Petitioner's motion to join

[2] Paper 31 is a private, unredacted version of the Patent Owner Response, and Paper 32 is a public, redacted version of the Patent Owner Response.

IPR2016-01496 with IPR2016-00596. IPR2016-01496, Paper 30. Subsequent filings addressing the grounds presented in the Petition for IPR2016-01496 include a Patent Owner Response (IPR2016-00596,[3] Papers 55, 56[4], "1496 PO Resp."[5]), and a Petitioner Reply (IPR2016-00596,[6] Paper 65, "1496 Pet. Reply"). All of the grounds presented in the Petition for IPR2016-00596 and all of the grounds presented in the Petition for IPR2016-01496 are pending in this *inter partes* review.

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 1–7, 11, and 14–27 of the '505 patent are unpatentable. *See* 35 U.S.C. § 316(e). We issue this Final Written Decision pursuant to 35 U.S.C. § 318(a).

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[3] This paper appears in the record of IPR2016-00596 because it was filed after the cases were joined.
[4] Paper 55 is a private, unredacted version of the Patent Owner Response, and Paper 56 is a public, redacted version of the Patent Owner Response.
[5] Because the substance of this paper addresses the grounds originally presented in the Petition for IPR2016-01496, subsequent citations use "1496" to identify this paper, notwithstanding that it appears in the record of IPR2016-00596. We apply the same convention with respect to other papers and exhibits that relate to the grounds originally presented in IPR2016-01496, but were filed in the record of IPR2016-00597 after joinder of the two cases.
[6] This paper (and each subsequent paper) appears in the record of IPR2016-00596 because it was filed after the cases were joined.

II. BACKGROUND

A. The '505 Patent

The '505 patent discloses an apparatus and method for fluid treatment of a wellbore. Ex. 1001, 1:16–19. The '505 patent discloses that many prior systems required inserting a tubing string into a bore hole "with the ports or perforations already opened." *Id.* at 2:10–12. The '505 patent states that this "can hinder the running operation and limit usefulness of the tubing string." *Id.* at 2:15–17. The '505 patent addresses this problem, disclosing that its "method and apparatus provide for the running in of a fluid treatment string, the fluid treatment string having ports substantially closed against the passage of fluid therethrough, but which are openable when desired to permit fluid flow into the wellbore." *Id.* at 2:26–30. Regarding applications for its system, the '505 patent discloses 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." *Id.* at 2:31–34.

The '505 patent shows details of a wellbore fluid treatment assembly in Figure 1b. *Id.* at 6:8–9. Figure 1b is reproduced below.

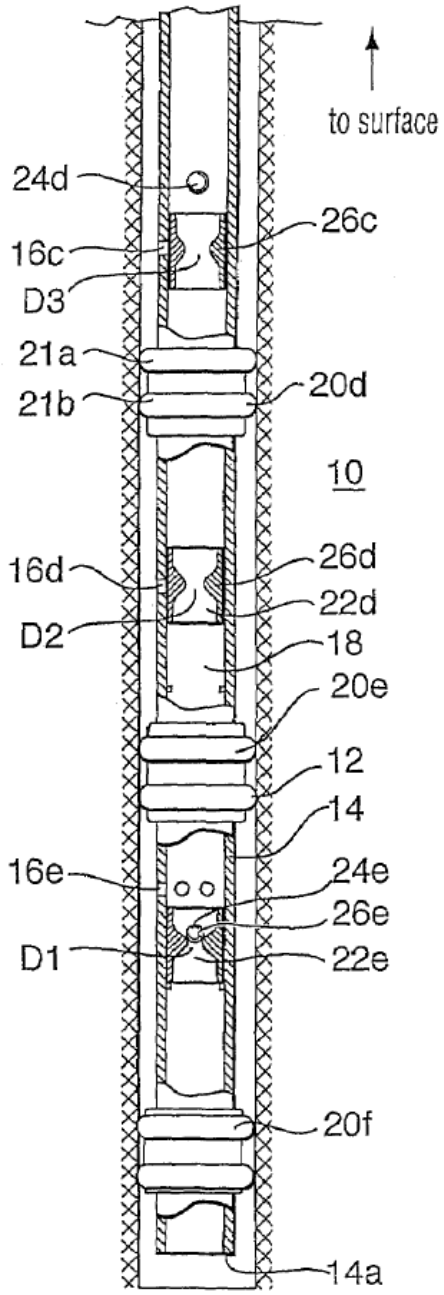

FIG. 1b

Figure 1b shows a wellbore fluid treatment assembly, including tubing string 14 disposed inside wellbore 12 of formation 10. *Id.* at 6:8–13.

Packers 20d, 20e, and 20f mount at different positions along the axis of tubing string 14. *See id.* at 6:17–19; Fig. 1b. The packers used are solid-body type packers having at least one extrudable packing element. *Id.* at 6:33–34. At ported intervals 16c, 16d, and 16e, ports 17 (not labeled in Figure 1b) open through tubing string 14. *Id.* at 6:13–16. Ported interval 16c sits above packer 20d, ported interval 16d sits between packers 20d and 20e, and ported interval 16e sits between packers 20e and 20f. *See id.* at 6:17–19, Fig. 1b.

Sliding sleeves 26c, 26d, and 26e are positioned inside tubing string 14 to regulate opening of ports 17. *Id.* at 6:41–42. Sliding sleeves 26c, 26d, and 26e mount over ports 17 of ported intervals 16c, 16d, and 16e, respectively, to close the ports 17. *See id.* at 6:42–44. Each of sliding sleeves 26c, 26d, and 26e can be moved to a position away from the associated ports 17 to open them. *Id.* at 6:46–53. In one embodiment, a ball or plug may actuate a sliding sleeve from the closed state to an open state. Ball 24e can travel through tubing string 14 and seat in sleeve 22e. *Id.* at 6:65–7:18. For example, ball 24e can travel through tubing string 14 and seat in sliding sleeve 26e. *Id.* at 6:65–7:11. Subsequently, pressure applied inside tubing string 14 can move ball 24e and sliding sleeve 26e to open ports 17 of ported interval 16e, as shown in Figure 1b. *Id.* at 7:2–15. This allows fluid flow between the inside and the outside of tubing string 14 through ports 17. *Id.* at 7:15–18. Other balls can be used to move the other sliding sleeves in sequence, so as to allow sequential treatment of different zones within wellbore 12. *Id.* at 8:1–35. To facilitate sequential treatment, the ’505 patent discloses that

> Each of the plurality of sliding sleeves has a different diameter seat and therefore each accept different sized balls. In particular, the lower-most sliding sleeve 22*e* has the smallest diameter D1 seat and accepts the smallest sized ball 24*e* and each sleeve that is progressively closer to surface has a larger seat.

Id. at 7:19–24.

B. Related Matters

The '505 patent is involved in a concurrent district court action, *Rapid Completions LLC v. Baker Hughes Inc.*, No. 6:15-cv-00724 (E.D. Tex.), which was filed July 31, 2015. IPR2016-00596, Paper 5. Additionally, the '505 patent has been challenged in IPR2016-01517.

C. The Challenged Claims

Of the challenged claims, claims 1, 19, and 24 are independent. Claim 1 is illustrative, and is reproduced below.

> 1. An apparatus for fluid treatment of a borehole,
>
> the apparatus comprising a tubing string having a long axis,
>
> a first port opened through the wall of the tubing string,
>
> a second port opened through the wall of the tubing string,
>
> the second port offset from the first port along the long axis of the tubing string,
>
> a first packer operable to seal about the tubing string and mounted on the tubing string to act in a position offset from the first port along the long axis of the tubing string,
>
> a second packer operable to seal about the tubing string and 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;
>
> a third packer operable to seal about the tubing string and 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 packer,

> at least one of the first, second and third packer being a solid body packer each including multiple packing elements and a hydraulically actuated setting mechanism for at least one of the first, second and third packers to act on fluid pressure communicated to the mechanism from within the apparatus;
>
> a first sleeve positioned relative to the first port, the first sleeve being moveable relative to the first port between a closed port position and a position permitting fluid flow through the first port from the tubing string inner bore and a second sleeve being moveable relative to the second port between a closed port position and a position permitting fluid flow through the second port from the tubing string inner bore;
>
> and a sleeve shifting means for moving the second sleeve from the closed port position to the position permitting fluid flow,
>
> the means for moving the second sleeve selected to create a seal in the tubing string against fluid flow past the second sleeve through the tubing string inner bore.

Ex. 1001, 14:12–44 (line breaks added).

D. The Pending Grounds

Claims 1–7, 11, and 14–27 of the '505 patent are challenged as allegedly unpatentable based on the following pending grounds (596 Dec. on Inst. 17–18; 1496 Dec. on Inst. 19):

Ground	References	Challenged Claim
§ 102	Thomson[7]	1–7, 11, 14–22, and 24–26
§ 103	Thomson and Hartley[8]	15
§ 103	Thomson and Ellsworth[9]	23 and 27

[7] 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) ("Thomson") (Ex. 1002).
[8] U.S. Patent No. 5,449,039, iss. Sep. 12, 1995 ("Hartley") (Ex. 1003).
[9] 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) ("Ellsworth") (Ex. 1004).

Ground	References	Challenged Claim
§ 103	Thomson and Echols[10]	11
§ 103	Thomson and Brown[11]	1–7, 11, 14–22, and 24–26
§ 103	Thomson, Hartley, and Brown	15
§ 103	Thomson, Ellsworth, and Brown	23 and 27
§ 103	Thomson, Echols, and Brown	11
§ 103	Lane-Wells[12] and Ellsworth[13]	1–7 and 14–27
§ 103	Lane-Wells, Ellsworth and Hartley[14]	15
§ 103	Lane-Wells, Ellsworth, and Echols[15]	11
§ 103	Lane-Wells, Ellsworth, and "based on the knowledge of a person of ordinary skill in the art."[16]	7 and 19[17]

As further support, Petitioner proffers Declarations of Ali Daneshy, Ph.D.[18] (596 Ex. 1007; 596 Ex. 1031; 1496 Ex. 1007). Patent Owner

[10] U.S. Patent No. 5,375,662 iss. Dec. 27, 1994 ("Echols") (Ex. 1005).
[11] U.S. Patent No. 4,018,272 iss. Apr. 19, 1977 ("Brown") (Ex. 1006).
[12] *Composite Catalog of Oil Field and Pipe Line Equipment 21st 1955–56 Edition*, World Oil, The Gulf Publishing Company (1496 Ex. 1002).
[13] 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) ("Ellsworth") (1496 Ex. 1004).
[14] U.S. Patent No. 5,449,039 iss. Sept. 12, 1995 ("Hartley") (1496 Ex. 1003).
[15] U.S. Patent No. 5,375,662 iss. Dec. 27, 1994 ("Echols") (1496 Ex. 1005).
[16] 1496 Pet. 6.
[17] We do not view this ground as differing from Petitioner's challenge of claims 7 and 19 as obvious over Lane-Wells and Ellsworth.

proffers Declarations of Harold E. McGowen III, PE. (596 Ex. 2034; 596 Ex. 2036; 1496 Ex. 2050; 1496 Ex. 2051; 1496 Ex. 2081).

III. ANALYSIS

A. Claim Construction

In an *inter partes* review, the Board interprets claim terms in an unexpired patent according to the broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *see In re Cuozzo Speed Techs., LLC*, 136 S. Ct. 2131, 2142–46 (2016). Under that standard, and absent any special definitions, we give claim terms their ordinary and customary meaning, as would be understood by one of ordinary skill in the art at the time of the invention. *See In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Any special definitions for claim terms must be set forth with reasonable clarity, deliberateness, and precision. *See In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994).

Petitioner proposes constructions for certain claim terms. 596 Pet. 21–27; 1496 Pet. 25–30. Patent Owner also addresses the meaning of certain claim language. 596 PO Resp. 3–7; 1496 PO Resp. 2–4. For purposes of this decision, we need only construe certain claim language, as discussed in detail immediately below. *Vivid Techs., Inc. v. Am. Sci. &*

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[18] Patent Owner criticizes Dr. Daneshy's testimony, arguing that Dr. Daneshy did not know certain legal criteria associated with determining obviousness of the claimed invention. 596 PO Resp. 43–46; 1496 PO Resp. 30–33. We have given Dr. Daneshy's testimony appropriate weight in view of Patent Owner's arguments. For example, in our analysis, we do not rely on Dr. Daneshy's ultimate conclusions regarding obviousness, and we afford his testimony on underlying factual issues appropriate weight.

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.").

1. *Claim 11—has engaged and moved*

Claim 11 recites "wherein the first port has mounted thereover a sliding sleeve and in the position permitting fluid flow, the first sleeve has engaged and moved the sliding sleeve away from . . . the first port." Petitioner proffers a construction for claim 11's recitation of "has engaged and moved." 596 Pet. 24–26.

Specifically, Petitioner argues that the "[broadest reasonable interpretation] of 'has engaged and moved' requires a process of two events that are temporally linked: the physical relationship between the first sleeve and the sliding sleeve changes to one of engagement, and the first sleeve moves the sliding sleeve." *Id.* at 24. Petitioner asserts that claim language requires that "engaged" and "moved" occur in a linked manner. *Id.* Petitioner also argues that, logically, if the first sleeve "has engaged and moved" the sliding sleeve to an open position, the first sleeve had not engaged the sliding sleeve before the first sleeve moved the sliding sleeve to the open position. *Id.* at 25–26. Petitioner asserts that the Specification of the '505 patent comports with its proffered claim construction, noting that in the example described in connection with Figure 8, sleeve 322 first engages and then moves sleeve 325. *Id.* at 25 (citing Ex. 1001, 12:32–39, 12:52–62, 3:28–31). Patent Owner does not dispute Petitioner's proposed construction or reasoning. *See* 596 PO Resp. 7. Petitioner persuades us that the broadest reasonable interpretation of "has engaged and moved" requires a process of

two events that are temporally linked—first, the physical relationship between the first sleeve and the sliding sleeve changes to one of engagement, and second, the first sleeve moves the sliding sleeve.

B. Alleged Anticipation of Claims 1–7, 11, 14–22, and 24–26 by Thomson

Petitioner explains how it believes Thomson discloses every limitation of claims 1–7, 11, 14–22, and 24–26. 596 Pet. 27–45; 596 Pet. Reply 1–2. Patent Owner argues that Thomson fails to disclose certain limitations of these claims. 596 PO Resp. 50–53. Having reviewed Petitioner's arguments and evidence, as well as Patent Owner's counterarguments and evidence, we find that Petitioner has demonstrated by a preponderance of the evidence that Thomson anticipates claims 1–7, 14–22, and 24–26. Because we find it persuasive, we adopt as our own Petitioner's explanation of how Thomson anticipates claims 1–7, 14–22, and 24–26. 596 Pet. 27–45; 596 Pet. Reply 1–2. We find, however, that Petitioner has not demonstrated by a preponderance of the evidence that claim 11 is anticipated by Thomson.

In the sections that follow, we discuss in greater detail certain salient aspects of the evidence and contentions regarding the alleged anticipation of claims 1–7, 11, 14–22, and 24–26 by Thomson. Section III.B.1 summarizes Thomson's disclosure. Section III.B.2 discusses Patent Owner's argument that Petitioner does not demonstrate that Thomson discloses a solid body packer with multiple packing elements. 596 PO Resp. 50–53. Patent Owner does not dispute Thomson's disclosure of any other element of claims 1–7, 11, 14–22, and 24–26. In view of our conclusion regarding the broadest reasonable interpretation of claim 11 (*see* Section III.A.1, *supra*), Section

III.B.3 discusses Petitioner's assertion of anticipation of claim 11 by Thomson.

1. 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. 1002, 1. Thomson's "project was initiated to develop a system that would allow multiple acid stimulations to be efficiently performed in the shortest possible time." *Id.* "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.

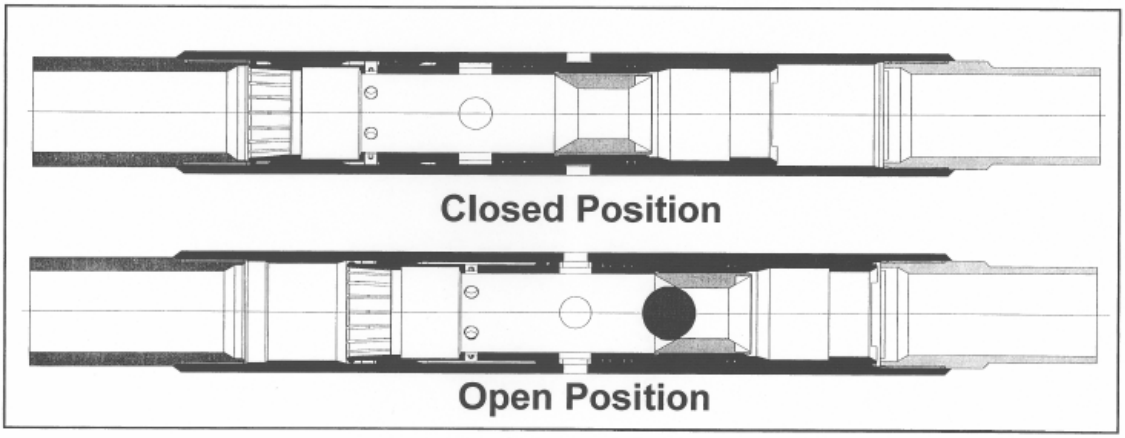


Figure 5
MSAF Tool in the Closed and Open Positions

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 moved 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.

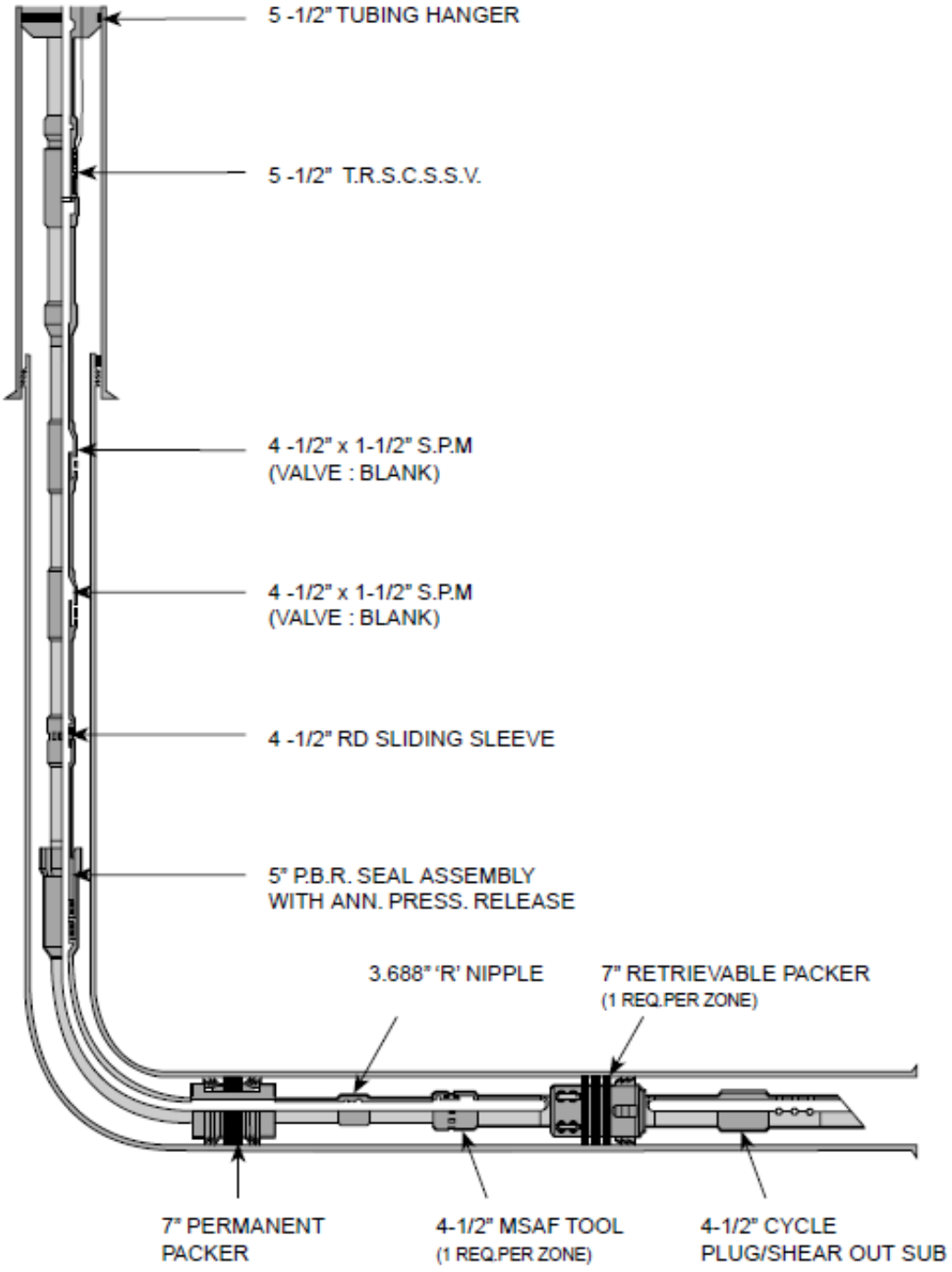
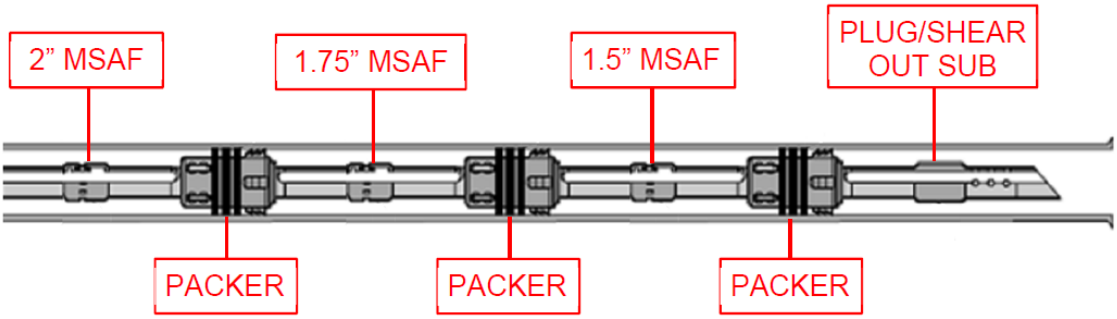


Fig. 3 — Schematic of a Typical Joanne Completion

Thomson's Figure 3 shows "a [s]chematic of a [t]ypical Joanne [c]ompletion." *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. 596 Pet. 28



Modified Figure 3
(annotated)

Petitioner's modified, annotated version of Figure 3 shows three MSAF tools and three packers mounted in alternating positions along a tubing string. *Id.* Apparently using the dimensions from 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.* This 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." Ex. 1002, 1; 596 Pet. 38.

For each well, Thomson discloses running its apparatus into the well in one trip, after perforating the well with tubing-conveyed perforating guns. *Id.* at 3. Thomson discloses subsequently setting the packers of the apparatus and stimulating the well. *Id.* Thomson discloses that

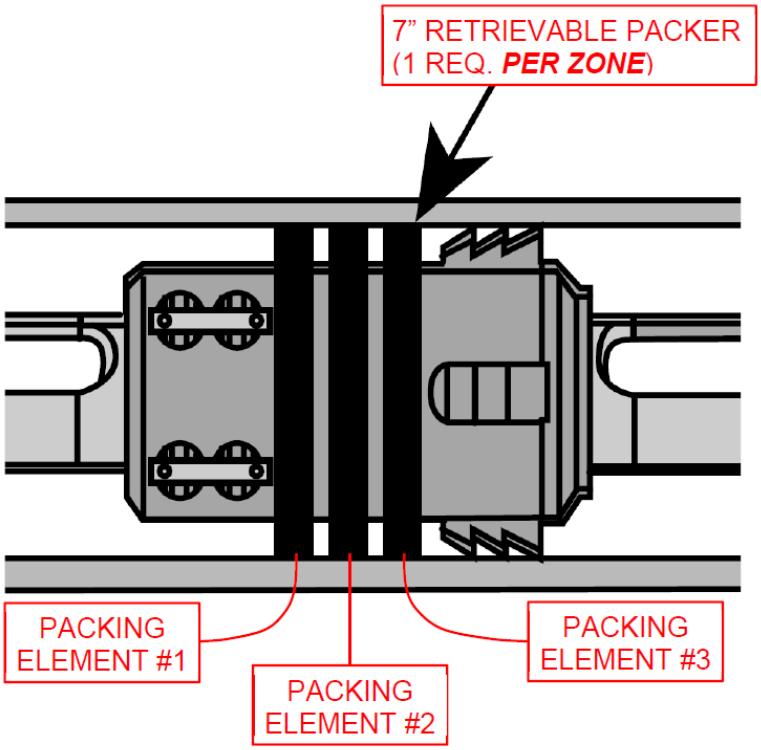
> [w]ith this system, stimulation of 10 separate zones is accomplished in 12–18 hours by a unique procedure that lubricates varying sized low-specific gravity balls into the tubing and then pumps them to a mating seat in the appropriate MSAF, thus sealing off the stimulated zone and allowing stimulation of the next zone which is made accessible by opening the sleeve.

Id. at 1. Based on these express disclosures, we find that Thomson teaches multistage fracturing of a wellbore.

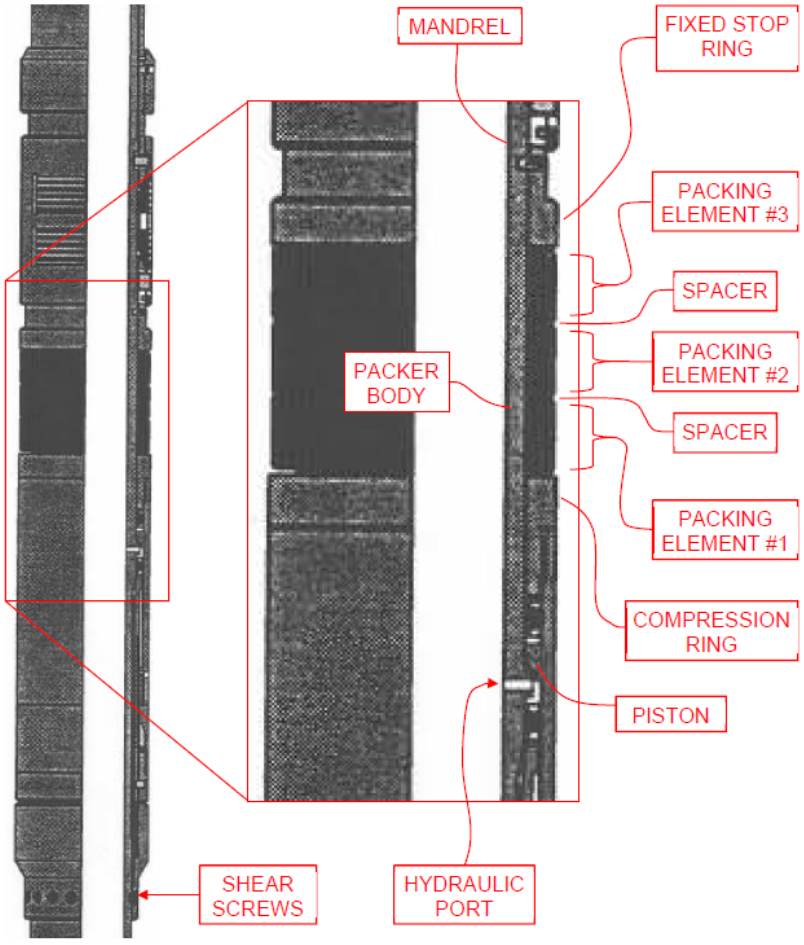
2. *Whether Thomson Teaches a Solid Body Packer with Multiple Packing Element—Claims 1–7, 11, and 14–22, and 24–26*

Each of independent claims 1, 19, and 24 recites "at least one of the first, second and third packer being a solid body packer each including multiple packing elements." Ex. 1001, 14:27–29, 15:62–64, 16:51–53. Petitioner asserts that Thomson discloses using multiple retrievable packers corresponding to the first, second, and third packers recited in independent claims 1, 19, and 24. 596 Pet. 31–34. Petitioner further argues that each of Thomson's retrievable packers includes multiple packing elements. *Id.* at 32–34. Petitioner asserts, and Dr. Daneshy testifies, that Thomson's retrievable packers are shown with multiple packing elements in both Figures 3 and 4. 596 Pet. 31–34; Ex. 1007 ¶¶ 70–73. Dr. Daneshy and Petitioner provide excerpts from Thomson's Figures 3 and 4 with

annotations identifying where they contend the figures show multiple packing elements in a retrievable packer. These excerpts from Figures 3 and 4 are reproduced below.



Excerpt of Figure 3
(annotated)



Excerpt of Figure 4 (Retrievable Configuration) (annotated)

The excerpt from Figure 3 and the excerpt from Figure 4 each shows a retrievable packer with annotations showing the structures Petitioner and Dr. Daneshy identify as multiple packing elements. Dr. Daneshy testifies that Figures 3 and 4 show a retrievable packer with multiple packing elements and spacer rings between them. Ex. 1007 ¶ 72. Dr. Daneshy further testifies that this type of solid-body packer commonly used multiple packing elements separated by spacer rings to constrain the packing elements and ensure proper extrusion. *Id.* (citing Ex. 1016, 3:62–65; Figs. 1, 2). We find Dr. Daneshy's testimony credible and persuasive.

Patent Owner asserts that Petitioner fails to demonstrate Thomson discloses a solid body packer with multiple packing elements, asserting that Thomson is ambiguous regarding the number of packing elements in its packers. 596 PO Resp. 50–53. Patent Owner argues that Thomson does not include enough detail to support Petitioner's assertions. *Id.* at 50. Patent Owner argues that the text of Thomson suggests its permanent and retrievable packers each have the same number of packing elements, whereas in Figure 3 "[o]ne packer appears to have a single element and the other packer appears to have multiple elements." *Id.* at 50–51. Given this, Patent Owner argues that a person of ordinary skill in the art would likely look to Figure 4 to figure out whether Thomson's packers have multiple packing elements. *Id.* at 51. Patent Owner therefore concludes that Petitioner has not established that Thomson's Figure 4 shows multiple packing elements. As for Dr. Daneshy's testimony, Patent Owner argues that it warrants no weight because he has not designed a packer, is not an expert on packers, and is not an expert on image analysis. *Id.* at 52–53.

Petitioner responds that Thomson's Figure 3 clearly identifies the "retrievable packer" as the one shown with multiple packing elements. 596 Pet. Reply 1. Regarding Patent Owner's attack on Dr. Daneshy's testimony, Petitioner argues that Dr. Daneshy need not design a packer to competently testify that Figure 4 shows multiple packing elements, further noting that Mr. McGowen did not disagree with Dr. Daneshy's testimony. *Id.* at 1–2. We find it compelling that Mr. McGowen did not disagree with Dr. Danseshy.

We find that the preponderance of the evidence shows that Thomson discloses using multiple retrievable packers, each of which includes multiple packing elements. Figure 3 of Thomson undisputedly shows the retrievable packer having multiple packing elements. *See* 596 PO Resp. 51 ("the other packer appears to have multiple elements"). Although the image quality of Figure 4 is lower than the image quality of Figure 3, Figure 4 also reasonably shows multiple packing elements with indentations in the outer surface where Petitioner asserts that spacers separate the multiple packing elements. Additionally, the Weitz reference (Ex. 1016) cited by Petitioner and Dr. Daneshy corroborates their explanation of what Thomson's Figure 4 shows. Ex. 1016, 3:62–65, Figs. 1, 2.

Given Petitioner's showing, even in view of the alleged ambiguities identified by Patent Owner, we find that a person of ordinary skill in the art would have understood Thomson as disclosing that its retrievable packers have multiple packing elements. *See, e.g.*, Ex. 1007 ¶¶ 70–73. None of the other evidence identified by Patent Owner casts significant doubt on the clearest evidence of how many packing elements Thomson's retrievable packer contains: Figure 3's undisputed depiction of the retrievable packer as having multiple packing elements. Patent Owner does not dispute that Thomson discloses using multiple of its retrievable packers, and, contrary to Patent Owner's suggestion that Figure 3's depiction of the retrievable packer and permanent packer is ambiguous (*see* 596 PO Resp. 50–51), we find Figure 3 clear that Thomson discloses a retrievable packer with multiple packing elements.

For the foregoing reasons, we find that Thomson anticipates claims 1–7, 14–22, and 24–26. We turn now to the reasons we find that Petitioner has not demonstrated by a preponderance of the evidence anticipation of claim 11 by Thomson.

3. *Claim 11*

With respect to claim 11's recitation of a first sleeve and a sliding sleeve, Petitioner cites Thomson's disclosure of a "ball seat [that] is threaded on the bore of this sleeve, and when the correct size ball lands on the ball seat, applied pressure from above moves the sleeve to the down/open position." Ex. 1002, 98; 596 Pet. 39–40. Petitioner indicates that this disclosure meets the limitations of claim 11 under a construction "as broad as the one implicitly asserted in the Litigation." 596 Pet. 40. Under such a broad construction, Petitioner suggests, Thomson's seat corresponds to the first sleeve, and Thomson's sleeve corresponds to the sliding sleeve. *Id.*

As discussed above, Petitioner persuades us that claim 11's recitation of "the first sleeve has engaged and moved the sliding sleeve away from . . . the first port" requires that first, the physical relationship between the first sleeve and the sliding sleeve changes to one of engagement, and second, the first sleeve moves the sliding sleeve. As Petitioner concedes, "[u]nder the [claim construction proffered by Petitioner] . . . , the 'first sleeve' is not met by Thomson's threaded seat because it is in a fixed relationship with the sliding sleeve, and therefore cannot be said to 'ha[ve] engaged' the sliding sleeve." 596 Pet. 49. We agree. Under our construction of claim 11, the evidence does not support a finding that Thomson's seat corresponds to the claimed first sleeve, as Thomson's seat is threaded into the sleeve; Thomson does not disclose that the physical relationship between its seat and the

sleeve changes to one of engagement before the seat moves the sleeve. Consequently, Petitioner does not demonstrate by a preponderance of the evidence that Thomson anticipates claim 11.

C. Alleged Obviousness of Claims 23 and 27 over Thomson and Ellsworth

Petitioner asserts, citing record evidence, that Thomson anticipates claims 19 and 24, from which claims 23 and 27 depend. 596 Pet. 27–36, 41–45. Regarding claims 23 and 27, Petitioner asserts that it would have been obvious in view of Ellsworth to use Thomson's apparatus in an open hole wellbore. *Id.* at 46–49.

Patent Owner argues that claims 23 and 27 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 (1966). 596 PO Resp. 7–50. 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. 383 U.S. at 148. We turn now to detailed discussions of these factors, followed by our conclusions regarding whether claims 23 and 27 would have been obvious.

1. Scope and Content of the Prior Art

a. Thomson

We discuss the scope and content of Thomson in Section III.B.1, above.

b. Ellsworth

Ellsworth discusses challenges in providing isolation in mostly open hole horizontal completions. Ex. 1004, 1. Ellsworth "presents several well

case histories that illustrate the application of advancements in establishing isolation in the open hole horizontal completions to accomplish various objectives in the successful application of horizontal wells." *Id.* Noting prior use of inflatable packers for isolation, Ellsworth discloses that "[m]ore recently, solid body packers (SBP's) (see Figure 4) have been used to establish open hole isolation." *Id.* at 3. Ellsworth's Figure 4 is reproduced below.

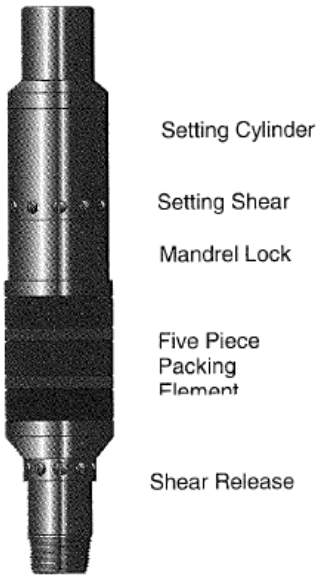


Figure 4 - The solid body packer is hydraulic set instead of inflatable (Guiberson / Halliburton Wizard II packer shown)

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.*, 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.*

Reporting the results of one installation of solid body packers in an open hole wellbore, Ellsworth states that "[t]he initial acid job using [solid body packers] indicated that the tools successfully provided isolation during the job." *Id.* at 6. Reporting on another installation, Ellsworth discloses that "mechanical confirmation indicated that the [solid body packers] were holding" and that "[p]roduction testing afterwards, as well as sleeve changes during the first 6 months indicated that successful isolation was achieved." *Id.* at 8. Regarding another installation, Ellsworth reports that "zonal segmentation in the build section of this well was clearly demonstrated." *Id.* In summarizing its disclosure, Ellsworth states that "[t]he ability to establish long-term zonal isolation in open hole producers opens the door to many new well producing configurations. The goal of cost effective use of horizontals can be enhanced with the ability to segment, and control production without the need to run and cement liners." *Id.*

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

As noted above, Petitioner asserts that Thomson anticipates claims 19 and 24. 596 Pet. 27–36, 41–45. As explained in Section III.B above, we are persuaded that Thomson anticipates claims 19 and 24. Consequently, the only difference between Thomson and claims 23 and 27 appears in the claim limitation "wherein when in a desired position the apparatus is adjacent an open hole section of the wellbore and the packers are set to seal the annulus between the apparatus and the wellbore wall." Ex. 1001, 16:31–34, 17:17–20. In other words, although Thomson teaches using its apparatus to perform multistage fracturing in a wellbore (*see* Section III.B.1, *supra*), it does not appear to teach doing so in an open-hole wellbore. Ellsworth

discloses using solid body packers to isolate segments of an open hole wellbore, (Ex. 1004, 4), but does not disclose using an arrangement of tubing string, sleeves, and packers in the exact manner required by claims 23 and 27. Thus, the difference between Thomson and claims 23 and 27 is that Thomson does not appear to use its apparatus, including its solid body packers, in an open hole wellbore, as disclosed in Ellsworth. However, using Thomson's apparatus in the manner disclosed by Thomson, except that it occurs in an open hole wellbore like those discussed in Ellsworth, would result in the claimed invention.

Patent Owner presents consistent remarks regarding the difference between claims 23 and 27 and the cited references. Patent Owner notes that "Thomson does not disclose positioning the apparatus adjacent an open hole section of the wellbore." 596 PO Resp. 42. Patent Owner observes that "Ellsworth does not disclose forcing wellbore treatment fluid out of a ball activated sliding sleeve port."[19] *Id.* at 43. Patent Owner does not dispute that combining Thomson and Ellsworth's disclosures in the manner suggested by Petitioner would result in the claimed invention. *See* 596 POR 42–43.

[19] Patent Owner also states that "Ellsworth teaches against the use of ball-activated sleeves that are only opened when a ball is dropped downhole and forced against a ball seat with fluid pressure." 596 PO Resp. 42–43. To the extent Patent Owner means to say that Ellsworth teaches away from the sleeves recited in the claims, we are not persuaded that Ellsworth criticizes, discredits, or otherwise discourages the use of the claimed invention. *See In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004).

3. *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 invention was made to a person having ordinary skill in the art to which said subject matter pertains.'" *KSR Int'l Co. v. Teleflex Inc.,* 550 U.S. 398, 405 (2007).

a. The Parties' Contentions

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, petroleum, or chemical engineering and at least 2-3 years of experience with downhole completion technologies related to fracturing." 596 Pet. 10 (citing Ex. 1007 ¶ 43). Petitioner adds that "a person of ordinary skill would have been familiar with various completion systems and stimulation techniques." *Id.* at 10–11 (citing Ex. 1007 ¶¶ 44–52). According to Petitioner, the knowledge of various completion systems and stimulation techniques would have included knowledge of using packers to isolate different zones of a well bore for selective stimulation, citing, as one example, Hutchinson.[20] *See id.* at 6–11 ("Here, the prior art described in Section V above demonstrates that a person of ordinary skill would have been familiar with various completion systems and stimulation techniques.").

Petitioner further asserts that a person of ordinary skill in the art would have recognized hydraulically set solid body packers as preferable to

[20] U.S. Patent No. 4,099,563 iss. July 11, 1978 (Ex. 1010).

cup type and inflatable packers in cased and open hole wells in at least some circumstances. *Id.* at 11 (citing Ex. 1007 ¶¶ 41–42, 51; Ex. 1004, 3; Ex. 1011, 3:67–4:4). Petitioner argues that a person of ordinary skill in the art would have understood that components initially designed for or used in cased wellbores could work in open-hole wellbores in at least some formations. *Id.* at 11 (citing Ex. 1007 ¶¶ 46–52). Indeed, Petitioner asserts that Patent Owner recognizes as much, citing statements made by Kevin Trahan, Patent Owner's expert witness in another proceeding. *Id.* at 11–12 (citing Ex. 1012, 18–19, 27; Ex. 1004, 3).

Patent Owner does not dispute the Petition's assertion that a person of ordinary skill in the art "would have had at least a Bachelor of Science degree in mechanical, petroleum, or chemical engineering and at least 2-3 years of experience with downhole completion technologies related to fracturing." 596 PO Resp. 8. 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 id.* at 8–12.

Patent Owner, however, suggests that the Petition presents an incomplete description of the level of skill in the art. Patent Owner argues that "[p]reparing a wellbore for oil or gas production can be significantly more complicated than simply drilling a hole in the ground." *Id.* at 10.

Relying on declaration testimony of Mr. McGowen and certain deposition testimony of Dr. Daneshy, Patent Owner contends that a person of ordinary skill in the art would have *only* considered cemented casing completion when planning to use multi-stage hydraulic fracturing to

stimulate oil and gas production. *Id.* at 13–16 (citing Ex. 2034, 22–25, 40; Ex. 2016, 30:6–31:3). 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. 2034, 22. Mr. McGowen explains that

> [f]or horizontal stage fracturing, it was thought that issues such as fracture spacing, tortuosity (high pump back pressure due to friction at the fracture initiation point) due to the fracture leaving the wellbore and rapidly changing direction and 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.

Id. at 23. In support of his testimony, Mr. McGowen quotes the disclosure in Emanuele[21] that "[u]nfavorable fracture initiation may cause problems with both fracture execution (screen-out) and with production response, by harming the wellbore-to-fracture connection." Ex. 2042, 9–10; Ex. 2034, 23. Mr. McGowen further asserts that it was believed multiple fractures too close together created complex fracture geometries or tortuosity near the wellbore, resulting in problems with fracturing. Ex. 2034, 25. Citing

[21] M. A. Emanuele, et al., *A Case History: Completion and Stimulation of Horizontal Wells with Multiple Transverse Hydraulic Fractures in the Lost Hills Diatomite*, Chevron U.S.A. Production Company, 1998 (Ex. 2042).

Crosby[22], Mr. McGowen testifies that "[m]any operators thought that the way to minimize fracture tortuosity was to control the fracture initiation process through the use of decreased perforation density . . . . Once again, this approach requires the use of cemented casing and precisely located perforations." *Id.* (citing Ex. 2039).

Arguing that a person of ordinary skill in the art would have viewed plug and perf fracturing as "critical to ensure that fractures are properly spaced" (PO Resp. 15), Patent Owner cites Dr. Daneshy's testimony that

> [i]f you put a fracture at plus 10 (which is 10 feet from that packer, on one side of it) and minus 10 (which is 10 feet from the packer on the other side of it), these two packers are 20 feet apart from each other. They basically drain the same segment of the well. You are not getting as much benefit from this as the case when the fracture is in the 100 feet from the packer on one side and 100 feet from the packer on the other side. Now you are draining 200 feet from them, and draining 200 feet from them gives you more production than only draining 20 feet.

Ex. 2016, 30:6–16. Patent Owner contends that "[t]his could cause a significant loss of production from the well." PO Resp. 16 (citing Ex. 2016, 30:17–31:3; Ex. 2034, 23–25). Patent Owner also argues that in 2007, in a chapter of the Encyclopedia of Hydrocarbon Designs[23], Dr. Daneshy explained that "[t]he main benefit of horizontal holes comes from their long contact with the permeable reservoir. Casing and perforating these holes reduces this contact. However, whenever completion operations require hydraulic fracturing, the horizontal holes are in fact cased, cemented, and

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[22] D.G. Crosby et al., *Methodology to Predict the Initiation of Multiple Transverse Fractures from Horizontal Wellbores*, University of New South Wales, 2001, (Ex. 2039).

[23] Ali Daneshy, *Encyclopedia of Hydrocarbons*. 2007 (Ex. 2002).

perforated to facilitate effective fracturing." Ex. 2002, 190; 596 PO Resp. 18–19.

Based on these assertions and evidence, Patent Owner contends that using cemented casing with plug and perf fracturing was the accepted way to efficiently and effectively do multi-stage fracturing in horizontal wells. *Id.* at 13–16. Indeed, Patent Owner asserts that a person of ordinary skill in the art would have believed that multistage hydraulic fracturing required cemented casing and plug and perf. *Id.* at 13.

Patent Owner also identifies certain other factors that allegedly would have informed the thinking of a person of ordinary skill in the art. Patent Owner contends that a person of ordinary skill in the art would have considered not only ways to save money in completing a well, but associated mechanical and economic risks. 596 PO Resp. 16–18. Patent Owner asserts that "petroleum engineering mistakes . . . can mean the loss of millions of dollars, loss of job, or worse, catastrophic failure and death." *Id.* at 19 (citing Ex. 2034, 18). Patent Owner contends that a person of ordinary skill in the art would have viewed Thomson's apparatus as risky, citing Mr. McGowen's testimony regarding certain challenges discussed in Thomson. *Id.* at 20 (citing Ex. 2034, 28). In particular, Patent Owner emphasizes Mr. McGowen's testimony that "[Thomson] attempts to put a positive spin on these events in the conclusions, but only completing 80% of the stages in a well (particularly a well in the North Sea) more than likely meant that millions of dollars in reserves were lost due to these failures." Ex. 2034, 28; 596 PO Resp. 20. Consequently, Patent Owner asserts that a person of ordinary skill in the art would not have considered using Thomson's

apparatus at all, much less modifying it. *Id.* Patent Owner also argues that a person of ordinary skill in the art would have had reasons other than instability of a formation to cement a wellbore, such as a desire to use plug and perf to control fracture spacing. *Id.* at 18–19.

Petitioner responds that a person of ordinary skill in the art would not have thought cemented casing was required for multistage fracturing of a horizontal wellbore. 596 Pet. Reply 10–14. Petitioner notes that, when deposed, Mr. McGowen admitted that "going *without* cemented casing would have been an option to consider." Ex. 1030, 75:25–76:2 (emphasis added); 596 Pet. Reply 11. Petitioner further argues that

> [Mr. McGowen] also conceded [open hole multistage] fracturing had been conducted using external casing packers and mechanically-shiftable sliding sleeves. [Ex. 1030, 75:25–79:4]. Coon[24] shows (in Fig. 1) and describes such a system, which "gave the operator the option of acid or low-volume sand fracturing." Ex. 1028 at 14/20; *id.* at 13/20 (title); *id.* at 2-3/20 (establishing Coon's pre-invention publication).

596 Pet. Reply 11.

Petitioner also argues that Mr. McGowen does not support adequately his testimony that a person of ordinary skill in the art would have believed cemented casing necessary for successful hydraulic fracturing. 596 Pet. Reply 12–13. For example, Petitioner notes that, contrary to Mr. McGowen's suggestion, Emanuele does not support the testimony that a person of ordinary skill in the art would have believed cemented casing

[24] Robert Coon and Doug Murray, *Single-Trip Completion Concept Replaces Multiple Packers and Sliding Sleeves in Selective Multi-Zone Production and Stimulation Operations*, Society of Petroleum Engineers, 1995 (Ex. 1028).

necessary to avoid the undesirable fracturing discussed in Emanuele. *Id.* at 12 (citing Ex. 1034, 23). Petitioner explains that Emanuele expresses concerns about undesirable fracturing that occurred in cemented and cased wells, not open hole wells. *Id.* (citing Ex. 2042, 10–11, 3–4; Ex. 1031 ¶¶ 31–33).

Indeed, a person of ordinary skill in the art would have understood that the undesirable fracturing that occurred in Emanuele's cemented wellbores was not an issue in open hole wellbores, Petitioner argues. *Id.* at 13 (citing Ex. 1032, 1, 7; Ex. 1031 ¶¶ 38–39, 46–47; Ex. 1033). Petitioner cites Ellis[25] as explaining that fracturing in an open hole can reduce or eliminate the type of undesirable fracturing discussed in Emanuele. *Id.* (citing Ex. 2042, 9–10; Ex. 1032, 1, 7; Ex. 1031 ¶¶ 42–45).

Petitioner also disputes Patent Owner's contention that a person of ordinary skill in the art would have viewed it as too risky to use Thomson's apparatus without a cemented a wellbore. 596 Pet. Reply 8–9; 596 PO Resp. 20. Petitioner argues that the challenges discussed in Thomson that Mr. McGowen characterized as risks were not uncommon for the industry. 596 Pet. Reply 9 (citing Ex. 1031 ¶¶ 11–15, 22). Petitioner further argues that Patent Owner's evidence reflects that using cemented casing with plug and perf posed risks. *Id.* (citing Ex. 2004, 1; Ex. 2001, 3). Petitioner also argues that in his deposition, Mr. McGowen retreated from his declaration that the challenges discussed in Thomson likely resulted in the loss of

[25] P.D. Ellis, et al., *Application of Hydraulic Fractures in Openhole Horizontal Wells*, Society of Petroleum Engineers, 2000 (Ex. 1032).

"millions of dollars in reserves." *Id.* at 15 (citing Ex. 1030, 60:2–61:6, 34:3–39:10, 41:21–24, 44:22–48:14).

Patent Owner responds that "[o]verall, the evidence shows that a [person of ordinary skill in the art] would have had serious concerns about removing Thomson's casing." 596 Surreply 2. Patent Owner argues that Ellis suggests switching from multistage fracturing in a cemented wellbore to single stage fracturing in an open hole wellbore, not multistage hydraulic fracturing in an open hole wellbore. *Id.* at 2–4. Patent Owner contends that "[a]ccording to Ellis, [casing a wellbore] was thought necessary for multi-stage fracturing." *Id.* at 3. Patent Owner bases this on Ellis's disclosure that when a particular well did not produce adequately without stimulation, "the contingency plan to set and cement a liner to pump multiple transverse fractures was implemented." Ex. 1032, 3; 596 Surreply, 2–3.

Patent Owner further argues that Ellis's disclosure fully comports with Mr. McGowen's testimony. 596 Surreply 4. Patent Owner asserts that Mr. McGowen attributed undesirable fracturing to initiation of multiple fractures too close together. *Id.* (citing Ex. 1034, 17, 25). Patent Owner argues that Ellis is consistent with this disclosure because its undesirable fractures resulted from using "high shot density" perforating guns. *Id.* (citing Ex. 1032, 4). Citing Mr. McGowen's testimony, Crosby, and deposition testimony of Dr. Daneshy, Patent Owner asserts that in order to avoid tortuosity, reduced production, and screen outs, a person of ordinary skill in the art "would space the perforations far enough apart to avoid fracture complexity." *Id.* (citing Ex. 2034, 25; Ex. 2039, 2; Ex. 2053, 89:11–22).

Patent Owner argues that Coon supports Patent Owner's position, not Petitioner's. *Id.* at 5. Patent Owner bases this on Coon's disclosure that "[t]he next evolutionary step of the ECP and sliding sleeve completion is the addition of a cased and cemented hole." Ex. 1019, 14; 596 Surreply 5. Patent Owner also argues that other authors also confirm a perception that multi-stage fracturing required cemented casing. 596 Surreply 5. In support of this, Patent Owner cites the statement in Damgaard[26] that "[s]uccessful liner installation and cementation is considered a prerequisite to ensure adequate zonal isolation for multiple fracture treatments in horizontal wells." *Id.* (citing Ex. 2054, 1). Patent Owner also cites the statement in Abass[27] that "[c]asing and cementing a horizontal well is essential to provide zone selectivity and isolation during fracture stimulation." *Id.* (citing Ex. 2055, 9).

In response, Petitioner takes issue with Patent Owner citing Dr. Daneshy's deposition testimony as support for an assertion that a person of ordinary skill in the art would have spaced perforations farther apart to avoid fracture tortuosity and attendant problems. 596 Sur-surreply 1–3. Petitioner explains that Dr. Daneshy stated that it was desired to avoid "complex fractures" in horizontal wells, but was not asked about and did not testify about whether such complex fractures were believed to cause "reduced production and screenouts," as Patent Owner contends. *Id.* Additionally,

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[26] A.P. Damgaard et al., *A Unique Method for Perforating, Fracturing, and Completing Horizontal Wells*, SPE Production Engineering, February 1992 (Ex. 2054).

[27] Hazim H. Abass et al., *A Case History of Completing and Fracture Stimulating a Horizontal Well*, Society of Petroleum Engineers, 1995 (Ex. 2055).

Petitioner notes that Dr. Daneshy testified that although a handful of experts in the world may have recognized the issue of close fractures possibly growing into one another, a person of ordinary skill in the art would not have. *Id.* at 3 (citing Ex. 2053, 78:8–75:15).

b. Analysis of LOSITA as to Multi-Stage Fracturing in Open Holes versus Cemented, Cased Holes

Petitioner persuades us that a person of ordinary skill in the art would have had at least a Bachelor of Science degree in mechanical, petroleum, or chemical engineering, along with at least 2–3 years of experience with downhole completion technologies related to fracturing. 596 Pet. 10; Ex. 1007 ¶ 44–52. Additionally, Petitioner persuades us that a person of ordinary skill in the art would have been familiar with various completion systems and stimulation techniques, including the use of packers for isolation and the option to use successfully solid body packers designed for cased wellbores in at least some open hole wellbores. 596 Pet. 6–9, 46–49; Ex. 1004, 3; Ex. 1007 ¶ 31–52; Ex. 1010; Ex. 1011, 3:67–4:4, 4:35–42; Ex. 1012, 18–19, 27.

Additionally, Petitioner persuades us that, contrary to Patent Owner's suggestion, it would not have been accepted wisdom for a person of ordinary skill in the art to believe that every multistage fracturing stimulation in a horizontal well required a cemented wellbore. Patent Owner's evidence persuades us that cementing a wellbore was a popular approach for multistage fracturing. *See, e.g.,* Ex. 2054, 1; Ex. 2055, 9; Ex. 2034, 23–25. But Mr. McGowen acknowledges, and Patent Owner does not dispute, that open hole multistage fracturing had been done and was a known technique to those of ordinary skill in the art. For example, Patent Owner does not

dispute Petitioner's observation that Coon discloses open hole multistage fracturing. 596 Pet. Reply 11; Ex. 1028, 14; 596 Surreply 5.

In combination with this, Mr. McGowen's admission that omitting cemented casing "would have been an option to consider" refutes Patent Owner's position. Ex. 1030, 75:25–76:2. Mr. McGowen elaborated that he believed the general direction in the field at the time was moving away from the simpler approach of open hole fracturing to developing more complicated methods to control fracture initiation. *Id.* at 76:2–76:18. But that does not support Patent Owner's contention that a person of ordinary skill in the art would have viewed a cemented liner as necessary for multistage fracturing in a horizontal well. *See* 596 PO Resp. 13–16.

Similarly, contrary to Patent Owner's position, Coon's statement that "[t]he next evolutionary step of the ECP and sliding sleeve completion is the addition of a cased and cemented hole" also fails to support a contention that it was accepted wisdom that multistage fracturing required a cemented wellbore. Ex. 1028, 14; 596 Surreply 5. Prior to discussing the different applications (including open hole and cased, cemented hole) of multistage completion equipment, Coon notes that "[c]urrent options are outlined below. Each has its own merits and limitations." Ex. 1028, 13. In other words, Coon indicates that multistage fracturing in open holes and in cased, cemented holes both have merits and limitations.[28]

[28] Indeed, Coon suggests doing "acid or low volume sand fracturing" in an open hole (*id.* at 14), which Mr. McGowen admits is the type of stimulation disclosed in Thomson, i.e., stimulation at relatively low pressures. Ex. 2034, 29. Thus, it appears that Thomson's stimulation likely presented a particularly suitable candidate for open hole execution.

The foregoing documentary evidence and Mr. McGowen's deposition admission demonstrate that the portions of Damgaard and Abass cited by Patent Owner overstate the perceived importance of cementing a wellbore during the period preceding Patent Owner's alleged invention. *See* Ex. 1028, 13–14; Ex. 1030, 75:25–76:2; Ex. 1031 ¶¶ 42–45; Ex. 1032, 1, 7; Ex. 2054, 1; Ex. 2055, 9. Additionally, as Petitioner notes, the *Encyclopedia of Hydrocarbons*, which bears a 2007 copyright notice, does not speak to the period preceding Patent Owner's application for patent. *See, e.g.*, 596 Pet. Reply 8; Ex. 2002, 190. Likewise, when Dr. Daneshy discussed fracture spacing in his deposition (taken in 2016) neither the questions nor Dr. Daneshy's answers addressed what a person of ordinary skill in the art would have known in the timeframe preceding Patent Owner's application for patent. *See, e.g.,* 596 Pet. Reply 13–14; Ex. 2016, 29:17–30:16. Furthermore, as explained above, Emanuele and Crosby do not support Mr. McGowen's testimony about the perceived problems with fracture initiation, and Mr. McGowen cites no other contemporaneous supporting evidence. *See* Ex. 2034, 23–25. The evidence considered as a whole demonstrates that, at the time preceding Patent Owner's application for patent, it was not accepted wisdom that multistage fracturing required cementing a wellbore, at least not for all circumstances.

Additionally, the evidence as a whole persuades us that, contrary to Patent Owner's assertion, a person of ordinary skill in the art would not have viewed Thomson's apparatus, or using it to perform multistage fracturing without a cemented wellbore, as excessively risky. Mr. McGowen cites portions of Thomson discussing certain things that occurred during its

fracturing operations, including Thomson's disclosure that "eight zones out of the original ten were stimulated." Ex. 1002, 4; Ex. 2034, 28. Noting that "[Thomson] attempts to put a positive spin on these events in the conclusions," Mr. McGowen testifies that "only completing 80% of the stages in a well (particularly a well in the North Sea) more than likely meant that millions of dollars in reserves were lost due to these failures." Ex. 2034, 28. When asked to elaborate on whether the alleged risks of Thomson would outweigh its economic rewards, however, Mr. McGowen could only offer that "[t]here's insufficient data in Thomson for anyone to figure that out." Ex. 1030, 60:2–7. Given the admitted lack of specific economic data in Thomson, as well as the absence of any supporting evidence for Mr. McGowen's estimate, we give limited weight to Mr. McGowen's assertion that millions of dollars in reserves were likely lost.

On the whole, the evidence also persuades us that a person of ordinary skill in the art would not have had reason to view Thomson's apparatus as excessively risky in other respects. Patent Owner refers to risk of "catastrophic failure and death," citing Mr. McGowen's declaration testimony about "the Deepwater Horizon/Macondo incident." 596 PO Resp. 19 (citing Ex. 2034, 18). But Patent Owner does not advance any evidence or reasoning that using Thomson's apparatus in a cemented or open wellbore would have presented any greater risk of such a result than other wellbore completions.

More generally, Mr. McGowen characterizes Thomson's discussion of certain obstacles that presented themselves during stimulation as "alarming." Ex. 2034, 28. Dr. Daneshy does not agree. *See* Ex. 1031

¶¶ 14–30. Dr. Daneshy testifies that issues like these commonly present themselves, even with well-proven systems and tools. Ex. 1031 ¶ 22. Dr. Daneshy explains that Thomson's discussion of these issues reflects a proactive preparedness to overcome such issues to implement successfully a new system. *Id.* at ¶ 21. Consistent with this, Thomson amply conveys that the challenges presented were overcome sufficiently, and that its apparatus proved very successful for stimulating wells. Thomson provides the following conclusions regarding use of its apparatus:

> The successful installation of four multiple packer/MSAF completions in chalk formation in the North Sea proved that the system was not only feasible but highly efficient, both from an operational standpoint and from a reservoir treatment standpoint, since the stimulations could be designed and matched to the requirements of each reservoir zone. This ensured that the most cost efficient treatments possible were applied and that there would be no compromise to the effectiveness of the procedures to enhance production. Also, since this completion technique substantially reduces operational time normally required to stimulate multiple zones, 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. 1002, 101.

Consistent with this positive assessment of the apparatus, Thomson indicates that its apparatus successfully stimulated every well, with only a small fraction of one well ultimately unstimulated. *Id.* at 99–100. Thomson discloses that "[a]fter the successful installation of the seven-packer completion in M1 [(the first well)], it was decided to attempt maximization of the number of zones for the next three wells." *Id.* Thomson indicates that

in the next "two wells with ten packers/nine MSAF tools, M5 and M4, the completions were completed without incident." *Id.* at 100. Regarding the final well, "M3," Thomson states that "eight zones out of the original ten were stimulated, and the well was salvaged." *Id.* Thus, out of dozens of well segments, all but two were stimulated successfully. In view of this, absent more compelling supporting evidence, we find unpersuasive Mr. McGowen's suggestion that a person of ordinary skill in the art would have doubted the merits of Thomson's apparatus. *See* Ex. 1034, 28; Ex. 1031 60:2–61:6, 34:3–39:10, 41:21–24, 44:22–48:14.

Regarding the allegedly perceived risks of undesirable and/or ineffective fracturing as a result of using Thomson's apparatus without cementing and performing plug and perf, we find the evidence supports Petitioner's position more so than Patent Owner's. As evidence of concern about undesirable fracture initiation, Mr. McGowen cites Emanuele's statement that "[u]nfavorable fracture initiation may cause problems with both fracture execution (screen-out) and with production response, by harming the wellbore-to-fracture connection." Ex. 2042, 9–10; Ex. 2034, 23. Therefore, Mr. McGowen testifies, cemented wellbores and plug and perf were viewed as necessary because "[u]npredictable results generated by complex fracture geometry near the wellbore was considered to be problematic." Ex. 2034, 23. As Petitioner explains, however, Emanuele discusses unfavorable fracture initiation that occurred in completions using cemented wells with plug and perf. Ex. 2042, 3–4, 10–11; Ex. 1031 ¶¶ 31–33; 596 Pet. Reply 12. Consequently, we find that Emanuele does little to support the contention that a person of ordinary skill in the art would have

viewed it as necessary to cement and plug and perf every well to avoid undesirable fracture initiation. Indeed, Petitioner persuades us that, as Ellis discloses and Dr. Daneshy testifies, a person of ordinary skill in the art would have understood that in at least some circumstances, fracturing in an open hole wellbore can avoid fracture problems caused by cementing and using plug and perf. Ex. 1032, 1, 7; Ex. 1031 ¶¶ 42–45; 596 Pet. Reply 13. On the whole, the evidence demonstrates that at a person of ordinary skill in the art would have viewed the likelihood of successfully using Thomson's apparatus in an open hole wellbore to be at least as great as the likelihood of successfully using the apparatus in a cemented wellbore.

We recognize that Patent Owner takes issue with Ellis because it discusses using single stage open hole fracturing, rather than multistage open hole fracturing, to avoid undesirable fracturing resulting from cementing and using plug and perf. 596 PO Surreply 3–5. We find, however, Patent Owner's emphasis on this distinction unpersuasive. Petitioner relies on the combined teachings of Thomson (which teaches multistage fracturing) and Ellsworth (which teaches open hole completion), not on Ellis, as demonstrating obviousness of multistage open hole fracturing. Moreover, Patent Owner does not provide persuasive evidence that a person of ordinary skill in the art would have believed that even though using open hole fracturing would avoid undesirable fracturing in a single-stage operation, it would not in a multistage operation.

4. *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 Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 415 (2007). 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 reason must be shown as to why a person of ordinary skill would have combined or modified 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).

Petitioner argues that it would have been obvious to use Thomson's apparatus in an open hole section of a wellbore. 596 Pet. 46–49. Petitioner argues that the efficiency and cost savings associated with not cementing the wellbore would have motivated a person of ordinary skill in the art to use Thomson's apparatus in an open hole wellbore. *Id.* at 48 (citing Ex. 1007 ¶¶ 47–49, 75; Ex. 1004, 9; Ex. 1002, 101). In this vein, Petitioner notes that Ellsworth discloses "cost effective use of horizontals can be enhanced with the ability to segment, and control production without the need to run and cement liners." Ex. 1004, 9; 596 Pet. 48. Petitioner also argues that Ellsworth teaches that, although inflatable packers historically had been used to provide isolation in open hole wellbores, solid body packers could be used

to successfully isolate segments of open hole wellbores. 596 Pet. 46–48 (citing Ex. 1004, 1, Abstract, 3; Ex. 1007 ¶¶ 41–42). Petitioner asserts that using Thomson's apparatus in an open hole wellbore would have been a straightforward task for a person of ordinary skill in the art, and would have yielded predictable results. *Id.* at 48 (citing Ex. 1007 ¶¶ 52, 75).

Patent Owner argues that a person of ordinary skill in the art "would not have modified the prior art as proposed by" Petitioner. 596 PO Resp. 48. Patent Owner offers several explanations for this. First, Patent Owner argues that Petitioner "improperly *assume*[*s*] that a [person of ordinary skill in the art] would have recognized that multi-stage open hole fracturing was even an option in the first place." 596 PO Resp. 47. We find this argument unpersuasive. As noted above in Section III.C.3, Coon discloses open hole multistage fracturing (Ex. 1028, 14), and Mr. McGowen acknowledges that open hole fracturing "would have been an option to consider" (Ex. 1030, 75:25–76:2).

Patent Owner further argues that even if a person of ordinary skill in the art would have recognized the possibility of using Thomson's apparatus in an open hole like that disclosed by Ellsworth, a person of ordinary skill in the art would not have used such an apparatus for fracture treatments. 596 PO Resp. 48–49. In connection with this, Patent Owner reiterates that "conventional wisdom was that cemented casing was necessary to produce effective fractures" (*id.* at 47) and that Thomson contains "numerous indications" that its apparatus "had serious risks and expense problems" (*id.* at 49). For the reasons discussed above in Section III.C.3, the evidence persuades us that (1) the accepted wisdom of a person of ordinary skill in the

art did not include believing that cementing a wellbore was necessary, and (2) the alleged risks of Thomson's apparatus would not have dissuaded a person of ordinary skill in the art.

On the whole, the evidence of record persuades us that a person of ordinary skill in the art would have had reason to use Thomson's apparatus in an open hole wellbore. We find that the option to save time and cost by not cementing a wellbore would have presented significant reason to use Thomson's apparatus in an open hole. *See, e.g.*, Ex. 1007 ¶¶ 47–49, 75; Ex. 1004, 9; Ex. 1002, 101. Indeed, Patent Owner does not dispute that saving time and cost would provide significant incentive to perform stimulation in an open hole wellbore. *See* 596 PO Resp. 47. Instead, Patent Owner suggests that certain accepted wisdom and perceived risks would have dissuaded a person of ordinary skill in the art from using Thomson in an open hole wellbore. *See id.* at 46–49. For the reasons explained immediately above and in Section III.C.3, Petitioner persuades us to the contrary.

Moreover, Petitioner persuades us that a person of ordinary skill in the art would have had a reasonable expectation of success in using Thomson's apparatus in an open hole wellbore. Patent Owner does not dispute Petitioner's assertion that a person of ordinary skill in the art would have expected solid body packers to provide effective isolation in an open hole wellbore in at least some formations. *See* 596 Pet. 11–12; PO Resp. 7–49; Ex. 1007 ¶¶ 41–42, 51; Ex. 1004, 3.

Additionally, Petitioner persuades us that a person of ordinary skill in the art would have had a reasonable expectation of success in stimulating an

open hole wellbore using Thomson's apparatus. As discussed in Section III.C.3 above, Mr. McGowen cites Emanuele in support of his testimony that a person of ordinary skill in the art would have had concerns about undesirable fracturing. Ex. 1034, 23 (citing Ex. 2042). But as Petitioner notes, Emanuele discusses concerns arising when using a cemented liner and stimulating a wellbore. 597 Pet. Reply 12; Ex. 2042, 10–11, 3–4; Ex. 1031 ¶¶ 31–33. And Ellis explains that fracturing in an open hole can reduce or eliminate the type of undesirable fracturing discussed in Emanuele. *Id.* (citing Ex. 2042, 9–10; Ex. 1032, 1, 7; Ex. 1031 ¶¶ 42–45). This evidence indicates that, when using Thomson's apparatus, a person of ordinary skill in the art might expect better success by stimulating in an open hole in at least some circumstances. Moreover, the evidence as a whole indicates that even if those of ordinary skill in the art might have expected some potential challenges with open hole multistage fracturing and cased hole multistage fracturing, a reasonable expectation of success still exists with both. After all, Patent Owner strenuously emphasizes the popularity of cemented wellbores in the industry, notwithstanding Emanuele's disclosure that challenges can arise with this approach.

Patent Owner argues that it would not have been obvious to use Thomson's apparatus in an open hole wellbore because then one would have "no guarantee that you're going to have a successful frack job." Tr. 41:9–13. Contrary to Patent Owner's understanding, obviousness does not require absolute predictability. *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 show obviousness. All that is required is a reasonable expectation of success.").

5. *Objective Indicia of Non-Obviousness*

Patent Owner presents evidence of objective indicia of non-obviousness, including proceeding contrary to accepted wisdom, 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). We begin our analysis by considering Patent Owner's evidence of nexus.

a. *Nexus*

The parties dispute whether Patent Owner has demonstrated a nexus between claims 23 and 27 and Packers Plus's StackFRAC, as well as Baker Hughes's FracPoint system. 596 PO Resp. 37–39; 596 Pet. Reply 16–18. Patent Owner has not provided evidence persuading us of a nexus of the StackFRAC or FracPoint apparatuses to claim 23. Whereas Mr. McGowen provides claim charts outlining how he believes the StackFRAC and FracPoint apparatuses meet the limitations of claim 27, he does not do so with respect to claim 23. *See* Ex. 2034, 7, 43, Ex. A, Ex. B. And Patent Owner does not otherwise provide evidence persuading us that the StackFRAC or FracPoint systems meet the limitations of claim 23. *See* 596 PO Resp. 37–39.

However, Patent Owner's evidence shows that the apparatus limitations in claim 27 read on the StackFRAC apparatus sold by Packers Plus. Ex. 2034, 7, 43, Exhibit A; *see also* Ex. 2029 ("StackFRAC systems use RockSEAL® hydraulically set mechanical packers to isolate zones together with ball-actuated hydraulically activated FracPORT™ sleeves."). Additionally, Patent Owner presents evidence persuading us that the StackFRAC apparatus is designed to be suitable for open hole fracturing. *See* Ex. 2013 (explaining that the "StackFRAC system is designed to provide open hole fracturing").

Regarding FracPoint, Petitioner suggests that, contrary to the indication in Exhibit B of Mr. McGowen's declaration, the FracPoint apparatus does not include "at least one of the first, second and third packer being a solid body packer each including multiple packing elements" (Ex. 1001, 16:51–53), as recited in claim 24 and required by claim 27. *See* 596 Pet. Reply 18. For purposes of this decision, we will assume without deciding that Patent Owner has demonstrated the FracPoint apparatus meets the apparatus limitations of claim 27.

Of course, claim 27 is a method claim that not only requires using certain apparatus, but also performing certain method steps with the apparatus. In particular, claim 27 requires "running the tubing string into a wellbore in a desired position for treating the wellbore" (Ex. 1001, 16:65–66), "wherein when in a desired position the apparatus is adjacent an open hole section of the wellbore and the packers are set to seal the annulus between the apparatus and the wellbore wall" (*id.* at 17:17–20). Petitioner argues that Patent Owner does not establish a nexus between claim 27 and

the StackFRAC and FracPoint apparatuses because Patent Owner does not demonstrate that Packers Plus or Baker Hughes performed any of the method steps of claim 27 using StackFRAC or FracPoint. 596 Pet. Reply 17.

Although Patent Owner does not establish that Packers Plus or Baker Hughes themselves performed the method of claim 27, Patent Owner provides evidence persuading us that in at least some instances, the apparatuses they sell are installed by others in open hole wellbore sections, in accordance with the method steps of claim 27. For example, whereas claim 27 recites "when in a desired position the apparatus is adjacent an open hole section of the wellbore" (Ex. 1001, 17:17–19), 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. The Packers Plus advertisement goes on to describe that the RockSEAL II solid-body packer "has a specially designed elastomer with the largest possible cross section to provide excellent expansion ratios for setting in oversized holes." Ex. 2017, 3. This description is consistent with "the packers are set to seal the annulus between the apparatus and the wellbore wall," as recited in claim 27. Ex. 1001, 17:19–20. Thus, although Packers Plus itself may not install the StackFRAC system, we are persuaded there is a nexus to claim 27, at least in those instances where a StackFRAC system is installed in an open hole section of a wellbore, in accordance with claim 27.

Regarding FracPoint, Baker Hughes documents disclose use of the apparatus in an open hole wellbore. For example, Patent Owner notes that Exhibit 2018 discloses that using FracPoint "eliminated the need for cementing the liner, coiled tubing operations, and wireline operations, while significantly reducing overall pumping time." Ex. 2018, 1; 596 PO Resp. 38. Patent Owner similarly notes Ex. 2019's statement that FracPoint "[e]liminates perforating & liner cementing operations." Ex. 2019, 12; 596 PO Resp. 38. Petitioner counters that these documents also discuss uses of FracPoint outside the scope of claim 27. 596 Pet. Reply 18. For example, Petitioner notes, Exhibit 2019, discusses using FracPoint in "[o]pen or cased hole applications" and in "[h]orizontal, vertical, or deviated wellbores." Ex. 2019, 12; 596 Pet. Reply 18. On the whole, the evidence persuades us that at least some FracPoint apparatuses are used in open hole wellbores. Accordingly, given our assumption that the FracPoint apparatus meets the apparatus limitations of claim 27, we assume that there is a nexus between FracPoint and claim 27 in at least those instances where FracPoint apparatuses are used in an open hole wellbore.

b. *Commercial Success*

In asserting commercial success of the patented invention, Patent Owner relies on its own commercial success, as well as Baker Hughes's. 596 PO Resp. 34–37. Patent Owner argues that "the Patented technology has generated hundreds of millions of dollars in annual revenue for Packers Plus," and that Petitioner has "been well positioned to profit from using the claimed invention." *Id.* at 35.

In support of Patent Owner's alleged commercial success with the patented invention, Patent Owner relies principally on the testimony of Packers Plus's Chief Financial Officer, J.J. Giraldi. Ex. 2035; 596 PO Resp. 24, 35. Mr. Giraldi 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." Ex. 2037, 1; 2038. Mr. Giraldi states further that Packers Plus is "generating [redacted] in annual U.S. revenue," and that "[t]he StackFRAC system has been critical to that success." *Id.*

Regarding Baker Hughes, Patent Owner argues that "between late 2008 and early 2015 Baker Hughes has generated over [redacted] dollars in U.S. revenue from FracPoint." 596 PO Resp. 35–36 (citing Ex. 2034, 42). From 2005 to 2012, Patent Owner argues, Baker Hughes claims installation of "over 40,000 FracPoint sleeves in North America." *Id.* at 35 (citing Ex. 2020, 6). Additionally, Patent Owner asserts that there has been a significant growth rate for the installation of FracPoint sleeves. *Id.* at 35–36 (citing Ex. 2020, 6).

Patent Owner argues that analysts have noted that open hole multistage fracturing has significantly impacted the hydraulic fracturing market. *Id.* at 36. In support of this, Patent Owner cites Exhibit 2011, which identifies open hole multistage and plug and perf as the "two most popular methods for stimulating horizontal multistage completions." Ex. 2011, 2; 596 PO Resp. 36. Patent Owner further argues that some experts believe open hole multistage fracturing did not emerge as the leading

fracturing method only because plug and perf represents "an historical comfort zone," not because of a technical advantage of plug and perf. 596 PO Resp. 36 (citing Ex. 2001, 5 ("The P&P technique is the more widely utilised approach; this likely reflects a reluctance to move from an historically established comfort zone to an unknown lower completion approach.")).

Patent Owner also argues that [redacted] 596 PO Resp. 36 (citing Ex. 2021, 10). Patent Owner further asserts that [redacted] *Id.*

Patent Owner argues that Dr. Daneshy has confirmed the commercial success of StackFRAC and FracPoint. 596 PO Resp. 37 (citing Ex. 2017, 94:2–96:5). Patent Owner adds that multiple Baker Hughes shareholder reports have touted the success of FracPoint. *Id.* (citing Ex. 2026, 5; Ex. 2027, 6–7; Ex. 2028, 13).

Petitioner's counterarguments generally suggest that Patent Owner's evidence lacks sufficient authenticity, support, and detail to demonstrate commercial success of the claimed invention. 596 Pet. Reply 21–26. Petitioner notes that Mr. Giraldi's testimony regarding Patent Owner's gross revenue omits underlying data and includes no detail regarding what the revenue was for. *Id.* at 21 (citing Ex. 2035, 1). Additionally, Petitioner notes that Patent Owner cites data about Patent Owner and Baker Hughes

selling StackFRAC and FracPoint apparatus, but does not purport that either Patent Owner or Baker Hughes actually installed the apparatus in wellbores, as required by claim 27.[29] *Id.* at 21–23, 26 (citing Ex. 2035, 1; Ex. 1030, 132:9–139:2; Ex. 2026; Ex. 2027; Ex. 2028). Additionally, Petitioner argues that Patent Owner does not provide evidence of market share or relevant market. *Id.* at 23.

Petitioner also faults Patent Owner's characterization of Exhibits 2001, 2011, and 2021 as allegedly providing evidence of the commercial success of the claimed invention. *Id.* at 24–26. Contrary to Patent Owner's characterization, Petitioner argues that Exhibit 2001 says nothing to the effect that plug and perf did not enjoy technical superiority to open hole multistage fracturing. *Id.* at 24 (citing 596 PO Resp. 37). Petitioner argues that Patent Owner overlooked a number of passages in Exhibit 2001 that discuss advantages of plug and perf, as well as disadvantages of open hole multistage fracturing. *Id.* at 24–25 (citing Ex. 2001, 3–5). Petitioner indicates that Exhibit 2011's discussion of open hole multistage completions includes the use of apparatus with packers (*e.g.*, inflatable packers) that do not constitute solid body packers with multiple packing elements, as required by claim 27. *See id.* at 25 (citing Ex. 2011, 2; Ex. 1030, 111:14–112:12, 113–114:18, 152:2–22; Ex. 1028, 14). Petitioner argues that Mr. McGowen interprets the revenue figures in Exhibit 2021 as apparatus sales only. *Id.* at 25–26 (citing Ex. 1030, 143:1–144:16). Petitioner further argues that Mr. McGowen acknowledges the revenue figures in Exhibit 2021

[29] As noted above in Section III.C.5.a, the evidence of record does not demonstrate a nexus for claim 23. Accordingly, we limit our discussion of commercial success to claim 27.

may include sales of apparatus outside the scope of claim 27, and that the 2012 revenue figure is only an estimate. *Id.* at 26 (citing Ex. 1030, 143:1–144:6, 145:18–148:15).

In view of the evidence of record, we do not find commercial success of the claimed invention. For several reasons, the evidence regarding Packers Plus's sales does not support a finding of commercial success. Mr. Giraldi, testifies that Packers Plus's annual revenue is [redacted], but fails to state what part of 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.

Additionally, as explained in Section III.C.5.a above, although we find a nexus between the StackFRAC system and the invention in claim 27 in those instances where the StackFRAC system is used in accordance with the method steps of claim 27, the evidence does not inform us how much of Packers Plus's revenue ties to uses of the StackFRAC apparatus in accordance with the method steps of claim 27, which are directed to "open hole" treatment. In this vein, we note that Packers Plus itself touts StackFRAC as "designated for open and cased hole stimulation," listing "[o]pen and cased hole horizontal and vertical wells" as "[a]pplications" of the StackFRAC multi-stage fracturing system. Ex. 2017, 4. Thus, the evidence does not demonstrate, even remotely, how much of Packers Plus's revenue is actually associated with the practice of the claimed invention as a

whole.[30] This weighs especially heavily against finding commercial success because Thomson's disclosure meets all of the apparatus limitations of claim 27. *See* Section III.B, *supra*; *Richdel, Inc. v. Sunspool Corp.*, 714 F.2d 1573, 1580 (Fed. Cir. 1983); *Classco, Inc. v. Apple, Inc.*, 838 F.3d 1214, 1220 (Fed. Cir. 2016).

Moreover, even if the evidence demonstrated the amount of revenue attributable to uses of StackFRAC in accordance with claim 27, Patent Owner does not provide evidence demonstrating the relevant market. Instead, Patent Owner asserts that "there is no requirement that a patentee demonstrate that the patented invention is the only product in the market or even that it is the most popular product in the market." 596 PO Resp. 34–35 (citing *Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1054 (Fed. Cir. 2016)). Patent Owner characterizes *Apple* as "finding that the iPhone has been commercially successful despite the fact that it is not the dominant phone in the smartphone market." *Id.* at 35.

We find Patent Owner's reliance on *Apple* unavailing. *Apple* addressed the issue of whether a nexus existed, not whether commercial success existed. *See Apple*, 839 F.3d 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,

[30] Regarding Dr. Daneshy's affirmative response to the question "[w]ould you say that StackFRAC has been commercially successful?" (Ex. 2016, 95:23–96:2), this also provides little or no support for the commercial success of the claimed invention as a whole, which requires using StackFRAC in a certain way.

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 method of claim 27 (Section III.C.5.a). Patent Owner's citation of *Apple* does not persuade us that we should also find commercial success in spite of the lack of persuasive evidence that use of StackFRAC in accordance with claim 27 has been significant in the relevant market.

Likewise, we find that the evidence regarding Baker Hughes's sales of FracPoint apparatus does not 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* Ex. 2034, 42; Ex. 2036, 42; Ex. 2049; Ex. 2081, 25–27; Ex. 2084, 25–27. Moreover, even if we assume Baker Hughes's estimate of FracPoint revenue is accurate, the evidence does not support a finding of commercial success of the claimed invention as a whole. As noted in Section III.C.5.a above, for purposes of this decision, we assume that the FracPoint apparatus meets the apparatus limitations of claim 27. Based on that assumption, we find a nexus between claim 27 and FracPoint for those instances involving use of the apparatus in accordance with the method of claim 27. But, as was the case with StackFRAC, the evidence regarding FracPoint apparatus sales does not demonstrate, even remotely, how much of the sold FracPoint

apparatus is used in accordance with claim 27.[31] In this vein, we note that the applications identified for FracPoint include "open or cased holes." Ex. 2019, 12.[32] Here again, this weighs especially heavily against finding commercial success because Thomson's disclosure meets all of the apparatus limitations of claim 27. *See* Section III.B, *supra*; *Richdel*, 714 F.2d at 1580; *Classco*, 838 F.3d at 1220.

Regarding Patent Owner's assertion of a "significant impact" in the hydraulic fracturing market from "open hole multistage fracturing systems," even if accurate, this offers little or no support for the commercial success of the claimed invention as a whole. *See* 596 PO Resp. 36 (citing Ex. 2011). Claim 27's invention as a whole involves more than an "open hole multistage fracturing system." For example, in the method of claim 27, the apparatus includes "a first packer . . . , a second packer . . . ; [and] a third packer . . . at least one of the first, second and third packer being a solid body packer each including multiple packing elements." Ex. 1001, 16:41–53. The evidence does not demonstrate that generic "open hole multistage fracturing systems" practice this (or other apparatus limitations of claim 27). Indeed, Mr. McGowen admits that open hole multistage fracturing had been done, albeit with different equipment than that recited in claim 27. Ex.

[31] Regarding Dr. Daneshy's affirmative response to the question "[w]ould you say Fracpoint's been commercially successful?" (Ex. 2016, 96:2–5), this also provides little or no support for the commercial success of the claimed invention as a whole, which requires using a stimulating apparatus in an open hole.

[32] Exhibit 2019, a 22-page slide deck bearing Baker Hughes markings, is improperly labeled as Exhibit 2016. Exhibit 2016 is a deposition of Dr. Daneshy.

1030, 75:25–79:4. Thus, even if "open hole multistage fracturing" has been commercially successful, this does not demonstrate commercial success of the claimed invention as a whole.

c. *Industry Praise*

Asserting that the StackFRAC system accounts for "the vast majority of Packers Plus'[s]" [redacted] annual U.S. revenue, Patent Owner argues that a variety of media sources, technical journals, and industry analysts have praised the StackFRAC system. 596 PO Resp. 24–28 (citing Exs. 2001, 2005–2009, 2020–2022, 2033–2037). Patent Owner argues, for example, that a confidential industry report by [redacted], obtained from a competitor, Baker Hughes, [redacted] *Id.* at 27–28 (citing Ex. 2021). Patent Owner also asserts that 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 28 (citing Ex. 2021, 4). Patent Owner argues further that Schlumberger, allegedly the largest oil and gas service company in the world, negotiated for and credited Packers Plus's technologies as facilitating the development of Schlumberger's StageFRAC multistage fracturing service for horizontal wells. *Id.* (citing Ex. 2022, 1) ("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 criticizes Patent Owner's allegations of praise by arguing that the cited documents do not praise the use of StackFRAC in accordance with the claimed method. 596 Pet. Reply 18–21. Instead, Petitioner argues that all of the documents "are focused on the StackFRAC system, already taught by Thomson . . . , rather than on [use of the StackFRAC system in accordance with claim 27]." *Id.* at 18.

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. 2005. Petitioner argues that this statement does not explicitly refer to using StackFRAC in an open hole, asserting that Thomson can be considered an "open hole" system because one could use it in an open hole. 596 Pet. Reply 20. We agree with Petitioner that "open hole ball drop systems" appear to have application in both open and cemented holes. *See, e.g.*, Ex. 2017, 4 ("StackFRAC® systems are designated for open and cased hole stimulation."). Nonetheless, we believe this particular article implies praise for actually using the system

in open holes to "unlock[] old resource plays that were thought to be too expensive or too technically challenging to tap." Ex. 2005.

Other examples of Patent Owner's evidence provide less convincing support for Patent Owner's assertion of industry praise. For instance, Canadian OilPatch Technology Guidebook (Ex. 2006) "profiled Packers Plus and its StackFRAC technology." 596 PO Resp. 26. This article describes Packers Plus as a "[m]ultistage fracking pioneer" that "revolutionized the completions sector." Ex. 2006. 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 that Thomson touts its ability to provide the same advantage of facilitating the performance of a number of fracturing stages, the persuasive value of Patent Owner's evidence of industry praise is somewhat diminished. *See, e.g.*, Ex. 1002, 97, Abst.; Ex. 1007 ¶ 67.

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 '505 patent.

d. *Copying*

We turn to Patent Owner's allegations of copying. 596 PO Resp. 29–34. 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 well completion. Ex. 2025. The other is labeled "Iso-Frac System," apparently the name (at one time) for Baker Hughes's competing system. Ex. 2024, 13. Patent Owner contends that Baker Hughes simply "replaced the Packers Plus logo and slogan with [the Baker Hughes] internal name for their competing system, which they deem to be 'equivalent.'" 596 PO Resp. 30. Patent Owner argues further that Baker Hughes's FracPoint system employs the same components as used in Packers Plus's StackFRAC system. *Id.* at 32–34.

Petitioner argues that the similarity between the FracPoint and StackFRAC systems does not show that Baker Hughes copied the use of the apparatus in an open hole, which claim 27 requires. 596 Pet. Reply 26–27. Additionally, Petitioner argues that "copying is only equivocal nonobviousness evidence in the absence of more-compelling objective indicia of other secondary considerations." *Id.* at 27 (citing *Ecolochem, Inc. v. S. Cal. Edison Co.*, 227 F.3d 1361, 1380 (Fed. Cir. 2000)).

Comparing the technical drawings in Exhibits 2024 and 2025, we are persuaded that Patent Owner's evidence creates an inference that Baker Hughes copied to some degree Packers Plus's StackFRAC system and

brought to market a similar and competing product—Iso-Frac. *Compare* Ex. 2024, 13, *with* Ex. 2053, 1. Regarding Petitioner's argument that the evidence does not show Baker Hughes copied the use of the apparatus in an open hole, we note that the bottom of the technical drawings in both Exhibits 2024 and 2025 specifies a "152.40mm Open Hole." Ex. 2024, 13; Ex. 2025, 1. On the whole, Patent Owner has provided persuasive evidence of some degree of copying, at least by Baker Hughes, and therefore we determine that such copying, as a factor tending towards non-obviousness, is accorded some weight. *See, e.g., Iron Grip Barbell Co., Inc. v. USA Sports, Inc.*, 392 F.3d 1317, 1325 (Fed. Cir. 2004) (copying may be demonstrated by access to and substantial similarity to patented product). Regarding Petitioner's argument about the equivocal nature of copying evidence, we take this into account in our overall analysis of obviousness.

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

Patent Owner argues that the claimed technology proceeded contrary to accepted wisdom at the time of the invention, and that the technology demonstrated unexpected results. 596 PO Resp. 21–24. Patent Owner suggests that the accepted wisdom at the time of the invention viewed it as necessary to use perforated casing to produce carefully spaced "disc-shaped 'bi-wing' fractures." *Id.* at 21. For the reasons explained in Section III.C.3 above, Petitioner persuades us that this was not the accepted wisdom at the time of the invention.

Additionally, the evidence of record does not support Patent Owner's assertion of unexpected or surprising results. Patent Owner argues that a

2006 Packers Plus document reporting the results of hundreds of open hole jobs noted that

> [w]hat has been witnessed in the field is when the horizontal wellbore is partitioned, each compartment has a unique pressure signature for fracturing and or stimulating. (Figure 2) This unique pressure signature for each stage provides real time evidence that the packers are providing the mechanical diversion for which they are designed. If the fracture or stimulation was going past the packer, then the pressures would be the same for the adjacent interval.

Ex. 2004, 3. Patent Owner's position derives little support from this statement, which discloses the technology works as desired, but does not disclose that the result was unexpected.

Patent Owner also asserts that Packers Plus "published microseismic data indicating just how effectively the patented technology has been able to generate fractures." 596 PO Resp. 22–23. According to the Packers Plus document publishing the microseismic data, it has "proven out key features of the StackFRAC Multi-Stage Fracturing System," including "[f]racture initiation between packers proving mechanical isolation" and "[f]ull coverage of the wellbore with specifically located stimulation." Ex. 2017, 4. This evidence also provides little support for Patent Owner's assertion of unexpected results. Here again, the evidence discloses that using StackFRAC provided the desired results. For example, the statement that testing had "proven out" the results of using StackFRAC conveys that using the system had provided the intended result. But it conveys little or no surprise, suggesting instead that the tests proved the expected operation of

the system.[33] Ex. 2017 does not corroborate Mr. McGowen's unsupported assertion that the results were "astonishing." Ex. 2034, 41.

Patent Owner also 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. 596 PO Resp. 22 (citing Ex. 2003 ("The Barnet Shale Paper")). The Barnett Shale paper explains that open hole multistage completions in the Barnett shale formation in Texas apparently outperformed cemented liner completions based on cost savings, improved fracture stimulation, and well production. Ex. 2003, 3. Once again, this evidence shows that open hole multistage fracturing performed as desired in a shale formation, but does not necessarily show that such results were unexpected or surprising. One of ordinary skill in the art would have known from at least Coon and Ellis that open hole multistage stimulation could be done, and that open hole stimulation held significant promise relative to cemented multistage fracturing using plug and perf. *See, e.g.,* Ex. 1028, 14; Ex. 1032, 1, 7; Ex. 1031 ¶¶ 42–45. On the whole, the evidence of record does not support a finding that the claimed invention produced unexpected results.

6. *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

[33] Moreover, Exhibit 2017 discloses that "StackFRAC® systems are designated for open and cased hole stimulation." Ex. 2017, 4. Thus, even if Exhibit 2017 disclosed unexpected results, it appears they would not be specifically for open hole multistage fracturing, as Patent Owner suggests. *See, e.g.,* 596 PO Resp. 23.

the differences between the prior art and claims 23 and 27, weigh heavily in favor of Petitioner's contention that claims 23 and 27 would have been obvious. As explained above in Section III.C.2, the only difference between Thomson and claims 23 and 27 is that Thomson's apparatus is used in a cased wellbore, not an open wellbore. Ellsworth discloses use of an apparatus like Thomson's in open hole wellbores in at least some circumstances, indicating that Thomson's apparatus would have been expected to successfully achieve sealing between its solid body packers and an open hole wellbore. *See, e.g.*, Ex. 1004, 4–6, 9; Ex. 1007 ¶¶ 41–42; 596 Pet. 47–48. Additionally, Thomson suggests that its apparatus provides desirable time and cost savings, noting that "[a]s more experience is obtained with the system, increased efficiency will undoubtedly be generated." Ex. 1002, 101. In this vein, Ellsworth's "Summary" discloses that the ability to use equipment like Thomson's without running and cementing liners furthers the goal of cost effective use of horizontal wellbore segments. Ex. 1004, 9. Performing operations in an open hole wellbore provides advantages in the form of reduced time and complexity, as compared to casing the wellbore. *See, e.g.*, Ex. 1002, 1. Disclosures like this contribute to a compelling motivation to use Thomson's apparatus again, and to do so in an open hole wellbore. *See also* Ex. 1007 ¶¶ 47–49, 75.

The level of ordinary skill in the art also weighs in favor of Petitioner's assertion that claims 23 and 27 would have been obvious. For the reasons explained immediately above and in Section III.C.4, we are persuaded that a person of ordinary skill in the art would have viewed it as

desirable to use Thomson's apparatus in an open hole wellbore. And although cased hole completions apparently enjoyed popularity as a 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 in at least some circumstances.[34] *See* Sections III.C.3, III.C.5.e. Additionally, for the reasons explained in Sections III.C.3, III.C.5.e, and III.C.4, we find that a person of ordinary skill in the art would have had a reasonable expectation of success in implementing Thomson's apparatus within an open hole. That some might not have thought it appropriate to perform open hole multi-stage fracturing in all circumstances is not determinative. *See KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 416 (2007) ("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 copying weighs against obviousness. *See* Section III.C.5.d. Patent Owner's evidence of industry praise also weighs in favor of non-obviousness, though to a lesser extent because some of that evidence may relate at least somewhat to factors other than the claimed invention as a whole. *See* Section III.C.5.c. The other evidence of objective indicia of non-obviousness does not weigh in favor of Patent Owner. *See* Sections III.C.5.b and III.C.5.e.

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[34] Consistent with this, the '505 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, 2:31–34.

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 23 and 27 would have been obvious.

D. Alleged Obviousness of Claim 15 over Thomson and Hartley

Claim 14 depends from claim 1 and recites "wherein the second sleeve has formed thereon a seat and the means for moving the second sleeve includes a sealing device selected to seal against the seat." *Id.* at 15:32–35. Claim 15 depends from claim 14 and recites "wherein the sealing device is a plug." *Id.* at 15:38–39.

Petitioner asserts that Thomson discloses these limitations of claims 14 and 15. 596 Pet. 37–38, 40. Petitioner argues that Thomson discloses a ball for actuating its MSAF tool, and that this ball corresponds to the sealing device recited in claim 14, as well as the plug recited in claim 15. *Id.* Petitioner further argues that to the extent Thomson's ball does not constitute a plug "it would have been obvious to use the plug of Hartley (Ex. 1003) in place of Thomson's ball to actuate the sliding sleeves of the MSAF tools." *Id.* at 45. In support of this, Petitioner argues that "Hartley uses its plug 96 to seal its seat 94 and shift its sliding sleeve from a closed position to an open position." *Id.* at 46 (citing Ex. 1003, 4:65–5:1, 7:57–8:8, Figs. 2–3; Ex. 1007 ¶ 74). Thus, Petitioner argues, Hartley's plug 96 serves the same purpose as Thomson's ball. *Id.* (citing Ex. 1007 ¶ 74). Consequently, Petitioner argues, a person of ordinary skill in the art would have recognized Hartley's plug 96 as an alternative that could be substituted for Thomson's ball in a straightforward manner with predictable results. *Id.* (citing Ex.

1007 ¶ 74). We determine that Petitioner has demonstrated obviousness of claim 15 over Thomson and Hartley by a preponderance of the evidence.

We find unpersuasive Patent Owner's only argument to the contrary. Patent Owner's only dispute regarding the alleged obviousness of claim 15 is the argument that Petitioner did not demonstrate that Thomson discloses solid body packers with multiple packing elements.[35] 596 PO Resp. 50–53. For the reasons explained above in Section III.B.2, we find this argument unpersuasive.

E. Alleged Obviousness of Claims 1–7, 11, 14–22, and 24–26 over Thomson and Brown

Petitioner argues that even if Thomson did not disclose packers meeting the packer-related elements of claims 1–7, 11, 14–22, and 24–26 (*see* Section III.B.2, *supra*), it would have been obvious to substitute Brown's retrievable packer in place of Thomson's retrievable packers. 596 Pet. 53–59; 596 Pet. Reply 3–5. Petitioner explains how it believes certain limitations of the claims would be met by Brown's packers. *Id.* Patent Owner counters that a person of ordinary skill in the art would not be motivated to replace Thomson's retrievable packers with Brown's. 596 PO Resp. 55–60. We find that Petitioner has demonstrated by a preponderance of the evidence that claims 1–7, 14–22, and 24–26 would have been obvious in view of Thomson and Brown. Because we find it persuasive, we adopt as

[35] With respect to Petitioner's challenge of claims 23 and 27 as allegedly obvious over Thomson and Ellsworth, Patent Owner advances objective evidence of non-obviousness. 596 PO Resp. 20–39. With respect to Petitioner's challenge of claim 15 as allegedly obvious over Thomson and Hartley, however, Patent Owner advances no such evidence or arguments. *See id.* at 50–55.

our own Petitioner's explanation of why claims 1–7, 14–22, and 24–26 would have been obvious over Thomson and Brown. 596 Pet. 53–59, 27–45 (explaining how Thomson discloses certain limitations); 596 Pet. Reply 3–5. We find that Petitioner has not demonstrated by a preponderance of the evidence that claim 11 would have been obvious in view of Thomson and Brown. We turn now to a summary of Brown, followed by detailed discussion of salient aspects of the parties' dispute regarding Petitioner's obviousness contentions.

1. *Brown*

Brown discloses "a well packer which is retrievably anchored or 'set' in a subsurface location within a well casing or other well conduit." Ex. 1006, 1:7–10. Figures 1 and 2 of Brown are reproduced below.

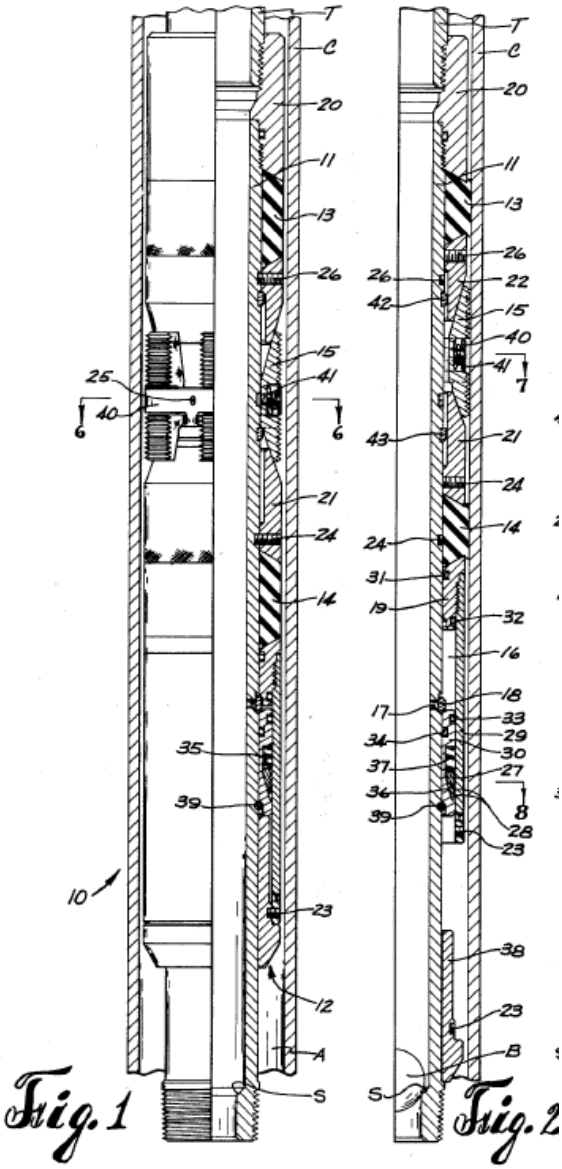
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Fig. 2

Figure 1 shows well packer 10 in an unset state within casing C. *Id.* at 4:3–5, 4:30–33. Figure 2 shows well packer 10 in a set state within casing C. *Id.* at 4:6–7, 4:30–33. Well packer 10 includes mandrel 11, supporting anchoring and sealing assembly 12. *Id.* at 4:30–35. Mandrel 11 connects to production tubing string T, which extends to the surface of the well. *Id.* at 4:35–37.

Sealing assembly 12 includes seals 13 and 14, as well slip elements 15. *Id.* at 4:38–39. Seal assembly 12 has slips 15 sandwiched between cones 21 and 22, which are sandwiched between seals 13 and 14, which are sandwiched between piston 19 and end piece 20. *Id.* at 4:38–39, 4:63–5:6, Fig. 2.

To set packer 10, Brown uses fluid pressure. *Id.* at 4:49–50. As shown in Figure 2, to allow pressurization inside the tubing, Brown discloses sealing ball B against seat S formed at the end of mandrel 11. *Id.* at 5:47–52. With the inside of the tubing pressurized, fluid pressure communicates from inside the tubing, through mandrel port 17, into chamber 16. *Id.* at 4:51–53, 5:51–53. The fluid pressure in chamber 16 pushes piston 19 upward. *Id.* at 5:51–53. Pushing piston 19 upward squeezes seals 13 and 14, cones 21 and 22, and slips 15 between piston 19 and end piece 20. *See id.* at 4:63–5:6, 5:51–6–16, Fig. 2. This compresses seals 13 and 14, sealing them against casing C. *Id.* at 4:64–68. It also forces cones 21 and 22 toward one another, "wedg[ing] the intermediate slip elements 15 outwardly into anchoring engagement with the casing C."[36] *Id.*

[36] During this process, shear pins 23, 24, 25, and 26 sever to allow the components to move in the described manners.

at 4:68–5:6, 6:3–23. "Once the slips are anchored, the forces exerted by the setting fluid cause the mandrel 11 to move downwardly relative to the slips." *Id.* at 6:16–19. "Once set, the packer 10 is firmly anchored to the casing C." *Id.* at 5:7–8. Brown adds that

> [t]he dual cone configuration holds the packer in place irrespective of the direction of the pressure differential acting on the packer. The upper and lower seals 13 and 14 form a seal between the mandrel and the casing to prevent fluid flow in the annular area A. The seals also isolate the slip elements and thus function to prevent debris in the annulus from accumulating about the slip and cone assembly.

Id. at 5:9–17.

Brown further discusses provisions for releasing packer 10. Brown notes that

> [c]onventionally, a set packer may be released from its set position by manipulating the tubing string to cause mechanical components in the packer to sever or shift to position which permits the slips and seals to retract. Once released, the tubing string and attached packer may be withdrawn from the casing.

Id. at 1:24–28. Brown discloses such an option, involving releasing packer 10 "from its set position by an upward pull exerted on the tubing string T." *Id.* at 7:9–11. Exerting upward force on mandrel 11 shears retrieving link 39, which enables a series of events that retracts slips 15 and seals 13 and 14, allowing withdrawal of packer 10 to the well surface. *Id.* at 7:9–29.

Brown also discloses that "[i]f, during the setting or running in procedure, the well packer should prematurely anchor to the surrounding well casing, it may be released by merely supplying sufficient pressure to cause the element 39 to sever." *Id.* at 6:39–43. Here again, severing link 39 enables a series of events releasing packer 10. *Id.* at 6:39–64.

2. *Claims 1–7, 14–22, and 24–26—Whether It Would Have Been Obvious to Substitute Brown's Retrievable Packers for Thomson's*

Petitioner contends that, to the extent Patent Owner may argue that Thomson's retrievable packers do not meet the packer limitations of the claims, it would have been obvious to substitute Brown's retrievable packer for each of Thomson's. 596 Pet. 53–57. Petitioner alleges a number of reasons that it would have been obvious to substitute Brown's retrievable packers for Thomson's. *Id.* Petitioner asserts that just like Thomson's packer, Brown's packer is set with hydraulic pressure through the tubing string and released by pulling the tubing string. *Id.* at 53 (citing Ex. 1006, [57]). Additionally, Petitioner asserts that Brown's packer provides many advantages over other packers. *Id.* at 55 (citing Ex. 1007 ¶¶ 85–92). For example, Petitioner notes Brown's disclosure that its packers anchor securely in the wellbore, regardless of the direction of pressure differential. *Id.* (citing Ex. 1006, 5:7–12). Petitioner also notes Brown's disclosure that its packer provides effective sealing that prevents undesirable fluid flow and prevents debris from accumulating in unwanted areas. *Id.* (citing Ex. 1006, 5:12–17; Ex. 1007 ¶ 92).

Petitioner argues that a person of ordinary skill in the art would have had many independent reasons to replace Thomson's retrievable packers with Brown's, citing Dr. Daneshy's testimony and Brown. *Id.* at 55–57. Petitioner argues that the two packing elements in Brown's packer provide desirable redundancy for the sealing function, and that the packer desirably resists movement of the packer and tool string. 596 Pet. 56; (citing Ex. 1006, 5:7–9; Ex. 1007 ¶¶ 89–91). Petitioner also argues that the ability

of Brown's packers to seal regardless of the direction of pressure differential would have motivated a person of ordinary skill in the art to use them in Thomson's apparatus. *Id.* (citing Ex. 1006, 5:9–12; Ex. 1007 ¶ 91). Petitioner further argues that a person of ordinary skill in the art would have wanted to use Brown's packer because its packing elements isolate its slip elements from wellbore fluids, providing protection and increased reliability. *Id.* at 56–57 (citing Ex. 1007 ¶ 92).

Petitioner also argues that substituting Brown's packer for Thomson's constitutes combining prior art elements according to known methods to yield predictable results. *Id.* at 57. Arguing that Thomson and Brown both disclose hydraulically set solid body packers, Petitioner contends that a person of ordinary skill in the art would have found it straightforward to substitute Brown's packer for Thomson's, which would have yielded only predictable results. *Id.* (citing Ex. 1007 ¶ 87). Consequently, Petitioner argues, the combination would have been obvious. *Id.* (citing *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007)).

Patent Owner argues that Petitioner does not demonstrate motivation to substitute Brown's packer for Thomson's, or even that Brown's packer could be used with Thomson's system. 596 PO Resp. 55–60. Noting that Brown's mandrel 11 moves, Patent Owner argues that "Thomson . . . teaches away from using packers that have a movable mandrel." *Id.* at 57. In support of this, Patent Owner cites Thomson's disclosure that

> [a]n important requirement in completions using multiple hydraulic-set packers is that no mandrel movement in relation to the slips of the packer should occur while setting. This enables any number of hydraulic-set packers to be set

> simultaneously without the requirement for expansion devices between the packers to account for mandrel movement.

Ex. 1002, 98; 596 PO Resp. 57. Patent Owner adds that other passages of Thomson further emphasize using packers with no mandrel movement.

Patent Owner also argues that "the Brown packer teaches a drop ball to set each packer." 596 PO Resp. 58. Consequently, Patent Owner argues, combining Thomson with Brown would require using one set of balls to set the packers, and another set of balls to actuate the MSAF tools. *Id.* at 59. Patent Owner criticizes that Petitioner does not offer an explanation of how such a system would work, or why a person of ordinary skill in the art would add such complexity to Thomson's system. *Id.*

Patent Owner further argues that Petitioner does not show Brown's packer could function properly during fracturing. *Id.* Patent Owner asserts that Brown's packers release in response to increased pressure in the tubing string with no ball in the packer seat. *Id.* (citing Ex. 1006, 9:39–42). Patent Owner posits that when an operator started pumping a fracturing treatment, increased pressure in the tubing string would cause the packers to release, foiling the fracturing operation. *Id.*

Petitioner responds that Patent Owner overstates Thomson's concerns regarding mandrel movement, and that Brown's packers do not implicate Thomson's stated concerns. 596 Pet. Reply 3–5. Petitioner argues that "Thomson teaches that to hydraulically set multiple packers, 'no mandrel movement *in relation to the slips of the packer* should occur while setting.'" *Id.* at 3 (quoting Ex. 1002, 98). Petitioner further explains that "[t]his enables any number of such packers to be set simultaneously '*without the requirement for expansion devices between the packers to account for*

mandrel movement.'" *Id.* at 3–4 (quoting Ex. 1002, 98; citing Ex. 1031 ¶¶ 5–6). Arguing that Thomson's ultimate goal is the ability to simultaneously set its packers, Petitioner contends that "Thomson teaches avoiding packers that require mandrel movement to set slips unless expansion joints/devices are included between them." *Id.* at 4 (citing Ex. 1031 ¶ 7).

Petitioner argues that Brown's packers would function consistent with Thomson's ultimate goal of simultaneously setting multiple packers. *Id.* at 3–4. Petitioner argues that movement of Brown's cone spreader elements 21, 22, not movement of Brown's mandrel 11, sets slips 15. *Id.* at 4 (citing Ex. 1006, 4:49–5:6; Ex. 1031 ¶¶ 8–10). Because Brown's packers rely on hydraulic pressure (rather than tension) to set them, pressurizing the entire tubing string can set multiple of Brown's packers simultaneously, Petitioner argues. *Id.* (citing Ex. 1031 ¶ 10). Petitioner argues that Brown's mandrel movement occurs after slips 15 set, and that the mandrel movement occurs simultaneously across multiple packers. *Id.* (citing Ex. 1031 ¶¶ 9–10). Additionally, Petitioner argues that Brown discloses tubing stretch that would accommodate any other incidental movement that occurs between the components. *Id.* (citing Ex. 1031 ¶¶ 9–10). Thus, Petitioner contends that substituting Brown's packers for Thomson's would not hinder simultaneous packer setting. *Id.* (citing Ex. 1031 ¶¶ 9–10).

Petitioner also addresses Patent Owner's argument that Brown's packers would necessitate another set of balls to allow setting the packers. 596 Pet. Reply 5; 596 PO Resp. 58–59. Contrary to Patent Owner's argument, Petitioner indicates, Brown's packers do not necessarily require a

ball to set them. Rather, Petitioner argues, Brown's packers only require fluid pressure to set them. 596 Pet. Reply 5; 596 Pet. 53–55. Petitioner asserts that "Thomson already teaches using a setting plug for that purpose." 596 Pet. Reply 5 (citing Ex. 1002, 99–100).

Additionally, Petitioner addresses Patent Owner's contention that Brown's packers would foil fracturing operations by releasing when exposed to pressure. 596 Pet. Reply 5; 596 PO Resp. 59–60. Petitioner argues that "the pressure increase [Patent Owner] cites concerning release following *inadvertent premature* setting is the same pressure increase used to set a packer in a *desired location*." 596 Pet. Reply 5 (citing Ex. 1006, 5:45–6:28). Petitioner adds that "[a]t the desired location, after that pressure is released, the packer "***remains set***." *Id.* (citing Ex. 1006, 6:29–36). Petitioner asserts that Dr. Daneshy explains Brown uses the same process as Thomson to release purposefully set packers. *Id.* (citing Ex. 1006, 7:6–29; Ex. 1007 ¶ 86).

We find Petitioner's evidence and arguments more persuasive than Patent Owner's. Petitioner provides multiple, undisputed and persuasive reasons that a person of ordinary skill in the art would have found it desirable to use Brown's packer in an application like Thomson's. *See* 596 Pet. 55–56.

Additionally, Petitioner persuades us that the statements in Thomson cited by Patent Owner would not dissuade a person of ordinary skill in the art from using Brown's packers. *See* 596 Pet. Reply 3–5. We agree with Petitioner that a person of ordinary skill in the art would understand that the desire to meet the ultimate goal of simultaneously setting multiple packers is

the only apparent reason Thomson mentions mandrel movement. *See id.* Thomson clearly states that the reason for avoiding mandrel movement is that "[t]his enables any number of hydraulic-set packers to be set simultaneously without the requirement for expansion devices between the packers to account for mandrel movement." Ex. 1002, 98. Furthermore, consistent with Petitioner's argument, Thomson does not express concerns about all mandrel movement, but only about certain mandrel movement, specifically mandrel movement that occurs "in relation to the slips . . . while setting." *Id.*; 596 Pet. Reply 3.

Furthermore, Petitioner persuades us that a person of ordinary skill in the art would understand from Brown's disclosure that its packer design would accommodate simultaneously setting multiple packers when used in Thomson's apparatus. 596 Pet. Reply 4–5. As Petitioner notes, Brown's slips 15 set before mandrel 11 begins moving. Ex. 1006, 6:11–18; 596 Pet. Reply 4. Once the slips are set, packer 10 anchors firmly to casing C preventing up or down movement of packer 10. Ex. 1006, 5:7–9. Because of this, if one included a series of Brown's packers in Thomson's tubing string, all of those packers would firmly set in their positions without any movement of each packer's mandrel 11. *See* Ex. 1031 ¶¶ 8–10. Only after this, would each mandrel 11 move downwardly relative to slips 15 of each packer 10. Ex. 1006, 6:9–18. As Dr. Daneshy testifies, when each mandrel 11 moves, it would do so in unison with all other mandrels and the intermediate components connecting them. Ex. 1031 ¶ 10. Furthermore, as Dr. Daneshy notes, Brown discloses tubing stretch (Ex. 1006, 6:23–26), which would accommodate any incidental discrepancy between the

movement of one mandrel 11 and an adjacent one. Ex. 1031 ¶¶ 9–10. Consequently, Petitioner persuades us that a person of ordinary skill in the art would not have viewed Thomson's statements about mandrel movement and simultaneously setting multiple packers as a reason to avoid using Brown's packers in Thomson's apparatus.

Additionally, Petitioner persuades us that, contrary to Patent Owner's argument, a person of ordinary skill in the art would have understood that using Brown's packers in Thomson's apparatus would not necessitate using additional balls to set the packers. *See* 596 PO Resp. 58–59; 596 Pet. Reply 5. Setting Brown's packer requires sealing the end of the tubing to allow pressurization of the inside of the tubing. *See* Ex. 1006, 5:47–54. And Brown happens to seal the end of its tubing with ball B. *Id.* But, as Petitioner notes, Thomson's apparatus already has a plug that seals the end of the tubing to allow pressurization for packer setting. *See* Ex. 1002, 99–100. For example, Thomson discloses that "[o]nce the lower half of the completion was on depth, pressure was applied down the tubing against the pump-out plug (conventional shear screw release) to set all seven packers simultaneously." *Id.* at 99. Thus, as Petitioner asserts, adding Brown's packers to Thomson's apparatus would not necessitate using any additional balls to set the packers. 596 Pet. Reply 5.

Petitioner further persuades us that, contrary to Patent Owner's argument, a person of ordinary skill in the art would not have expected that Brown's pressure-release capability would foil fracturing operations. *See* 596 PO Resp. 59–60; 596 Pet. Reply 5. Patent Owner suggests that any time pressure is applied inside the tubing string, Brown's packer releases. *See*

596 PO Resp. 59–60. As Petitioner notes, Brown directly contradicts this, disclosing applying pressure inside the tubing string to intentionally set packer 11, after which the packer "remains set." Ex. 1006, 4:63–5:12, 6:29–36; 596 Pet. Reply 5. Thus, pressure can be applied inside the tubing string without releasing the packer. This would have allowed a person of ordinary skill in the art to apply pressure inside Thomson's tubing string to perform the stimulation it discloses, without releasing Brown's packers. If and when it was desirable to release Brown's packers, an operator could have increased the pressure inside the tubing string to a "sufficient pressure to cause the element 39 to sever," thereby releasing the packers. *See* Ex. 1006, 6:39–44. The mere speculation of Patent Owner's attorney argument does not persuade us that using Thomson's apparatus for stimulation would have severed link 39 inadvertently, particularly given Mr. McGowen's testimony suggesting that Thomson uses a relatively low-pressure stimulation. 596 PO Resp. 59; Ex. 1034, 29.

In sum, Petitioner demonstrates by a preponderance of the evidence that it would have been obvious to substitute Brown's packer for each of Thomson's retrievable packers. Additionally, Petitioner persuades us that the resulting combination would meet all of the limitations of claims 1–7, 14–22, and 24–26. 596 Pet. 27–45, 53–57.

3. *Claim 11*

In its challenge of claim 11 as obvious over Thomson and Brown, Petitioner relies on Thomson as teaching claim 11's limitation "wherein the first port has mounted thereover a sliding sleeve and in the position permitting fluid flow, the first sleeve has engaged and moved the sliding sleeve away from a the first port." *See* 596 Pet. 39–40, 53–59. For the

reasons explained in Section III.B.3 above, Petitioner does not persuade us that Thomson discloses this claim limitation. Accordingly, Petitioner does not demonstrate by a preponderance of the evidence that claim 11 would have been obvious over Thomson and Brown.

F. Alleged Obviousness of Claim 15 over Thomson, Hartley, and Brown

Petitioner's challenge of claim 15 as obvious over Thomson, Hartley, and Brown builds on Petitioner's challenge of claim 15 as obvious over Thomson and Hartley. Petitioner contends that, to the extent Patent Owner argues Thomson's retrievable packers do not meet the packer limitations of the claims, it would have been obvious to substitute Brown's retrievable packer for each of Thomson's. 596 Pet. Reply 53–57. Regarding this challenge of claim 15, Patent Owner argues only that it would not have been obvious to substitute Brown's retrievable packer for Thomson's. 596 PO Resp. 55–60.

As discussed in Section III.E.2 above, Petitioner persuades us that it would have been obvious to substitute Brown's retrievable packer for each of Thomson's. Furthermore, as discussed in Section III.D, Petitioner persuades us that it would have been obvious to substitute Hartley's plug for Thomson's ball. 596 Pet. 45–46. Additionally, Petitioner persuades us that the resulting combination would meet all of the limitations of claim 15. 596 Pet. 27–36, 40, 45–46, 53–57.

G. Alleged Obviousness of Claims 23 and 27 over Thomson, Ellsworth, and Brown

Petitioner's challenge of claims 23 and 27 as obvious over Thomson, Ellsworth, and Brown builds on Petitioner's challenge of claims 23 and 27

as obvious over Thomson and Ellsworth. Petitioner contends that, to the extent Patent Owner argues Thomson's retrievable packers do not meet the packer limitations of the claims, it would have been obvious to substitute Brown's retrievable packer for each of Thomson's. 596 Pet. Reply 53–57.

As discussed in Section III.C.4 above, Patent Owner argues that it would not have been obvious to combine the teachings of Thomson and Ellsworth in the manner proposed by Petitioner. Additionally, Patent Owner argues that it would not have been obvious to substitute Brown's retrievable packer for Thomson's. 596 PO Resp. 55–60.

As discussed in Section III.C.4 above, we find Petitioner's evidence and arguments regarding the combination of Thomson and Ellsworth more persuasive than Patent Owner's. As discussed in Section III.E.2 above, Petitioner also persuades us that it would have been obvious to substitute Brown's retrievable packer for each of Thomson's. Additionally, Petitioner persuades us that the resulting combination would meet all of the limitations of claims 23 and 27. 596 Pet. 27–36, 41–49, 53–59.

H. Alleged Obviousness of Claims 1–7 and 14–27 over Lane-Wells and Ellsworth

Petitioner argues that Lane-Wells discloses a system using three packers and two ball-actuated sliding sleeves for three-zone acidizing in an open hole. 1496 Pet. 30–35. Petitioner notes that Lane-Wells does not identify what sort of packer its apparatus uses. *Id.* at 35. Petitioner argues that it would have been obvious to use Ellsworth's packer in Lane-Wells's system. *Id.* at 35–39. Petitioner argues that such a combination of the references' teachings would meet the limitations of claims 1–7 and 14–27. *Id.* at 39–58.

Patent Owner disputes Petitioner's contentions on multiple bases. As a threshold issue, Patent Owner argues that Petitioner has not demonstrated that Lane-Wells qualifies as prior art. 1496 PO Resp. 33–39. Patent Owner also presents various arguments related to the factors identified in *Graham*, including (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. *Id.* at 4–33, 39–43. We turn now to detailed discussion of the parties' disputes.

1. *Whether Lane-Wells is Prior Art*

The parties dispute whether Lane-Wells was sufficiently publicly accessible to qualify as a printed publication. Petitioner's evidence of public accessibility includes two declarations. In one, Margaret Kieckhefer testifies about receipt of Lane-Wells by the Library of Congress and its shelving for public accessibility. 1496 Ex. 1002, 1–2. In another, Velma J'Nette Davis-Nichols testifies about the activities of Gulf Publishing Company (hereafter, "GPC") relative to Lane-Wells. Ex. 1124.

Ms. Kieckhefer, "employed at the Library of Congress as a Senior Information and Reference Specialist," testifies that "[w]hen a journal or book is received at the library, it is usually date stamped within a few days of its receipt, and shelved for public access within a couple of weeks thereafter." 1496 Ex. 1002, 1 ¶¶ 2, 4. Regarding Lane-Wells specifically, Ms. Kieckhefer testifies that the date stamp it bears reflects that it was received on November 14, 1955. *Id.* at 1 ¶ 5.

Ms. Davis-Nichols, "the Specialized Product Sales Manager at the world headquarters of [GPC]," testifies that "[t]he Composite Catalog is and

was a compilation of product catalogs from different companies."[37] Ex. 1124,1–2 ¶¶ 1, 6. Ms. Davis-Nichols elaborates that "GPC sold companies the right to include their catalog pages within the Composite Catalog, and *GPC sold the Composite Catalog, including the 21st edition, to members of the public*." *Id.* at 2 ¶ 6 (emphasis added). Ms. Davis-Nichols testifies that "I . . . manage, and have managed since 2002, the public's access to [GPC's] on-site library." *Id.* at 1 ¶ 2. Ms. Davis-Nichols adds that "GPC's Library includes old copies of the Composite Catalog . . . , including the 21st edition published in 1955" (*id.* at 1 ¶ 4), i.e., the edition on which Petitioner relies. Ms. Davis Nichols testifies that

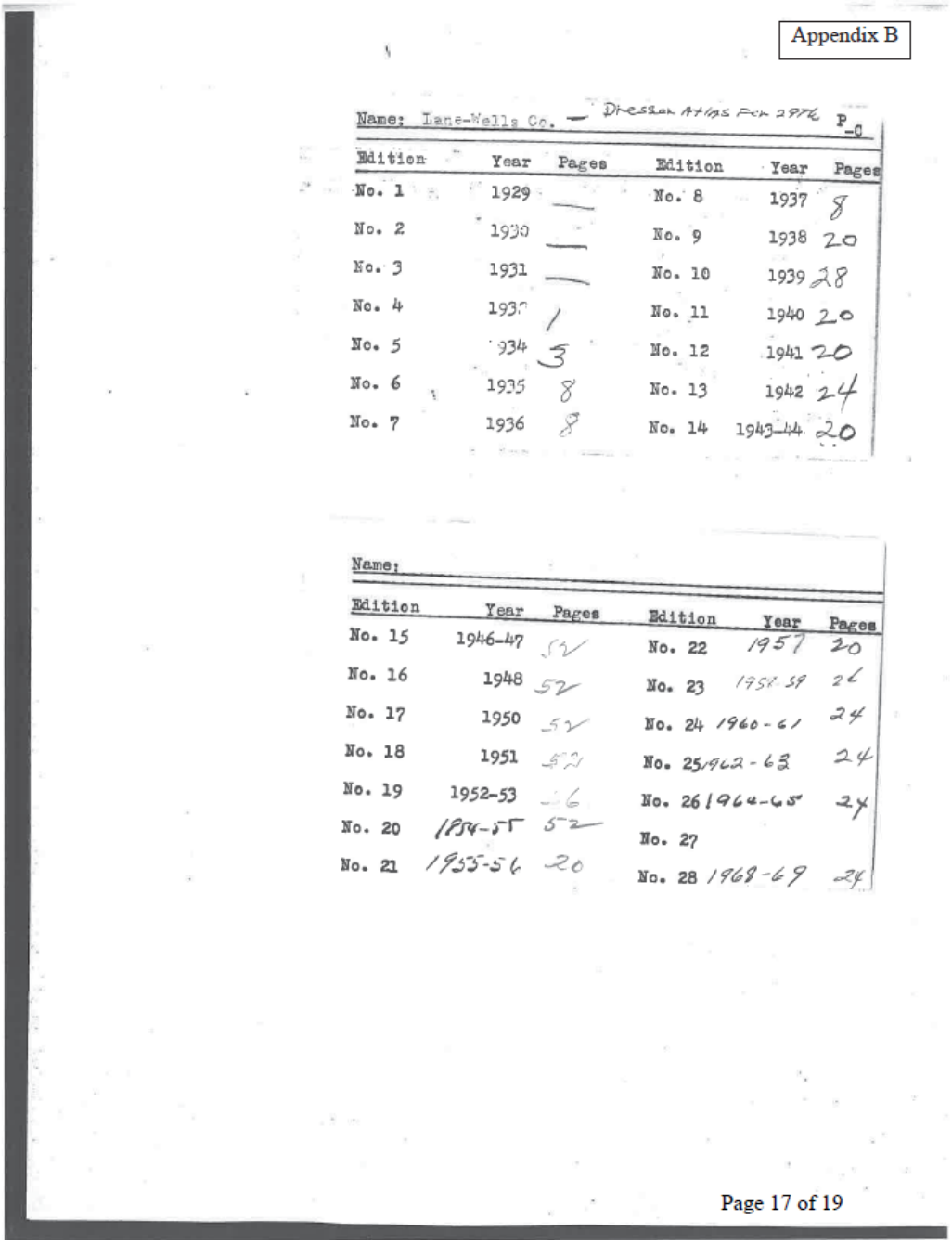
> [i]n the year 2000, any member of the public who wanted to view old copies of the Composite Catalog, including the 21st edition, could make an appointment with our Houston office to visit the Library and review what was in it. They would have been free to request copies of the materials we kept there, and we would have made those copies for them for a fee of a few dollars per page.

Id. 2 ¶ 4. Ms. Davis-Nichols further testifies that

> [t]he Library includes a catalog of index cards that show some of the years that certain companies purchased publication space within the Composite Catalog. True and correct copies of the front and back of the index card for the Lane-Wells company are attached as Appendix B.

Id. at 2 ¶ 5. Appendix B of Ms. Davis-Nichols's declaration is reproduced below.

[37] The disclosure Petitioner relies on as prior art appears within the "Lane-Wells" section of a larger publication titled "Composite Catalog." *See* 1496 Ex. 1002, 5, 9–10.



Appendix B

Name: Lane-Wells Co. — Dresser Atlas Pub 1976 P-C

Edition	Year	Pages	Edition	Year	Pages
No. 1	1929	—	No. 8	1937	8
No. 2	1930	—	No. 9	1938	20
No. 3	1931	—	No. 10	1939	28
No. 4	1933	1	No. 11	1940	20
No. 5	1934	3	No. 12	1941	20
No. 6	1935	8	No. 13	1942	24
No. 7	1936	8	No. 14	1943-44	20

Name:

Edition	Year	Pages	Edition	Year	Pages
No. 15	1946-47	52	No. 22	1957	20
No. 16	1948	52	No. 23	1958-59	24
No. 17	1950	52	No. 24	1960-61	24
No. 18	1951	52	No. 25	1962-63	24
No. 19	1952-53	56	No. 26	1964-65	24
No. 20	1954-55	52	No. 27		
No. 21	1955-56	20	No. 28	1968-69	24

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Appendix B of Ms. Davis-Nichols declaration includes tabulated information regarding editions, years, and pages. Ex. 1124, 17. Ms. Davis-Nichols explains that Appendix B "shows that the Lane-Wells company

purchased 20 pages for its catalog that went in the 21st edition. Visitors to the Library in 2000 had access to this catalog." *Id.* at 2 ¶ 5.

Patent Owner argues that Petitioner has not shown distribution or meaningful indexing of Lane-Wells sufficiently to establish public accessibility. 1496 PO Resp. 33–39. Patent Owner argues that the Kieckhefer declaration establishes no more than that the Library of Congress received and maintained Lane Wells as of 1955. *Id.* at 37. Patent Owner contends that this is insufficient to establish public accessibility, as a matter of law. *Id.* (citing *In re Lister*, 583 F.3d 1307, 1314 (Fed. Cir. 2009)). Patent Owner argues that the Kieckhefer declaration only indicates GPC stored Lane-Wells, without explaining how a person of ordinary skill in the art could find Lane-Wells without already knowing of it. *Id.* Patent Owner further argues that Petitioner's evidence does not identify "catalog keywords or any catalog information at all." *Id.* Patent Owner likens these alleged facts to those in *Blue Calypso, LLC v. Groupon, Inc.*, 815 F.3d 1331, 1349 (Fed. Cir. 2016), *Application of Bayer*, 568 F.2d 1357, 1361 (C.C.P.A. 1978), and *SRI Int'l, Inc. v. Internet Sec. Sys., Inc.*, 511 F.3d, 1186, 1197 (Fed. Cir. 2008). 1496 PO Resp. 37.

Patent Owner argues that both the Kieckhefer and Davis-Nichols declarations fail to establish "that Lane-Wells was actually distributed and received by persons of ordinary skill in the art." *Id.* at 38. Even if Lane-Wells was received by the Library of Congress, Patent Owner argues, this does not establish distribution to persons of ordinary skill in the art, as opposed to submission with the Library of Congress for archival purposes or proof of copyright. *Id.* Regarding Ms. Davis-Nichols testimony that GPC

sold Lane-Wells to the public, Patent Owner objects that "[i]t provides no corroboration that a skilled artisan actually received the document during the relevant time frame." *Id.* Patent Owner likens these alleged facts to those in *Carella v. Starlight Archery & Pro Line Co.*, 804 F.2d 135, 139 (Fed. Cir. 1986). *Id.*

Additionally, Patent Owner argues that Petitioner should be foreclosed from asserting public accessibility because Petitioner argued in a motion for joinder that "none of multiple, diligent searches conducted by skilled, professional searchers prior to filing the 598 Proceeding discovered Lane-Wells, nor should they have, given that Lane-Wells was not in a text-searchable form, and does not appear to have been depicted in any patent." 1496 PO Resp. 38 (citing IPR2016-01506, Paper 6, 5–6).

Petitioner responds that its evidence demonstrates "[b]oth public accessibility and actual dissemination." 1496 Pet. Reply 17. Lane-Wells was received at the Library of Congress decades before the relevant date, Petitioner asserts. 1496 Pet. Reply 17. Petitioner emphasizes that Ms. Kieckhefer testified that Lane-Wells was "shelved for *public access*," as opposed to merely storage. *Id.* (citing 1496 Ex. 1002, 1 ¶¶ 4–5). Petitioner argues that "Product catalogs like Lane-Wells—which lack a confidentiality or 'draft' designation—'are the types of documents normally intended for public dissemination.'" *Id.* (citing *Instradent USA, Inc. v. Nobel Biocare Servs. AG,* IPR2015-01786, slip op. at 20 (Paper 106) (P.T.A.B. Feb. 15, 2017), aff'd *Nobel Biocare Servs. AG vs. Instradent USA, Inc.*, 2018 WL 4354227 (Fed. Cir 2018)). Petitioner argues that Ms. Davis-Nichols's confirms both public accessibility and dissemination with her testimony that

"Lane-Wells was (1) published in 1955, (2) available to the public at GPC[']s library in 2000 and indexed in GPC's catalog of index cards, and (3) sold to members of the public." *Id.* at 17–18 (citing Ex. 1124, 1–2 ¶¶ 4–6).

We find that the preponderance of the evidence demonstrates public accessibility of Lane-Wells. 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 Lane-Wells—a catalog created by members of the oil industry listing products for use in oil wells and bearing the date "1955-1956" (1496 Ex. 1002, 5) with no indication of confidentiality or other suggestion of any reason for restraints on dissemination. *See Nobel*, 2018 WL 4354227, *7 (Affirming public accessibility finding for type of document intended for public dissemination with no indication otherwise). We agree with Petitioner that, by its very nature, this sort of document would have been highly likely to be accessible to the interested public, particularly in light of Ms. Davis-Nichols's testimony that "[i]n the year 2000, any member of the public who wanted to view old copies of the Composite Catalog, including the 21st edition, could make an appointment with our Houston Office to visit the Library and review what was in it" and "would have been free to request copies of the materials." Ex. 1124, 2 ¶ 4. Based on this unrestricted availability, we also find credible Ms. Davis-Nichols's testimony that "GPC sold the Composite Catalog, including the 21st edition[, which contained Lane-Wells], to members of the public." *See* Ex. 1124, 2 ¶ 6. Moreover, considering that the document was produced by

members of the oil industry to advertise apparatus for use in oil wells, we find that the evidence indicates that persons interested and ordinarily skilled in the art would have been among those that received the document. We find this especially true given that Lane-Wells was created to sell apparatus for oil wells decades before Patent Owner's application for the '505 patent.

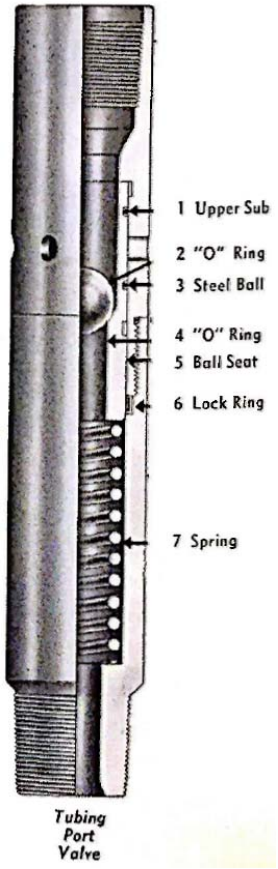
Contrary to Patent Owner's suggestion, we find *Carella* inapposite here. In *Carella*, "there was no credible evidence in the record indicating the Rite-Flite sight was known or used by, or was otherwise accessible to, the public until after the mailing of the WBHA advertisement on August 17, 1966." 804 F.2d at 139. In other words, the issue was not whether the mailing of the document made it publicly accessible, but *when* it became publicly accessible. Here, the evidence demonstrates that Lane-Wells was created in 1955, decades before the earliest possible priority date of the '505 patent. *See, e.g.*, Ex. 1002, 1 ¶¶ 4–5 (Lane-Wells deposited with the Library of Congress in 1955), 5 ("21st 1955 – 1956 Edition"); Ex. 1001, [60] (listing earliest possible priority date as Nov. 19, 2001). In view of the timing of these events and the unrebutted testimony that GPC sold Lane-Wells to members of the public (Ex. 1124, 2 ¶ 6), we find that a preponderance of the evidence indicates that Lane-Wells was distributed without restraint to persons of ordinary skill in the art prior to the earliest possible priority date of the '505 patent. Indeed, the date on the document, the nature of the document, and the evidence of its presence in the Library of Congress corroborates Ms. Davis-Nichols's testimony regarding the dissemination of the document. *See, e.g.*, *Nobel*, 2018 WL 4354227, *7–9.

We find unavailing Patent Owner's arguments regarding difficulty locating Lane-Wells in the Library of Congress, GPC's library, or elsewhere. *See* 1496 PO Resp. 37–39. Contrary to Patent Owner's assertion that the evidence does not identify "any catalog information at all" (*id.* at 37), the Davis-Nichols declaration identifies catalog information in the form of the GPC library's index cards showing that Lane-Wells had purchased pages in the 1955 edition of the catalog. 1496 Ex. 1124, 2, ¶ 5; *id.* at 17. Given that Lane-Wells appears to be a supplier of components for use in oil wells, the index cards indicating Lane-Wells's contribution to the 1955 edition of the catalog would appear to allow a person of ordinary skill in the art to find it. Moreover, even if there was insufficient indexing of Lane-Wells, the combination of the other evidence of dissemination with the evidence of placement in two libraries collectively reinforces Petitioner's position that Lane-Wells was publicly accessible.

2. *Scope and Content of the Prior Art*

a. *Lane-Wells*

Lane-Wells discloses a tubing port valve. Lane Wells shows the tubing port valve in the picture reproduced below.

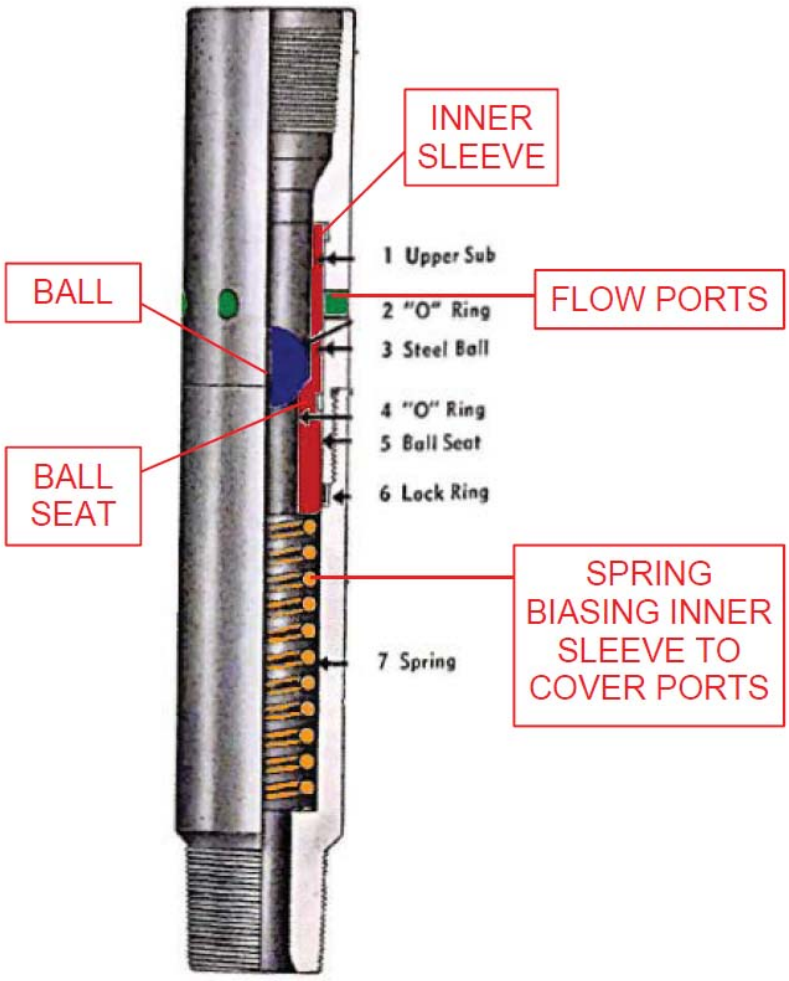


Lane-Wells's picture shows the tubing port valve and certain of its components, including an upper sub, two o rings, a steel ball, a ball seat, a lock ring, and a spring. 1496 Ex. 1002, 17. Lane-Wells discloses that

> [a]fter [the] Tubing Port Valve is placed in tubing string above packer and run in, the packer is set and the well head closed in. With the well secure, a ball is dropped through the tubing to seat in the Tubing Port Valve. Flow through tubing is stopped and pump pressure build-up causes spring to compress which opens side ports. This 'inside out' circulation allows safe displacement of fluids in the annulus.
>
> The Tubing Port Valve also provides a means of acidizing two zones with packer setting in either open-hole or cased hole completion. Three zone acidizing is possible with a three packer set-up and two different sized Tubing Port Valves.

Id.

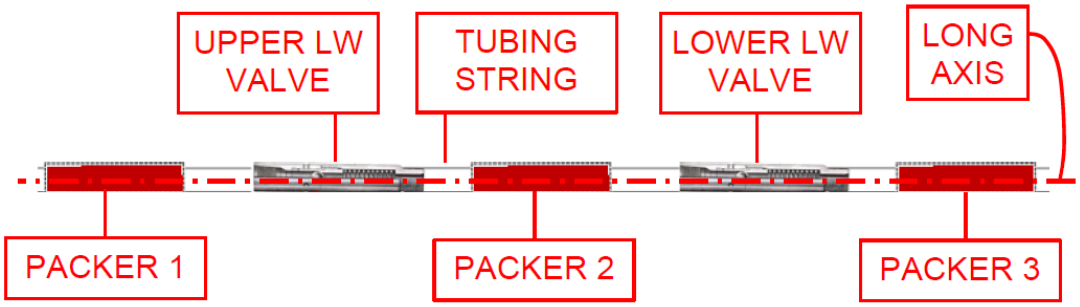
Petitioner provides an annotated version of Lane-Wells's picture, which is reproduced below.



Petitioner's annotated version of Lane-Wells's picture identifies certain structures of the tubing port valve as consituting an inner sleeve, flow ports, a ball, a ball seat, and a spring. 1496 Pet. 31 (citing 1496 Ex. 1007 ¶ 69). Petitioner asserts that Lane-Wells's disclosed action of compressing the spring to open the side ports provides "'inside out' circulation [that] allows

safe displacement of fluids in the annulus." 1496 Pet. 32 (citing 1496 Ex. 1007 ¶ 69).

Petitioner also addresses how a person of ordinary skill in the art would understand Lane-Wells's disclosure that "[t]he Tubing Port Valve also provides a means of acidizing two zones with packer setting in either open-hole or cased hole completion. Three zone acidizing is possible with a three packer set-up and two different sized Tubing Port Valves." 1496 Ex. 1002, 17; 1496 Pet. 32 (citing 1496 Ex. 1007 ¶ 70). Dr. Daneshy testifies that "[a] person of ordinary skill in the art would understand the last sentence of this quote to describe a three-zone system . . . , in which two Tubing Port Valves are positioned between three packers." 1496 Ex. 1007 ¶ 70. Petitioner illustrates such a system in the picture reproduced below.



Petitioner's picture shows an apparatus with packers and valves in alternating positions. *Id.*

Petitioner argues that a person of ordinary skill in the art would understand that the packers of such a system would set and isolate the annulus between the tubing string and the wellbore or casing. 1496 Pet. 32–33 (citing 1496 Ex. 1007 ¶ 71). Dr. Daneshy elaborates that "[o]nce set, the packers would create three isolated zones: one between Packer 1 and Packer

2, one between Packer 2 and Packer 3, and one below Packer 3." 1496 Ex. 1007 ¶ 71.

Petitioner further asserts that a person of ordinary skill in the art would understand Lane-Wells's disclosure of "two different sized Tubing Port Valves" for multizone acidizing "to mean that the Lower Lane-Wells Tubing Port Valve . . . has an inner sleeve with a smaller diameter ball seat than the ball seat of the inner sleeve of the Upper Lane-Wells Tubing Port Valve." 1496 Pet. 33 (citing 1496 Ex. 1007 ¶ 72). Petitioner explains that this system would use a first ball to mate with the smaller diameter seat of the lower sleeve to open the lower sleeve, followed by a larger ball to mate with the larger diameter seat of the upper sleeve to open the upper sleeve. 1496 Pet. 34–35 (citing 1496 Ex. 1002, 17; 1496 Ex. 1007 ¶ 73). Petitioner notes that Lane-Wells does not specify what type of packers it uses. 1496 Pet. 35 (citing 1496 Ex. 1007 ¶ 74).

We find that a person of ordinary skill in the art would understand Lane-Wells as disclosing the above-discussed claim elements, as identified by Petitioner. Indeed, Patent Owner does not dispute that a person of ordinary skill in the art would understand Lane-Wells as disclosing all of the foregoing. *See* 1496 PO Resp., generally.

b. *Ellsworth*

The scope and content of Ellsworth is discussed above in Section III.C.1.b.

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

Petitioner cites Lane-Wells as teaching every limitation of claims 1–7 and 14–27, except for the details regarding the construction of each of the

packers recited in the challenged claims. *See* 1496 Pet. 30–35, 39–57. Patent Owner does not dispute that Lane-Wells teaches every limitation of claims 1–7 and 14–27, except for the details of the construction of the claimed packers. *See* 1496 PO Resp., generally. In view of the arguments and evidence, we find that Lane-Wells differs from claims 1–7 and 14–27 only in that Lane-Wells does not specify the details of the construction of each of its packers. For example, because it does not specify what type of packers it uses, Lane-Wells does not teach "at least one of the first, second and third packer being a solid body packer each including multiple packing elements," as recited in claim 1. Because we find it persuasive, we adopt as our own Petitioner's explanation of what Lane-Wells teaches and, consequently, the difference between Lane-Wells and claims 1–7 and 14–27. 1496 Pet. 30–35, 39–57.

Petitioner asserts that Ellsworth discloses a solid body packer with a construction that meets the packer limitations of claims 1–7 and 14–27. 1496 Pet. 42–44, 49, 51–56 (citing 1496 Ex. 1004, 3, 5, 7–8; 1496 Ex. 1007 ¶¶ 68, 80–86, 92; 1496 Ex. 1016, 3:62–65, Figs. 1, 2; 1496 Ex. 1006, Figs. 1–3; 1496 Ex. 1001, 8:58–61). For example, Petitioner asserts that Ellsworth's solid body packer includes multiple packing elements. 1496 Pet. 42–44. Patent Owner does not dispute that Ellsworth's packer meets the packer limitations of claims 1–7 and 14–27. *See* 1496 PO Resp., generally. In view of Petitioner's evidence and explanation, we find that Ellsworth teaches a solid body packer with a construction that meets that claims' limitations regarding the construction of the packers. Accordingly, we find that using Ellsworth's solid body packer in the apparatus described by Lane-

Wells would meet all of the limitations of claims 1–7 and 14–27. Indeed, we find persuasive, and adopt as our own, Petitioner's explanation of how the combination of Ellsworth's solid body packer with Lane-Wells's apparatus would meet all of the limitations of claims 1–7 and 14–27. 1496 Pet. 39–57.

4. *Level of Ordinary Skill in the Art*

The level of ordinary skill in the art is discussed above in Section III.C.3.

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

Noting that Lane-Wells does not identify what type of packers its system uses for multistage acidizing, Petitioner asserts that it would have been obvious to use Echols's solid body packers. 1496 Pet. 35–39. Petitioner asserts that a person of ordinary skill in the art would have sought a packer compatible with acidizing and capable of providing multiple zones in an open hole. *Id.* at 35 (citing 1496 Ex. 1007 ¶ 74). Petitioner argues that Ellsworth discloses its solid body packer had been used successfully when isolating and acidizing multiple zones in an open wellbore. *Id.* at 36 (citing 1496 Ex. 1007 ¶ 75). Citing Dr. Daneshy's testimony, Petitioner asserts that it would have been straightforward to use Ellsworth's solid body packers and Lane-Wells's components together. *Id.* at 36–37 (citing 1496 Ex. 1007 ¶¶ 25–54, 79; 1496 Ex. 1006; 1496 Ex. 1020). Petitioner argues that a person of ordinary skill in the art would have had reason to use Ellsworth's solid body packers with Lane-Wells's systems in circumstances like those described in Ellsworth—carbonate formations and open hole wellbores that drill close to gauge-hole. *Id.* at 38–39 (citing 1496 Ex. 1002, 15; 1496 Ex.

1004, 3–9; 1496 Ex. 1007 ¶¶ 43, 76–78). Because Ellsworth proves solid body packers successful for such circumstances, Petitioner reasons, a person of ordinary skill in the art would have chosen them to manage risk. *Id.* at 38 (citing 1496 Ex. 1007 ¶ 77).

Patent Owner argues that Petitioner does not demonstrate a person of ordinary skill in the art would have been motivated to combine the disclosures of Lane-Wells and Ellsworth. 1496 PO Resp. 39–43. Patent Owner argues that Ellsworth suggests solid body packers may present greater risks than inflatable packers, but justifies using them at additional cost and risk because of a desire to provide longer-lasting isolation. *Id.* at 41 (citing 1496 Ex. 1004, 1, 3, 8). Patent Owner states that "[i]ndeed, the case histories reported in Ellsworth describe results where the packers were held in place for over a year." *Id.* Arguing that "[a] typical multi-stage acidizing job should take a matter of days, and it is typically performed at lower pressures to avoid fracturing the formation," Patent Owner argues that Petitioner has not demonstrated that a desire to provide longer-term isolation would have motivated a person of ordinary skill in the art to incur the additional cost and expense of solid body packers. *Id.* at 42. Patent Owner also argues that Mr. McGowen testifies that a person of ordinary skill in the art would avoid the approach Petitioner suggests, citing Mr. McGowen's testimony that

> [i]f the POSITA considered the Lane-Wells text at all, the POSITA would rely upon the conventions present at the time the information was published (circa 1955) to determine what type of packer the authors were thinking of using in the suggested application. Baker-Hughes own exhibits illustrates prior art that would cause a POSITA to assume that Exhibit

> 1002 (Lane-Wells) refers to the use of inflatable packers not SBPs and in fact these references teach away from the use of SBPs in an open hole. See, e.g., Ex. 1009 at 1:43-44 ("Inflatable packers are preferred for use in sealing an uncased well bore."); Ex. 1017 at 912 (discussing the use of external casing packers (ECPs), which are inflatable packers, in an open hole under "ECP AND SLIDING SLEEVES, IN OPEN HOLE").

1496 Ex. 2081, 9; 1496 PO Resp. 42.

Petitioner persuades us that a person of ordinary skill in the art would have had reason to use Ellsworth's solid body packers in Lane-Wells's disclosed system. Petitioner provides evidence demonstrating amply that a person of ordinary skill in the art, having reviewed Ellsworth, would have believed Ellsworth's packers would perform their isolating function well for acidizing. 1496 Pet. 36; 1496 Ex. 1004, 3, 5, 6; 1496 Ex. 1007 ¶ 75. This would have made Ellsworth's packers an attractive choice. Additionally, Petitioner's evidence and explanation persuades us that a person of ordinary skill in the art would have had a reasonable expectation of successfully using Ellsworth's solid body packers with the components disclosed in Lane-Wells to perform multizone acidizing. *See, e.g.*, 1496 Pet. 36–39; 1496 Ex. 1004, 6 ("The initial acid job using [solid body packers] indicated that the [solid body packers] successfully provided isolation during the job."); 1496 Ex. 1007 ¶¶ 75–79.

We find unpersuasive Patent Owner's attorney argument that Ellsworth's disclosure provides reasons for concern regarding solid body packers. Patent Owner's attorney argument that Ellsworth "notes that, unlike with inflatable packers, there may be an increased risk that the solid body packers will fail" misstates the disclosure of Ellsworth. Patent Owner

apparently derives this mistaken belief from Ellsworth's disclosure that "[t]he formations in Rainbow Lake often contain vugs and fractures. When possible, the packers are run in pairs to minimize the chance of failure due to setting in a vug." 1496 Ex. 1004, 3; 1496 PO Resp. 41.

To the extent that it suggests concern about challenges presented by vugs and fractures, Ellsworth says nothing to support Patent Owner's suggestions that those challenges relate exclusively to solid body packers, as opposed to any packer. Ellsworth does not support Patent Owner's attorney argument that "solid body packers may seat in a vug and fail whereas an inflatable packer could have a much longer seal that could overcome the vug." 1496 PO Resp. 41. To the contrary, Ellsworth reports that its solid body packers successfully provided isolation in multiple open hole wellbores. 1496 Ex. 1004, 4 ("Production testing . . . indicated that successful isolation was achieved."), 6 ("The initial acid job using [solid body packers] indicated that the [solid body packers] successfully provided isolation during the job."), 8 ("Production testing afterwards, as well as sleeve changes during the first 6 months indicated that successful isolation was achieved as oil/water/gas ratios during production have been changed significantly following changes in inflow selection to the different laterals. In particular, the gas production changed significantly during this process."), 9 ("[Solid body packers] have successfully provided zonal isolation.").

Regarding Patent Owner's contention that Ellsworth used solid body packers because they provide isolation for longer periods of time than inflatable packers, this seemingly presents more reason that a person of ordinary skill in the art would desire using the solid body packers. And

Patent Owner provides no evidence in support of its attorney argument that using solid body packers increases expense. 1496 PO Resp. 41–42. Nor does Patent Owner cite any evidence to support its argument that "[a] typical multi-stage acidizing job should take a matter of days, and it is typically performed at lower pressures to avoid fracturing the formation." *Id.* at 42.

Additionally, we find the evidence does not support Mr. McGowen's testimony that the prior art "references teach away from the use of [solid body packers] in an open hole." 1496 Ex. 2081, 9. The statement in Echols that "[i]nflatable packers are preferred for use in sealing an uncased well bore" does not criticize, discredit, or otherwise discourage using solid body packers.[38] *See Fulton*, 391 F.3d at 1201; 1496 Ex. 2081, 9. Nor does Coon's discussion of using external casing packers in open and cemented holes. Ex. 1496 Ex. 2081, 9. Regarding Mr. McGowen's testimony that a person of ordinary skill in the art would have thought Lane-Wells disclosed in 1955 using inflatable packers, we find that his testimony does not negate the unrebutted fact that Ellsworth disclosed in 1999 that solid body packers work well for acidizing in open holes. 1496 Ex. 2081, 9; *see, e.g.*, 1496 Ex. 1004, 6 ("The initial acid job using [solid body packers] indicated that the [solid body packers] successfully provided isolation during the job.").

For the foregoing reasons, Petitioner persuades us that a person of ordinary skill in the art would have had reason to use Ellsworth's solid body packers in the system disclosed by Lane-Wells.

[38] Moreover, even if Echols did teach away from the use of solid body packers in 1994, Ellsworth supersedes this disclosure in 1999 by touting solid body packers as a desirable way to provide isolation in open hole wellbores.

6. *Objective Indicia of Non-Obviousness*

Patent Owner presents objective evidence of non-obviousness, including proceeding contrary to accepted wisdom, nexus, copying, commercial success, industry praise, and the length of time between the prior art dates and the claimed invention. For all but commercial success and the length of time, Patent Owner's arguments and evidence are substantively the same as the evidence and arguments discussed above in Section III.C.5. *Compare* 596 PO Resp. 20–39, *with* 1496 PO Resp. 6–30. As explained in Section III.C.5.e above, Petitioner persuades us that, contrary to Patent Owner's assertions, open-hole multistage fracturing did not proceed contrary to the accepted wisdom. As explained in Section III.C.5.d, Patent Owner persuades us of copying. And as explained in Section III.C.5.c, Patent Owner persuades us of some degree of industry praise. We turn now to Patent Owner's assertions of commercial success and that non-obviousness is suggested by the length of time that passed between the dates of the prior art and the claimed invention.

a. *Commercial Success*

Patent Owner argues commercial success of Packers Plus's StackFRAC system and Baker Hughes's FracPoint system. 1496 PO Resp. 25–27. For the reasons explained above in Section III.C.5.b, the evidence regarding StackFRAC and FracPoint does not demonstrate commercial success of the invention of claims 23 and 27 as a whole. Additionally, with respect to claims 1–7, 11, 14–23, 25, and 26, Patent Owner does not provide evidence persuading us that StackFRAC or FracPoint practices these claims. *See* 1496 PO Resp. 13, 21; 1496 Ex. 2050, 7, 43 Appendix A (Providing

detailed allegation of how StackFRAC practices claims 24 and 27 of the '505 patent, but not addressing other claims), Appendix B (Providing detailed allegation of how FracPoint practices claim 1, but not addressing other claims). Furthermore, because Thomson anticipates claims 1–7, 14–22, and 24–26 (*See* Section III.B), Patent Owner's arguments of commercial success are unavailing as to these claims. *See Richdel, Inc. v. Sunspool Corp.*, 714 F.2d 1573, 1580 (Fed. Cir. 1983); *Classco, Inc. v. Apple, Inc.*, 838 F.3d 1214, 1220 (Fed. Cir. 2016).

Patent Owner argues that "Weatherford's sales also demonstrate the commercial success of its ZoneSelect system." *Id.* at 26 (citing 1496 Ex. 2081, 25). In support of this, Patent Owner asserts that open hole multistage fracturing accounts for 12 percent of Weatherford's "fracture system sales." *Id.* We find this unpersuasive of commercial success because it provides no information regarding how Weatherford's open hole multistage fracturing business compares within the overall market.[39]

b. *Time*

Patent Owner argues that the length of time by which Lane-Wells predates the filing date of the claimed invention demonstrates non-obviousness. 1496 PO Resp. 30 (citing *Leo Pharm. Prod., Ltd. v. Rea*, 726 F.3d 1346, 1359 (Fed. Cir. 2013)). We find Patent Owner's reliance on *Leo* inapposite. Patent Owner argues that "[h]ere, Petitioner['s] primary reference was published over *fifty* years ago." 1496 PO Resp. 30. We find this unpersuasive because Ellsworth was published within a few years of

[39] Patent Owner does not point to Weatherford advertising to bolster its contention of commercial success based on Weatherford's ZoneSelect. *See* 1496 PO Resp. 25–27.

Patent Owner's application for patent. *See* 1496 Ex. 1004, 1; Ex. 1001 [22], [62]. Furthermore, in *Leo*, the long time period was asserted in conjunction with evidence that there was "a long felt but unsolved need for a combined treatment of vitamin D and corticosteroid" to treat psoriasis. *See Leo Pharm.*, 726 F.3d at 1359 (Fed. Cir. 2013). ("The record also shows evidence of *long* felt but unsolved need, *i.e.*, the need for a single formulation to treat psoriasis."). In this case, Patent Owner fails to provide any persuasive evidence of a long-felt but unsolved need. For these reasons, we do not find any persuasive value in Patent Owner's assertions regarding the length of time between the prior art and the claimed invention.

7. *Overall Conclusions 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 claims, weigh heavily in favor of Petitioner's contention that the claims would have been obvious in view of Lane-Wells and Ellsworth. As explained above in Section III.H.3, the only difference between Lane-Wells and the challenged claims is that Lane-Wells, which does not specify what type of packers its apparatus uses, does not meet the claims' limitations regarding the construction of the packers. Ellsworth discloses the use of solid-body packers that meet the claim limitations regarding packer construction. *See* 1496 Pet. 42–44, 49, 51–56 (citing 1496 Ex. 1004, 3, 5, 7–8; 1496 Ex. 1007 ¶¶ 68, 80–86, 92; 1496 Ex. 1016, 3:62–65, Figs. 1, 2; 1496 Ex. 1006, Figs. 1–3; 1496 Ex. 1001, 8:58–61). Additionally, Ellsworth discloses successfully using those solid body packers for exactly the application disclosed in Lane-Wells—acidizing in an

open hole wellbore. 1496 Ex. 1004, 6. These disclosures provide sound motivation to use Ellsworth's packers in Lane-Wells's apparatus, as a person of ordinary skill in the art would have viewed Ellsworth's packers as a proven way to provide isolation for Lane-Wells's application. *See* 1496 Ex. 1007 ¶¶ 75–79.

The level of ordinary skill in the art also weighs in favor of Petitioner's assertion that the challenged claims would have been obvious. As explained above in Section III.C.3, a person of ordinary skill in the art would have understood that solid body packers would have been a desirable alternative to cup type and inflatable packers in at least some circumstances. 1496 Pet. 14 (citing Ex. 1496 1007 ¶¶ 41–44, 46, 48–54; 1496 Ex. 1004, 3; 1496 Ex. 1011, 3:67–4:4; 1496 Ex. 1012, 18–19, 34). Additionally, Petitioner persuades us that it would have been a straightforward task for a person of ordinary skill in the art to combine Ellsworth's solid body packers with Lane-Wells's apparatus to perform successfully multizone acidizing in an open hole wellbore. 1496 Pet. 36–37; 1496 Ex. 1007 ¶¶ 25–54, 79.

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 copying weighs against obviousness. *See* Sections III.C.5.d, III.H.6. Patent Owner's evidence of industry praise also weighs in favor of non-obviousness, though to a lesser extent because some of that evidence may relate at least somewhat to factors other than the claimed invention as a whole. *See* Section III.C.5.c, III.H.6. The other evidence of objective indicia of non-obviousness does not weigh in favor of Patent Owner. *See* Sections III.C.5.b, III.C.5.e, III.H.6.a, III.H.6.b.

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 1–7 and 14–27 would have been obvious.

I. Alleged Obviousness of Claim 15 over Lane-Wells, Ellsworth, and Hartley

Claim 14 depends from claim 1 and recites "wherein the second sleeve has formed thereon a seat and the means for moving the second sleeve includes a sealing device selected to seal against the seat." *Id.* at 15:32–35. Claim 15 depends from claim 14 and recites "wherein the sealing device is a plug." *Id.* at 15:38–39.

Petitioner asserts that Lane-Wells discloses these limitations of claims 14 and 15. 1496 Pet. 48, 50–51. Petitioner argues that Lane-Wells discloses a ball for actuating its MSAF tool, and that this ball corresponds to the sealing device recited in claim 14, as well as the plug recited in claim 15. *Id.* Petitioner further argues that to the extent Lane-Wells' ball does not constitute a plug "it would have been obvious to use the plug of Hartley (Ex. 1003) in place of Lane-Wells' ball to actuate the inner sleeves of the Tubing Port Valves." *Id.* at 58. In support of this, Petitioner argues that "Hartley uses its plug 96 to seal its seat 94 and shift its sliding sleeve from a closed position to an open position." *Id.* (citing 1496 Ex. 1003, 4:65–5:1, 7:57–8:8, Figs. 2–3; 1496 Ex. 1007 ¶ 95). Thus, Petitioner argues, Hartley's plug 96 serves the same purpose as Lane-Wells' ball. *Id.* (citing 1496 Ex. 1007 ¶ 95). Consequently, Petitioner argues, a person of ordinary skill in the art would have recognized Hartley's plug 96 as an alternative that could be

substituted for Lane-Wells' ball in a straightforward manner with predictable results. *Id.* (citing 1496 Ex. 1007 ¶ 95). We determine that Petitioner has demonstrated obviousness of claim 15 over Lane-Wells, Ellsworth, and Hartley by a preponderance of the evidence.

We find unpersuasive Patent Owner's arguments to the contrary. Patent Owner argues that Petitioner has not demonstrated Lane-Wells is prior art (1496 PO Resp. 33–39), that Petitioner has not demonstrated that it would have been obvious to combine Lane-Wells and Ellsworth (*id.* 39–43), and that objective indicia of non-obviousness demonstrate non-obviousness (*id.* at 6–30). For the reasons explained above in Sections III.H.1, III.H.6, and III.H.5, we find these arguments unpersuasive.

J. Alleged Obviousness of Claim 11 over Lane-Wells, Ellsworth, and Echols

Petitioner argues that it would have been obvious to add Echols's dual-sleeve arrangement to Lane-Wells's system. 1496 Pet. 59–62. Petitioner argues that Echols expressly "suggests using [its dual-sleeve arrangement] for injecting treatment fluids like Lane-Wells'." *Id.* at 60. Petitioner elaborates that "[a]fter describing its invention for setting packers, Echols explains that its dual-sleeve arrangement 'may also be used for injecting completion chemicals through the exposed port into the annulus surrounding the tubing string.'" *Id.* (citing 1496 Ex. 1005, 6:45–53). Petitioner asserts that it would have been obvious to add Echols's dual-sleeve arrangement to Lane-Wells system "to provide additional injection points above Lane-Wells' Tubing Port Valves in each of these zones." *Id.* at 61 (citing 1496 Ex. 1007 ¶¶ 99–100). Petitioner argues that a person of ordinary skill in the art would have expected this system "to be beneficial for

treating longer zones, or zones with larger thicknesses, to provide additional fractures or porosity at both sleeves to improve porosity and thus production from the formation." *Id.* (citing 1496 Ex. 1007 ¶ 101). Petitioner further argues a person of ordinary skill in the art would have expected this to provide production advantages. *Id.* at 61–62 (citing 1496 Ex. 1017, 1; 1496 Ex. 1018, 2; 1496 Ex. 1007 ¶ 100).

We find that Petitioner has demonstrated by a preponderance of the evidence that claim 11 would have been obvious over Lane-Wells, Ellsworth, and Echols. Because we find it persuasive, we adopt Petitioner's explanation of why it believes claim 11 would have been obvious as our own.

We find unpersuasive Patent Owner's counterarguments. Patent Owner argues that Petitioner has not demonstrated Lane-Wells is prior art (1496 PO Resp. 33–39), that Petitioner has not demonstrated that it would have been obvious to combine Lane-Wells and Ellsworth (*id.* 39–43), and that objective indicia of non-obviousness demonstrate non-obviousness (*id.* at 6–30). For the reasons explained above in Sections III.H.1, III.H.6, and III.H.5, we find these arguments unpersuasive.

K. Other Grounds

Petitioner has also asserted obviousness of claim 11 over Thomson and Echols (596 Pet. 49–53), obviousness of claim 11 over Thomson, Echols, and Brown (596 Pet. 4), and obviousness of claims 7 and 19 over Lane-Wells, Ellsworth, and "based on the knowledge of a person of ordinary skill in the art" (1496 Pet. 63–67). We need not address these assertions, having determined that Petitioner has demonstrated unpatentability of these claims on other bases (*see* Sections III.B, III.E, and III.J).

IV. CONCLUSION

For the reasons expressed above, we determine that Petitioner has demonstrated the following by a preponderance of the evidence:

Claims 1–7, 14–22, and 24–26 are unpatentable as anticipated by Thomson;

Claim 15 is unpatentable as obvious over Thomson and Hartley;

Claims 23 and 27 are unpatentable as obvious over Thomson and Ellsworth;

Claims 1–7, 14–22, and 24–26 are unpatentable as obvious over Thomson and Brown;

Claim 15 is unpatentable as obvious over Thomson, Hartley, and Brown;

Claims 23 and 27 are unpatentable as obvious over Thomson, Ellsworth, and Brown;

Claims 1–7 and 14–27 are unpatentable as obvious over Lane-Well and Ellsworth;

Claim 15 is unpatentable as obvious over Lane-Wells, Ellsworth, and Hartley; and

Claim 11 is unpatentable as obvious over Lane-Wells, Ellsworth, and Echols.

Additionally, for the reasons expressed above, we determine that Petitioner has not shown by a preponderance of the evidence that:

Claim 11 is unpatentable as anticipated by Thomson; or

Claim 11 is unpatentable as obvious over Thomson and Brown.

IV. ORDERS

After due consideration of the record before us, it is:

ORDERED that claims 1–7, 11, and 14–27 have been shown to be unpatentable; 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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