

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INTELLIGENT WELLHEAD SYSTEMS, INC.,
Petitioner,

v.

DOWNING WELLHEAD EQUIPMENT, LLC,
Patent Owner.

IPR2024-00300
U.S. Patent 11,560,770

PATENT OWNER RESPONSE

TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	TECHNOLOGICAL BACKGROUND	1
	A. Hydraulic Fracturing	1
	B. Zipper Fracturing.....	3
	C. Summary of the '770 Patent: The “CP Swap.”	7
III.	CLAIM CONSTRUCTION	10
IV.	THE PETITION FAILS TO PROVE THE CHALLENGED CLAIMS ARE UNPATENTABLE.....	10
	A. Grounds 1–2: The Krupa Grounds fail as a matter of law because the Petition does not establish Krupa as prior art.....	10
	B. Grounds 3-6: The Carr Grounds do not anticipate or render obvious the Challenged Claims.....	12
	1. Carr is fundamentally different than the '770 patent.....	12
	2. Grounds 3 & 4: Carr does not anticipate or render obvious the Challenged Claims.	16
	a. Independent Claims 1, 14, 27.	16
	b. Dependent Claims 2, 15, 28 are not anticipated or rendered obvious by Carr.....	27
	c. Dependent Claims 3, 16, 29 are not anticipated or rendered obvious by Carr.....	29
	d. Dependent Claims 11, 24, 36 are not anticipated or rendered obvious by Carr.....	30

C.	Ground 5: The combination of Carr and Beuterbaugh does not render the Challenged Claims obvious.	33
1.	Beuterbaugh is fundamentally different than Carr.	33
2.	Petitioner fails to show a POSITA would have been motivated to add Beuterbaugh’s valve sequencing to Carr.....	36
3.	Dependent Claims 2, 15, 28 are not rendered obvious by Carr in view of Beuterbaugh.....	40
4.	Dependent Claims 3, 16, 29 are not rendered obvious by Carr in view of Beuterbaugh.....	40
D.	Ground 6: The combination of Carr, Beuterbaugh, and Jackson does not render the Challenged Claims obvious.....	40
E.	Grounds 7-8: The Tolman Grounds do not anticipate or render obvious the Challenged Claims.....	42
1.	The purpose of the ’770 Patent is to <i>improve</i> traditional zipper systems like Tolman.	42
2.	Petitioner has failed as a matter of law to identify with particularity which valve in Tolman is the claimed “ <i>first valve</i> ” of Claims 1, 14, and 27.....	44
3.	Petitioner does not point to a single “valve” in Tolman that meets all limitations of the claimed “ <i>first valve.</i> ”.....	49
a.	Tolman’s “manifold valve 214” does not meet the requirements of the claimed “ <i>first valve.</i> ”.....	50
b.	Tolman’s alleged “tree valve(s)” associated with flowback do not meet the requirements of the claimed “ <i>first valve.</i> ”	51

c.	None of the valves in Tolman operate in the claimed sequence in response to determining that a fluid condition has been satisfied.	54
4.	Tolman does not teach or suggest “ <i>closing the first valve after opening the second valve.</i> ” (elements [1.4]/[14.5]/[27.5])	55
5.	Petitioner’s alternative “two system” theory fails to anticipate or render obvious claim elements 1.3, 14.4, and 27.4.	56
6.	Petitioner’s alternative “injecting fluids” theory fails to anticipate or render obvious the Challenged Claims.	57
7.	Dependent Claims 3, 16, 29 are not anticipated or rendered obvious by Tolman.	58
8.	Dependent Claims 5, 6, 9, 18, 19, 22, 31, and 32 are not anticipated or rendered obvious by Tolman.	59
V.	OBJECTIVE EVIDENCE DEMONSTRATES THAT THE CHALLENGED CLAIMS WERE NONOBVIOUS	60
A.	Freedom Series’ continuous pumping swap feature implements the invention of the Challenged Claims.	61
B.	Industry praise supports nonobviousness.....	65
1.	The Freedom Series received an industry award and significant praise.	65
2.	The praise directly results from the claimed invention.	67
III.	CONCLUSION.....	70

Patent Owner's Exhibit List

Exhibit	Description
Ex.2001	Wayback Machine - Downing Continuous Pumping Web Page
Ex.2002	Downing Continuous Pumping WordPress Page
Ex.2003	Tim Marvel Email RE Continuous Pumping Webpage with Attachment
Ex.2004	Marvel LinkedIn Post 1/12/2020
Ex.2005	Declaration of Tim Marvel
Ex.2006	Declaration of John Hughett
Ex.2007	CV of John Hughett
Ex.2008	Deposition Exhibit – SLB Energy Glossary, “zipper manifold”
Ex.2009	Deposition Exhibit – SLB Energy Glossary, “missile”
Ex.2010	Deposition Exhibit – SLB Energy Glossary, “gate valve”
Ex.2011	Deposition Exhibit – Annotated Fig. 5 of US2019/0233275 (Carr)
Ex.2012	Declaration of John Hughett in Support of Patent Owner Response
Ex.2013	Deposition Transcript of Robert A. Durham (Aug. 15, 2024)
Ex.2014	Downing Continuous Pumping Website (Sept. 16, 2024)
Ex.2015	Gulf Energy Excellence Awards 2023 Winners (Sept. 16, 2024)
Ex.2016	Gulf Energy Excellence Awards 2023 Finalists (Sept. 16, 2024)
Ex.2017	Wayback Machine - Gulf Energy Excellence Awards Methodology 2023 (archived Jun. 1, 2023)
Ex.2018	Wayback Machine - Gulf Energy Excellence Awards Nominations 2023 (archived Mar. 4, 2024)

Exhibit	Description
Ex.2019	Downing 2023 Gulf Energy Award Submission
Ex.2020	Liberty News - Liberty Announces Milestone Achievement of 24 Hours of Continuous Pumping Time (dated Sept. 27, 2021)
Ex.2021	Xstim Consulting, www.xstimconsulting.com (Sept. 17, 2024)
Ex.2022	XStim Consulting - About Us, www.xstimconsulting.com/about-us (Sept. 17, 2024)
Ex.2023	XStim Consulting – Fourteen Forty Pump Time Record, www.xstimconsulting.com/news/fourteen-forty-pump-time-record (Sept. 17, 2024)
Ex.2024	Downing LinkedIn Post – Aaron Dressel https://www.linkedin.com/posts/downingusa_permianbasin-permian-eagleford-activity-6849475549518192640-tX5_/ (Sept. 11, 2024)
Ex.2025	Q2 2023 Occidental Petroleum Corp Earnings Call of Aug. 3, 2023, https://www.oxy.com/siteassets/documents/investors/quarterly-earnings/oxy2q23transcript.pdf
Ex.2026	Downing LinkedIn Post – Occidental https://www.linkedin.com/posts/downingusa_haynesville-midcon-permianbasin-activity-7094430459455033344-jm8R?trk=public_profile_like_view (Sept. 16, 2024)
Ex.2027	Downing LinkedIn Post – Addison Kowal https://www.linkedin.com/posts/downingusa_permianbasin-permian-eagleford-activity-6885324063816912896-4RM4/ (Sept. 11, 2024)
Ex.2028	Chesapeake Energy Corporation Reports 2023 Second Quarter Results, Aug 1, 2023 (https://investors.chk.com/2023-08-01-CHESAPEAKE-ENERGY-CORPORATION-REPORTS-2023-SECOND-QUARTER-RESULTS)

Exhibit	Description
Ex.2029	Downing LinkedIn Post – Chesapeake https://www.linkedin.com/posts/downingusa_haynesville-midcon-permianbasin-activity-7092898981432754176-zo98?trk=public_profile_like_view/ (Sept. 17, 2024)
Ex.2030	Wayback Machine – Different Types of Pumps – Positive Displacement Pumps, https://web.archive.org/web/20200812201325/https://www.processindustryforum.com/article/different-types-pumps-positive-displacement-pumps (archived Aug. 12, 2020)
Ex.2031	US Patent Application Pub. No. 2021/0054727
Ex.2032	Declaration of Timothy Marvel in Support of Patent Owner Response

I. INTRODUCTION

Patent Owner Downing Wellhead Equipment invented a novel way of instantaneously transitioning between wells while hydraulically fracturing. This technique—called a continuous pumping swap—has allowed operators in the field to keep their pumps running for record breaking lengths of time, drastically lowering non-productive time. Praised by operators and copied by competitors, Downing’s novel CP swap is embodied in and protected by the claims of the ’770 Patent.

One of those competitors, Petitioner Intelligent Wellhead Systems, seeks to invalidate the ’770 Patent—but does so with conventional prior art systems lacking the novel CP swap. Not surprisingly, Petitioner struggles to map the challenged claims to the prior art, as evidenced by the Petition’s lack of particularity, disclosure gaps, and unsupported assertions of obviousness.

Downing respectfully asks the Board to confirm these deficiencies in the Petition and find the challenged claims not unpatentable.

II. TECHNOLOGICAL BACKGROUND

A. Hydraulic Fracturing

Hydraulic fracturing was developed in the early 20th Century and has become an essential process in the production of oil and gas in North America. Ex.2012, ¶98. Innovations in hydraulic fracturing technologies have been and

continue to be vital for the oil and gas industry to meet growing global energy demands.

Hydraulic fracturing is a process used to enhance oil and gas extraction out of an underground formation by (i) creating fractures in the formation with an explosive device (a “perforating gun”) and (ii) pumping high pressure fluid and sand (“proppant”) into the fractures to hold them open, thus allowing oil and gas to freely flow out of the fractures and into the well. Ex.2012, ¶100. Hydraulic fracturing operators typically fracture wells in stages by plugging and perforating (“PnP”) sequential fracture zones in a formation. *Id.* Depending on the length of the well, there may be anywhere between 10 and 100 or more stages per well. *Id.* Traditionally, hydraulic fracturing was a “one well at a time” method—all stages in a single well had to be completed before operations could move on to the next well. *Id.*

Operators, eager to mitigate non-productive time (“NPT”) associated with the “one well at a time” method, began drilling multiple wells in close proximity so a stage in one well could be fractured while a stage in an adjacent well is prepared. Ex.2012, ¶101. In early versions of this multi-well method, such as that described in the Carr reference, nearby wells shared an upstream fluid source but still relied upon separate pump arrays to pressurize and inject an isolated and independent fluid flow into each well. *See* Ex.1004, Fig. 5, [0022].

B. Zipper Fracturing.

More recently, a method known as “zipper fracturing” was developed to further reduce NPT associated with multi-well sites. Ex.2012, ¶102. In a zipper operation, adjacent wells are connected to a common “zipper manifold” and share a common pressurized fluid flow. Ex.2012, ¶¶102-103. This common fluid flow is redirected between wells within the zipper manifold. Importantly, the ’770 Patent describes and is specifically directed to improving a zipper fracturing system.

As explained in the Jacobs article relied upon by Petitioner’s expert, Dr. Durham, zipper fracturing requires a zipper manifold. *See* Ex.1009 (“Zipper Fracture Takes Hold”), 2 (“In terms of extra equipment, the only added system requirement is what is called a zipper manifold.”). The Schlumberger Energy Glossary defines “zipper manifold” as:

A system of frac valves that directs treatment fluid from the missile to multiple frac trees. The zipper manifold facilitates quick redirection of fracturing pressure from one well to another, enabling pump trucks to run nearly continuously to minimize downtime.

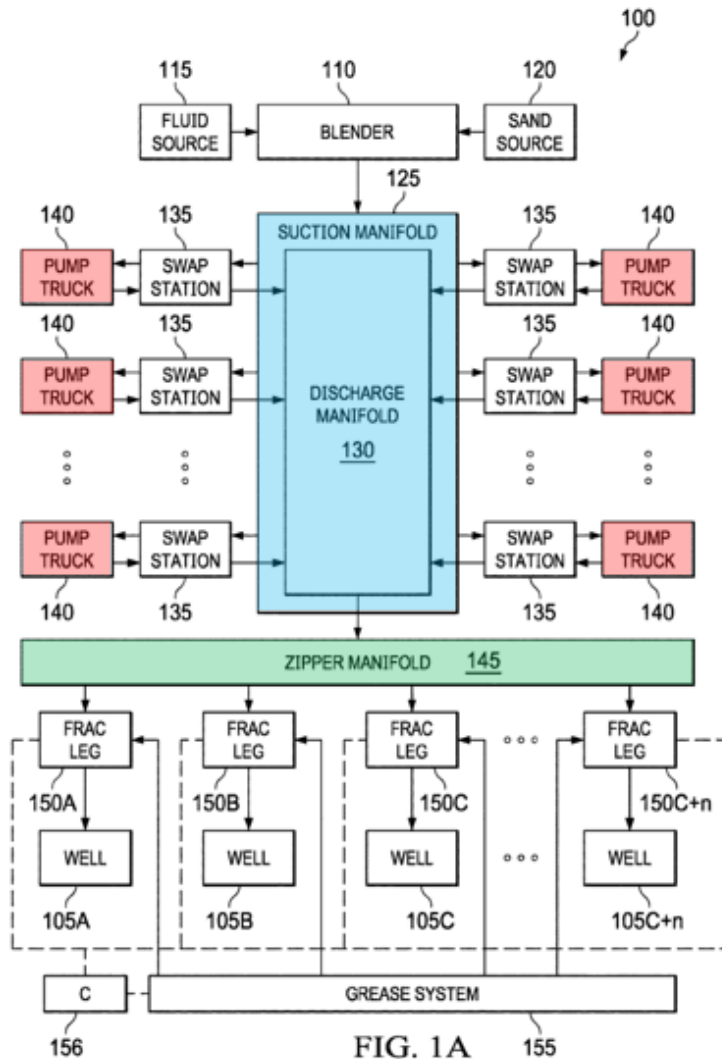
Ex.2008. Both experts agree that this definition of zipper manifold is consistent with the understanding of a POSITA as of May 2021. Ex.2012, ¶104; Ex.2013 (Durham Dep.), 61:4-62:22.

An important aspect of the zipper manifold, as captured in the above definition, is that the manifold “redirect[s]” pressurized fluid from the missile to

“multiple” wells. Ex.2008; *see also* Ex.2009 (Schlumberger Energy Glossary definition of “missile”). That is, the zipper manifold receives a single flow of fracturing fluid that has already been pressurized in the missile and directs this common pressurized fluid flow to one of the many wells connected to the zipper manifold. Ex.2008; Ex.2012, ¶105.

Figure 1A of the '770 Patent illustrates a diagram of a conventional¹ zipper fracturing setup, with a zipper manifold 145 (green) and an upstream missile (blue) to which the pumps (red) are connected.

¹ Both experts agree that '770 Patent Fig.1A illustrates a conventional zipper fracturing setup with a conventional zipper manifold and missile. Ex.2012, ¶¶106-107; Ex.2013 (Durham Dep.), 74:1-22; 71:23-72:3.



Ex.1001, Fig.1A (annotated); Ex.2012, ¶106.

As shown in Fig.1A, discharge manifold 130 collects pressurized fracturing fluid from multiple pump trucks 140, combines the fluid into a common pressurized fluid flow, and communicates the common pressurized fluid flow to the zipper manifold 145. Ex.1001, 5:45-65. The zipper manifold 145 then directs the common pressurized fluid flow to one of the wells 105A-C+n. Ex.1001, 5:45-65. Zipper valves 170a-b, shown in Fig.2A, control which of the wells receive

the common pressurized fluid flowing through the zipper manifold. Ex.1001, 6:8-9, 7:60-8:1. The '770 Patent uses the term “zipper valve” in the conventional manner to describe valves that redirect the pressurized fluid flow between multiple wells on a zipper manifold. Ex.2012, ¶107; Ex.2013 (Durham Dep.), 81:7-23 (testifying that a zipper valve’s “[f]unction is used to direct fluid flow between the wells”).

The reduction in NPT enabled by zipper fracturing resulted in its widespread adoption in the industry. Ex.2012, ¶¶108-109; *See, e.g.*, Ex.1009, 1. But operators accustomed to significant downtime between pumping operations had to adapt to the relatively fast-paced pumping schedule in zipper fracturing operations. Ex.1009, 2. The Jacobs article described this quicker schedule as “continuous” because of the relatively short amount of downtime between pumping operations as compared to the hours previously required with earlier methods. *Id.*

But describing these previous zipper-based pumping operations as “continuous” was a misnomer—zipper fracturing operations were not truly continuous because they still required at least a 15-minute stoppage of pumping operations during the transition between wells. Ex.1009, 2 (“[W]hen doing zipper fracturing the break in stimulation operations may only last 15 minutes as workers switch from one well to another.”); Ex.2012, ¶¶109-110. This delay is due to the time it takes to shut down the pumps, close the valve to the first well, open the

valve to the second well, and start the pumps back up to begin fracturing the next well. Ex.2012, ¶111. This sequence avoids having two wells' valves open simultaneously, which was traditionally thought to be “critical” for safety purposes. *See* Ex.1031, 4 (Tolman article), 4 (stating that it is “[c]ritical to maintaining safety” to close valves on wells not being stimulated to “isolate[e]” them); *see also* Ex.1006 (Tolman patent), 7:19-30 (same); Ex.2012, ¶111. Downing's novel system and method claimed in the '770 Patent upended this traditional understanding.

C. Summary of the '770 Patent: The “CP Swap.”

The '770 Patent describes and claims a novel process of hydraulic fracturing that eliminates NPT associated with switching from hydraulically fracturing one well connected to a zipper manifold to the next well connected to the zipper manifold. Ex.2012, ¶112; Ex.1001, Figs. 1A-20 (showing the claimed hydraulic fracturing system and process implemented utilizing zipper manifolds and zipper valves). NPT is eliminated by enabling hydraulic fracturing operations to continuously pump fluid as the system “swaps” from one well to the next ***without any break in pumping operations***—a process referred to as a “continuous pumping swap” or “CP swap.” Ex.1001, Figs.16D-16E, 14:43-51.

To perform a CP swap, while a first valve associated with a first well is open, a second valve associated with a second well is also opened while hydraulic

fracturing fluid is still being pumped into the first well, and then the first valve associated with the first well is closed:

As shown in FIGS. 16D and 16E, executing the CP swap from hydraulically fracturing (at the step 262) the n_1 well (e.g., well 105D) to hydraulically fracturing (at the step 262) the n_1+1 well (e.g., well 105B) transitions the zipper valves from one well to the other, opening the second well and subsequently shutting-in the first well, all while pumping.

Ex.1001, 14:43-48.

As shown below in '770 Patent Fig.16D, during the CP swap process, transitioning from one well to the next in a zipper fracturing operation “is instantaneous and the total time between stages measured at treatment pressure is less than 20 seconds (as fast as 19 seconds in some instances).” Ex.1001, 14:49-51.

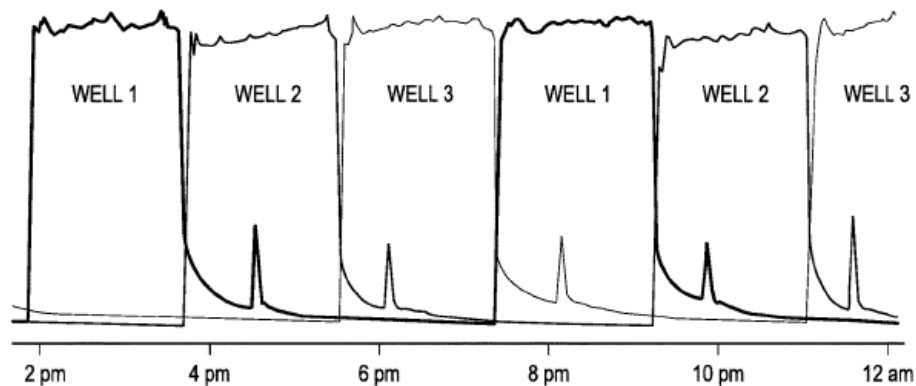


FIG. 16D

The claimed CP swap process also recites that the above-described series of valve opening and closing steps occur “in response to determining that the fluid

communicated via the manifold has satisfied one or more conditions.” Ex.1001, claims 1, 14, 27. Specifically, a CP swap between a first well and second well occurs when the fluid communicated to the “first well” via the manifold has satisfied a condition. Ex.1001, claims 1, 14, 27. The ’770 Patent describes this claimed process in association with Fig.12:

More particularly, as shown in FIG. 12 : at the sub-step 251*a*, a frac rate of the n_1 well (e.g., well 105D) is checked; and, at the sub-step 251*b*, if the frac rate of the n_1 well is below the upper threshold rate (e.g., 10 bbl) and above the lower threshold rate (e.g., 0 bbl) for a threshold amount of time (e.g., 10 s), a CP swap from hydraulically fracturing the n_1 well to hydraulically fracturing the n_1+1 well is permitted at step 260...

Ex.1001, 13:43-50.

In other words, when swapping from the first well (n_1) to the second well (n_1+1), the zipper valve associated with the second well will only be opened to initiate a CP swap when the condition of the fluid communicated to the first well (n_1) is satisfactory. The reason the condition of the fluid communicated to the *first* well is checked even though the zipper valve to the *second* well is being opened is because both wells are connected to the same zipper manifold and share a common pressurized fluid flow, as illustrated in Fig.1A above. See Ex.2012, ¶119. In traditional non-zipper systems, where each well has its own isolated fluid flow

path, such a cross-well check would not be needed or logical before opening a well's valve—the fluid conditions associated with each well would be independent, as explained below with respect to Carr. *See* section IV.B.1.

Prior to the novel CP swap process of the '770 Patent, no other method of hydraulic fracturing provided for continuous pumping while swapping between wells on a zipper manifold during a zipper fracturing operation.

III. CLAIM CONSTRUCTION

Patent Owner contends that claim construction is not necessary and that every claim term should be afforded its plain and ordinary meaning.

IV. THE PETITION FAILS TO PROVE THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. Grounds 1–2: The Krupa Grounds fail as a matter of law because the Petition does not establish Krupa as prior art.

The Petition relies upon U.S. Patent Publication No. 2022/0268141 to Krupa (Ex.1003) as the primary reference in Grounds 1 and 2 (the “Krupa Grounds”).

Petitioner contends that “*Krupa* is 35 U.S.C. §102(a)(2)-prior art” solely because Krupa claims priority to U.S. Provisional App. No. 63/153,607 (the “Krupa Provisional”), filed February 25, 2021, which is earlier than the '770 Patent's priority date of May 17, 2021. Petition, 4 (“Because *Krupa*'s effective filing date is February 25, 2021—before '770's priority date (May 17, 2021)—*Krupa* is 35 U.S.C. §102(a)(2)-prior art.”). The Petition does not show (or even allege) that the

subject matter relied upon in Krupa is supported by the Krupa Provisional.

Petitioner has thus failed to establish that Krupa is prior art.

Because Krupa’s filing date of February 18, 2022 is after the priority date for the Challenged Claims of the ’770 Patent (May 17, 2021), Petitioner had the initial burden in the petition to qualify Krupa as prior art. 35 U.S.C. § 102(d)(2); *Apple Inc. v. Telefonaktiebolaget LM Ericsson*, No. IPR2022-00348, Paper 9, at 4 (Sept. 21, 2022) (“Among other obligations, a petitioner carries a burden of production to show ***in its petition*** that the asserted references qualify as prior art.”) (citing *Dynamic Drinkware*, 800 F.3d at 1380). To meet that initial burden, Petitioner was required to show in the Petition that the Krupa Provisional “describes the subject matter” relied upon in Krupa. 35 U.S.C. § 102(d)(2); *see also Penumbra, Inc. v. RapidPulse, Inc.*, IPR2021-01466, Paper 34 at 32-34 (Mar. 10, 2023) (precedential as to § II.E.3) (“[U]nder the AIA, . . . the provisional or other earlier application(s) to which the reference patent document claims a right of priority must ‘describe[] the subject matter’ relied upon in the reference patent document as prior art” (quoting 35 U.S.C. § 102(d)(2)); *Forescout Techs., Inc. v. Fortinet, Inc.*, IPR2021-01328, Paper 12, at 9-10 (Jan. 27, 2022) (“[Petitioner] has ***an initial burden*** . . . to show that the subject matter that [Petitioner] relies on in [the reference] is also found in the [provisional]”).

Petitioner failed to make that showing in the Petition—nor could it have, the Krupa Provisional was not filed as an exhibit. *See* Petition, vi-ix.

Thus, because the Petition does establish Krupa as prior art, the Krupa Grounds fail to establish unpatentability of the Challenged Claims.

B. Grounds 3-6: The Carr Grounds do not anticipate or render obvious the Challenged Claims.

1. Carr is fundamentally different than the '770 patent.

Unlike the '770 Patent, Carr does not describe or solve problems associated with zipper manifold-based fracturing. Instead, Carr describes an older problem in hydraulic fracturing operations where, fluid preparation equipment (e.g., hydration blender, chemicals, mixing blender, proppant, etc.) were broken down and relocated to fracture the next well after completing the first (generating significant NPT). Ex.1004, [0003]. Carr attempts to solve this problem with a “well treatment facility 100...at a centralized location 105” that allows hydraulic fracturing fluid to be “manufactured, formed and/or mixed at a centralized location” prior to being transferred to multiple wells on a single pad—***but while maintaining isolated and independent fluid flow paths to each well.*** *See, e.g.,* Ex.1004, [0013]-[0017], [0033]-[0035], Fig.5.

Carr Fig.5, reproduced below and annotated by Petitioner’s expert during his deposition, illustrates the separate fluid flow paths for first well 140 and second

well 142. Ex.2011; Ex.2012, ¶131 (agreeing with Dr. Durham’s annotations). For first well 140 (annotated in yellow), fluid flow begins at the water supply 104 and chemicals 106; fluid then travels through hydration blender 102 and into mixing blender 108; fluid then travels through proportion valve 474² and first valve 470 directs fluid to first well 140 via the “first isolated manifold path 122” where the fluid is pressurized by an array of pumps 130 that are exclusively connected to the first isolated manifold path 122. Ex.2012, ¶132. In Carr, each isolated manifold path has a “separate array of pumps 130.” Ex.1004, [0022].

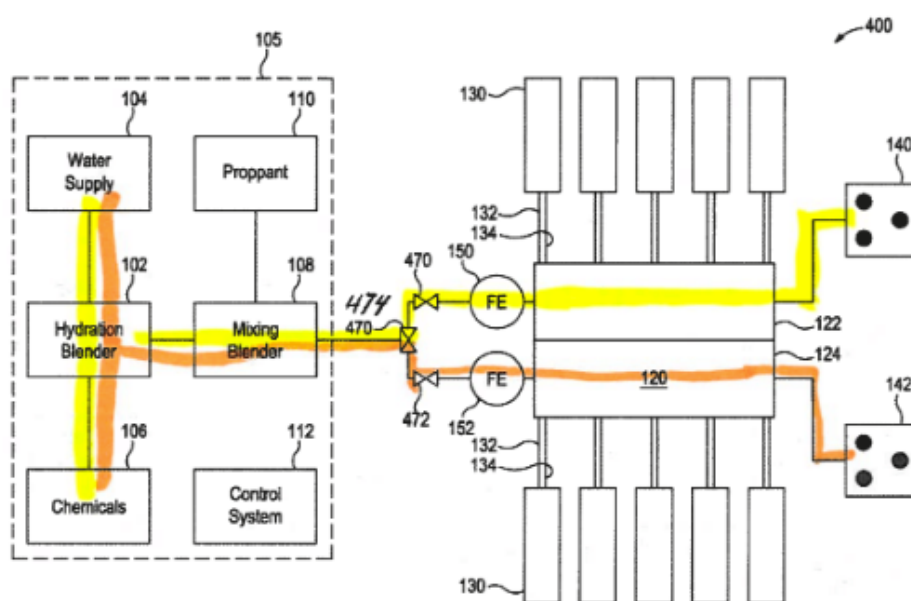


FIG. 5

² Proportion Valve (474) is mislabeled as (470) in Carr Fig.5. Dr. Durham confirmed this correction during his deposition and annotated Fig.5 accordingly.

Ex.2011; *see also* Ex.1004 at [0021], [0022], [0023], [0027], [0033], Claims 1, 9, 16; Ex.2013 (Durham Dep.), 138:14-140:24; Ex.2012, ¶132. For the second well 142, the fluid flow path (in orange) overlaps within the central treatment facility 105, but proportion valve 474 directs the fluid instead to the second valve 472 along the “second isolated manifold path 124” where the fluid is pressurized by a “separate array of pumps 130” and directed into the well 142. *Id.*

Critically, once fluid intended for each respective well (140, 142) enters the manifold 120, it travels via independent and isolated manifold paths 122 and 124 respectively associated with each well³—*and does not mix and cannot be redirected to either well*. Ex.1004, [0026], [0033], Claims 1, 9, 16; Ex.2013 (Durham Dep.), 143:5-21; Ex.2012, ¶133; Ex.2012, ¶133. As such, Carr’s manifold 120 is not a zipper manifold as understood by a POSITA (and as illustrated in the ’770 Patent). Ex.2012, ¶133; *see also* Ex.2008 (defining “zipper

³ First isolated manifold path 122 and second isolated manifold path 124 remain independent fluid flow paths even where manifold 120 is a so-called “integrated manifold.” Ex.1004, [0026], claim 9. Each of the isolated manifold paths are simply contained within an integrated body, called a “missile.” *See* Ex.1004, [0021], [0026]; Ex.2013 (Durham Dep.), 145:17-22, 146:9-148:11.

manifold” as a manifold that “facilitates quick redirection of fracturing pressure from one well to another”). Both experts agree that Carr’s manifold is properly understood as a “missile”—it intakes low-pressure fluid, feeds the fluid to pumps, and outputs highly pressurized fluid. *See* Ex.2009 (definition of “missile”); Ex.2012, ¶133; Ex.2013 (Durham Dep.), 154:1-5 (testifying that manifold 120 is “what would historically be called a missile”), 154:17-22, 146:9-148:11. Moreover, Carr does not have a zipper manifold downstream from its missile for “redirection” of a common fluid flow between the wells 140 and 142. Ex.2008; Ex.1004, Fig. 5. Each “isolated manifold path” outputs fluid directly to a respective well.

Most importantly, because each isolated manifold path is independently pressurized by “separate” pumps and directs fluid to wells with different geologic characteristics, the fluid conditions in each manifold path will be different. Ex.1004, [0022]; Ex.2012, ¶¶134-135; Ex.2013 (Durham Dep.), 94:24-95:10, 151:21-152:3, 153:5-17. Each manifold path’s flow meter separately and independently measures the different fluid conditions to control the respective valves 470 and 472 in light of the wells’ different fluid flow targets. Ex.1004, Fig.5, [0033]-[0035], [0058], [0060]; Ex.2012, ¶135. Dr. Durham confirmed this during this deposition:

A. Carr teaches a different flow meter associated with each path so that you can measure fluid flow separately and independently, as opposed to having a single meter upstream of valve 474, for example.

Q. Why would that be important?

A. So that you can measure flow independently.

Q. Because the fluid conditions can be different, right?

A. Sure. So that you have more information.

Ex.2013 (Durham Dep.), 153:5-17, 150:8-151:2; *see also* Ex.2012, ¶135.

Based on these distinguishing features, Carr's system simply has no need to perform the '770 Patent's claimed well swapping technique, which only applies to wells sharing a common pressurized fluid flow. Ex.2012, ¶134-137.

2. Grounds 3 & 4: Carr does not anticipate or render obvious the Challenged Claims.

a. Independent Claims 1, 14, 27.

The '770 Patent independent claims recite a method (claim 1), apparatus (claim 14), and system (claim 27) directed to the novel continuous pumping swap technique described in the specification. Claim 1 is representative:

1. A method, comprising:

communicating fluid to a first well via a manifold and a first valve, the first valve being associated with both the manifold and the first well; and

in response to determining that the fluid communicated via the manifold has satisfied one or more conditions:

opening a second valve;

communicating fluid to a second well via the second valve; and

closing the first valve after opening the second valve.

This claim language requires operating the valves of **both** the first and second wells in a ***specific ordered sequence*** in response to a condition of the fluid communicated to the ***first*** well. Petitioner has not established that Carr’s technique of stimulating wells with independent and isolated fluid paths anticipates or renders obvious the Challenged Claims.

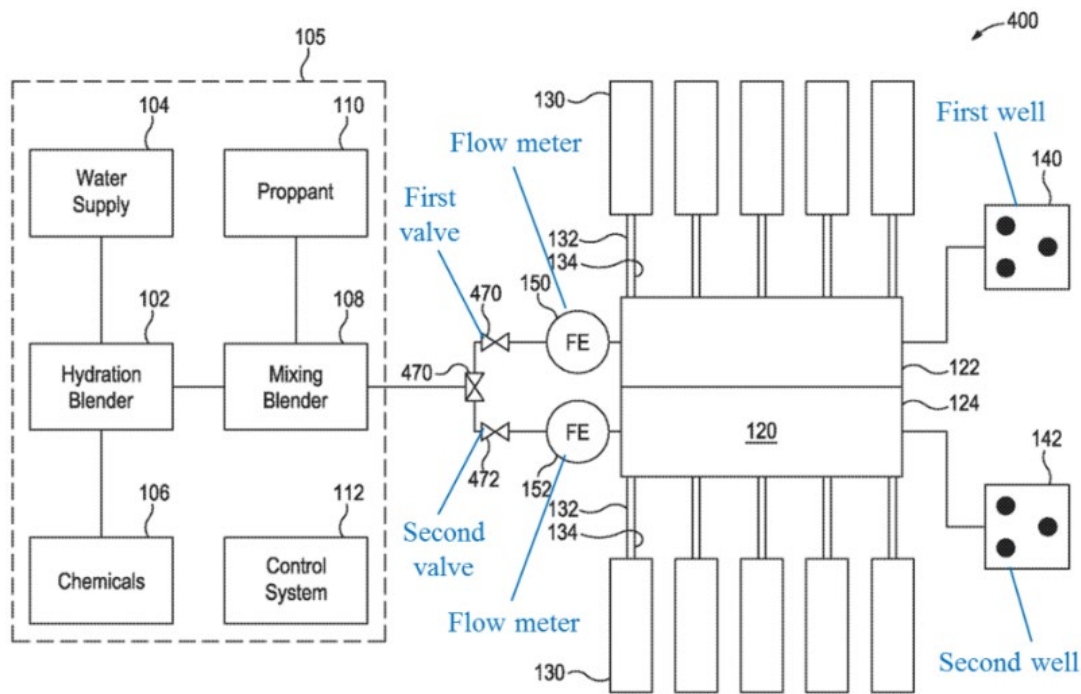
- (i) **Carr does not anticipate or render obvious performing the claimed valve sequence “*in response to determining that the fluid communicated via the manifold has satisfied one or more conditions.*”**

The Challenged Claims require “*communicating fluid to a first well via a manifold*” and then performing a specific valve sequence “*in response to determining that the fluid communicated via the manifold has satisfied one or more conditions.*” Antecedent basis dictates that “*the fluid communicated via the manifold*” in the second limitation refers to the fluid communicated “*to the first well*” in the first limitation. See *Wi-Lan, Inc. v. Apple, Inc.*, 811 F.3d 455, 462 (Fed. Cir. 2016) (“Subsequent use of the definite articles ‘the’ or ‘said’ in a claim refers back to the same term recited earlier in the claim.”). Thus, the fluid

communicated “*to the first well*” is the fluid determined to satisfy one or more conditions. In response to such determination, the following valve sequence is performed: (i) “*opening a second valve;*” (ii) “*communicating fluid to a second well via the second valve;*” and (iii) “*closing the first valve after opening the second valve.*” Accordingly, the claims require performing operations on a ***second*** well in response to fluid communicated to a ***first*** well.⁴ Carr necessarily fails to teach or suggest this claimed interdependency between wells because Carr’s wells are stimulated via “isolated manifold paths” with independent fluid conditions.

As shown below, the Petition maps Carr Fig. 5 to the Challenged Claims.

⁴ As discussed above, the claimed interdependency between the first and second wells is borne out of a shared fluid flow through a zipper manifold.



Petition, 50; *see also* Ex.2012, ¶139. For the element “*communicating fluid to a first well via a manifold and a first valve,*” Petitioner points to the fluid communicated to the first well 140 via valve 470 and the isolated manifold path 122. Petition, 49-50 (citing Ex.1004, [0033]). Based on this initial mapping, Petitioner must show that the fluid communicated to the first well 140 is “*the*” fluid that satisfies one or more conditions before performing the claimed valve sequence. *See, e.g.* Ex.1001, claim 1 (“*in response to determining that the fluid communicated...*”). In other words, to satisfy the claim, Carr must teach determining that fluid in the ***first*** isolated manifold path 122 satisfies a condition

and opening the *second* valve 472 in response. Carr does not teach or suggest such a sequence—nor would a POSITA find it obvious. *See* Ex.2012, ¶¶138-143.

As noted above in Section IV.B.1, Carr’s flow meter 150 provides flow rate information for first isolated manifold path 122, which is used to “control the position of the first valve 470” in light of the “fluid flow targets for the first well 140.” Ex.1004, Fig.5, [0033]-[0035], [0023], [0058] (“adjusting the *first* valve in response to the *first* flow rate”); Ex.2012, ¶135. Separately and independently, flow meter 152 provides flow rate information for second isolated manifold path 124, which is used to control the position of the second valve 472 in light of the fluid flow targets for the second well 142. *Id.*, [0033]-[0035], [0060] (“adjusting the *second* valve in response to the *second* flow rate”); Ex.2012, ¶135; Ex.2013 (Durham Dep.), 153:5-17 (“Carr teaches a different flow meter associated with each path so that you can measure fluid flow *separately and independently*”), 94:24-95:10, 151:21-152:3.⁵ Moreover, even though the isolated manifold paths receive fluid from the same centralized source 105, the fluid, once split, is still “isolated” within each manifold path and thus must be monitored “separately and

⁵ Separately, Petitioner has not established that merely “control[ling] the position” of the valves 470 and 472 in light of fluid flow targets meets the requirement of “opening” and “closing” the first and second valves. Ex.1004, [0035].

independently.” Ex.1004, Fig.5, [0033]; Ex.2013 (Durham Dep.), 153:5-17; Ex.2012, ¶¶134-135.

Petitioner fails to appreciate this critical distinction. In its mapping for “*in response to determining that the fluid communicated via the manifold has satisfied one or more conditions,*” Petitioner generally points to Carr’s flow measurements for **both** the first well 140 and the second well 142 (despite previously identifying only the first well 140 for “*communicating fluid to a first well*”). Petition, 49-51. In the mapping for the responsive “*opening a second valve,*” Petitioner again points to opening **both** the first and second valves 470 and 472. *Id.* (“Carr discloses using a first valve and a second valve to control fluid flow to an associated well.”). At no point does Petitioner make the required showing that Carr opens its **second** valve 472 in response to determining that the fluid communicated to the **first** well 140 satisfies a condition. Nor could it—Carr’s system simply does not operate in that manner. *See* Ex.2012, ¶¶136-137, 141-142. It would make no sense in Carr to control the second valve 472 on the second isolated manifold path 124 based on the separate and independent fluid conditions within the first isolated manifold path 122. Ex.2012, ¶¶136-137, 141-142.

The Petition attempts to paper over Carr’s deficiencies with a single conclusory sentence alleging inherency and obviousness:

A POSITA would find it necessary and at least obvious to close a first valve to a first well after opening a second valve to a second well based on the fluid flow targets to stimulate the first and second wells “individually” and “simultaneously.”

Petition, 52-53 (citing Ex.1002, ¶¶331-332); *see* Ex.2012, ¶142. This statement does not address the above deficiencies because it does not allege that a POSITA would have found it inherent or obvious that Carr opens its second valve 472 in response to determining that the fluid communicated to the first well 140 satisfies a condition. And, even if Petitioner had made such an assertion, the Petition does not present evidence or explanation sufficient to meet the requirements for inherency or obviousness. For example, Petitioner does not show that Carr “necessarily” opens second valve 472 in response to a condition of the fluid in first well 140, as required for inherency. *See Bettcher Indus., Inc. v. Bunzl USA, Inc.*, 661 F.3d 629, 639 (Fed. Cir. 2011). Again, Petitioner could not make that showing because Carr expressly teaches “adjusting the *first* valve in response to the *first* flow rate.” Ex.1004, [0058].

Similarly, Petitioner does not establish that a POSITA would have found it obvious to control Carr’s system in the manner required by the claims. And even if Carr’s system were “capable of” opening the second valve 472 in response to a condition of the fluid in the first well 140, Petitioner does not make the required

showing that a POSITA would have been motivated to do so. *See ParkerVision, Inc. v. Qualcomm Inc.*, 903 F.3d 1354, 1363 (Fed. Cir. 2018) (holding claims not unpatentable because Petitioner failed that the prior art device, “even if capable of doing so, actually would [perform the claimed function], or why a person of ordinary skill in the art would have been motivated to use” the prior art device in the manner claimed). Indeed, a POSITA would have found it nonsensical to operate a valve in Carr’s second isolated manifold path 124 based on a separate and independent fluid condition in the first isolated manifold path 122. Ex.2012, ¶¶136-137; Ex.2013 (Durham Dep.), 153:5-17; Ex.2012, ¶142.

Thus, the Petition fails to establish that Carr anticipates or renders obvious independent claims 1, 14, 27.

(ii) Carr does not anticipate or render obvious performing the claimed valve sequence in the claimed order.

Carr additionally fails to perform the claimed ordered sequence of:

(i) “*opening a second valve;*” (ii) “*communicating fluid to a second well via the second valve;*” and (iii) “*closing the first valve after opening the second valve.*”⁶

The Petition’s mapping of this claimed sequence essentially relies on a

⁶ There is no dispute these steps must be performed in the recited order. *See* Ex.2013 (Durham Dep.), 134:4-11.

single sentence in Carr: “The first valve 470 and the second valve 472 can allow for the first well 140 and the second well 142 to each be stimulated individually by opening the respective first valve 470 or the second valve 472 and closing the other valve.” Petition, 51-52 (citing Ex.1004, [0033]). But this sentence does not provide the desired support.

First, on its face, this sentence does not specify any order in which the first valve 470 and the second valve 472 are opened and closed. It does not, for example, say “by opening the respective first valve 470 or the second valve 472 and *[then]* closing the other valve.” Rather, Carr is merely explaining that when wells 140 and 142 are “stimulated individually,” their respective valves will not be open at the same time (as opposed to when the wells are stimulated simultaneously). *See* Ex.2012, ¶¶145-146.

Second, no order should be implied, because, as explained above in Section IV.B.1, Carr’s first and second valves 470 and 472 are on independent and “isolated” fluid flow paths that are pressurized with “separate” pumps. Ex.1004, [0033], [0022]; *see also* Ex.2012, ¶¶146-147. Independent operation of valves 470 and 472 is necessary to achieve Carr’s goal of hitting each well’s separate “fluid flow targets.” Ex.1004 (“utilizing flow data from the first flow meter 150 and the second flow meter 152 in light of fluid flow targets for the first well 140 and/or the second well 142”); *see also* Ex.2012, ¶147. The Board should thus reject

Petitioner’s attempt to read into Carr the claimed valve sequence that requires dependence between the valves. *See KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 421 (warning against a temptation to read into the prior art the teachings of the invention in issue). If any particular sequence should be imputed to Carr, it should be the valve sequence conventionally utilized in fracturing industry when sequentially fracturing two wells: closing the valve of the first well and *then* opening the valve of the second well. Ex.2012, ¶148.

Third, Petitioner’s secondary reliance on Carr’s teaching of stimulating wells “simultaneously” adds nothing. *See* Petition, 51-52 (citing Ex.1004, [0033]). When stimulating wells 140 and 142 “simultaneously,” Carr’s valves 470 and 472 would open simultaneously and close simultaneously. Ex.2012, ¶¶149-151. Petitioner further does not explain how or why stimulating “simultaneously” meets the claimed valve sequence, which on its face requires that the valves ***not*** operate simultaneously—i.e., “*closing the first valve after opening the second valve.*”

Fourth, the Petition fails to establish that the claimed valve sequence would be inherent or obvious. As mentioned above, Petitioner’s entire inherency and obviousness analysis for the Carr Grounds is a single conclusory sentence. *See* Petition, 52-53 (“A POSITA would find it necessary and at least obvious...”). Without an evidence-based showing that the claimed valve sequence is “necessarily” present in Carr, this sentence is insufficient to establish inherency.

Bettcher Indus., Inc., 661 F.3d at 639. And without the required “reasoned explanation,” this sentence is insufficient to establish a *prima facie* case of obviousness. *In re Nuvasive, Inc.*, 842 F.3d 1376, 1382-83 (Fed. Cir. 2016) (for obviousness, “‘conclusory statements’ alone are insufficient”). Moreover, even if Carr were “capable of” performing the claimed valve sequence, Petitioner has not explained “why a person of ordinary skill in the art would have been motivated to use” such a sequence, as required. *See ParkerVision, Inc.*, 903 F.3d at 1363.

Petitioner’s citations to Dr. Durham’s declaration are similarly insufficient. *See* Petition, 52-53 (citing Ex.1002, ¶¶331-332); *Xerox Corp. v. Bytemark, Inc.*, IPR2022-00624, Paper 9 at 15-16 (Aug. 24, 2022) (precedential). In a single sentence, citing no evidence in support, Dr. Durham asserts that: Carr would “close valve 470” in response to flow conditions while simultaneously stimulating both wells. Ex.1002, ¶331. This is nonsensical. Carr states that “the control system 112 can be utilized to **control the position** of the first valve 470.” Ex.1004, [0035]. Controlling the position of valve 470 during treatment cannot mean completely closing it—as doing so would cut off fluid flow to the well and potentially deadhead the pumps. Ex.2012, ¶¶151-152 (explaining that a POSITA would understand that valve 470 would not be closed during treatment of well 140).

Accordingly, Petitioner fails to meet its burden to show that Carr discloses or renders obvious the specific valve sequence recited in the Challenged Claims.

For the above reasons, Grounds 3 and 4 do not illustrate that independent claims 1, 14, and 27 (and their corresponding dependent claims) are unpatentable.

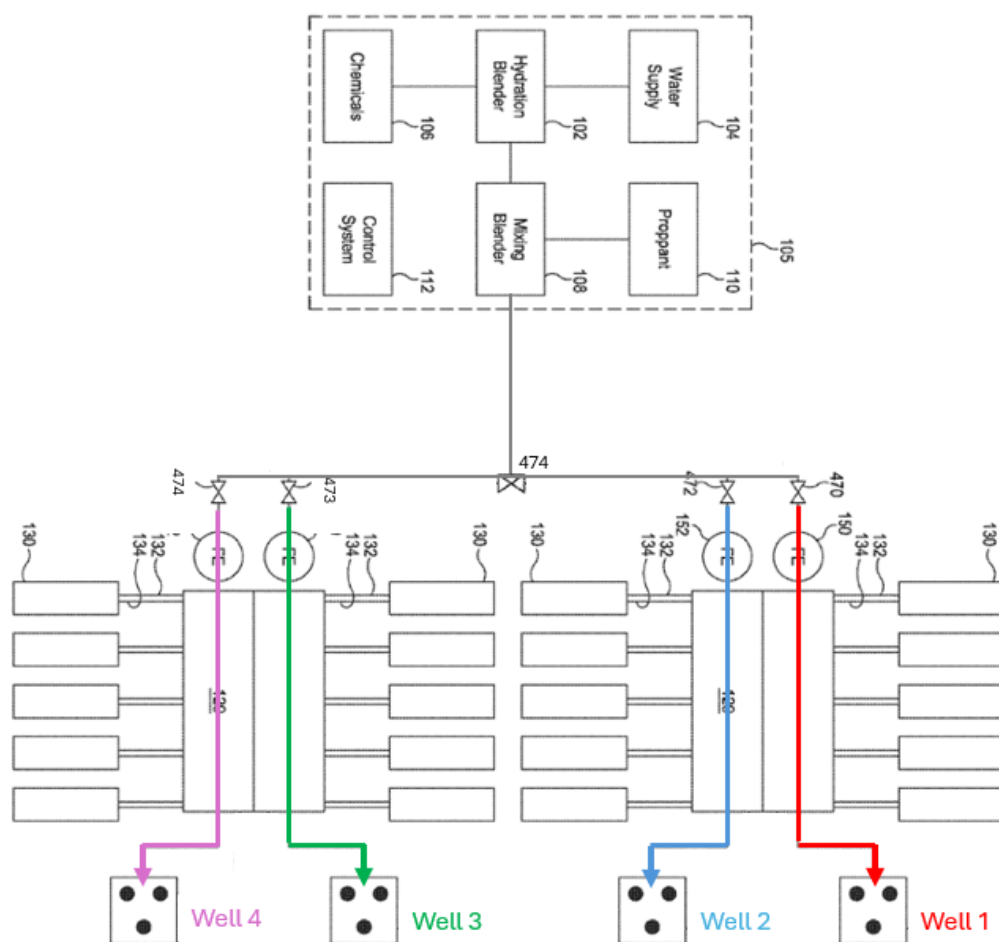
b. Dependent Claims 2, 15, 28 are not anticipated or rendered obvious by Carr.

Dependent claims 2, 15, and 28 recite a “*third well*” with associated “*third valve*” and a “*fourth well*” with associated “*fourth valve*,” where the third valve and third well must be associated with the same “*manifold*” as the “*first well*.” See *Wi-Lan*, 811 F.3d at 462 (explaining antecedent basis). Carr does not teach or suggest this.

Petitioner asserts that Carr’s two-well system would be equally applicable to the claimed four-well system and would comprise nothing more than a “mere repetition of elements.” Petition, 53. Dr. Durham agreed, testifying during his deposition that in a four-well system each additional well would similarly be associated with its own isolated manifold path, flow meter, valve, and pumps. Ex.2013 (Durham Dep.), 158:17-21 (“Q. And there would be a third isolated manifold path with its own associated flow meter, valve, pumps, and well? A. Yes.”); see also Ex.2012, ¶159. However, Petitioner ignores one critical point: these dependent claims require more than simply adding a third and fourth well—they require that: (i) the same manifold that communicates fluid to the first well also communicate fluid to the third well; and (ii) the third and fourth valves must

be opened and closed in response to satisfying a condition of the fluid communicated via the manifold (i.e., the same manifold that communicates fluid to the first well). *See, e.g.*, 1001, claim 2; Ex.2012, ¶155. Petitioner makes no showing—because it cannot—that the same fluid feeding the first well 140 would also feed a third well, nor that the third and fourth valves are operated “*in response*” to a fluid condition of the first isolated manifold path.

Petitioner’s assertion also fails logically. Because each of Carr’s isolated manifold paths requires its own separate pump array, which Carr shows as being arranged on the periphery of the manifold 120, a POSITA would understand that, due to physical constraints, any third and fourth well (and their respective isolated manifold path, valve(s), and pumps) would be, for example, positioned adjacent to the first and second wells, as shown below:



Ex.2012, ¶¶156-160. It is also clear from the exemplary Carr four-well system above that fluid communicated to first well 140 would not be the same fluid communicated to the third well. *Id.*

Accordingly, Carr does not anticipate or render obvious dependent claims 2, 15, and 28.

c. Dependent Claims 3, 16, 29 are not anticipated or rendered obvious by Carr.

Dependent claims 3, 16, and 29 recite specific valve sequences performed with four valves within a four-well system. As described in Section IV.B.2.b, Carr

only teaches a two well system and, thus, cannot serve as an anticipatory reference. *See* Ex.2012, ¶162. Petitioner’s assertion that “a POSITA would have found such valve sequencing obvious ‘in light of fluid flow targets’” goes, at most, to whether Carr’s hypothetical system would be “capable of” such sequencing, which is insufficient to establish obviousness. *Petition*, 54; *ParkerVision, Inc.*, 903 F.3d at 1363.

Moreover, a POSITA, would ***not*** have found it obvious to coordinate the opening and closing of different wells’ valves in light of Carr’s fluid flow targets. Ex.2012, ¶134-135, 141-142, 147, 163. As previously explained, Carr’s fluid flow targets are associated with a specific well, and are achieved by controlling the valve in that well’s ***own*** isolated manifold path and based on the independent fluid conditions in that isolated manifold path. *Id.*; *see also* Ex.1004, Fig.5, [0033]-[0035], [0023], [0058] (“adjusting the first valve in response to the first flow rate”).

Carr does not anticipate or render obvious claims 3, 16, and 29.

d. Dependent Claims 11, 24, 36 are not anticipated or rendered obvious by Carr.

Dependent claims 11, 24, and 36 require that the first valve and/or second valve is a “*zipper valve*.” Petitioner paints this term as meaningless, asserting that “‘zipper valves’ are not distinguished from any other valve capable of allowing

fluid flow into a well.” Petition, 59. Petitioner is wrong, as illustrated by the ’770 Patent and the testimony of both experts.

The term “zipper valve” has a specific meaning and function to a POSITA in hydraulic fracturing and is used in this conventional way in the ’770 Patent. Ex.2012, ¶¶103-107, 113-122, 165-168 (citing Ex.1001, Ex.2031). A “zipper valve” redirects a common pressurized fluid flow between multiple wells attached to a zipper manifold, as illustrated in every embodiment in the ’770 Patent. Ex.2012, ¶165. For example, in ’770 Patent Fig. 1A, the zipper manifold 145 has the conventional functional of redirecting pressurized fluid flow between the wells 105A-C+n. Ex.1001, Fig.1A; Ex.2009 (defining “zipper manifold”); *see also* Ex.2012, ¶¶165-166. Zipper valves 170a-b, shown in ’770 Patent Fig. 2A, control which of the wells 105A-C+n receive the common pressurized fluid flowing through the zipper manifold—*i.e.*, they allow the zipper manifold to redirect fluid to a specific well. Ex.1001, 6:8-9, 7:60-8:1, Fig.2A; Ex.2012, ¶¶165-167. Moreover, the ’770 Patent distinguishes the zipper valves 170a-b from other valves, such as pump-down valves 160a-b and master valves 165a-b, which have different placement and functionality. Ex.1001, 6:5-11; *see also* Ex.2012, ¶167. The term “zipper valve” must be read in light of the above description in the ’770 Patent specification. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1315 (Fed. Cir. 2005) (en banc); *see also Merck Co. v. Teva Pharms. USA, Inc.*, 347 F.3d 1367, 1371

(Fed. Cir. 2003) (“A fundamental rule of claim construction is that terms in a patent document are construed with the meaning with which they are presented in the patent document.”).

Consistent with the '770 Patent, Dr. Durham explains in his expert declaration that zipper valves are “used to swap fracturing operations from one wellhead to another.” Ex.1002, ¶378. He also confirmed this understanding in his deposition, testifying that a zipper valve’s “[f]unction is used to direct fluid flow between the wells ... it would have to have that function to be a zipper valve.” Ex.2013 (Durham Dep.), 81:7-23. This directly contradicts Petitioner’s assertion in the Petition that a zipper valve does not have “any distinguishable functionality.” Petition, 59.

When “zipper valve” is given its plain and ordinary meaning consistent with the specification, Carr fails to anticipate or render obvious dependent claims 11, 24, and 36. Petitioner maps Carr’s first and second valves 470 and 472 to the claimed “*first valve*” and “*second valve*.” Petition, 50. The first and second valves 470 and 472, however, do not redirect a common pressurized fluid flow between multiple wells attached to a zipper manifold. *See supra* Section IV.B.1; Ex.2012, ¶¶131-133, 168. Instead, Carr’s manifold 120 is not a zipper manifold and each valve 470 and 472 is within its own isolated manifold path. Ex.1004, [0033], Fig. 5; Ex.2012, ¶¶131-133, 168; Ex.2008. Neither valve 470 nor 472 has the capability

of redirecting fluid between wells in a manner consistent with the zipper valves of the '770 Patent. Ex.1004, [0033], Fig.5⁷; Ex.2012, ¶¶131-133, 168.

Carr thus does not anticipate or render obvious Claims 11, 24, 36.

C. Ground 5: The combination of Carr and Beuterbaugh does not render the Challenged Claims obvious.

1. Beuterbaugh is fundamentally different than Carr.

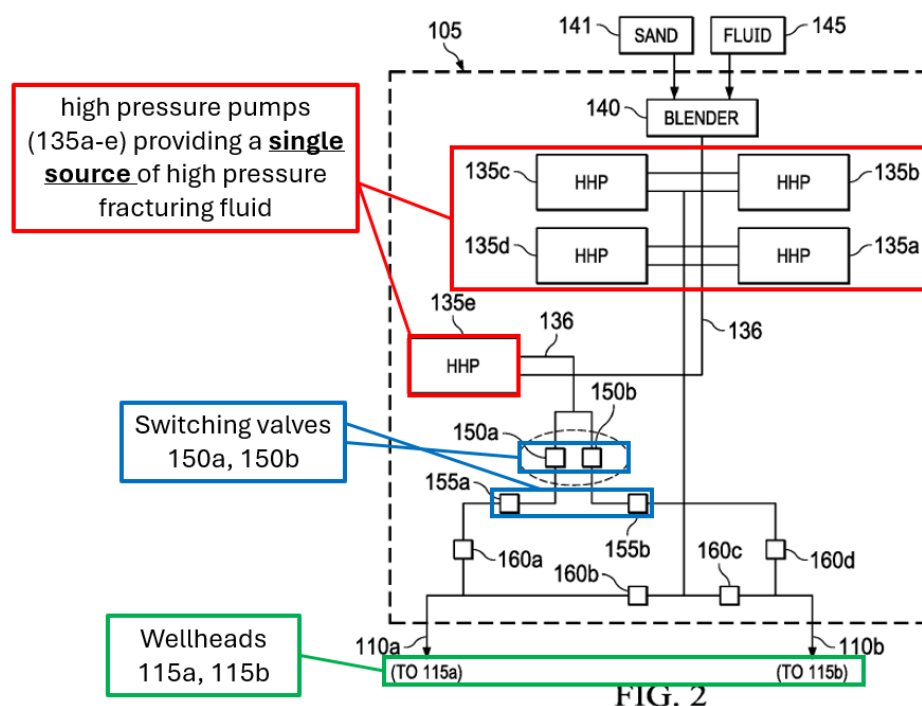
Beuterbaugh describes a system and method for increasing well production and performance using a pulsing operation that rapidly switches between the stimulation of wells located on the same zipper manifold (and thus share the same fluid flow). *See* Ex.1005, Abstract, [0015] Fig.2; Ex.2012, ¶170. The distinguishing features of Beuterbaugh—and what provides the claimed reduction of “wear and tear on the pumps” and other surface equipment—is that Beuterbaugh requires that:

⁷ Although Carr explains that proportioning valve 474 can split the fluid flow the first and second isolated manifold paths (Ex.1004, 0034), Petitioner has not mapped proportioning valve 474 to the claimed first and second valves. Nor could it—one valve cannot map to two valves that must be opened and closed sequentially.

- (1) the wells share “a single source of high pressure fracturing fluid”
(i.e., the pressure pumps (135a-135e) are positioned ahead of switching valves (150a-150e));
- (2) the pressure pumps 135a-135e run at a constant rate and provide substantially constant pressure to the switching valves (150a-150e);
- (3) there be an “absolute shut off of fracturing fluid flow after one of the switching valves 150a, 150b shifts to a closed position;” and
- (4) the sequence for pulsing between switching valves 150a-150e is based on a predetermined amount of time.

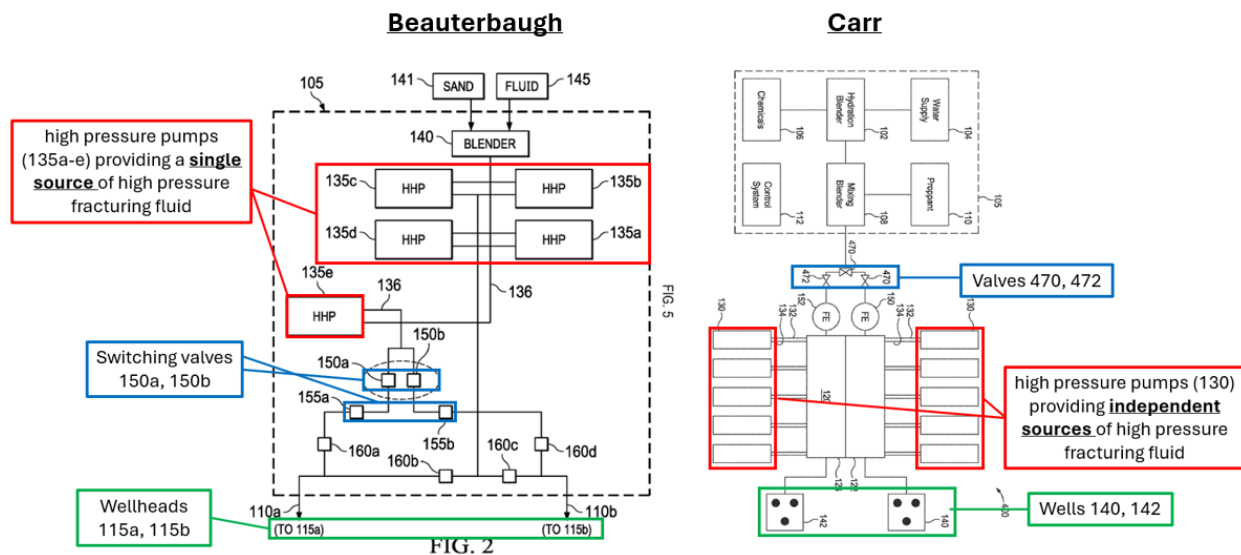
Ex.1005, [0015], [0018], [0019], claims 1, 12, 14, 19; Ex.2012, ¶¶172-173.

The Beuterbaugh system is shown (with annotations) below:



Ex.1005, Fig.2; Ex.2012, ¶171. Beuterbaugh describes reducing wear and tear on the high pressure pumps and surface equipment by locating a *single source* of fracturing fluid and a series of high pressure pumps (135a-135e) *ahead* of switching valves 150a-150b, 155a-155b. Ex.1005, [0015], [0018]; Ex.2012, ¶172. With this configuration, each wellhead 115a, 115b receives pulses of substantially *constant high pressure* fluid despite switching valves 150a-150b, 155a-155b fully closing (with the “absolute shut off of fracturing fluid” when closed) between pulses. *Id.*

The Beuterbaugh system is distinct from traditional non-zipper fracturing setups (i.e., Carr) where *each wellhead has its own pumps and own isolated fluid flow path*. Ex.2012, ¶174. As shown in the comparison of Beuterbaugh Fig.2 and Carr Fig.5, a traditional system (i.e., Carr) could not realize any of the Beuterbaugh benefits without reconfiguring Carr’s hydraulic fracturing setup. *Id.*, ¶175.



As explained more fully below, Petitioner seeks to combine Carr and Beuterbaugh but, in doing so, makes a fatal legal error—it cherry picks a single valve sequence in Beuterbaugh without considering the entirety of the prior art reference, including what it fairly suggests to a POSITA. *See W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1552 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984). Had Petitioner considered the entirety of Beuterbaugh, and what it fairly suggests to a POSITA, the inapplicability of Beuterbaugh (including the alleged benefits of its valve sequencing), would be clear. Accordingly, Petitioner fails to establish that Carr in view of Beuterbaugh render the Challenged Claims obvious.

2. Petitioner fails to show a POSITA would have been motivated to add Beuterbaugh’s valve sequencing to Carr.

Petitioner fails to prove that a POSITA would have substituted Beuterbaugh’s valve sequencing into Carr because Petitioner’s reasons for the combination are inapplicable to Carr’s fundamentally different system⁸. *See KSR*,

⁸ As noted in the Institution Decision, Petitioner does *not* rely on Beuterbaugh for the claimed valve sequence being performed “*in response to*” determining a fluid condition. Petition 62-76; Inst. Dec., 26; *see also* Ex.2013 (Durham Dep.), 176:13-

550 U.S. at 418 (requiring “rational underpinning to support the legal conclusion of obviousness”).

Petitioner relies upon two alleged motivations as why a POSITA would have substituted Beuterbaugh’s valve sequencing into Carr: (i) “Beuterbaugh’s valve sequencing allows the ‘*overlap of fluid flows* to each well [to] be controlled to optimize the downhole pressure waves and to minimize the surface impacts’”; and (ii) “Beuterbaugh’s valve sequencing between alternating switching valves and associated plug valves allows ‘*absolute shut off* of fracturing fluid’ by the plug valves upon switching wells.” Petition, 66 (citing Ex.1005, [0024], [0019]). Both alleged motivations, however, are based on benefits specific to Beuterbaugh’s system that are not compatible with Carr’s different system in which wells are fed by isolated manifold paths. Ex.2012, ¶176.

First, Carr’s system does not have an “overlap of fluid flows to each well” that can be controlled and optimized, as in Beuterbaugh. *See* Ex.2012, ¶178. As described in Section IV.B.1, the fluid flows to Carr’s wells are “isolated” and ***do not overlap***. *See* Ex.1004, [0033], Fig.5; Ex.2011; Ex.2012, ¶178. Once

178:7. Accordingly, Carr in view of Beuterbaugh (Ground 5) necessarily fails for the same reasons as Carr alone (Grounds 3 and 4).

unpressurized fracturing fluid is split into each of Carr’s first and second isolated manifold paths 122, 124, the fluid *does not overlap and cannot be redirected between wells*. Ex.2013 (Durham Dep.), 143:5-21; Ex.1004, [0026], [0033], Claims 1, 9, 16; Ex.2012, ¶¶131-133, 178.

Also, once in an isolated manifold path, the fluid is *independently pressurized* and the rate of flow is separately controlled in view of the independent fluid conditions within each well—meaning each well may be stimulated at a different rate according to its own “fluid flow target.” *See supra* Section IV.B.1; Ex.2012, ¶¶131-135. To this point, Carr states that fluid flow may be “exclusively controlled by adjusting the output of the pumps 130.” Ex.1004, [0025]. In contrast, Beuterbaugh’s valve sequence is predicated upon its pumps running at a “at a ***constant rate*** to provide a substantially ***constant pressure*** of the blended fracturing fluid to the one or more switching valves 150a, 150b.” Ex.1005, [0018]. As such, a POSITA considering the “entirety” of Beuterbaugh would have found the benefits of its valve sequencing, as well as the valve sequencing itself, inapplicable to Carr. Ex.2012, ¶¶178, 181; *W.L. Gore*, 721 F.2d at 1552.

Second, Petitioner further alleges that utilizing Beuterbaugh’s valve sequence in Carr would allow for “‘absolute shut off of fracturing fluid’ by the plug valves.” Petition, 66. But, “absolute shut off of fracturing fluid” is not a benefit of Beuterbaugh’s valve sequence—it’s a benefit of the ***plug valves***: “The

plug valves 155a, 155b allow absolute shut off of fracturing fluid flow after one of the switching valves 150a, 150b shifts to a closed position in case there is some leakage flow.” Ex.1005, [0019]; Ex.2012, ¶179. Carr’s system does not have “plug valves” and Petitioner does not propose adding such valves to Carr. Thus, this alleged motivation is similarly inapplicable to Carr. Ex.2012, ¶179.

Petitioner has thus failed to articulate a reason with “rational underpinning” as to why one of ordinary skill in the art would have combined Carr and Beuterbaugh as proposed. *See KSR*, 550 U.S. at 418.

Lastly, even if Beuterbaugh’s valve sequencing was somehow deployed in Carr, the valve sequence would not be “*in response to*” fluid conditions in only one isolated manifold path, as explained above in Section IV.B.2.a.i. *See* Ex.2012, ¶180. Carr does *not* disclose (nor would it be obvious to a POSITA) that flow information from Carr’s *first* flow meter 150 would be used to take any action with respect to *second* valve 472 given that each isolated manifold path 122, 124 has its own flow path, pressurization source, and pressure/flow conditions. *Id.*

In sum, incorporating Beuterbaugh’s valve sequencing into Carr is only a “simple substitution” if the entirety of Beuterbaugh is ignored, as Petitioner has done. When the context of Beuterbaugh’s system is considered, as required, it is apparent that each of Petitioner’s alleged motivations for the combination would be inapplicable in Carr’s system. *See* Ex.2012, ¶181. Thus, Petitioner fails to meet its

burden of showing that a POSITA would have been motivated to combine Carr and Beuterbaugh to arrive at the Challenged Claims.

3. Dependent Claims 2, 15, 28 are not rendered obvious by Carr in view of Beuterbaugh.

For the same reasons as stated with respect to Carr alone (*see* Section IV.B.2.b), the combination of Carr and Beuterbaugh does not render obvious dependent claims 2, 15, and 28. *See also* Ex.2012, ¶182.

4. Dependent Claims 3, 16, 29 are not rendered obvious by Carr in view of Beuterbaugh.

For the same reasons as stated with respect to Carr alone (*see* Section IV.B.2.c), the combination of Carr and Beuterbaugh does not render obvious dependent claims 3, 16, and 29. *See also* Ex.2012, ¶182.

D. Ground 6: The combination of Carr, Beuterbaugh, and Jackson does not render the Challenged Claims obvious.

Petitioner adds Jackson to Carr and Beuterbaugh to cure Carr's deficiency related to the flowrate thresholds in dependent claims 5, 6, 9, 18, 19, 22, 31, and 32. Petition, 69-70. As explained below, Jackson does not cure the deficiencies in Carr and Beuterbaugh, and a POSITA would not have been motivated to combine Jackson (a single-well system) with Carr and/or Beuterbaugh (multi-well systems). *See* Ex.2012, ¶¶186-190.

Jackson describes a traditional single-well hydraulic fracturing operation. Ex.1007⁹, Abstract, Fig. 2; Ex.2012, ¶184. More specifically, Jackson describes a method of moving between *fracking stages in a single well* by “introducing a supply of fracturing fluid [e.g., nitrogen] to the formation until a first threshold is reached, adjusting the flow of the fracturing fluid to reach a second threshold, adjusting the flow to reach a third threshold and ceasing flow of the fracturing fluid to the formation.” Ex.1007, 3, 12; Ex.2012, ¶185. However, Jackson does not teach using flow-rate conditions to determine *when to switch fracturing from one well to another*, as required by the Challenged Claims. *See* IPR2023-00256, Paper 11 at 21 (Denial of Institution); IPR2024-00583, Paper 9 at 36 (Denial of Institution). Thus, even when combined, Carr, Beuterbaugh, and Jackson fail to teach swapping between *two wells* based on *flow rate*. Ex.2012, ¶¶186-188.

Further, neither Petitioner nor Dr. Durham explains how Jackson’s teaching of using flow rate to move between stages in a single well is relevant to determining when to switch fracturing between two wells. Ex.2012, ¶¶188-190;

⁹ Petitioner inadvertently labeled the filed copy of the Jackson Reference as Exhibit 1005; however, the Jackson reference is actually Exhibit 1007. Durham Dep. Tr. at 201:23-202:9.

ActiveVideo Networks, Inc. v. Verizon Commc'ns, Inc., 694 F.3d 1312, 1328 (Fed. Cir. 2012) (rejecting expert testimony that “fail[ed] to explain why a person of ordinary skill in the art would have combined elements from specific references in the way the claimed invention does”).

Accordingly, the Petition fails to prove that Carr, Beuterbaugh, and Jackson render obvious dependent claims 5, 6, 9, 18, 19, 22, 31, and 32.

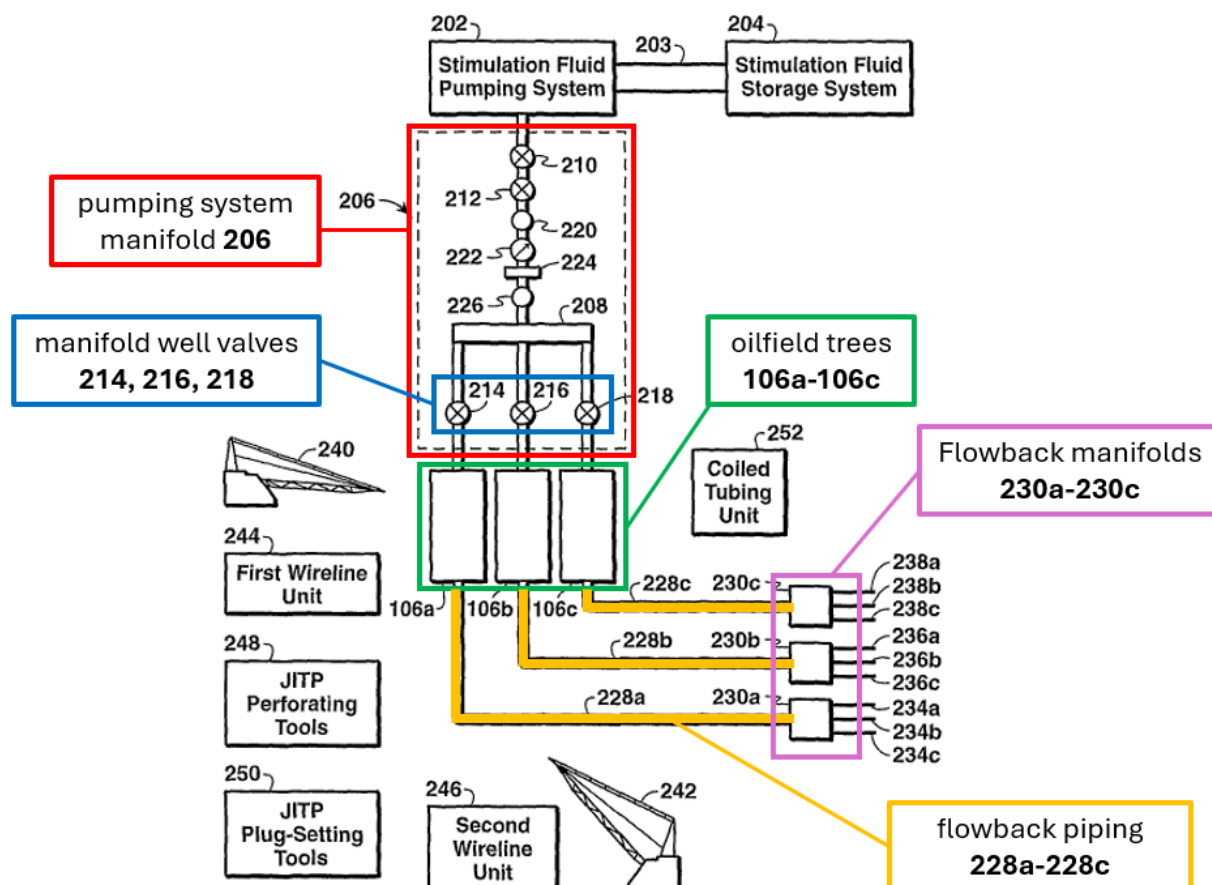
E. Grounds 7-8: The Tolman Grounds do not anticipate or render obvious the Challenged Claims.

The Tolman Grounds fail as a matter of law because the Petition fails to map Tolman’s elements to the claims “with particularity.” *See* 35 U.S.C. § 312(a)(3). And, even ignoring this procedural failure, Petitioner fails to identify a single valve in Tolman that meets all limitations of the claimed “*first valve*.”

1. The purpose of the ’770 Patent is to *improve* traditional zipper systems like Tolman.

Tolman is one of the earliest references to describe (what is now) a traditional zipper fracturing operation, with multiple wells connected to a zipper manifold. Ex.1006, Abstract; Ex.2012, ¶192. Although Tolman improved upon traditional single-well stimulation operations, Tolman does not teach or suggest the claimed continuous pumping swap. *See* Ex.1006, 1:50-2:4, 8:63-9:16; 10:30-59; Ex.2012, ¶192.

An annotated image of the Tolman system is shown below:



Ex.1006, Fig.2 (annotated); Ex.2012, ¶193.

Notwithstanding Tolman’s improvements on then-existing methods, Tolman still suffers from the same disadvantage of traditional fracturing systems—its pumps must be shut down when transitioning between stimulating wells, creating non-productive time (NPT). *See supra*, Section II.B; Ex.2012, ¶194. Tolman repeatedly emphasizes that ***only one well*** connected to each pumping system is treated at a time, while other wells connected to the same system are “***hydraulically isolated*** from the pressure and energy created by the stimulation

fluid pumping system” so that operators may perform other operations on those wells. Ex.1006, 4:8-15, 9:8-15; Ex.2012, ¶194. This isolation requires the common pumping system 202 to be shut down during a well transition—for example, to prevent dead heading the pumps. Ex.2012, ¶¶ 151, 194. That is, Tolman’s technique may “*reduce* ‘non-pumping time’ time” between well stimulations, but it does not eliminate it. Ex.2012, ¶194; Ex.1006, 9:11-16. As such, Tolman is precisely the type of fracturing system upon which the ’770 Patent improves—i.e., by permitting a continuous pumping swap between wells without requiring pumps to be shut down. *See supra*, Section II.C.

2. Petitioner has failed as a matter of law to identify with particularity which valve in Tolman is the claimed “*first valve*” of Claims 1, 14, and 27.

The Petition must identify, in writing and “with particularity,” a valve in Tolman that meets all limitations for the claimed “*first valve*.” 35 U.S.C. §312(a)(3). To meet this requirement, the Petition must “specify where each element of the claim is found in the prior art.” 37 C.F.R. § 42.104(b)(4)). This requirement is “of the utmost importance.” *Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016). “[L]ack of clarity” in a petition enables petitioners “to deviate from the arguments initially presented in the Petition in a manner that may prejudice” patent owners. *ADT LLC v. Vivint, Inc.*, IPR2022-00642, Paper 7 at 14 (Oct. 4, 2022). Accordingly, “[t]he IPR petition...

must provide an understandable explanation of the element-by-element specifics of the patentability challenges” and, given “the expedited nature of IPRs,” the petitioner is not permitted to backfill or supplement shortcomings in the petition after the fact. *Corephotonics, Ltd. v. Apple Inc.*, 84 F.4th 990, 1001-02 (Fed. Cir. 2023). The Petition falls well short of these requirements.

To establish that Tolman teaches the claimed “*first valve*,” Petitioner initially identifies **both** “manifold well valve 214” and an unspecified “tree valve” on the wellhead tree 106a. Petition, 71-72 (elements 1.1, 4.2, 27.1) (“A first manifold well valve 214 and a tree valve (not shown) installed on the first well’s tree 106a may be opened to inject fluid into the first well.”). Petitioner does not indicate whether it maps these two valves to the claimed “*first valve*” together or in the alternative. Notably, the subsequent mapping never again references first manifold valve 214 and instead variously identifies: (i) an unspecified “well tree valve,” (ii) plural “well tree valves,” (iii) “a first well tree valve,” and (iv) even more generically, “first well’s valves.” *See* Petition, 75-77 (elements 1.3, 1.4, 14.4, 14.5, 27.4, 27.5). None of these references to unspecified tree valves meet the particularity requirement of § 312(a)(3).

It is undisputed that Tolman’s wellhead trees have multiple tree valves. Ex.1005, 8:13 (referencing “wellhead tree valves”); *see also* Petition, 75 (“Tolman discloses well tree valves are closed during isolation and open during

stimulation.”); Ex.2012, ¶¶195, 197. As such, Petitioner was required to—but did not—identify **which** specific tree valve(s) it believes corresponds to the claimed “*first valve*.” § 42.104(b)(4)).

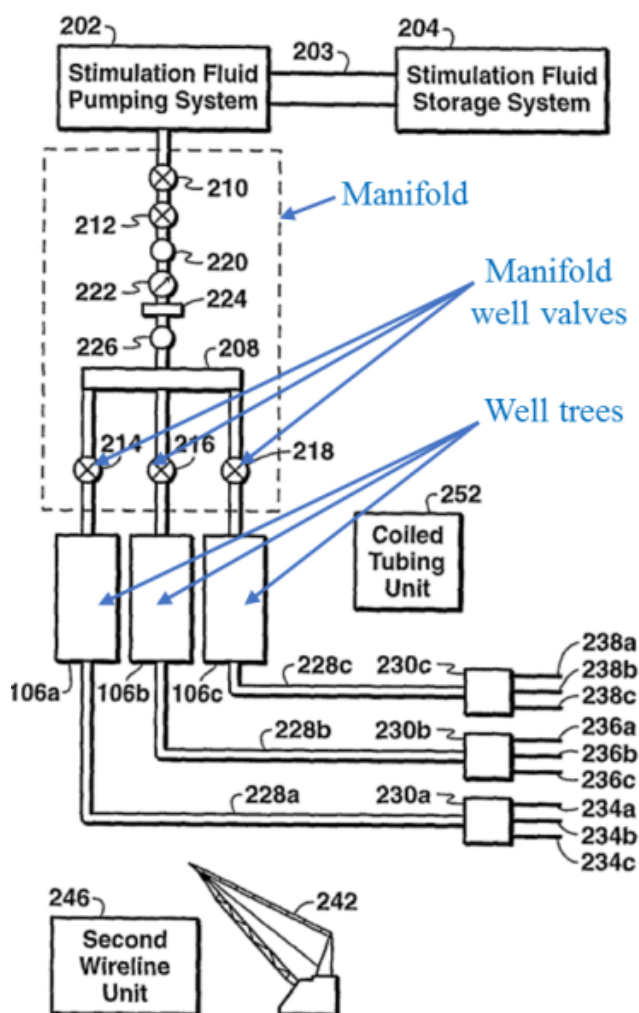
Petitioner’s vague assertion that a “POSITA would understand that a well tree valve would also need to be open while fluid is being flowed back” is not helpful. Petition, 75-76. Petitioner again fails to identify **which** tree valve would be open. *Id.* This explanation also contradicts Tolman, which expressly states that a well tree valve is **closed** during isolation. Ex.1006, 7:27-30 (“To enhance reliability, it may be preferred that two valves, such as a manifold well valve 214-218 and **a valve (not shown) on the tree 106a-106c**, are **closed** during any given isolation from the other wells.”). Even more confusing is that Petitioner apparently agrees with Tolman, stating in the same paragraph that Tolman’s “**well tree valves are closed during isolation**.” Petition, 75. Thus, in the same breath, Petitioner asserts that an unspecified “tree valve” must be both open and closed during isolation. *Id.*, 75-76. Such ambiguity fails the requirements of 35 U.S.C. §312(a)(3) and 37 C.F.R. § 42.104(b)(4)).

Dr. Durham’s declaration only confuses the issue further. For example, in mapping element [1.3], Durham refers to “**the**” tree valve associated with the first well. Ex.1002, ¶548 (“a POSITA would have understood that it would be necessary **for the ‘tree valve’ associated with first well 104a** to be open”). But, in

other paragraphs, Dr. Durham acknowledges that a well tree has multiple valves. Ex.1002, ¶544 (“[A] POSITA would have known that a ‘tree’ is a structure located above a wellbore that contains *valves* used for allowing or preventing flow into and/or out of the well.”). Again, asserting that wellhead trees have multiple tree valves but refusing to identify which specific “tree valve” is the claimed “*first valve*” fails the requirements of 35 U.S.C. §312(a)(3).

By the time Petitioner reaches the last claim element (“*closing the first valve...*”), it has dropped any mention of a tree valve, referring only to “closing first well’s valves” during shut it. Petition, 77. The reader is left to assume that the same unspecified tree valve Petitioner relied upon earlier in the mapping would be closed. This too is improper. § 312(a)(3) (requiring a petition to identify “in writing” the grounds for the challenge).

Petitioner’s and Dr. Durham’s lack of particularity naturally flows from Tolman’s lack of particularity. Tolman’s Fig. 2 illustrates well trees 106a-c as generic boxes without any valves:



Petition, 72 (annotating Ex.1006, Fig.2); Ex.2012, ¶197. In the description of Fig. 2, Tolman only generically refers to “a valve (not shown) on the tree 106a-106,” “one or more valves be installed on trees 106a-106c,” and “wellhead tree valves.” Ex.1006, 7:29-33, 8:13, 13:39. Thus, even if the Board endeavored to glean more information from Tolman itself, it could not. This lack of disclosure in Tolman with respect to the tree valves, combined with Petitioner’s and Dr. Durham’s lack of specificity, does not allow Patent Owner (or the Board) to

discern where Petitioner believes “each element of the claim is found in the prior art.” *See* 37 C.F.R. § 42.104(b)(4)); Ex.2012, ¶197.

In sum, because the Petition fails to map Tolman to the claimed “*first valve*” with the “particularity” required under § 312(a)(3), the Tolman Grounds fail as a matter of law. *Corephotonics*, 84 F.4th at 1002. Petitioner cannot correct these failures—the Board is not permitted to entertain new theories “absent from the petition.” *Wasica*, 853 F.3d at 1286; *Corephotonics*, 84 F.4th at 1001-02 (It is the “initial petition” that “define[s] the scope of the litigation all the way from institution through to conclusion.”) (quoting *SAS Inst., Inc. v. Iancu*, 584 U.S. 357, 367 (2018)).

3. Petitioner does not point to a single “valve” in Tolman that meets all limitations of the claimed “*first valve*.”

Even ignoring the legal deficiency of Petitioner’s mapping, none of Tolman’s identified valves individually meet *every* requirement of the claimed “*first valve*.” Specifically, to prove unpatentability, Petitioner must have identified at least one valve in Tolman that meets *all* limitations of the claimed “*first valve*.” *See Wi-Lan*, 811 F.3d at 462 (“Subsequent use of the definite articles ‘the’ or ‘said’ in a claim refers back to the same term recited earlier in the claim.”). Petitioner fails to do so.

a. Tolman’s “manifold valve 214” does not meet the requirements of the claimed “first valve.”

As noted above, Petitioner points to both first manifold valve 214 and/or unspecified well tree valve(s) to show that Tolman teaches the claimed “*first valve*.” Tolman’s first manifold valve 214 does not meet the limitations of the claimed “*first valve*” because it is closed when manifold valve 216 (the alleged “second valve”) is opened—in direct contradiction to elements 1.4, 14.5, 27.5, which require “*closing the first valve **after** opening the second valve*” and “*close the first valve **after** opening the second valve*.” See Ex.2012, ¶¶199-202.

Specifically, Tolman explains that when first manifold well valve 214 is “open” and well 104a is being stimulated, second and third manifold valves 216 and 218 are “closed” for isolation. Ex.1006, 8:56-62; *see also id.*, 4:5-16, 7:4-7, 7:21-30, 10:30-35; 13:35-40; Ex.2012, ¶200. And when second manifold well valve 216 (alleged to be the “*second valve*”) is “open” to stimulate well 104b (second well), first and third manifold well valves 214 and 218 are “closed.” Ex.1006, 11:15-21; Ex.2012, ¶200. First manifold well valve 214 therefore cannot be the claimed “*first valve*” because it is not open when second manifold well valve 216 (the second valve) is opened. *See also* Inst. Dec. at 32; Ex.2012, ¶202.

b. Tolman’s alleged “tree valve(s)” associated with flowback do not meet the requirements of the claimed “first valve.”

Petitioner alleges that “during flowback from the first well, *while a first well tree valve is open*, a second well valve is opened to allow stimulation fluid to be pumped into the second well.”¹⁰ Petition, 75-76. Petitioner’s unspecified “tree valve” associated with flowback also does not meet the limitations of the claimed “first valve” for numerous independent reasons.

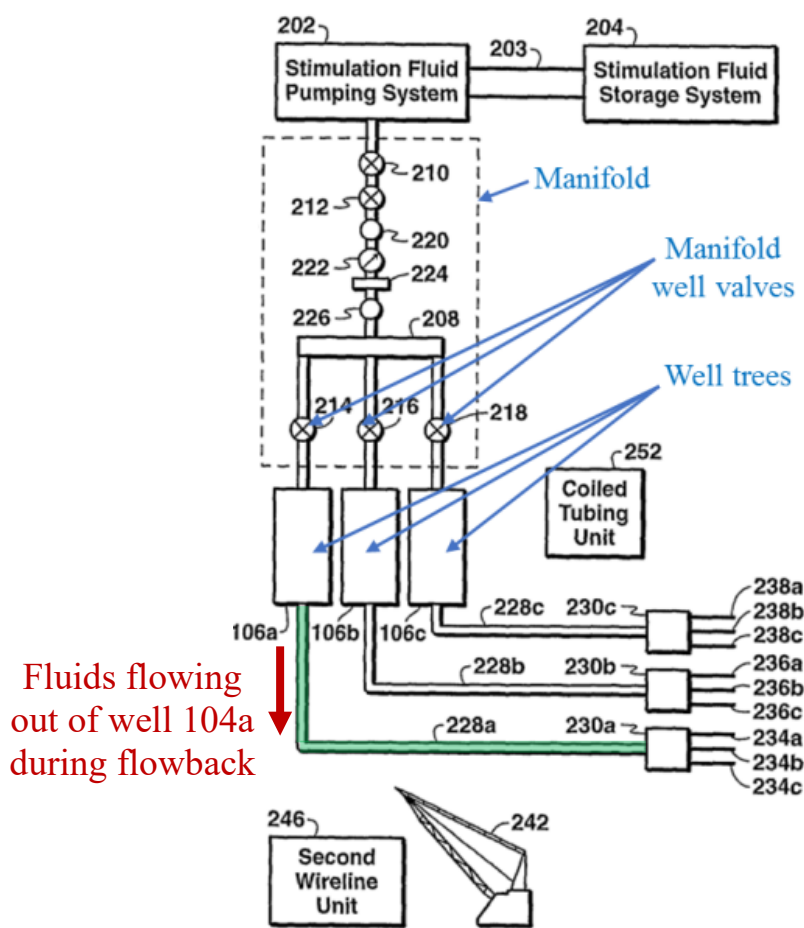
(i) Tolman’s alleged “tree valve(s)” associated with flowback do not communicate fluid to the first well.

To meet the claimed “first valve,” Tolman’s alleged flowback tree valve must, among other things, “communicat[e] fluid *to a first well* via a manifold.” See claim elements 1.1, 14.2, 27.1. But Tolman’s tree valve(s) associated with flowback communicate fluid *out of a well*—not *to* a well. Ex.1006, 10:65-11:3 (“[F]lowback operations may be performed to force close the proppant fractures... and *recover the stimulation fluid* used to form the proppant fractures...and *produce hydrocarbons* to the sales lines.”), 6:33-35 (“[T]he hydrocarbons *from the wells* 104a-104c typically flow *through the flowback manifolds* 230a-230c for

¹⁰ Petitioner incorrectly identifies the “second valve” as “second manifold well valve 214” instead of valve 216. Petition, 76; Ex.1006, 6:58-61.

further processing or sales), 8:21-23, 11:15-30, 13:51-56; Ex.2012, ¶¶203-204 (explaining that Tolman’s flowback operations involve moving fluid or gas *out of the well*).

As illustrated below in Tolman’s Fig. 2, flowback line 228A is the line through which hydrocarbons and other fluids flow *out* of well 104a:



Ex.1006, Fig. 2 (annotated); Petition, 72; Ex.2012, ¶205.

Tolman states that “the wells 104a-104c *produce hydrocarbons through piping 228a-228c* that is coupled between the respective oil field trees 106a-106c and the

flowback manifolds 230a-230c.” Ex.1006, 6:23-26. And when asked about Fig. 2 of Tolman in his deposition, Dr. Durham agreed that fluids flow **out** of well 104a via pipe 228a during flow back operations:

Q. And what is the function of the pipe that’s labeled 228A?

A. It’s for flowback operations.

Q. And so fluids flow out of Well 106A through Pipe 228A?

A. Correct.

Ex.2013 (Durham Dep.), 191:18-23. Accordingly, because Tolman’s tree valve(s) associated with flowback communicates fluid **out of the first well**, it fails to meet recited “*first valve*” that communicates fluid “to” the first well. Ex.2012, ¶206.

(ii) Petitioner fails to prove that Tolman’s controller/computer system controls the “tree valve(s).”

To the extent Petitioner relies upon unspecified tree valves being controlled by Tolman’s computer system to meet the claims, the Petition fails to prove such control. The only portions of Tolman cited with respect to valve control discuss controlling **manifold well valves 214, 216, and 218**—not tree valves. *See* Petition 70-77; Ex.2012, ¶¶207-2011. The Petition masks this failure by selectively

quoting/omitting critical portions of Tolman. For example, for claim elements 14.1 and 27.3, the Petition relies on a portion of Tolman, which is quoted *in full* below:

Also, the pumping system manifold **206** may include a processor based device, such as a computer system, as well. **The computer system for the pumping system manifold 206 may include mechanisms to adjust the valves 210, 214, 216 and 218 between the open and closed positions,** and communicate with the various gauges **220, 222 and 226** and ball-sealer injector **224**. In fact, the computer systems of the stimulation fluid pumping system **202** and the pumping system manifold **206** may be configured to interact with each other to manage the pumping stimulation treatment process for the plurality of wells **104a-104c**.

Ex.1006, 14:11-22; Petition, 70-71, 73-74; *see also* Ex.1006, 8:50-62; Petition, 74.

As shown above, the Petition's only evidence regarding a computer system/controller capable of controlling the operation of Tolman's valves (including in response to determining that a fluid condition has been met) relates exclusively to the operation of Tolman's *manifold well valves 214, 216, and 218* during stimulation operations. Ex.2012, ¶2010. Petitioner cites nothing (nor makes any obviousness argument) that such operations apply to Tolman's tree valves.

c. None of the valves in Tolman operate in the claimed sequence in response to determining that a fluid condition has been satisfied.

Regardless of which valves in Tolman Petitioner relies on to meet the limitations of the claimed "*first valve*," Petitioner fails to show that either the manifold well valves 214, 216, or 218, or the one or more unspecified "tree

valve(s)” perform the entire claimed valve sequence “*in response to*” determining that that a single fluid condition or set of conditions has been satisfied. The Petition instead maps to different fluid conditions for different valve activations.

For example, Petitioner contends Tolman discloses opening a second valve (manifold well valve 216) in response to one fluid condition (treatment being complete on the first well) and then closing the first valve (tree valve) based on a *different* condition (flowback being complete on the first well and the well being ready to be shut in). Petition, 75-77 (claim elements 1.2-1.4, 14.3-14.5, 27.4-27.6). Because the Challenged Claims require performing the entire “valve opening/closing” sequence in response to a single fluid condition or set of conditions, Grounds 7 and 8 fail. *See* Ex.2012, ¶¶212-214.

4. Tolman does not teach or suggest “*closing the first valve after opening the second valve.*” (elements [1.4]/[14.5]/[27.5])

As discussed above, Petitioner identifies a tree valve associated with flowback on Tolman’s first well 106c as the recited “*first valve.*” For the recited “*second valve,*” Petitioner identifies Tolman’s second manifold well valve 216 associated with second well 106b. Petition, 72-73. Based on this mapping, to meet the requirement of “*closing the first valve after opening the second valve,*” Tolman must teach or suggest closing the flowback tree valve after opening the second well’s manifold well valve 216. But according to Petitioner’s own explanation,

Tolman's flowback tree valve is closed (via shut in) after *closing* the second well's manifold well valve 216 (for flowback). Petitioner states: "When fracturing operations are completed in the second well and fluids are flowed back through the second well, the first well is shut-in." Petition, 77 (citing Ex.1006, 11:63-67, 46-49). At the time fluids are flowed back through the second well, its manifold valve is already closed. Ex.1006, 11:63-12:13; Ex.2012, ¶¶215-216. Thus, if the "first well is shut-in" during the second well's flowback, the first well's flowback tree valve (the alleged "*first valve*") is closed after the manifold well valve 216 (the alleged "*second valve*") has already been closed. Ex.2012, ¶216. Accordingly, Petitioner's mapping fails to establish "*closing the first valve after opening the second valve.*"

5. Petitioner's alternative "two system" theory fails to anticipate or render obvious claim elements 1.3, 14.4, and 27.4.

Almost in passing, Petitioner makes an alternative, nonsensical argument that Tolman teaches "*opening a second valve; communicating fluid to a second well via the second valve*" because Tolman describes using two or more of the systems shown in Figure 2 at a site. Petition, 77. To make this argument, Petitioner asserts that "the Claims do not require 'the second valve' to be associated with the same manifold as 'the first valve'"—meaning, the two systems could be entirely separated and/or unrelated. Petition, 77. However, Petitioner fails to prove that all

other claim limitations are met with respect to this “second system” theory. Indeed, Petitioner does not explain how or why a POSITA would open a valve on one system and then open a second (completely unrelated) valve on a second (completely unrelated) system, or that the decision to do so would be “*in response to*” satisfaction of a fluid condition of the unrelated first system. *See* Ex.2012, ¶¶217-218. Thus, Petitioner’s half-baked “two system” theory fails to meet their burden.

6. Petitioner’s alternative “injecting fluids” theory fails to anticipate or render obvious the Challenged Claims.

Petitioner additionally argues, independent of its primary analysis, that Tolman’s disclosure of “injecting fluids” into the second well while stimulating the first well would render obvious the claimed valve sequence. Petition, 78-79. This theory fails to anticipate or render obvious the Challenged Claims because it is silent as to the claim requirement that opening a second valve is “*in response to*” determining a condition of the fluid communicated to the first well. Ex.2012, ¶¶219-223. Without that analysis, Petitioner cannot succeed on this alternative theory.

Even ignoring that failing and importing Petitioner’s “*in response to*” mapping from its main theory into this alternative theory (which Petitioner did not do), the alternative theory still fails. Specifically, for the “*in response to*”

limitation, Petitioner points to “determining if a stimulation treatment is complete” on the first well. Petition, 74-75. In its “injecting fluids” theory, however, Petitioner points to “opening a second well’s valve *during* the first well’s stimulation to allow fluid injected into the second well.” Petition, 78-79. It is logically impossible to open a second well’s valve “*during*” the first well’s stimulation in response to the first well’s stimulation being “complete.” *See* Ex.2012, ¶¶221.

Thus, for each of the forgoing reasons, independently and collectively, Grounds 7 and 8 fail to show the Challenged Claims are unpatentable.

7. Dependent Claims 3, 16, 29 are not anticipated or rendered obvious by Tolman.

Petitioner also fails to meet its burden respect to dependent claims 3, 16, and 29, which require performance of a specific valve sequence on a four-well system. Tolman teaches only a three well system and thus cannot serve as an anticipatory reference.

Petitioner’s assertion of obviousness also fails as a matter of law because the Petition does not assert the claimed valve sequence would be performed “*in response to*” determining that any fluid condition has been met, as required. Petition, 79-80; *see also* Ex.2012, ¶¶225-228. Moreover, Petitioner’s speculative assertion that it would have been obvious to manipulate four different valves “for

simultaneous and concurrent operations” lacks rational underpinning when Tolman expressly warns that an operator should **not** manipulate valves of other wells when stimulating a first well. *See* Ex.1006, 13:36-40 (“[I]f the operations on the first well involve high pressure pumping...the manipulating the manifold well valves and wellhead tree valves should not be concurrently performed”); *see also* Ex.2012, ¶227.

Thus, Tolman does not anticipate or render obvious claims 3, 16, and 29.

8. Dependent Claims 5, 6, 9, 18, 19, 22, 31, and 32 are not anticipated or rendered obvious by Tolman.

Dependent Claims 5, 6, 9, 18, 19, 22, 31, 32 require that satisfying the one or more “flow rate conditions” requires consideration of one or more “*thresholds*” E.g., Ex.1001, claim 5. However, Tolman does not describe (expressly or inherently) any flow rate “threshold(s).” *See* Ex.2012, ¶¶229-232.

For example, the determination in Tolman step 318 (“Are Planned Stimulation Treatments Complete”) is not related to the evaluation of any fluid condition (or threshold) of any individual well (let alone comparing a flow rate to any threshold). Rather, the determination in step 318 is simply whether the ***entire fracturing plan*** is complete—i.e., if the plan was to fracture 5 wells, the determination is whether all 5 wells were fractured. Ex.1006, 9:17-19; Ex.2012, ¶230. If complete, “then the equipment associated with the stimulation treatments

may be rigged-down and moved off the surface pad 102.” Ex.1006, 9:39-42; Ex.2012, ¶230. And if not complete, “the pumping system manifold 206 may be adjusted to prepare for the next well.” Ex.1006, 9:17-22; Ex.2012, ¶230.

Nonetheless, Dr. Durham argues that it would be obvious to a POSITA that the “determining” step relates to a flow rate threshold—*i.e.*, determining if stimulation fluid flow into the first well had stopped. Ex.1002, ¶591. But Dr. Durham provides no evidence or explanation in support of his theory. *See Xerox Corp.*, Paper 9 at 15-16. Worse, Tolman directly contradicts Dr. Durham’s theory—Tolman’s step 318 determination is *not made on a well-by-well basis*; rather, it is simply a project-based question: are we “done” or “not done” with the planned treatments? Ex.1006, 9:17-48; Ex.2012, ¶231.

Accordingly, Tolman does not anticipate or render obvious claims 5, 9, 18, 22, and 31.

V. OBJECTIVE EVIDENCE DEMONSTRATES THAT THE CHALLENGED CLAIMS WERE NONOBVIOUS

Downing both invented the continuous pumping swap claimed by the ’770 Patent and implemented it into its Freedom Series Completion System (“Freedom Series”) that remotely controls hydraulic fracturing equipment. Ex.2032, ¶¶8-10. The CP swap feature of the Freedom Series has allowed operators in the field to keep their pumps running for record breaking lengths of time, drastically lowering

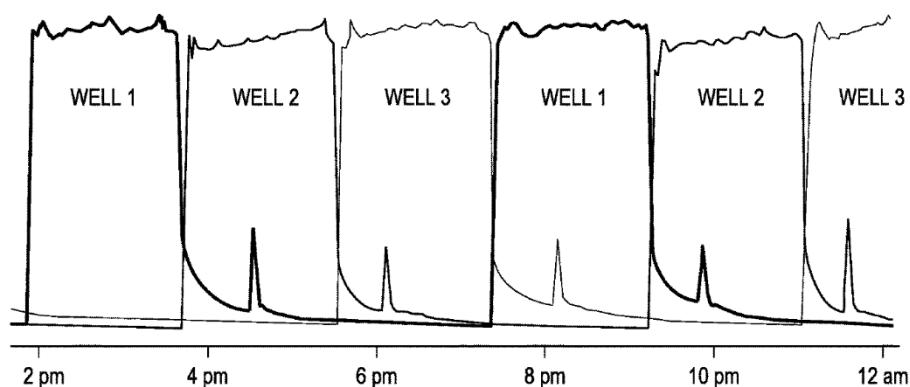
non-productive time. *See* Ex.2032, ¶¶9-28. These real-world efficiency gains led to industry-wide recognition and praise—objective evidence that the Challenged Claims were not obvious. *See Ortho-McNeil Pharm., Inc. v. Mylan Lab ’ys, Inc.*, 520 F.3d 1358, 1365 (Fed. Cir. 2008) (objective indicia of nonobviousness, including industry praise, “constitutes independent evidence of nonobviousness” that “must be considered”); *Plantronics, Inc. v. Aliph, Inc.*, 724 F.3d 1343, 1355 (Fed. Cir. 2013); *Stratoflex, Inc. v. Aersoquip Corp.*, 713 F.2d 1530, 1538 (Fed. Cir. 1983) (“[E]vidence of secondary considerations may often be the most probative and cogent evidence in the record. It may often establish that an invention appearing to have been obvious in light of the prior art was not.”).

A. Freedom Series’ continuous pumping swap feature implements the invention of the Challenged Claims.

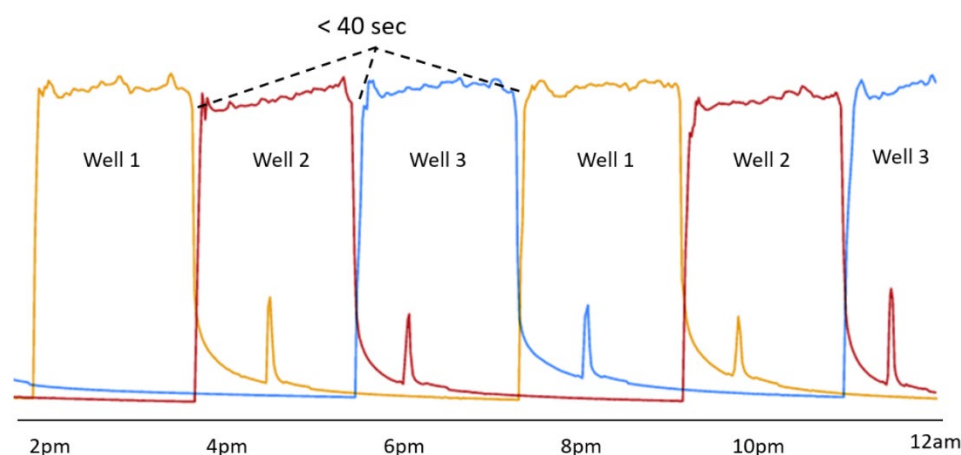
In September 2020, Downing added its novel CP swap feature into the Freedom Series to provide operators with the ability to continuously pump through well transitions. Ex.2032, ¶10; Ex.2001; Ex.2002. The CP swap remains a crucial feature of the Freedom Series through present day. Ex.2032, ¶10; Ex.2014. As the CP swap feature was being commercialized via the Freedom Series, the ’770 Patent application was drafted to protect the CP swap technique. Ex.2032, ¶8. Accordingly, portions of the ’770 Patent specification mirror Downing’s original

continuous pumping webpage, which highlights the Freedom Series' continuous pumping capability. *See* Ex.1001; Ex.2001; Ex.2014.

For example, in describing the CP swap feature, the '770 Patent specification states that the CP swap “transitions the zipper valves from one well to the other, opening the second well and subsequently shutting-in the first well, all while pumping” such that “[t]he transition is instantaneous.” Ex.1001, 14:43-50; Ex.2032, ¶7. Downing's webpage, which predates the '770 Patent application, contained identical language (and still contains such identical language to this day). Ex.2001, 1; Ex.2014, 1. Downing's original webpage also featured the same figure as the '770 Patent (Fig. 16D) illustrating fluid conditions associated with three wells as the Freedom Series performs actual CP swaps between the wells. *See* Ex.2032, ¶7.



Ex.1001, Fig.16D.



Ex.2001, 2.

The '770 Patent claims embody the novel CP swap of the Freedom Series. Ex.2012, ¶¶233-239; Ex.2032, ¶¶7-8. To perform a CP swap, the valves of a zipper manifold are controlled to transition “from one well to the other, opening the second well and subsequently shutting-in the first well, all while pumping.” Ex.2014, 1; Ex.2001, 1; Ex.2020; Ex.2032, ¶7. Further, the above well fluid condition timeline on the Freedom Series website (and in the '770 Patent) illustrates that the fluid conditions associated with a first well (e.g., “Well 1”) determine when a valve on a second well (e.g., “Well 2”) can open. Ex.2012, ¶238. In each transition, the second well’s valve opens when the fluid pressure in the first well drops. *Id.*

The CP swap of the Challenged Claims enables continuous pumping operations. Ex.2012, ¶¶240-41. As recited in the Challenged Claims, performing a

CP swap requires: (1) opening a first valve and communicating fluid via a manifold to a first well (begin stimulation operations in the first well); (2) while the first valve is open and in response to determining that the fluid communicated to the first well via the manifold has satisfied one or more conditions (i.e., it is safe to perform a CP swap?), opening a second valve and communicating fluid to a second well (fluid is flowing to both the first and second well); and (3) then closing the first valve after opening the second valve (completing stimulation operations in the first well). *See, e.g.*, Ex.1001, claim 1; *see also* Ex.2012, ¶¶240-41. Enabling this seamless transition between wells—with two valves temporarily open during the transition—allows the pumps to keep running. Ex.2012, ¶¶112, 122, 240.

Conventional well transitions required closing the first well's valve before opening the second well's valve so that both valves were not open at the same time.

Ex.2012, ¶¶111. This simultaneous closure required the pumps to be shut down to avoid a dangerous “deadhead” condition. Ex.2012, ¶¶151, 240. Thus, the ability to continuous pump through well transitions is predicated upon claimed CP swap. *Id.*

The ability to continually pump through well transitions provides significant efficiency benefits because it eliminates the time needed to shut down, re-prime (in some instances), and restart the pumps (at least 15 minutes for traditional zipper fracturing operations). *See* Ex.2012, ¶¶122, 241; Ex.2001, 1; Ex.2014, 1. As an example, if a typical zipper fracturing operation has five wells, with an average of

60 stages per well, implementing the CP swap feature can save as much as 15 hours per well and 75 hours of NPT per project, resulting in more efficient operations and faster completions. Ex.2012, ¶241. This is crucially important to an industry focused on decreasing NPT.

B. Industry praise supports nonobviousness.

1. The Freedom Series received an industry award and significant praise.

In 2023, the Freedom Series received the Gulf Energy Information Excellence Award for Best Completions Technology (“Best Completions Award”). Ex.2015, 1; Ex.2032, ¶¶11-17. The Gulf Energy Information Excellence Award “recognize[s] the energy industry’s leading innovations and thought leaders” and “celebrate[s] and recognize[s] cutting-edge technological developments.” Ex.2015, 1; Ex.2016,1. In 2023, the Gulf Energy Information Excellence Award received over 400 submissions, and winners were chosen by “industry experts from the field and academia.” Ex.2015, 1; Ex.2018. The Best Completions Award illustrates that industry experts regarded the Freedom Series as innovative and cutting-edge technology. Winning the Best Completions Award is highly probative evidence illustrating nonobviousness. *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1334 (Fed. Cir. 2016) (“Industry participants, especially competitors, are not likely to praise an obvious advance over the known art.”).

Industry participants have also extolled the Freedom Series with CP swap for shattering continuous pumping records. In 2021, the Freedom Series was praised in connection with Liberty Oilfield Services (“Liberty”) reaching a “milestone achievement of 24 hours of continuous pumping time.” Ex.2020, 1-2. Ex.2032, ¶18. Liberty used the Freedom Series to “safely achieve the momentous goal of eliminating downtime and continuously pumping all 1,440 minutes in the day.” Ex.2020, 1-2; Ex.2032, ¶18. XStim Consulting, a consulting company associated with the Liberty operation, stated that the Liberty operation was “the first ever continuously pumped zipper frac.” Ex.2023, 1; Ex.2021, 2; Ex.2022, 2; Ex.2032, ¶19. Aaron Dressel of XStim Consulting praised the Liberty operation as “[b]y far the most impressive week of fracking” that “set a new precedent for zipper frac operations.” Ex.2024, 1; Ex.2032, ¶18. Occidental Petroleum Corporation (“OXY”) also used the Freedom Series with CP swap in its Delaware operation that “shattered OXY’s previous record for continuous frac pumping time by nearly 12 hours for a total of 40 hours and 49 minutes.” Ex.2025, 3; Ex.2026, 1; Ex.2032, ¶¶20, 24.

Other industry participants also hailed the Freedom Series with CP swap for its ability to eliminate non-pumping time. Addison Kowal, a completion engineer at Crescent Point Energy (“CPE”), shared that in one operation, they “targeted 18 days with decreased well swap time,” but the Freedom Series enabled them to

“safely achieve our most efficient pad in the basin, shaving an additional 1.3 days off our target.” Ex.2027, 1; Ex.2032, ¶26. Further, Chesapeake Energy Corporation (“Chesapeake”) used the Freedom Series with CP swap in its Haynesville operation and announced that “continuous pumping technology employed in 2023 has led to a greater than 20% increase in efficiencies relative to previous zipper operations.” Ex.2028, 1; Ex.2029, 1; Ex.2032, ¶27.

2. The praise directly results from the claimed invention.

The Freedom Series winning the Best Completions Award and receiving substantial industry praise is a direct result of its implementation of the claimed CP swap feature that enables continuous pumping. Ex.2032, ¶10; *see Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1332 (Fed. Cir. 2019) (the objective evidence “must have a nexus to the claims, *i.e.*, there must be a legally and factually sufficient connection between the evidence and the patented invention.”); *Fox Factory, Inc. v. SRAM, LLC*, 944 F.3d 1366, 1373–74 (Fed. Cir. 2019) (“evidence of secondary considerations [must be] the ‘direct result of the unique characteristics of the claimed invention’”) (quoting *In re Huang*, 100 F.3d 135, 140 (Fed. Cir. 1996)).

As discussed above, operators can only continuously pump through well transitions because of the claimed CP swap. Ex.2012, ¶¶122, 240; Ex.2032, ¶¶7-8. The praise for the Freedom Series breaking continuous pumping records is thus

predicated upon its implementation of the CP swap. For example, Liberty Oilfield Services was able to reach a “milestone achievement of 24 hours of continuous pumping time” because it “utilized Downing’s Freedom Series iControl, a completion system that instantaneously transitions from one well to the other, opening the second well and subsequently shutting-in the first well, all while pumping, eliminating the time between stages.” Ex.2020, 1-2; Ex.2032, ¶¶18-19, 25. And Mr. Dressel of XStim Consulting emphasized that the records set by the Liberty operation were “not possible without Downing’s Freedom Series.” Ex.2024, 1; *see also* Ex.2023, 1; Ex.2032, ¶19.

Additionally, the Gulf Energy Information Excellence Awards required Downing to submit a nomination. Ex.2017. Timothy Marvel, Vice President of Business Development and Technology at SEF Energy¹¹, nominated the Freedom Series for Best Completions Technology. Ex.2032, ¶¶12-13; Ex.2019. In describing the Freedom Series, Mr. Marvel explained that Downing had “developed an automated completion system that methodically eliminates time between plug and perf stages with the goal of fracturing the reservoir 24 hours a day, 7 days a week.” Ex.2019, 1; Ex.2032, ¶12. Downing identified one of the barriers to fracturing 24/7 as “the time between stages (this includes transition time

¹¹ Patent Owner is a subsidiary of SEF Energy. Ex.2004 ¶ 4.

and pressure tests),” and then developed an automated completion system that “eliminates the time between stages with near instantaneous transitions from one stage to the next enabling operators to continuously pump for the duration of the completion.” Ex.2019, 1; Ex.2032, ¶12. Mr. Marvel explained that the Freedom Series “enables 24/7 fracturing representing up to a 50% increase in current pumping efficiency (significantly reducing the number of days required to frac a pad as well as the cost per well).” Ex.2019, 1; Ex.2032, ¶13. On this submission, the Freedom Series was granted the Best Completions Award. The benefits highlighted in the nomination submission—eliminating transition time between stages and increasing pumping efficiency—are the direct result of the claimed CP swap feature. Ex.2012, ¶¶122, 241.

In sum, the praise directed to the Freedom Series’ ability to increase continuous pumping duration, eliminate non-pumping time, and enable faster and more efficient completion of fracturing operations stems from performing the claimed CP swap. *See supra* Section V.A. This extensive industry praise establishes that the Challenged Claims were not obvious.

III. CONCLUSION

For the foregoing reasons, Patent Owner requests that the Board find the Challenged Claims not unpatentable.

Respectfully submitted,

Dated: September 19, 2024
HAYNES AND BOONE, LLP
2801 N. Harwood St., Suite 2300
Dallas, Texas 75201
Customer No. 27683

/Scott T. Jarratt/
Scott T. Jarratt
Lead Counsel for Patent Owner
Registration No. 70,297

CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. §42.24(d), Patent Owner hereby certifies, in accordance with and reliance on the word count provided by the word-processing system used to prepare this Patent Owner Response, that the number of words in this paper is 13,554. This word count excludes the table of contents, table of authorities, mandatory notices under §42.8, certificate of service, certificate of word count, signature block, and appendix of exhibits. *See* 37 C.F.R. §42.24(c).

/Scott T. Jarratt/
Scott T. Jarratt
Lead Counsel for Patent Owner
Registration No. 70,297

CERTIFICATE OF SERVICE

The undersigned certifies that, in accordance with 37 C.F.R. §42.6(e),
service was made on Petitioner as detailed below.

Date of service September 19, 2024

Manner of service Electronic Service: terry@obwb.com;
margonis@obwb.com;
cooper@obwb.com;
witbeck@obwb.com;
schechter@obwb.com;
OBWB-IWS-Downing@obwb.com

Documents served **Patent Owner Response; Exhibit List and
Exhibits Ex.2008 – Ex.2032**

Persons served Tammy J. Terry
Lisa E. Margonis
Califf T. Cooper (*pro hac vice*)
Laura J. Witbeck
Peter C. Schechter
OSHA BERGMAN WATANABE & BURTON LLP
1100 Louisiana Street, Suite 4900
Houston, TX 77002

/Scott T. Jarratt/
Scott T. Jarratt
Lead Counsel for Patent Owner
Registration No. 70,297