

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

PROFRAC HOLDING CORPORATION
and
U.S. WELL SERVICES, LLC,
Petitioners

v.

HALLIBURTON ENERGY SERVICES, INC.,
Patent Owner

Case No. Case IPR2023-01318
U.S. Patent 7,931,082

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Submitted Electronically

**PATENT OWNER'S RESPONSE
UNDER 37 C.F.R. §42.120**

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LIST OF EXHIBITS

Petitioner's Exhibits	
No.	Exhibit Description
1001	U.S. Patent No. 7,931,082
1002	File History of U.S. Patent No. 7,931,082
1003	Declaration of Dr. Michael Nikolaou
1004	Curriculum Vitae of Dr. Michael Nikolaou
1005	U.S. Patent Application Publication No. 2009/0114392 to Tolman et al. ("Tolman")
1006	U.S. Patent Application Publication No. 2005/0166961 to Means et al. ("Means")
1007	U.S. Patent No. 6,236,894 to Stoisits et al. ("Crawford")
1008	U.S. Patent Application Publication No. 2004/0050550 to Lehman et al. ("Lehman")
1009	U.S. Patent No. 9,410,410 to Broussard et al.
1010	U.S. Patent App. Pub. No. 2012/0255734 to Coli et al.
1011	U.S. Patent App. Pub. No. 2013/0306322 to Sanborn et al.
1012	S. Dalvi, Fundamentals of Oil & Gas Industry for Beginners (Notion Press 2015) (excerpts)
1013	RESERVED
1014	U.S. Patent No. 3,560,053 to Ortloff
1015	U.S. Patent No. 3,664,422 to Bullen
1016	International Publication Number WO 2005/111369 to Crossley et al.
1017	WD Texas Statistics

Patent Owner's Exhibits	
No.	Exhibit Description
2001	U.S. Patent No. 5,515,920 to Luk
2002	Deposition Transcript of Dr. Michael Nikolaou re: IP2023-01319 Pat. No. 7,841,394 (June 6, 2024)
2003	Deposition Transcript of Dr. Michael Nikolaou re: IPR2023-01318 Pat. No. 7,931,082 (July 10, 2024)
2004	Declaration of Robert A. Durham
2005	Curriculum Vitae of Robert A. Durham
2006	Bourgoyne, Adam T., Jr., Keith K. Millheim, Martin E. Chenevert, and F.S. Young, Jr., <i>Applied Drilling Engineering</i> , Society of Petroleum Engineers (1986).
2007	Staff of Royal Dutch / Shell Group of Companies, <i>The Petroleum Handbook</i> , (1983).
2008	Rahman, S. S. and G. V. Chilingarian, <i>Casing design-theory and practice</i> (1995).
2009	Manrique, E.J., J.L. Mogollon, J.A. Linares, and M. Farrera, <i>Basic Nitrogen Compounds in Crude Oils: Effect on Mineral Dissolution during Acid Stimulation Processes</i> , International Symposium on Oilfield Chemistry (1997).
2010	Michael Morton, <i>Unlocking the Earth: A Short History of Hydraulic Fracturing</i> , GEO ExPro, Vol. 10, No. 6, December 2013 (available at https://geoexpro.com/unlocking-the-earth-a-short-history-of-hydraulic-fracturing/) (last accessed July 17, 2023).
2011	Carl T. Montgomery and Michael B. Smith, <i>Hydraulic Fracturing: History of an Enduring Technology</i> , Journal of Petroleum Technology vol. 62 issue 12 (Dec. 2010).
2012	Grieser, B., et al., <i>The Rocket Science Behind Water Frac Design</i> , SPE Production and Operations Symposium, Oklahoma City, OK (March 2003).
2013	Van Domelen, M. S., et al., <i>State-of-the-Art Fracturing in the North Sea</i> , Offshore Technology Conference (1995).
2014	Stephenson, SV, EL Woodall, CD Donaghe, and RE Dant. <i>Fracturing Process Control and Automation: Phase 2</i> , (1993).

2015	L.P. Moore, L.P. and H. Ramakrishnan,, <i>Restimulation: Candidate Selection Methodologies and Treatment Optimization</i> , SPE Annual Technical Conference (2006).
2016	IEEE RP 1017, “IEEE Recommended Practice for Field Testing Electric Submersible Pump Cable” (2004).
2017	Swanson, T. A., et al, <i>The Successful Use of Both Kinetic Hydrate and Paraffin Inhibitors Together in a Deepwater Pipeline with a High Water Cut in the Gulf of Mexico</i> , SPE International Symposium on Oilfield Chemistry (2005).
2018	Chen, Huey J., Gene Kouba, and Seong Lee, <i>Optimizing Corrosion Inhibitor Injection Rate in Flow Lines</i> , CORROSION (2003).
2019	Pizzarelli, S. G., O. E. Gonzalez, P. Justiniano, S. A. Olivares, and J. J. Potma, <i>Results of Thermal Horizontal Completions with Sand Control in Lake Maracaibo, Venezuela: Case Histories of Horizontal Gravel Packs in Bachaquero-01 Reservoir</i> , SPE International Thermal Operations and Heavy Oil Symposium and International Horizontal Well Technology Conference (2002).
2020	Chike, Uchendu, Obadare Awoleke, and Nwoke Linus, <i>Solvent / Acid Blend Provides Economic Single Step Matrix Acidizing Success for Fines and Organic Damage Removal in Sandstone Reservoirs: A Niger - Delta Case Study</i> , SPE Annual Technical Conference and Exhibition (2004).
2021	Conaway, Charles F, <i>The Petroleum Industry: A Nontechnical Guide</i> . Pennwell Books (1999).
2022	Braek, A. M., R. A. Almehaideb, and R. Hughes, <i>Application of Eos to Optimize the Design of an Early Production Scheme of an Onshore Oil Field in Abu Dhabi</i> , Abu Dhabi International Petroleum Exhibition and Conference (1998).
2023	Paktinat, J., et al. (2011). <i>Case Studies: Improved Performance of High Brine Friction Reducers in Fracturing Shale Reserviors</i> . SPE Eastern Regional Meeting.

I. INTRODUCTION

Halliburton Energy Services, Inc. (“Patent Owner”) respectfully submits this Response in accordance with 37 C.F.R. §42.120, responding to the Petition for *Inter Partes* Review (the “Petition”) filed by ProFrac Holding Corporation and U.S. Well Services, LLC (“Petitioner”) challenging Claims 1-15 and 17-27 (the “challenged claims”) of U.S. Patent No. 7,931,082 (the “’082 Patent”) and the Board’s Decision Granting Institution of *Inter Partes* Review (“ID”).

Petitioner fails to establish a motivation to combine Tolman and Means with a reasonable expectation of success due to the significant differences between fracture stimulation operations and production operations that Petitioner completely ignores. For similar reasons, Petitioner fails to establish a motivation to combine Tolman and Crawford with a reasonable expectation of success.

Petitioner also fails to show that Tolman, Means, or their combination, teaches flow of one or more well development task fluids from a centralized well treatment fluid center to one or more centralized well treatment factories as required by all claims. Petitioner further fails to show that Tolman, Means, Crawford, or their combination teaches flow of one or more recovered well treatment fluids from the one or more centralized service factories to the centralized well treatment fluid center as required by all claims.

For the reasons set forth more fully below, the Petition should be denied.

II. LEVEL OF ORDINARY SKILL IN THE ART

In my opinion, a person of ordinary skill in the art (“POSITA”) at the time of the invention of the Asserted Patents would have a bachelor’s degree in electrical engineering, mechanical engineering, chemical engineering, petroleum engineering, computer science or an equivalent field and at least four years of industry experience in oil and gas operations, including experience with the oilfield equipment used during drilling, completion, and/or production. A person could also have qualified as a person of ordinary skill in the art with some combination of (1) more formal education (such as a master’s degree) and less industry experience (at least two years), or (2) less formal education and more industry experience..EX2004 at ¶¶60-62.

III. CLAIM CONSTRUCTION

For purposes of this Response, Patent Owner interprets the claims “in accordance with the ordinary and customary meaning” as understood by a POSITA. 37 C.F.R. §42.100(b); EX2004 at ¶107.

IV. OVERVIEW OF THE ’082 PATENT

A. Patent Specification and Claims

As described in more detail in Patent Owner’s preliminary response, the ‘082 Patent provides specific flow paths (well treatment center 102 → centralized service factory 104 → Well → centralized service factory 104 → well treatment center 102) not disclosed in the prior art. Paper 6 at 3-5; EX1001 Fig.1.

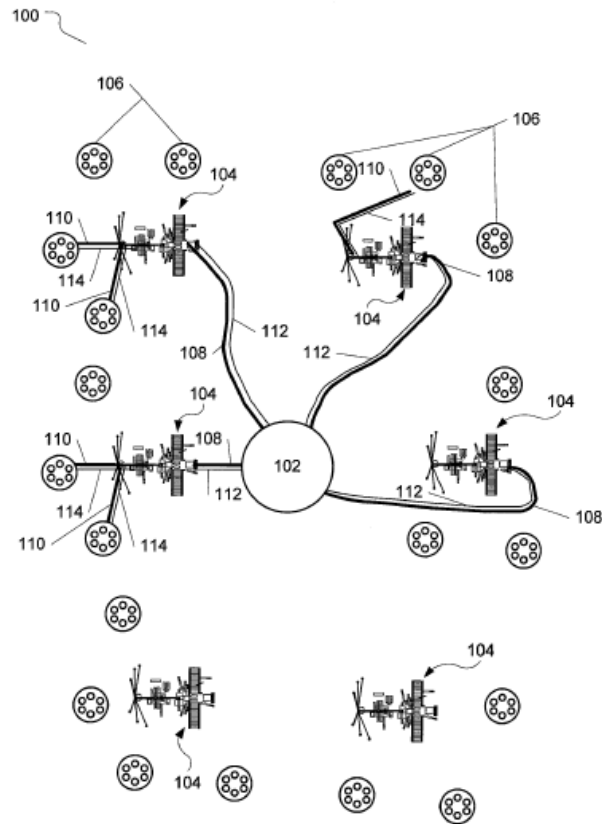


FIG. 1

B. Priority Date

U.S. Patent Application No. 11/873,186 (“the ’186 Application”) leading to the ’082 Patent was filed on October 16, 2007. The ’082 Patent issued on April 26, 2011. *Id.* at (45). Petitioner applies the ’186 Application filing date of October 16, 2007 as the priority date; Patent Owner does not dispute this priority date for the purposes of this Response. Pet. at 3.

C. Prosecution History

The Examiner issued an Office Action on March 23, 2009, rejecting all claims under 35 U.S.C. §102 as anticipated by U.S. Patent Application Publication No.

2009/0114392 to Tolman (“Tolman”). *Id.* at 380-382. In a response dated June 12, 2009, Applicant argued against these rejections without substantive amendments to the claims, arguing that Tolman does not disclose a centralized well treatment fluid center. *Id.* at 463-64.

The Examiner issued another Office Action on January 25, 2010, rejecting claims 1-15, 17-21, 24, 28, 29, and 31 under 35 U.S.C. §§102 and 103 as anticipated or in the alternative obvious over U.S. Patent No. 7,367,411 to Leuchtenberg (“Leuchtenberg”). *Id.* at 549, 552. The Examiner further noted that U.S. Pat. No. 6,236,894 to Stoisits et al. (“Stoisits,” also referred to in the Petition and this Preliminary Response as “Crawford”) teaches a system of centralizing well services for a plurality of wells and is considered relevant to the ’186 Application. *Id.* at 550. In a response dated June 12, 2009, Applicant argued against these rejections without substantive amendments to the claims.

The Examiner issued another Office Action on September 30, 2010, again rejecting all claims under 35 U.S.C. §102 as anticipated by Tolman. *Id.* at 777-78. In a response dated November 4, 2010, Applicant argued against these rejections without amendments to the claims, again pointing out that Tolman does not disclose a centralized well treatment fluid center. *Id.* at 812-13. On January 27, 2011 the Examiner issued a notice of allowance. *Id.* at 821-24.

V. OVERVIEW OF PRINCIPAL CITED REFERENCES

A. Tolman

U.S. Patent Application Publication No. US 2009/0114392 to Tolman *et al.* is entitled “Method and Apparatus Associated with Stimulation Treatments for Wells.” EX1005. Tolman was filed on July 24, 2006 and published on May 7, 2009. *Id.*

Tolman teaches a “method and apparatus associated with the production of hydrocarbons.” *Id.* Abstract. “In one embodiment, the method describes connecting multiple wells to a stimulation fluid pumping system [202] via a pumping system manifold [206].” *Id.* Abstract, Fig.2. For example, Figure 2 illustrates the configuration of surface equipment involved in the stimulation treatment of three wells 104a-104c (not shown).

Tolman’s configuration includes two systems. In the first system (annotated in blue below), “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.” *Id.* [0028].

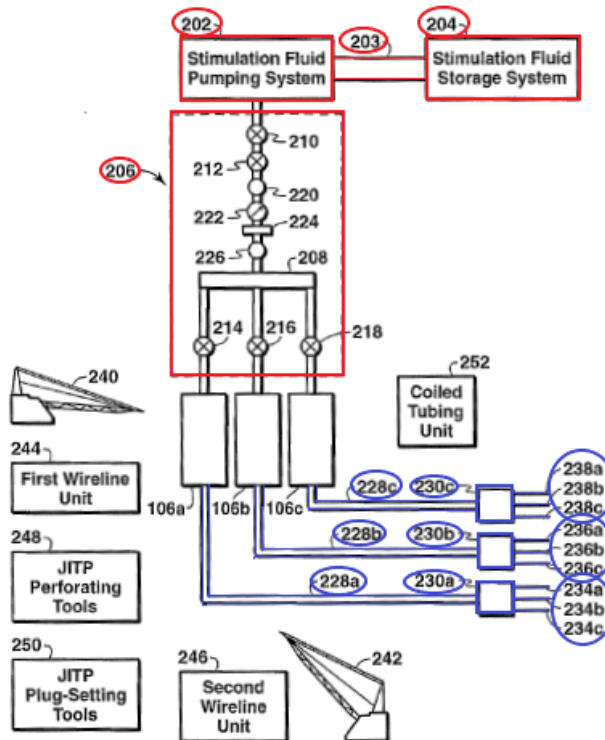


FIG. 2

Id. Fig.2 (annotated).

The second system (annotated in red above) includes “a stimulation fluid pumping system 202 and stimulation fluid storage system 204.” *Id.* [0029]. Unlike the claimed centralized well treatment fluid center which both flows fluids **to** wells and receives fluid **from** wells (e.g., via “a plurality of distribution lines” *and* “a plurality of return lines,” respectively), Tolman discloses one location for flowing fluids **to** wells (red) and separate location for receiving fluids **from** the wells (blue). EX2004 ¶¶52 (citing EX1005 Fig.2; *see also id.* at Abstract, [0008], [0010]-[0011], [0021], [0028]-[0031], [0035], [0037]-[0039], [0044], [0046]-[0052], [0053],

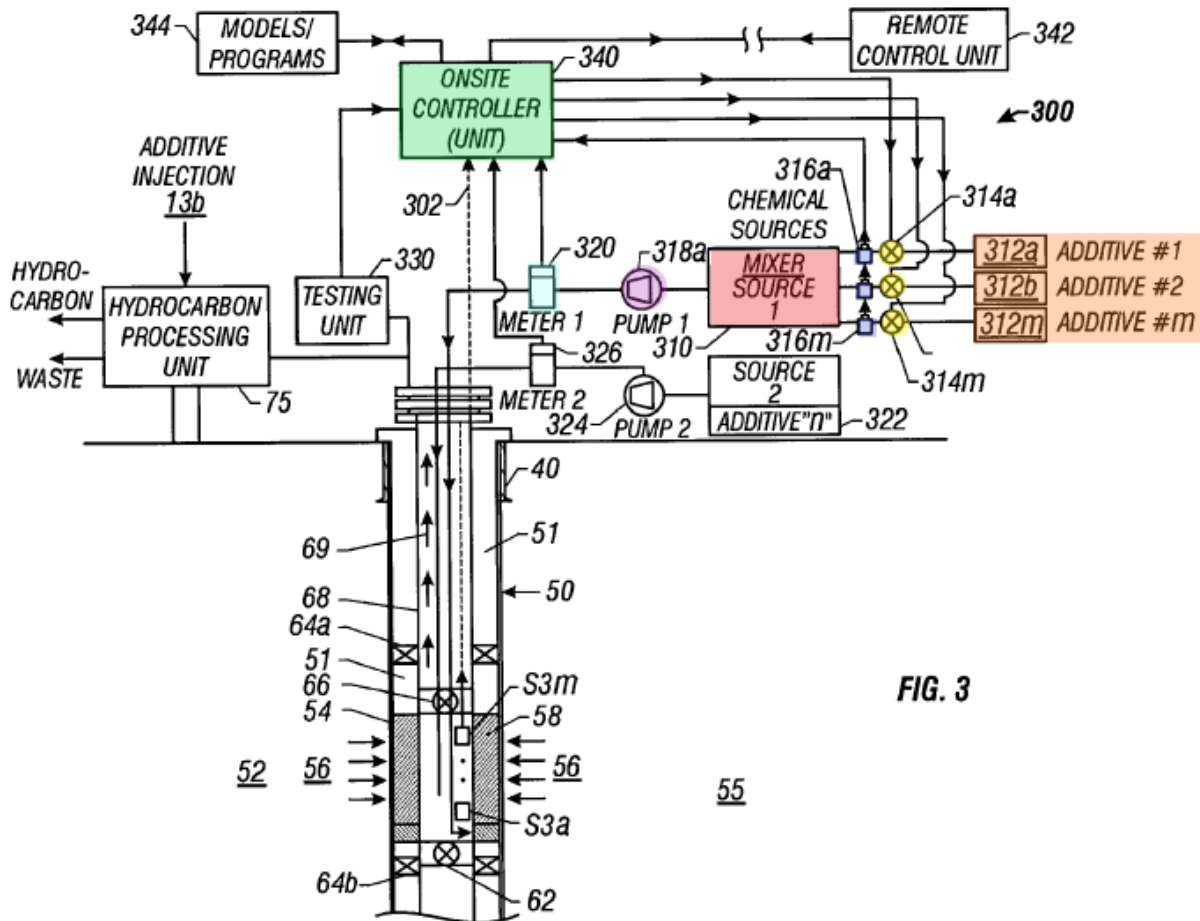
[0056]-[0059], [0067], Cls. 2-3, 8, 14, 24, 33, 38, 49 (describing separate systems involved in the flow of fluids to and from the wells)).

B. Means

U.S. Patent Application Publication No. 2005/0166961 to Means *et al.* is entitled “Closed Loop Additive Injection and Monitoring System for Oilfield Operations.” EX1006. Means was filed on February 7, 2005 and published on August 4, 2005. *Id.*

In contrast with Tolman’s system, which disclose fracture-stimulation equipment and techniques Means system discloses production equipment and techniques. EX2004 ¶54. The additive system is located at each individual well. EX2004 ¶55. For example, FIG. 3 of Means (annotated below) is a schematic of the additive injection system 300 including a mixer 310 [red] for mixing or combining at the wellsite a plurality of additive#1–additive#m stored in sources 313a-312m respectively [orange].” *Id.* at [0047]. “[A]dditives to be combined, such as additives additive#1–additive#m [orange] are metered into the mixer by associated pumps 314a–314m [yellow]. Meters 316a–316m [blue] measure the amounts of the additives from sources 312a–312m [orange] and provide corresponding signals to the control unit 340 [green], which controls the pumps 314a–314m [yellow] to accurately dispense the desired amounts into the mixer 310 [red]. A pump 318 [purple] pumps the combined additives from the mixer 310 [red] into the well 50,

while the meter 320 [cyan] measures the amount of the dispensed additive and provides the measurement signals to the controller 340 [green].” *Id.*



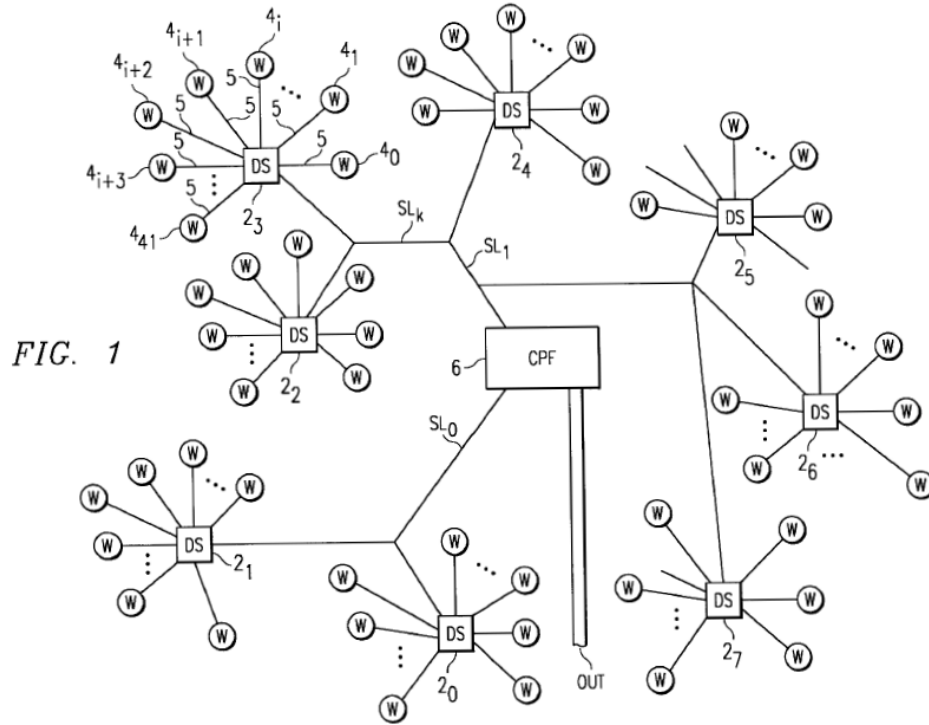
Id. at Fig.3 (annotated).

C. Crawford

U.S. Patent No. 6,236,894 to Stoitsits *et al.* (“Stoitsits” or “Crawford”)¹ is entitled “Petroleum Production Optimization Utilizing Adaptive Network and Genetic Algorithm Techniques.” EX1007. Crawford was filed on December 19, 1997 and issued on May 22, 2001. *Id.*

Crawford is directed to production and more specifically to “production optimization from large production fields.” *Id.* at 1:17-18. Crawford describes a production field including “many wells 4, deployed at various locations within [a] field, from which oil and gas products are to be produced in the conventional manner.” *Id.* at 6:10-13, FIG.1.

¹ The first-named inventor is Stoitsits and the second-named inventor is Crawford. EX1006. The IPR Papers refer to this reference as “Crawford” (although the prosecution history refers to it as “Stoitsits”).



Id. at FIG.1. Each well is connected to one of multiple drill sites 2 by a surface line 4. *Id.* at 6:24-27. “Each drill site 2 gathers the output from its associated wells 4 and forwards the gathered output to central processing facility 6 via one of surface lines SL.” *Id.* at 6:32-34. Central processing facility 6 receives oil, water, and gas (including both recycled lift gas and formation gas) phases from drill sites 2 via Surface lines SL and includes the appropriate separation and compression equipment for separating the desired phases from one another.” *Id.* at 6:55-59.

D. Lehman

U.S. Patent Pub. No. 2004/0050550 to Lehman *et al.* is entitled “Re-use Recovered Treating Fluid.” EX1008. Lehman was filed on September 16, 2002 and published on March 18, 2004. *Id.*

Lehman is directed exclusively to fracture stimulation operations. EX2004 ¶59. More specifically, Lehman is directed to “treating fluid production and subterranean formation treatment methods as well as compositions for treating fluids, all of which relate to reuse of at least part of a prior treating fluid.” *Id.* at Abstract, [0018]. One method includes “treating a subterranean formation intersected by a well, comprising performing a treatment on a well using a treating fluid residual recovered from a prior treatment, wherein using a treating fluid residual recovered from a prior treatment includes conditioning the recovered treating fluid residual.” *Id.* at [0020].

VI. PETITIONER HAS NOT ESTABLISHED THE CHALLENGED CLAIMS ARE OBVIOUS

A. Legal Requirements of a Petition Asserting Obviousness

Petitioner bears the burden of proving a proposition of unpatentability by a preponderance of the evidence on the grounds asserted in the Petition. 35 U.S.C. §314(e). The grounds asserted must be described with “particularity” in the petition. 35 U.S.C. §312(a)(3); *Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016) (“It is of the utmost importance that petitioners ... adhere to the requirement that the initial petition identify ‘with particularity’ the ‘evidence that supports the grounds for the challenge to each claim.’” (quoting 35 U.S.C. §312(a)(3))). Specifically, the Petition “must specify where each element of the claim is found in the prior art patents or printed publications relied upon.” 37

C.F.R. §42.104(b)(4). Petitioner must therefore show that “the structural features of [the challenged claims] were **known prior art elements.**” *K/S HIMPP v. Hear-Wear Technologies, LLC*, 751 F. 3d 1362, 1365-66 (Fed. Cir. 2014); *Personal Web Techs., LLC v. Apple*, 848 F.3d 987, 991 (Fed. Cir. 2017).

Under 35 U.S.C. §103, Petitioner must prove that the claimed subject matter would have been obvious to a POSITA at the time of the invention. In considering obviousness, the Board must determine the scope and content of the prior art and differences between the prior art and the claims and the level of ordinary skill in the pertinent art. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966).

A claim limitation must be proven to be in the prior art; it cannot be proven by conclusory testimony unsupported by concrete evidence. *See Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1363-66 (Fed. Cir. 2016) (reversing the Board’s obviousness determination, which relied on “common sense,” because the petitioner’s expert declaration lacked “evidence and a reasoned explanation”). Petitioner must offer “a sufficient explanation of how the references may be combined, from the perspective of one with ordinary skill in the art, to arrive at the claimed invention, and why the proffered combination accounts for all the features of each claim.” *Dominion Dealer Sols., LLC v. AutoAlert, Inc.*, IPR2013-00223, Paper 9 at 19 (P.T.A.B. Aug. 15, 2013); *see also Arendi*, 832 F.3d at 1362 (“[O]ur cases repeatedly warn that references to ‘common sense’—whether to supply a

motivation to combine or a missing limitation—cannot be used as a wholesale substitute for reasoned analysis and evidentiary support . . .”).

“[A] clear, evidence-supported account of the contemplated workings of the combination is a prerequisite” to concluding “that a relevant skilled artisan would have been motivated to make the combination and reasonably expect success in doing so.” *Personal Web Techs. LLC v. 848 F.3d* at 994. Moreover, “[o]bviousness may not be established using hindsight or in view of the teachings or suggestions of the inventor.” *Para-Ordnance Mfg., Inc. v. SGS Importers Int’l, Inc.*, 73 F.3d 1085, 1087 (Fed. Cir. 1995); *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984).

B. All Grounds Fail as to All Claims Because the Tolman/Mean/Crawford Combination Does Not Disclose or Render Obvious Each Element of Independent Claims 1 and 17.

The Petition argues Tolman’s fracture-stimulation equipment as the base reference for all of the limitations in independent claims 1 and 17, including that Tolman’s stimulation treatment fluid storage system (204) reads on the claimed centralized well treatment fluid center, and that the combined pump (202) and pumping system manifold (206) read on the claimed one or more centralized service factories. Pet. 19–22 (citing EX1005 ¶¶10, 20, 26, 29–30, 38, 64, Fig. 2; EX1003 ¶¶75, 77); *see also id.* at 23–24. Petitioner further argues that Tolman teaches that the stimulation fluid is a well development task fluid, which is flowed from the

stimulation treatment fluid storage system (204) to the pump (202) and pumping system manifold (206). *Id.* at 22–23 (citing *e.g.*, EX1005 ¶¶29; EX1003 ¶¶75, 80).

Petitioner further relies on a combination of Tolman and Means for the claimed flow of well development task fluids from the centralized well treatment fluid center to the centralized service factories (*i.e.*, 1[A] and 17[C]). Petitioner proposes combining Means’s teaching of a closed-loop additive injection system with various pieces of Tolman’s fracture-stimulation equipment. For example, Petitioner argues that “[t]he Tolman/Means system would include Means’s pumps 314a–314m and meters 316a–316m in Tolman’s Pumping System 202 (part of ‘the one or more centralized service factories’) and be used to selectively increase, decrease, or shut off the reception of additives #1–m.” Pet. at 24. Petitioner argues that Means’s additives are also well development task fluids that would be stored at Tolman’s storage system 204 and mixed at Tolman’s pumping system 202 with Tolman’s stimulation fluid. *Id.* at 11–12, 23–24 (citing EX1005 ¶¶29, 59; EX1006 ¶¶5, 6, 40, 47; EX1003 ¶¶69, 80–81).

Petitioner further relies on a combination of Crawford with Tolman/Means for the claimed flow of recovered well treatment fluids from the centralized service factories between to the centralized well treatment fluid center (*i.e.*, 1[E] and 17[E]). Petitioner argues that Tolman’s “[m]anifolds 230a–230c (part of ‘the one or more centralized service factories’) direct (‘flow’) fluid (including ‘the one or more

recovered well treatment fluids’) to various destinations.” Pet. 31 (citing EX1005 ¶28; EX1003 ¶97). Petitioner argues that “Tolman explains that multiple flowlines may be coupled to processing units, like the one described in Crawford.” Pet. at 33. “Because fluids like water may be reused for future stimulation treatment after being separated from other recovered well fluids, Crawford’s centralized processing unit should be part of Tolman’s Storage System 204, which provides fluids for stimulation treatment. *Id.* “The Tolman/Mean/Crawford system includes surface lines between Tolman’s flowback manifolds and the Crawford’s central processing facility carry the well treatment fluids recovered from Tolman’s wells.” *Id.* at 34.

1. ***Claim Limitations 1[A] and 17[C]: “flowing from a centralized well treatment fluid center to one or more centralized well treatment factories one or more well development task fluids”/ “a plurality of distribution lines coupled between the centralized well treatment fluid center and the one or more centralized service factories, wherein the plurality of distribution lines are adapted to flow one or more well development task fluids”***

However, even if it would have been obvious to combine the teachings of Tolman, Means, and Crawford as proposed in the Petition, the Petition fails to show how the Tolman/Mean/Crawford combination discloses or suggests these limitations required by independent claims 1 and 17. First, the Petition fails to establish that the Tolman/Mean combination discloses, teaches, or suggests flowing one or more well development task fluids from a centralized well treatment fluid center to one or more centralized well treatment factories. EX2004 ¶156.

As previously explained, Petitioner argues that both Tolman and Means teach flow of well development task fluids. Petitioner argues that Tolman's stimulation fluid is a well development task fluid, which is flowed from the stimulation treatment fluid storage system (204) to the pump (202) and pumping system manifold (206). Pet. at 22–23 (citing *e.g.*, EX1005 ¶¶29; EX1003 ¶¶75, 80). Petitioner further argues that Means's additives are well development task fluids that would be stored at Tolman's storage system 204 and mixed at Tolman's pumping system 202 with Tolman's stimulation fluid. *Id.* at 11–12, 23–24 (citing EX1005 ¶¶29, 59; EX1006 ¶¶5, 6, 40, 47; EX1003 ¶¶69, 80–81). Petitioner further argues, “before mixing, [Means's] additives are ‘well development task fluids’ because they are used in well treatment. Pet. at 23 (citing EX1006 [0047], [0006]; EX1003 ¶¶69).

However, neither Tolman nor Means, individually or in combination, disclose, teach or suggest flow of well development task fluids, from a centralized well treatment fluid center, or otherwise. EX2004 ¶156. Tolman states that “[t]he stimulation fluid storage system 204 is a vessel that holds a sufficient volume of fluid for the planned stimulation treatments.” EX1005 [0029]. Tolman further discloses that “stimulation fluid may be injected into one or more of the wells 104a-104c.” EX1005 [0031]. In other words, Tolman teaches that the same fluid that is flowed into the wells 104a-104c to treat the wells (*i.e.*, well treatment fluid) is also flowed from the stimulation fluid storage system 204 (*i.e.*, Petitioner's proposed

centralized well treatment fluid center). EX2004 ¶1555. Tolman’s “stimulation fluid” is thus analogous to the “well treatment fluid” of the ’082 Patent, not a well development task fluid. *Id.* The ’082 Patent, on the other hand, claims flow of a different fluid (*i.e.*, well development task fluid) from the centralized well treatment fluid center than the well treatment fluid, which, in contrast with the well development task fluids, is prepared from well development task fluids and flowed into the wells. *Id.* Tolman at best teaches flow of a well treatment fluid from the stimulation fluid storage system 204 and to the wells 104a-104c and further does not teach flow of well development task fluids from any location. *Id.*

In the proposed combination, Dr. Nikoloau appears to assert that Means’ additives are both “well development task fluids” and “well treatment fluids.” EX2004 ¶153. However, the same additives cannot be both “well development task fluids” and “well treatment fluids.” The two fluids are distinctly different according to the ’082 Patent and distinctly claimed; the same fluid cannot meet both limitations. *Id.* For example, the ’082 Patent explains that “[t]he configuration for receiving the well development task fluids may include coupling modules necessary to receive the well development task fluids, process and prepare the well treatment fluids from the well development task fluids and flow the well treatment fluids to the plurality of wells.” EX1001 8:6-11. This distinction is also apparent from the claims. Independent claim 1 recites “preparing...one or more well treatment fluids

from the one or more well development task fluids.” Independent claim 17 recites “[a] plurality of distribution lines are adapted to flow one or more well development task fluids.” However, dependent claim 24 recites that “the each of the plurality of distribution lines are adapted to flow one or more well treatment fluids” (*i.e.*, in addition to being adapted to flow one or more well development task fluids as recited in its independent claim 17). The ’082 Patent thus makes clear that well development task fluids and well treatment fluids are distinct and the same fluid(s) cannot meet both limitations. EX2004 ¶153.

Further, Means’ fluids are not “well development task fluids” (*i.e.*, fluids used in the development of the well), as they are distinctly fluids used in the **production** of wells, not in well development. EX2004 ¶153. Even the section of Means quoted by Dr. Nikolaou makes this clear as Means is discussing chemicals (additives) introduced into **producing** wells. *Id.* (citing Ex 1003 ¶86, quoting Ex 1006 [0005]); *see also* EX1006 [0006], [0040], [0047]. Dr. Nikolaou also agreed in his deposition that well development task fluids are not used during production. *See, e.g.*, EX2003 47:2-47:14 (stating that the fluids used during production are “different fluids of different nature” than well development task fluids). A POSITA would have understood that chemicals for controlling “corrosion, scale, paraffin, emulsion, hydrates, hydrogen sulfide, asphaltenes and formation of other harmful chemicals” in **production** fluid, would have little to no value in a well development operations

such as a well-treatment operation such as hydraulic fracturing. *Id.* None of Means' additives are a "well development task fluid" as the term is used in the '082 Patent. *Id.* (And further, no combination of these additives would result in a "well treatment fluid" as the term is used in the claim or in the '082 Patent. *Id.*.) Because Means's additives are production additives used for an entirely different purpose than well development or well treatment (*i.e.*, production), Means fails to disclose, teach, or suggest flow of well development task fluids from a centralized well treatment fluid center. *Id.*

Tolman and Means in combination also fail to disclose, teach, or suggest flow of well development task fluids from a centralized well treatment fluid center. As explained above, Petitioner proposes that Means's additives and Tolman's stimulation fluid are well development task fluids that would be stored at Tolman's storage system 204 and mixed together at Tolman's pumping system 202. Flow of Tolman's stimulation fluid and Means's production additives from Tolman's stimulation fluid storage system 204 is simply flow of a well treatment fluid and production additives, neither of which are well development task fluids. EX2004 ¶156. The combination of Tolman and Means fails to disclose flow of well development task fluids from a centralized well treatment fluid center.

2. ***Claim Limitations 1[E] and 17[E]: "flowing from the one or more centralized service factories to the centralized well treatment fluid center the one or more recovered well treatment fluids" / "a plurality of return lines coupled between the***

centralized well treatment fluid center and the one or more centralized service factories, wherein the plurality of return lines are adapted to flow one or more recovered well treatment fluids”

The Petition fails to establish that the Tolman/Mean's combination discloses, teaches, or suggests flowing one or more recovered well treatment fluids from one or more centralized well treatment factories to a centralized well treatment fluid center, as required by independent claims 1 and 17. Petitioner argues that the combination of Tolman, Means, and Crawford render this feature obvious, and more specifically suggests that Crawford's forwarding of "output" (*i.e.*, oil, gas, and water) from drill sites 2 to a central processing facility 6 via one or more surface lines SL discloses this specific feature of the claim. Pet. at 31, 33; EX1003 ¶¶98, 100.

However, Crawford does not disclose flow of recovered well treatment fluids to a centralized well treatment fluid center, or to any other location. Crawford discloses flow of production fluids (*i.e.*, oil, gas, and water). EX2004 ¶165; *see, e.g.*, EX1007 2:48-51 ("[T]he wells in a modern production field are linked together by a network of surface lines which transport the produced gas, oil, and water from each well to the centralized processing facilities").

A POSITA would understand that production fluids are different than recovered well treatment fluids. EX2004 ¶166. For example, the '082 Patent states that "[t]he recovered fluids ... may be well treatment fluids, production fluids, water,

or any other fluid recoverable from a well known to one of ordinary skill in the art.”

EX1001 8:15-17. While both well treatment fluids and production fluids are recovered from wells, a POSITA would understand that they are different types of fluids with different purposes. EX2004 ¶166. Dr. Nikolaou agrees:

Q· What is the difference between production fluid and recovered well treatment fluids?

A· So recovered well treatment fluids are fluids that you inject and you pick up, and you do these for a certain purpose, as we explained through a number of examples a few moments ago.

Production fluids are fluids that mother earth gives us when we let her do that by creating a well and let those fluids move to the top.

EX2003 64:25-65:11. Based on the '082 Patent and general knowledge, a POSITA would further understand that a recovered well treatment fluid is a fluid that has been recovered from a well after it has been flowed into the well to treat the well, thus the reason for the term “recovered well treatment fluid.” EX2004 ¶166. A POSITA would also understand that a production fluid is also a fluid that is recovered from the well, but is “water or hydrocarbons” or other fluids that originate from the formation (*i.e.*, and not recovered after being flowed into the well to treat the well like recovered well treatment fluids). EX2004 ¶166. For example, claim 1 of the '082 Patent recites flowing one or more well treatment fluids to at least one of a

plurality of wells followed by recovering the one or more well treatment fluids (*i.e.*, recovered well treatment fluids) from the at least one of a plurality of wells (after which the recovered well treatment fluid is flowed to the centralized well treatment fluid center). A POSITA would understand this round-trip flowpath of well treatment fluid into and out of a well was characteristic of well treatment fluids such as fracturing fluid but not a production fluid. *Id.* A POSITA would understand that production fluids were also recoverable from wells but only flow one-way (out of the well from the formation, as described in Crawford). *Id.*

The '082 Patent does state that the recovered well treatment fluids may be production fluids, EX1001 2:4-5; 6:37-38, but in such instances, the '082 Patent specifically refers to “production fluid,” because a POSITA would understand that the production fluid was not used to treat wells and is therefore not a recovered well treatment fluid, but a different fluid also recovered from the well. EX2004 ¶167 (citing EX1001 cls. 6-7, 23, 26; *see also*, EX1001 3:31-34 (Return lines 112 may be adapted to flow recovered well treatment fluids or production fluid from the centralized service factories 104 to the centralized well treatment fluid center 102)). Crawford’s oil, gas, and water are not recovered well treatment fluids but production fluids. EX2004 ¶167. Crawford therefore fails to disclose flow of recovered well treatment fluids to a centralized well treatment fluid center, or otherwise. EX2004 ¶167.

Crawford further does not teach or suggest flow of recovered well treatment fluids. EX2004 ¶168. Crawford is directed to “production optimization from large production fields” and more specifically to “decisions involved in later life production operation” (also known as “secondary processes”) that “are used to increase and continue production from modern production fields.” EX1007 1:17-18, 1:29-33. Crawford is thus only concerned with the later stages of production, which is at the opposite end of the well life spectrum from well development activities such as well treatment. EX2004 ¶168. The only fluids flowing out of the wells during later stage production are production fluids. *Id.* Crawford does not reference and in no way implicates well development activities such as well stimulation and flowback and therefore does not teach or suggest flow of recovered well treatment fluids to any location, much less flow of recovered well treatment fluids to a centralized well treatment fluid center. *Id.*

C. All Grounds Fail as to All Claims Because the Petition Does Not Provide a Sufficient Motivation to Combine Tolman and Means with a Reasonable Expectation of Success.

Petitioner and its expert Dr. Nikolaou were unable to find a single reference that discloses flowing one or more well development task fluids from a centralized well treatment fluid center to one or more centralized service factories as required by the independent claims, and thus rely on the combination of Tolman and Means, as described above.

The Petition's proposed combination of Tolman and Means fails because, as both experts agree, Tolman and Means relate to two different phases of oil and gas operations (*i.e.*, production versus well development (including well treatment)), and the Petition fails to provide a sufficient rationale for why a POSITA would have been motivated to combine Means's production equipment with Tolman's fracture-stimulation equipment with a reasonable expectation of success.

1. Tolman and Means Relate to Two Distinct Phases of Oil and Gas Operations

Both experts agree there are three separate phases of a well in oil and gas production: (1) drilling, (2) completion (including stimulation), and (4) production. EX2004 at ¶¶67-106; EX1003 §IVA-B; EX2003 at 22:17-27:4 (drilling), 27:8-36:15 (completion including stimulation or fracturing), 37:13-38:6 (oil and gas production). Unlike the first two phases, Dr. Nikolaou remarkably did not include a discussion of oil and gas production in his declaration. Dr. Nikolaou stated that well stimulation was the focus of all of his discussion because "that's what the '082 Patent is about." EX2005 at 38:4-10. However, Dr. Nikolaou also conceded in his deposition that the two secondary references that he relies on, Means and Crawford, both exclusively relate to production operations, not well stimulation. *See, e.g.*, EX2003 83:10-83:17, 95:20-22; 101:12-19.

Both experts also agree that Tolman relates to **fracture stimulation** operations. EX2004 ¶¶48-49; EX2005 67:3-8 ("In summary, my position is that

there is a pretty good description of how to coordinate stimulation from a central location, and that means how to prepare, deliver and recover fluids for that operation...”), 71:15-20 (“Q:All right. So the only fluid that is stored in the stimulation fluid storage system is stimulation fluid, correct? A:Yeah. Yea, the term suggests that. It says stimulation fluid, yes.”); *see also, e.g.*, EX1005 at Title, Abstract, [0005]-[0006]. Both experts further agree that Means relates exclusively to **production** operations. *See, e.g.,* EX2004 ¶54; *see, e.g.*, EX2003 62:4-7 (“Q:And all of the additive injection system equipment illustrated in Figure 3 is production equipment, is that correct? A:Yes, this is the site of production. There is a well in production, that’s correct, yes.”); *see also, e.g.*, EX1005 at Abstract, [0005]-[0008], [0032], [0046].

Dr. Durham explains that fracture stimulation of hydrocarbon bearing formations is a technique that has been used to increase or speed up oil and gas production for nearly as long as oil and gas production has existed. EX2004 ¶82. Fracture stimulation involves pumping a fluid (typically water but sometimes also foam or gas) containing chemicals and proppant into a hydrocarbon bearing formation as sufficient pressure to crack (fracture) the formation’s rock. *Id.* ¶85. The proppant enters the fractures and keeps them open to allow oil and gas to flow from the fractures into the wellbore and then to the surface during subsequent oil and gas production operations. *Id.* At the time of the ’082 Patent, fracture stimulation

required higher volumes of fracturing fluid, higher pressures, and higher horsepower pumps than in the past due largely to the advent and expansions of horizontal wells. *Id.* ¶¶83-84.

Dr. Durham explains that oil and gas production involves the flow of significant volumes of production fluid (*e.g.*, hydrocarbons and water) from the hydrocarbon bearing formation into wells and to the surface, and then to separation and storage facilities. *Id.* ¶¶98-99. Wells are commonly overpressured such that the fluid flows to the surface without any assistance. *Id.* ¶94. In other instances such as the later life production operations discussed in Means, artificial lift operations, such as electric submersible pumps, are required to produce the fluid. *Id.* ¶95; *see also* EX1007 1:25-29, 1:33-36 (“While the primary production phase of operation may be effected in a relatively straightforward manner, later life operation of the production field requires important decisions for optimum production and economic return” including use of “secondary processes” such as “waterflooding, gas lift, and gas injection). Oil and gas production from a well at the time of the ’082 Patent commonly lasted more than ten years, sometimes up to 30 years, with proper maintenance. *Id.* ¶93.

Both experts agree that fracture-stimulation operations, such as those in Tolman, and production operations, such as those in Means or Crawford, happen sequentially. *See, e.g.*, EX2004 ¶93; EX2005 at 33:8-9, 34:6-9 (describing the

“number of steps in stimulation” to “have your fractures where you want them, then you take that water back and you have your well ready now for production.”); *see also* EX1005 at FIG.3 (Step 320 “Move Stimulation Equipment,” Step 322 (“Provide Production Tubing”), Step 324 “Produce Hydrocarbons”). They further agree that equipment used in fracture-stimulation operations is removed from the well before production operations begin. *See, e.g.*, EX2004 ¶93; EX2003 at 38:21-23 (“Stimulation uses its own equipment. Production uses its own equipment. That is correct.”), 38:24-39:8 (“Q:What typically happens to the stimulation equipment once production operations have commenced? A:Again, that’s resource, a location issue. So if you no longer need that equipment in a particular well site, you move it to another well site....”); *see also* EX1005 at FIG.3 (step 320-324 describing removal of stimulation equipment followed by installation of production equipment).

Fracture-stimulation operations and production operations further differ with respect to at least: (1) equipment, (2) pressures, (3) fluid types, and (4) fluid volumes. With respect to equipment, Dr. Durham explains entirely different equipment is used for fracture-stimulation operations as compared to production operations. *See, e.g.*, EX2004 at ¶93. For example, fracture-stimulation operations require multiple high-pressure pumps, a blender or hydration unit, storage tanks, and a manifold at the

surface while production operations require trees, collection and separation equipment, and lower pressure pumps. *Id.* ¶¶86, 94-99.

With respect to pressure, Dr. Durham explains that a significant amount of pumping horsepower (about 8,800 to 12,400 hhp) would be required to generate pressure sufficient to fracture the formation (around 6,000 to 15,000 psi). EX2004 ¶88. Dr. Durham further explains that the horsepower and pressure required for production operations are significantly lower. EX2004 ¶100. Dr. Nikolaou agreed during his deposition, testifying that “Production additives have to be added downhole. They have to withstand basically the hydraulic head pressure and whatever friction the production fluids experience as they move up. So the pressure at which these additives would be added would be somewhat lower [than the pressure that the stimulation fluid pumping system pumps stimulation fluid downhole].” EX2003 74:5-74:15. Dr. Nikolaou further testified that for production pressures in comparison with fracture-stimulation pressures “we don’t try to fracture rock. So when you try to fracture a rock, typically, you have to withstand the strength of the rock, which is why hydraulic fracture typically works at higher pressures.” *Id.* at 74:25-75:5.

With respect to fluid types, Dr. Durham explains that fracture stimulation involves pumping liquids (*e.g.*, water, foam, or gas) and proppant (*e.g.*, sand) into the formation. EX2004 at ¶66; *see also* EX1005 [0043]. Dr. Nikolaou gave a similar

description in his deposition. EX2003 at 55:9-15 (“It’s mainly water and sand and what other additives you may use so that you can have the right properties for flow....”). In contrast, during production operations, production chemicals, such as hydrate, paraffin, and wax inhibitors, may be injected to aid in the flow of fluids from the formation to the surface by preventing the buildup of solids. EX2004 ¶100; EX2003 at 162:4-8; EX1005 at [0009], [0033]. Dr. Nikolaou further testified in his deposition that additives used in production are not used in fracture-stimulation operations. EX2003 at 85:12-18 (“[T]he fluid that you inject in production will likely not coincide with additives that you use in stimulation, although there may be something that may be uncommon, for example, viscosity adjustments or something like that.”).

With respect to fluid volumes, Dr. Durham explains that, at the time of the '082 Patent, fracture-stimulation operations would have required introducing about 2,000–2,500 gal/ft of stimulation fluid into the well whereas production operations would have used very small volumes of production additives by comparison. EX2004 ¶84, 100; *see also* EX1005 [0043] (disclosing “approximately 23,000 gallons of stimulation fluid (approximately 547 barrels of fluid) of stimulation fluid” per stage, pumped at “20 barrels/minute” over a period of “27 minutes”). Dr. Nikolaou agreed in his deposition that the “stimulation fluid will fill up the whole well pretty much, the space that’s available then, so that eventually the

fluid, the water---that is the fracturing water---would be pressurized enough to open up the rock....” EX2003 at 87:1-6. The additives, in contrast, do not fill up the well as they are “added to the production fluids” and are “part of the production.” *Id.* at 87:9-14; *see also id.* at 88:1-11 (“Well, I would say that the amount of fluid that you find in stimulation...the stimulation fluid that you find in the well, is larger than the amount of fluid that you inject in a well during production as an additive for the simple reason, like I said, that the production operation involves fluids that need to move up the well to be produced, oil and gas that is.”).

With respect to fluid rates, Dr. Durham explains that, at the time of the '082 Patent stimulation fluids were pumped at rates on the order of barrels per minute while production chemicals were pumped at rates on the order of quarts or barrels per day. EX2004 ¶100; *see also* EX1005 [0043] (disclosing stimulation fluid pumped 20 barrels/minute). Dr. Nikolaou admitted in his deposition that fluid rates for both stimulation and production operations “would vary” but he did not know the large differences in magnitude of the rates, which suggests that he did not consider these differences when proposing a combination that would involve applying Means’ additive injection system to Tolman’s fracture stimulation equipment. EX2003 at 77:4-10 (“Q:Would a rate on the order of barrels per minute sound about right for the rate at which stimulation fluids are typically pumped downhole? A:Frankly, I don’t remember the specific number off the top of my

head.”), 89:1-6 (“Q:Would a rate of quarts per day for Means’ additive injection system sound about right? A:I—I don’t remember these numbers, to be honest with you, off the top of my head at all.”).

2. *The Petition Fails to Establish a Motivation to Combine Tolman’s Fracture-Stimulation Equipment with Means’s Production System*

The Petition fails to provide a sufficient reason a POSITA would have been motivated to combine Tolman’s **fracture-stimulation** equipment with Means’s **production** system, each of which relate to distinct, sequential phases of well operations as discussed above. EX2004 ¶114. First, as Dr. Durham explains, the Petition’s analogous art argument that Tolman and Means are both directed to “well operations” is an oversimplification and overgeneralization of the field of endeavor. *Id.* The ’082 Patent is directed to centralizing well servicing and well treatment. *See, e.g.*, EX1001 at (54); cls. 1, 17. Means, on the other hand, is directed to additive injection systems for producing wells. *See, e.g.*, EX1006 [0005] (“A variety of chemicals...are often introduced into producing wells, hydrocarbon processing units, oil and gas pipelines and chemical processing units...”). As previously explained, well servicing including well treatment is a separate and distinct phase of operation from production. EX2004 ¶114. Petitioner does not account for these distinct phases of well operations, each with its own concerns, equipment, and

service providers, as discussed above. *Id.* Means is not in the same field of endeavor as the '082 Patent.

In addition, the Petition's framing of the problem solved by the '082 inventors of "conserv[ing] labor, infrastructure, and environmental impact" is not only overbroad but incomplete. EX2004 ¶115. (citing Pet. at 12 (EX1003 ¶66)). The problem described by the '082 inventors is the movement of equipment, supplies, and personnel during the servicing and treatment of wells, which may result in "environmental impacts" and "expos[e] mobile equipment to adverse weather conditions" which can "jeopardize well treatment operations and worker safety." EX2004 ¶115 (citing, *generally* EX1001 at 1:6-38). Means's problem, on the other hand, is "additive pumping systems at unmanned locations" that are "either injecting incorrect amounts of the additives" or are "totally inoperative." EX2004 ¶115. (citing EX1006 [0005]).

Neither Means nor the Petition addresses how unmanned additive systems are relevant to the problem of the '082 Patent, because they are not. EX2004 ¶115. Means's additive systems are installed at the well at the beginning of production and typically remain in place for years and therefore do not encounter the same problems encountered by the well servicing and treatment equipment and supplies described in Tolman due to constant movement from well-to-well. *Id.* There are no on-site personnel associated with Means's additive injection system as there are with the

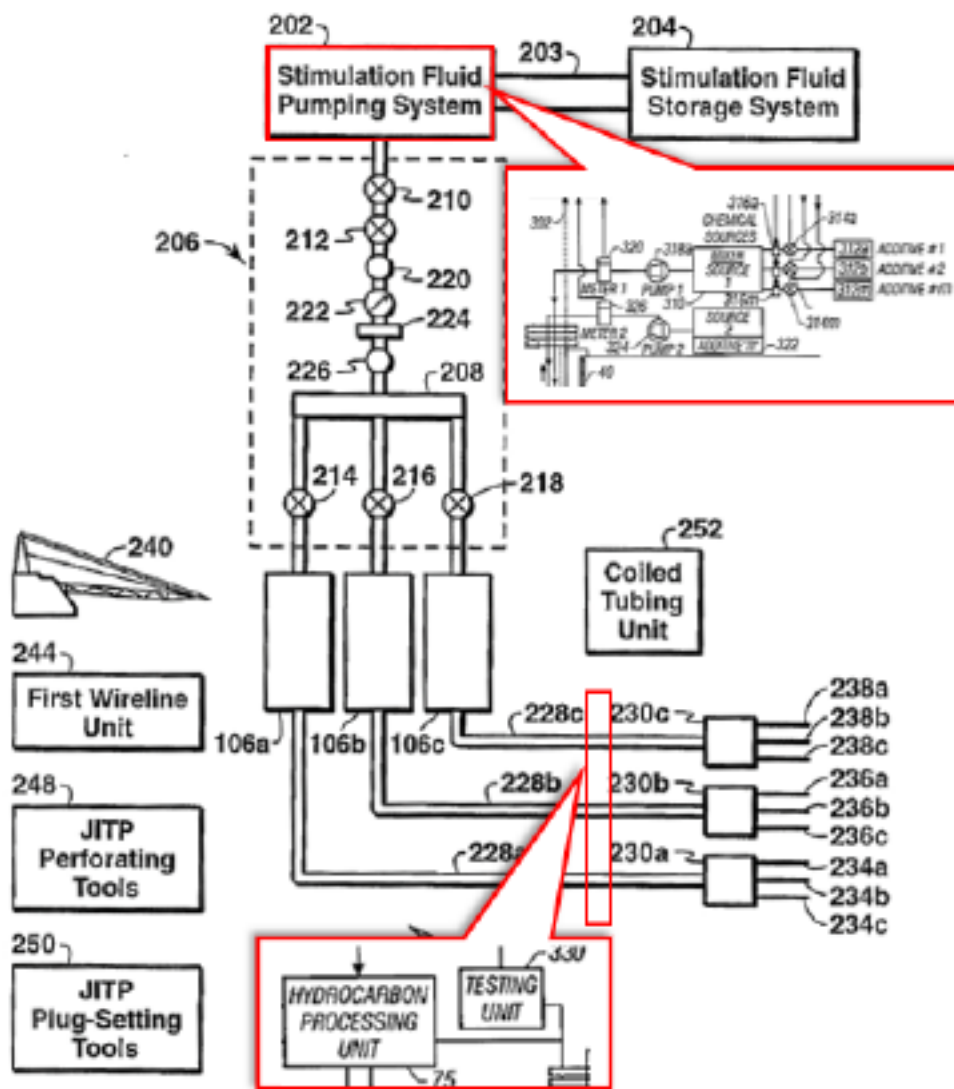
stimulation equipment involved in Tolman; Means' personnel are already located remotely and do not need to move from well to well. *Id.* Means is not reasonably pertinent to the actual problem described in the '082 Patent, which are directed towards addressing the problems of constant movement from well to well. *Id.* Therefore, Means is not an analogous reference. *Id.*

In addition, there are several reasons why a POSITA would not be motivated to combine Means's additive injection system with Tolman's stimulation fluid pumping system 202. First, Means's additive system is not compatible with Tolman's pumps. EX2004 ¶116. As part of this combination, Dr. Nikolaou argues that "Means discloses a closed-loop additive injection system used along with oilfield pumps, like those in Tolman." Pet. at 14 (citing EX1003 ¶106). However, the oilfield pumps disclosed in Tolman and Means could not be more different. EX2004 ¶116. Tolman's stimulation fluid pumping system 202 is a *system* of multiple stimulation pumps interconnected by a manifold. EX2004 ¶116 (citing, *e.g.*, EX1005 Fig. 2). A POSITA would further understand that each of the pumps in Tolman's stimulation fluid pumping system 202 would be a large, above-ground, positive displacement (*e.g.*, plunger) pump powerful enough to perform stimulation treatments such as hydraulic fracturing, which involves "injecting fluids into a formation at high pressures and rates that the reservoir rock fails." EX2004 ¶116 (citing EX1005 [0065]). In contrast, the pump associated with each wellsite in

production operations such as the one disclosed in Means is a single “electrical submersible pump.” EX1006 [0005]. These pumps are relatively small, electrically-driven centrifugal pumps submersed in the production fluid downhole and are used to pump fluid from the well at relatively low pressures, and rates. EX2004 ¶116. Because Tolman’s stimulation fluid pumping system 202 is so different in both form and function from the electrical submersible pump that is connected to Means’s additive injection system, a POSITA would not be motivated to combine Means with Tolman. EX2004 ¶116.

Second, combining Means’s additive system with Tolman’s pumps would change the “basic principles under which [Means] was designed to operate” and would render Means “inoperable for its intended purpose.” *Plas-Pak Indus., Inc. v. Sulzer Mixpac AG*, 600 F. App’x 755, 758 (Fed. Cir. 2015); EX2004 ¶117. For example, Means attributes the ability of its additive system to “make precise measurements of the flow rate of the injected additive” to “[a] suitable precision low-flow, flow meter.” EX2004 ¶117 (citing EX1006 [0023]). Specifically, The “flow meter in the supply line measures the flow rate of the additive through the supply line and generates signals representative of the flow rate” and then “[a] controller at the wellsite determines the flow rate from the flow meter signals and in response thereto controls the flow rate of the additive to the well.” EX2004 ¶117 (citing EX1006 Abstract). Petitioner includes these low-flow meters in its

combination with Tolman's stimulation fluid pumping system 202, along with Means's additive mixer, additive pumps and "any necessary sensors and controls," explaining that "a POSITA would have understood that by combining the teachings of Tolman with Means, improved well efficiency could be attained by fine-tuning the mixture of additives." Pet at 10-11.



EX1005 Fig. 2 (as annotated by Petitioner with Means' additive system). ¶Means's additive system consists of precision equipment designed to be connected to a single

electric submersible pump that delivers additives at small pressures, quantities, and rates and would not be able to meet the demand or withstand the flow rates and pressures required by Tolman's stimulation pumping system. EX2004 ¶117. Because Means's low-flow meters would not be able to deliver precise measurements and thus fine-tune the mixture of additives in a high-flow environment, adding Means's additive system to Tolman's pumps would change the basic principles under which the additive system was designed to operate and it would further no longer function according to its intended purpose. *Id.* Thus, a POSITA would not be motivated to combine Means with Tolman.

Without the low-flow flow meter and pump functioning as they should as part of Means's additive system, the combined system would no longer convey the benefits alleged in Dr. Nikolaou's proposed reasons to combine. EX2004 ¶118. Means' additive system can no longer "precisely provid[e] additives to the wellbore" and thus "prolong[] the life of the wellbore." *Id.* (citing ID at 12-13). Means additive system would no longer be capable of preventing "[i]nsufficient amounts of treatment additives" and therefore a POSITA would not be motivated to combine based on this reason. EX2004 ¶118 (citing Pet. at 15). In addition, the additive system would not longer confer any economic benefits due to the "supply [of] precise of amounts of additives" because it can no longer "periodically or continuously monitor the actual amount of the additives being dispensed." EX2004

¶118 (citing Pet. at 15). Means additive system is no longer able to “dispense[] precise amounts of additives, monitor[] the dispensed amounts, communicate with remote locations, take corrective actions locally and/or in response to commands received from the remote locations” or mitigate the increased costs of Means’s additive system based on “improved well efficiency attained by fine-tuning the mixture of additives.” EX2004 ¶118 (citing Pet. at 15-16).

Third, Means’ benefits relied on by Petitioner would not extend to Tolman’s system. EX2004 ¶119 (citing ID at 12 (citing Pet. 10-16)). Benefits extend from one device to another when they are “similar devices” that are improved in the “same way” (unless the “actual application is beyond that person’s skill”), *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 401 (2007). As previously explained, Tolman’s stimulation fluid pumping system and Means’s electrical submersible pump are different in almost every respect of form and function and are therefore not “similar devices.” EX2004 ¶119. Due to the pumps’ different functions and also due to the fact that Means’s low-flow meter would *not* function in Tolman’s high pressure, high flow environment, they could also not be improved in the same way. *Id.* A different solution other than Means’s low-flow meter would be required to more precisely deliver additives during fracture-stimulation and that solution is presented in neither Means nor Tolman. *Id.* The application of Means to Tolman is thus beyond a POSITA’s skill. *Id.* Tolman’s fracture-stimulation equipment and Means’

production equipment are different equipment that serve different functions and a POSITA would not combine them. *Id.*

Fourth, there is nothing in the prior art that would motivate a POSITA to combine fracture stimulation equipment such as disclosed in Tolman with production equipment such as disclosed in Means. There is nothing in any of Petitioner's references—Tolman, Means, or Crawford—that supports the combination of fracture-stimulation equipment with production equipment. EX2004 ¶120. In fact, Tolman teaches away from doing so because it teaches that, “[i]f the planned stimulation treatments for the wells are complete, then the equipment associated with the stimulation treatments may be **rigged-down and moved off the surface pad 102**, as shown in block 320” for FIG. 3, before “run[ning] production tubing in each of the wells, as shown in block 322” and utilizing the wells “to produce hydrocarbons, as shown in block 324.” EX2004 ¶120 (citing EX1005 at [0040], FIG. 3). Petitioner impermissibly relies on hindsight provided by the '082 Patents combination of equipment from different phases to combine Tolman's fracture-stimulation equipment and Means's production equipment. EX2004 ¶120.

Accordingly, the Petition fails to establish that a POSITA would have been motivated to combine Tolman's fracture-stimulation equipment with Means's production equipment as proposed in the Petition, and therefore, the Tolman/Means combination does not render the challenged claims obvious.

3. *The Petition Fails to Establish a Reasonable Expectation of Success in Combining Tolman's Fracture-Stimulation Equipment with Means's Production Additive System*

As previously discussed in Patent Owner's preliminary response, the Petition never addresses reasonable expectation of success and therefore cannot establish obviousness. *See* POPR at 28. The Board agreed that Petitioner never addresses reasonable expectation of success, but also stated that at this stage, "[t]he prior art combinations provided here by Petitioner do not appear to be such a technological leap that a person of ordinary skill in the art would have had significant trouble making the combinations as proposed by Petitioner. Rather, they appear to be the predictable use of prior art elements according to their established functions." ID at 21.

However, this is not one of those instances in which reasonable expectation of success can be inferred, because Petitioner's combination is not a predictable use of Means's production system according to its established function. EX2004 ¶121. As previously explained, Means's production additive system relies on a low-flow meter to measure and provide precise amounts of production additives (in small amounts and low rates) to low-flow electrical submersible pumps. To work with Tolman's stimulation system, the additive system would have to provide additives in such large amounts and at such high rates that the low-flow meters would no longer work according to their established function (*i.e.*, make precise measurements

of additives to supply precise amounts of additives). *Id.* Petitioner's combination is therefore not a predictable use of Means's system according to its established function and this is not an instance where reasonable expectation of success can be inferred. *Id.* The combination would require a technological leap to adapt Means' production equipment to high-quantity, high-flow, high-pressure conditions of fracture-stimulation equipment, yet Dr. Nikolaou never explains (nor could he simply based on Means of the other references) how a POSITA would modify Means's low-flow meter to combine with Tolman's high-flow system with any reasonable expectation of success. *Id.*

Indeed, Means additive system would perform a **different** function in combination with Tolman because it would be used for fracture-stimulation as opposed to production as in Means. EX2004 ¶122. As Dr. Durham explains, there are several considerations in addition to the modification to the low-flow meters for whether there is a reasonable expectation of success in using Means's production system to perform Tolman fracture-stimulation techniques. *Id.* These include, for example, whether the equipment in Means's system could withstand the much higher volumes, pressures, and rates required to flow fluids required for a fracture-stimulation operation. *Id.*

Dr. Nikolaou did not address these considerations anywhere in his declaration. EX2004 ¶123. Without addressing these fundamental aspects of fracture-stimulation

operations and any corresponding changes to Means' production equipment, it is impossible that Dr. Nikolaou could have considered whether a POSITA would have had a reasonable expectation that Means's production equipment could be used for Tolman's fracture-stimulation operations as proposed. *Id.*

Furthermore, as Dr. Durham explains, a POSITA would not have had a reasonable expectation of success in using Means's production additive system to perform Tolman's fracture-stimulation techniques when accounting for the above-mentioned considerations. EX2004 ¶124. First, at the time of the '082 Patent, injection pressures of production additives were just enough to overcome the pressure in the gathering system pipelines and production tubing, typically hundreds of pounds per square inch (PSI) EX2004 ¶124. In contrast, at the time of the '082 Patent, fracturing fluids were typically flowed at pressures of up to about 10,000-15,000 psi in order to fracture the formation. *Id.* A POSITA would have had no reason to believe that the equipment in Means's additive system would be capable of withstanding the pressures required for fracture-stimulation as disclosed in Tolman. *Id.*

Second, as discussed above, at the time of the '082 Patent, the fluid volumes and rates used in production operations, such as Means, were orders of magnitude different as compared fluid volumes and rates used in fracture-stimulation operations, such as Tolman (*e.g.*, quarts to barrels per day v. barrels per minute).

EX2004 ¶125. Given this difference, a POSITA would have had no reason to expect Means's production additive system to be capable of flowing fluids for a fracture-stimulation operation at the required volumes and rates to fracture the formation. *Id.*

Because of the significant differences between production operations and fracture-stimulation operations, a POSITA would not have had a reasonable expectation of success in combining Means's production additive system with Tolman's fracture-stimulation equipment as proposed in the Petition, and therefore, the Means/Tolman combination does not render the challenged claims obvious. *Id.*

¶126.

D. All Grounds Fail as to All Claims Because the Petition Does Not Provide a Sufficient Motivation to Combine Tolman/Mean with Crawford with a Reasonable Expectation of Success.

Petitioner and its expert Dr. Nikolaou were also unable to find a single reference that discloses flowing one or more recovered well treatment fluids from the one or more centralized service factories to the centralized well treatment fluid center as required by the independent claims. As acknowledged by Dr. Nikolaou, "Tolman does not expressly disclose that these flow lines direct the recovered well fluid to the 'centralized well treatment fluid center....'" Pet. at 31. Instead, Dr. Nikolaou further relies on the combination of Tolman/Mean with Crawford as previously described. *Supra* §VI.B. The Petition's combination of Tolman/Mean

with Crawford fails similarly to Petitioner's initial combination of Tolman with Means for the reasons below.

1. *Tolman and Crawford Relate to Two Distinct Phases of Oil and Gas Operations and Are Different in Scale*

As previously explained with respect to Petitioner's combination of Tolman and Means, fracture stimulation and production operations are different and a POSITA at the time of the '082 Patent would not have been motivated to combine the references to arrive at the claims. *Supra* §VI.C.1. Just like Means, both experts agree that Crawford relates exclusively to **production** operations. EX2004 at ¶¶56-57; *see, e.g.*, EX2003 at 95:20-22 (“Q:So Crawford is directed to production operations, is that correct? A:That is correct.”); *see also, e.g.*, EX1005 at Title, Abstract, 1:16-18.

As a production reference, Crawford is distinguishable from Tolman for the same reasons as discussed above with respect to Means. *Supra* §VI.C.1. In addition, the operations disclosed in Tolman and Crawford differ in terms of scale. EX2004 at ¶128. For instance, Tolman focuses on the problem of “having ***multiple wells at a single location.***” EX1005 [0004]. Tolman explains that “certain combinations of operations may be complicated, restricted, or prevented by the presence of multiple wells [at a single location].” *Id.* [0005]. “For instance, when stimulating a well on a surface pad having multiple wells, stimulation operations are typically performed on only the single well. When the well is being stimulated, equipment and personnel

have to wait because the stimulation operations are performed in a sequential manner and initiation of additional wellbore preparation operations may be deferred until completion of the stimulation operations.” *Id.* The solution that Tolman offers “enable[s] reliable and cost-effective execution of concurrent or simultaneous wellbore preparation and stimulation operations in multiple wellbores ***located at a single surface location.***” *Id.* [0006] (emphasis added). For example, Tolman’s Figure 2 illustrates an exemplary surface pad configuration, including “equipment involved with stimulation treatments by a JITP hydraulic proppant fracture stimulation of ***three wells 104a-104c on [a] surface pad 102.***” *Id.* [0027] (emphasis added).

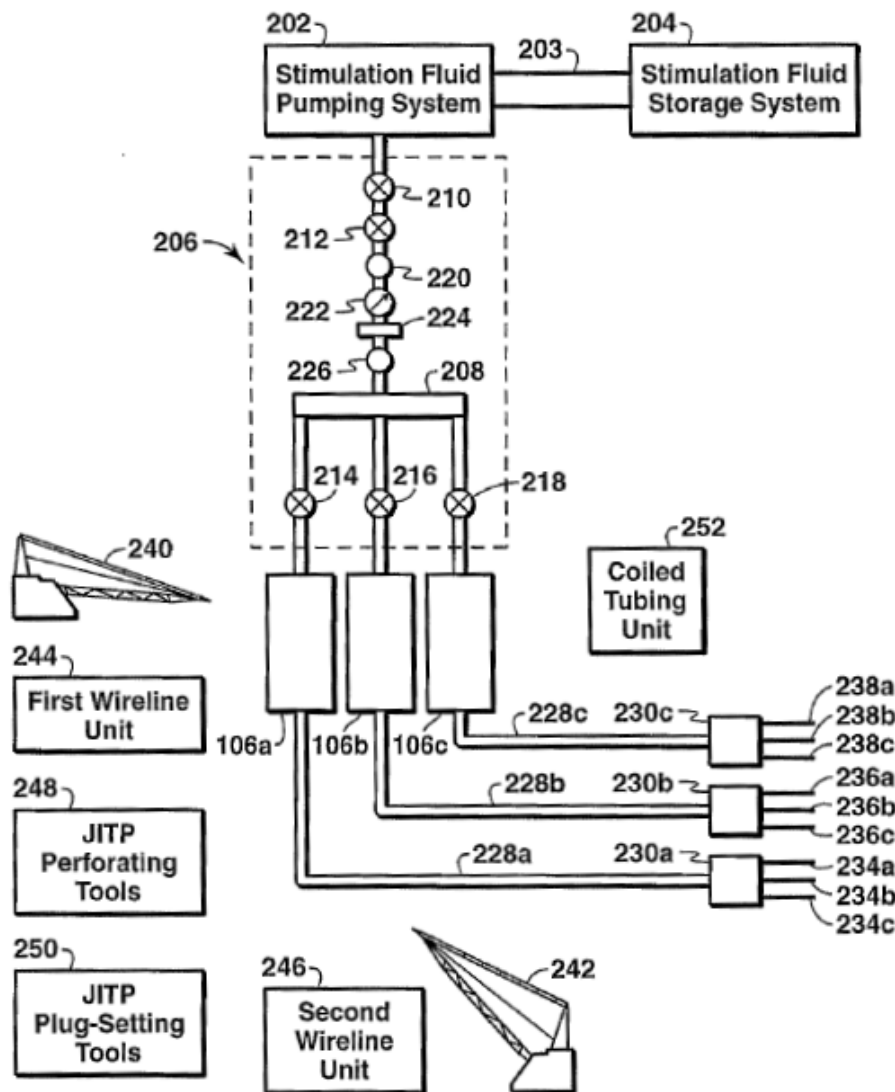
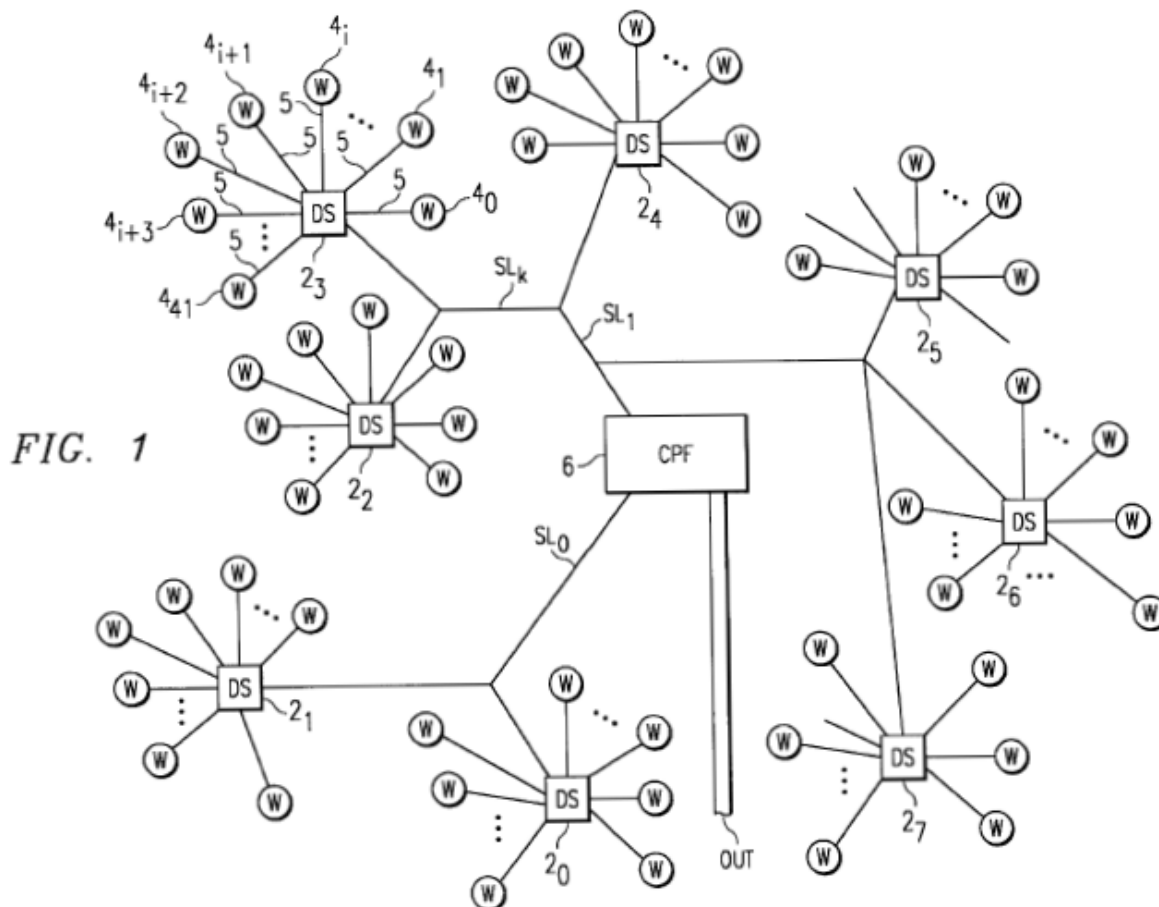


FIG. 2

EX1005 Fig.2.

Crawford, on the other hand, is “directed to production optimization from *large production fields*.” EX1007 at 1:17-18 (emphasis added). As illustrated in Crawford’s Figure 1, “modern large oil and gas production fields *may include hundreds of wells* [‘W’] and a complex network of surface-deployed pipelines

(‘surface lines’) [‘SL’] that interconnect these wells with centralized processing facilities [CPF 6].” *Id.* at 1:19-23 (emphasis added):



Crawford states that “[t]he capacity and pressure within each of the surface lines [SL] is an important factor in the production from its associated wells [W], because, as noted above, it is the pressure differential between the reservoir pressure and the wellhead pressure (plus the static head and frictional losses in the well) that determines the volume of production from the well.” *Id.* at 2:51-57. Crawford further states that “[i]n large production fields, however, the wellhead pressure is determined by the oil, water, and gas loads from other wells [W] at the same drill

site [DS 2], from other drill sites [DS 2], and also the capacity of the central processing facilities [CPF 6], relative to the field production. This complex interaction of the wells with one another, and also with the central processing facilities, still further complicates the optimization of field operations.” *Id.* 2:57-64. Crawford is thus specifically directed to “optimizing the operation of a complex and *large oil and gas production field*, in which discontinuous possible operation of individual wells or productive zones within the wells of the field are considered and optimized.” *Id.* at 4:48-52 (emphasis added).

2. The Petition Fails to Establish a Motivation to Combine Tolman’s Fracture-Stimulation Equipment with Crawford’s Production System

The Petition fails to provide a sufficient reason a POSITA would have been motivated to combine Tolman’s smaller-scale **fracture-stimulation** system with Crawford’s large-scale **production** system. EX2004 ¶130. First, as Dr. Durham explains, the Petition’s analogous art argument that Tolman and Crawford are both directed to “well operations” is an oversimplification and overgeneralization of the field of endeavor. The ’082 Patent is directed to centralizing well servicing and well treatment. *See, e.g.*, EX1001 at (54); cls. 1, 17. Crawford, on the other hand, is directed to “production optimization from *large production fields*.” EX1007 at 1:17-18. As previously explained, well servicing including well treatment is a separate and distinct phase of operation from production. EX2004 ¶130; *see also supra* §VI.C.1. Petitioner does not account for these distinct phases of well operations,

each with its own concerns, equipment, and service providers, as discussed above. *Id.* Crawford is not in the same field of endeavor as the '082 Patent. *Id.*

In addition, the Petition's framing of the problem solved by the '082 inventors of "conserv[ing] labor, infrastructure, and environmental impact" is not only overbroad but incomplete. Pet. at 31-32. The true problem described by the '082 inventors is the movement of equipment, supplies, and personnel during the servicing and treatment of wells, which may result in "environmental impacts" and "expos[e] mobile equipment to adverse weather conditions" which can "jeopardize well treatment operations and worker safety." EX2004 ¶131 (citing EX1001 at 1:6-38). Crawford's problem, on the other hand, is related to optimizing loads from a complex network of wells and the capacity of the associated central processing facilities across a large production field. EX2004 ¶131 (citing EX1006 [0005]). Neither Crawford nor the Petition addresses how Crawford's optimization method are relevant to the problem of the '082 Patent, because it is not. EX2004 ¶131. Crawford's production equipment and associated personnel do not move. *Id.* Like the production equipment in Means, Crawford's production equipment is installed at each well at the beginning of production and typically remains in place for years and therefore does not encounter the same problems encountered due to the constant movement of well servicing and treatment equipment and supplies described in Tolman. *Id.* There are typically no personnel located at Crawford's wells W or drill

sites 2. *Id.* The central processing facility and associated personnel remain in the same place in the production field for the productive life of the field. *Id.* Crawford is not reasonably pertinent to the actual problem described in the '082 Patent and is therefore not an analogous reference. *Id.*

In addition, there are several reasons why a POSITA would not be motivated to “use Crawford’s central processing facility, surface lines, and optimization method in the combined of Tolman and Means.” Pet. at 35. First, there is nothing in the prior art that would motivate a POSITA to combine fracture stimulation equipment such as disclosed in Tolman with production equipment such as disclosed in Crawford. EX2004 ¶132. As previously noted, there is nothing in any of Petitioner’s references—Tolman, Means, or Crawford—that supports the combination of fracture-stimulation equipment with production equipment into a centralized center. *Id.* In fact, Tolman teaches away from doing so because it teaches that, “[i]f the planned stimulation treatments for the wells are complete, then the equipment associated with the stimulation treatments may be **rigged-down and moved off the surface pad 102**, as shown in block 320” for FIG. 3, before “run[ning] production tubing in each of the wells, as shown in block 322” and utilizing the wells “to produce hydrocarbons, as shown in block 324.” EX2004 ¶132 (citing EX1005 at [0040], FIG. 3 (Step 320 “Move Stimulation Equipment,” Step 322 (“Provide Production Tubing”), Step 324 “Produce Hydrocarbons”)). The

stimulation equipment has been moved by the time that “the hydrocarbons from the wells 104a-104c typically flow through the flowback manifolds 230a-230c for further processing or sales.” EX2004 ¶132 (citing EX1005 [0028]). Indeed, Crawford does not disclose any stimulation equipment remaining across the hundreds of producing wells in the production field. EX2004 ¶132. Petitioner impermissibly relies on hindsight provided by the ’082 Patents combination of equipment from different phases to combine Tolman’s fracture-stimulation equipment and Crawford production equipment. *Id.*

Second, (and independently of whether a POSITA would be motivated to combine Tolman’s stimulation fluid storage unit with Crawford’s central processing facility), there is nothing in the prior art that would motivate a POSITA to modify Crawford’s *flow of production fluids* to the centralized processing facility to the *flow of recovered well treatment fluids* (and then from there, to include the central processing facility in the same location that also flows one or more well development task fluids). EX2004 ¶133. There is nothing in any of the Petitioner’s references—Tolman, Means, or Crawford—that teaches or suggests Petitioner’s modification from production fluids to recovered well treatment fluids. *Id.* As previously discussed, the ’082 Patent distinguishes recovered well treatment fluids from production fluids and a POSITA based on general knowledge and the terms would understand them as different fluids as well. *Id.*; *See supra* §VI.B.2. Tolman similarly

distinguishes between recovered well treatment fluids and production fluids. EX2004 ¶133. Tolman states that “stimulation operations may include various activities, such as pumping operations wireline operations, flowback operations, and other logistical coordination operations.” EX2004 ¶133 (citing EX1005 at [0035]). And as previously discussed, only after “the stimulation treatments [including flowback] for the wells are complete,” the equipment associated with the stimulation treatments are rigged-down and moved off of the surface pad 102, and the production tubing is installed, are the wells “utilized to produce hydrocarbons” (*i.e.*, production fluid). *Id.* [0040]. Crawford only discusses the flow of production fluids (*i.e.*, “produced gas, oil, and water from each well to the centralized processing facilities”) and does not discuss recovered well treatment fluids at all. EX2004 ¶133 (citing EX1007 at 2:50-51). There is thus nothing that would motivate a POSITA to modify the flow of Crawford’s flow of production fluids to recovered well treatment fluids to accomplish the combination. EX2004 ¶133.

Third, Petitioner does not consider the sequential nature of the equipment used and fluids flowed during Tolman’s fracture-stimulation vs. Crawford’s production in its combination. EX2004 ¶134. Petitioner states that “[b]ecause fluids like water may be reused for future stimulation treatment after being separated from other recovered well fluids, Crawford’s processing facility should be part of Tolman’s Storage System 204, which provides fluids for stimulation treatment.” Pet. at 16-17.

However, Crawford's central processing facility flows *production fluid*, not recovered well treatment fluid. EX2004 ¶134. Crawford does not discuss completion operations or equipment. EX2004 ¶134. And as Petitioner acknowledges, Tolman teaches flow of stimulation fluids and hydrocarbons to *different* locations using stimulation and production equipment, respectively (*i.e.*, "flowback pits, flow test units, sales lines, tankage, oil/gas/water separating and processing units and/or other similar devices"). EX2004 ¶134 (citing EX 1005 [0028]). Tolman further teaches that the stimulation equipment has been moved by the time that the hydrocarbons are being produced using Crawford's equipment. EX2004 ¶134. There is no thus connection between Tolman's stimulation fluid storage system 204 and Crawford's central processing facility in either time or space and therefore there is no reason that a POSITA would be motivated to first modify Crawford's central processing facility to flow recovered well treatment fluids and then include it in a center with Tolman's stimulation fluid storage system 204. EX2004 ¶134.

Fourth, a POSITA would not be motivated to scale-up Tolman's system or scale down Crawford to achieve Petitioner's proposed combination. EX2004 ¶135. As previously discussed, The systems of Tolman and Crawford operate at different scales, Crawford, across an entire geographically spread out production field and Tolman, at a single surface pad.. *Id.* To make this combination, a POSITA would either need to scale-up Tolman's stimulation fluid storage system 204 across a large

field or scale-down Crawford's central processing facility 6 to collect production fluids from wells at a single location. *Id.* Without the hindsight provided by the '082 Patent, a POSITA combining Tolman and Crawford would include one of Tolman's surface pad configurations including the stimulation fluid storage system 204 on each the surface pads (drill sites) for each Crawford's wells. *Id.* Dr. Nikolaou appears to ignore this difference in scale entirely, moving straight to combining the equipment. *Id.* There is nothing in Crawford or Tolman that teaches or suggests that scaling up or scaling down either system would be beneficial. *Id.* It is only with the hindsight provided by the '082 Patent that Dr. Nikolaou arrives at his proposed combination. *Id.* None of the references teach or suggest scaling Tolman's equipment in this way. *Id.*

Petitioner's description of the combination and motivation to modify fail to address the differences in scale between Tolman storage unit and Crawford's processing unit. EX2004 ¶136. Petitioner's first motivation to modify argues that "using one central processing unit over multiple processing units located at each well site would allow workers and a company to focus maintenance efforts on a single building." Pet. at 34. Even so, Petitioner fails to explain why a POSITA would be further motivated to scale the single processing unit from Tolman (which receives flowback from a single location such as a single surface pad) to multiple surface pads. *Id.* As shown in Crawford, receiving production fluids from multiple surface

pads by a central processing facility was common at the time of the '082 Patent. *Id.* The same cannot be said for receiving recovered well treatment fluids such as Tolman's flowback fluids, which were limited to a single surface pad. *Id.* A POSITA would not combine Tolman's stimulation fluid storage system and Crawford's central processing facility in the way that Petitioner suggests. *Id.*

Further, this motivation focuses on the processing units alone (*i.e.*, modifying Tolman's processing units located at each well site) and completely ignores the required parallel modifications to Tolman's stimulation fluid storage unit. EX2004 ¶137. By focusing only on scaling up Tolman's processing units but ignoring Tolman's stimulation fluid storage system in its first motivation, Petitioner fails to address why a POSITA would be motivated to combine Crawford's processing unit and Tolman's stimulation fluid storage system. *Id.* In addition, Tolman and Crawford involve different fluids that are used during different stages of the well life cycle. Crawford does not teach receiving recovered well fluids by the central processing facility; it teaches receiving of *production fluids*. *Id.* ¶138. The '082 Patent specifically distinguishes production fluid and recovered well treatment fluid. *Id.*

Even if POSITA's motivation somehow took Tolman's stimulation equipment into account, a POSITA would not be motivated to scale-up Tolman's stimulation fluid storage unit because a POSITA would understand that the costs and

inefficiencies of scaling up Tolman’s stimulation equipment in the same way as the processing units would outweigh any benefit of “focus[ing] maintenance efforts on a single building.” EX2004 ¶139. Unlike Crawford’s production equipment including the central processing unit, which is designed to receive production fluid from hundreds of wells across a production field at the same time and over a long period of time, Tolman’s stimulation equipment including the stimulation fluid storage unit is designed to flow well treatment fluid to one well at a time for short periods of time. *Id.* (comparing, e.g., EX1005 Fig.3 (step 312 “Pump Stimulation Treatment into One of the Wells” vs. step 315 “Conduct Other Operations in the Remaining Wells”), [0043] (“Hence, the pumping time for a JTTP fracture stimulation treatment may be approximately 2 hours and 15 minutes for each well”), with, e.g., EX1007 (“[M]odern large oil and gas production fields may include hundreds of wells and a complex network of surface-deployed pipelines...that interconnect these wells with centralized processing facilities.”)). Scaling up Tolman’s stimulation fluid storage system in the same manner as the processing units would not make a difference in terms of personnel and equipment because Tolman’s stimulation fluid storage system would still only treat one well at time across the production field. EX2004 ¶139. Unlike Crawford’s central processing unit, a POSITA would understand that it would be more beneficial to have multiple stimulation fluid storage systems located at multiple well sites across the production

field stimulating multiple wells at the same time as opposed to centralizing Tolman's stimulation fluid storage system and treating one well at a time. EX2004 ¶139. Tolman acknowledges as much when it suggests that "two wells may be stimulated concurrently or simultaneously" on the same surface pad by using "two stimulation fluid pumping systems," "two stimulation storage systems 204, pumping system manifolds, and other associated piping," each of which are "associated with two different groups or sets of wells." *Id.* (citing EX1005 [0067]). Moreover, a POSITA would understand that additional piping and associated equipment would be needed to connect the scaled-up stimulation fluid storage system to the stimulation fluid pumping system at the well site, which would increase costs and introduce additional points of equipment failure, not to mention the increase in fluid pressures and flow rates that would be required to flow fluids a much larger distance between the stimulation fluid storage system and the well, without the added benefit of treating multiple wells at the same time. EX2004 ¶139. A POSITA would understand that the costs of scaling up Tolman's fracture-stimulation equipment across a production field would outweigh any benefit from "focus[ing] maintenance efforts on a single building"; thus, a POSITA would not be motivated to make the combination. EX2004 ¶139.

Petitioner's second motivation to modify Tolman is similarly flawed as the first. Petitioner states that "Crawford describes a process that optimizes well

production using a central processing facility,” which would have “motivated a POSITA to use Crawford’s central processing facility, surface lines, and optimization method in the combined system of Tolman and Means.” Pet. at 34-35. However, Petitioner does not explain why, and a POSITA would not have been motivated to apply Crawford’s *production* optimization methods to *recovered well treatment fluids*. EX2004 ¶140. Crawford is directed to a method for optimizing the production of production fluid during later life production operations. *Id.*; EX1007 1:19-38. Well treatment fluids are recovered during well development (*i.e.*, before production begins). EX2004 ¶140. A POSITA would not be motivated to optimize the amount of well treatment fluid recovered in the way that a POSITA is motivated to optimize production fluids. *Id.* Recovering well treatment fluid is a matter of recovering whatever is left downhole after a well stimulation (*e.g.*, fracturing) operation to make room for the production fluid. *Id.* A POSITA would therefore not be motivated to use Crawford’s central processing facility or its optimization method for production fluids on recovered well treatment fluids.

Furthermore, Crawford’s system optimizes production by managing the flow of production fluid from hundreds of wells to the central processing facility across an entire production field at the same time. *Id.* Such an optimization method has no applicability to Tolman’s fracture-stimulation equipment, which flows well treatment fluid to and recovers well treatment fluid from one well at a time (as

opposed to collecting production fluid flowed from multiple wells). *Id.* A POSITA would thus have not been motivated to modify Tolman/Means to incorporate Crawford's central processing unit in Tolman's storage system 204 based on Crawford's production optimization method. *Id.*

Petitioner's third and final motivation to modify also fails to consider the sequential nature of fracture-stimulation and production operations. Petitioner proposes that "a POSITA would also have understood that it is beneficial to recover produced water [defined by Dr. Nikolaou as fluid returned to the surface from a hydraulic fracturing operation] for use in subsequent hydraulic fracturing operations as recycled water" to "reduce regulation-driven disposal costs and operation-driven water supply costs." Pet. at 35. However, as previously discussed, Crawford does not have anything to do with fracturing operations or fluid returned to the surface from fracturing operations. Crawford is exclusively directed to optimizing production and only involves production fluid. EX2004 ¶141. Crawford discloses neither fracture-stimulation equipment or fluid (recovered, or otherwise). *Id.* And Tolman teaches that the fracture-stimulation equipment has been moved before production takes place. *Id.* According to Tolman and Crawford, the equipment and fluids involved in Petitioner's proposed combination occur sequentially and do not overlap. *Id.* Therefore a POSITA would have no reason to modify Tolman/Means with Crawford based on a motivation to recycle water from Crawford's production

fluid for well treatment fluid, because stimulation operations would be complete and Tolman's equipment would be gone by the time that Crawford's centralized processing unit begins receiving production fluid. *Id.*

Accordingly, the Petition fails to establish that a POSITA would have been motivated to further modify Tolman/Means system with Crawford as proposed in the Petition, and therefore, the Tolman/Means/Crawford combination does not render the challenged claims obvious. *Id.* ¶142.

3. *The Petition Fails to Establish a Reasonable Expectation of Success in Combining Tolman's Fracture-Stimulation Equipment with Means's Production Additive System*

Petitioner does not address reasonable expectation of success with respect to its modification of Tolman/Means with Crawford. EX2004 ¶143; ID at 20-21. Petitioner's modification is also not one of those instances in which reasonable expectation of success can be inferred because Petitioner's combination is not a predictable use of Crawford's production system and optimization method according to its established function. EX2004 ¶144. As previously explained, Crawford's central processing facility collects production fluid from producing wells. *Id.* To work with Tolman's stimulation fluid storage system (and meet the claims), the flow of production fluid to Crawford's optimization method and central processing facility would need to be modified to flow recovered well treatment fluid. *Id.* Petitioner's combination is therefore not a predictable use of Crawford's central

processing facility and optimization method according to its established function and this is not an instance where reasonable expectation of success can be inferred. *Id.* The combination would require a technological leap to adapt Crawford's central processing facility and optimization to the flow of recovered well treatment fluid, yet Dr. Nikolaou never explains (nor could he simply based on Crawford or any of the other prior art) how a POSITA would modify Crawford to perform the function of optimizing a different fluid during a different well operation. *Id.*

Indeed, Crawford's central processing facility and optimization method would perform a **different** function in combination with Tolman, because it would be used for fracture-stimulation operations in the proposed combination as opposed to production operations as in Crawford. EX2004 ¶145. As Dr. Durham explains, Crawford's optimization techniques concern maximizing production from multiple wells at the same time, which does not apply to the flowback of recovered well treatment fluids. EX2004 ¶145. Tolman's flowback operations occur one well at a time. And the goal of flowback is simply to clear the well treatment fluid in the well so that production can begin. EX2004 ¶145.

As previously discussed, Dr. Nikolaou did not address the fundamental differences between fracture-stimulation operations and production anywhere in his declaration. Without addressing these differences, it is impossible that Dr. Nikolaou could have established whether a POSITA would have had a reasonable expectation

that Crawford's system designed for production operations across an entire production field could be used in Tolman's well-by-well fracture-stimulation operations as proposed. EX2004 ¶146.

Furthermore, as Dr. Durham explains, a POSITA would not have had a reasonable expectation of success in combining Tolman/Means with Crawford. EX2004 at ¶147. Crawford operates on a vastly different scale than Tolman or Means. *Id.* The line sizes and layout in Crawford are designed for collection of production fluids in "later life operation of the production field" including "secondary processes.. *Id.* (citing EX1007 1:29–30). Crawford's teachings are directed to "secondary production processes [that] are used to increase and continue production from modern production fields," in particular the use of "Gas Lift" operations. *Id.* (citing EX1007 1:31-33). Secondary production processes (secondary recovery) are used when pressure and flowrates have declined significantly from initial production. *Id.* In addition, flowrates for production are in the "bbls / day" order of magnitude as opposed to the "bbls / min" of well stimulation (fracturing) and flowback. *Id.* Further, pressures for producing wells were hundreds of PSI while pressure for fracturing / flowback operations were at least 8,000 PSI. *Id.*

A POSITA would thus not have had a reasonable expectation of success in using Crawford's "production field" operation combined with Tolman/Means' "stimulation fluid" operation. EX2004 ¶148. The lines and equipment in Crawford's

operation would not be suitable for carrying the “well treatment fluids” of Tolman due to their physical size and the length of the lines. *Id.* A POSITA would have understood Crawford to teach facilities spread out over a long distance, handling barrels of fluid per day at hundreds of PSI. *Id.* The higher pressures used in treatment would require increasing the pressure rating of the lines, increasing the expense of the lines, discouraging the use of Crawford. *Id.* The smaller diameter lines (lower flow), and longer distances, of Crawford would create significant pressure drop using the treatment system of Tolman / Means. *Id.* Such a pressure drop would have to be compensated with increased pumping equipment, which also increases expense. *Id.* Accordingly, a POSITA would not have looked at Crawford as there would be no reasonable expectation of success in using the “centralized processing facilities” of Crawford with the well treatment system of Tolman Means in the way proposed. *Id.*

E. All Grounds Also Fail as to the Dependent Claims

1. *Dependent Claims 2-15 and 18-31*

Dependent claims 2-15 and 18-31 each depend directly or indirectly from independent claim 1 or 17. Thus, all grounds fail as to dependent claims 2-15 and 18-31 for the same reasons provided above with respect to independent claims 1 and 17.

a) Dependent Claim 3

Further, neither Dr. Nikolaou nor Petitioner point to any disclosure in the combination of disposing of the recovered well treatment fluids, much less disposing of these fluids *at the centralized well treatment fluid center* as the claim requires. EX2004 ¶173. In fact, such disclosure or teaching is found nowhere in the combination. *Id.* Dr. Nikolaou points to the same disclosure of Tolman that fails to show recovery of fluids at the service factory to allegedly show disposal of fluids at the centralized well treatment fluid center. *Id.* It is not inherent that these devices dispose of the fluid. *Id.* ¶174. It is certainly not inherent that these devices dispose of the fluid at the specific location claimed. *Id.*

b) Dependent Claim 7

Further, Dr. Nikolaou's description of Means' surface processing unit 75 as disclosing separating the production fluid into at least two or more *second* production fluids is misplaced. EX2004 ¶180. As Dr. Nikolaou points out, *Means'* surface processing unit 75 removes solids "and certain other materials such as hydrogen sulfide". *Id.* (citing EX1003 ¶138). Solids are certainly not a second production fluid, as they are not a fluid. *Id.* And, as a POSITA would understand, removing hydrogen sulfide from production fluids does not involve "separating" hydrogen sulfide into a second fluid stream. *Id.* Such a process would be highly dangerous as hydrogen sulfide is both highly toxic and extremely corrosive. *Id.* The

process of removing hydrogen sulfide from a production fluid stream involves adding a product, such as a sulfa, formaldehyde, or an iron sponge, to the fluid stream to react with the hydrogen sulfide and convert it into a less hazardous product, such as iron sulfide and hydrogen. *Id.* This is certainly not separation of the production fluid into one or more second production fluids. *Id.*

Further, although Crawford does disclose the use of a “separator 8 for separating the water, oil and gas phases from the flow received from drill sites,” Crawford does not disclose that the separator is located at the same location as the location that provides the well development task fluids (i.e., the centralized well treatment fluid center). EX2004 ¶181. Accordingly, the combination of Tolman, Means and Crawford fails to render obvious Claim 7.

2. *Lehman Does Not Cure the Failures of Tolman, Means, and Crawford*

Petitioner points to Lehman as allegedly teaching portions of Claims 3 and 20, 4 and 19, 7-9, 11, 25, and 29- 31 which are missing from the combination of Tolman, Means, and Crawford. Petitioner points to Lehman as teaching a flowback and reuse system which Petitioners claim would have been an obvious addition to the system of Tolman, Means and Crawford. However, as discussed below, the claims do not simply require a flowback and reuse system, which was known at the time of the '082 Patent, but specific flowpaths and ordered sequence of equipment operations which are not disclosed, or suggested, by Tolman, Means, Crawford or

Lehman. EX2004 ¶¶211-212. Thus, ground 2 fails as to Claims 3 and 20, 4 and 19, 7-9, 11, 25, and 29- 31 for this reason and the same reasons as provided above.

a) Dependent Claims 3

Further, Lehman does discuss “flow back fluid disposal costs” but does not disclose how and where the fluid would be disposed. EX2004 ¶214. There is no teaching or suggestion in Lehman that disposal is conducted “at the centralized well treatment fluid center” as required by Claim 3. EX2004 ¶214.

b) Dependent Claim 8

Further, while Lehman states that “the selected fluid may likely be *stored* at the original well site or at some more convenient, possibly centralized location,” EX1008 [0046], Lehman fails to disclose *conditioning* or *disposing* of the fluid at the centralized location and therefore does not disclose and/or would not render obvious the claimed “centralized well treatment fluid center [that] is configurable to separate the production fluid into at least two or more second production fluids.” EX2004 ¶219.

c) Dependent Claim 9

Further, Lehman fails to disclose, teach or suggest flow of production fluids from a centralized well treatment center to a distribution center. There is nothing in Tolman, Means, Crawford, or Lehman that teaches or suggests flow to Lehman’s “centralized location” from Tolman/Mean/Crawford’s stimulation fluid storage

system. EX2004 ¶221. At most, Lehman discloses is flow to the centralized location from a well site. *Id.* (citing EX1008 [0046]).

a) Dependent Claim 19

Dr. Nikolaou argues that “the Tolman/Mean/Crawford system would select whether to filter and condition the recovered well treatment fluid ... at a Crawford’s central processing unit located in Stimulation Fluid Storage System 204 in the combined system of Tolman, Means, Crawford, and Lehman.” EX2004 ¶216 (EX1003 ¶267). According to claim 18 however, the claimed modules including the reconditioning module are “disposed about each of the one or more centralized service factories” and therefore Petitioner’s so-called reconditioning module resulting from the combination of Tolman/Mean/Crawford/Lehman would not be located where the claim requires. EX2004 ¶216.

VII. CONCLUSION

For the foregoing reasons, Patent Owner respectfully requests that the Board deny the Petition.

August 2, 2024
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CERTIFICATE OF WORD COUNT

The undersigned certifies that the foregoing Response has a word count of 13,962, as defined by 37 C.F.R. §42.24 using the word count feature of Microsoft Word.

August 2, 2024

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CERTIFICATE OF SERVICE

In accordance with 37 C.F.R. §42.6(e), the undersigned certifies that on the 2nd day of August, 2024, a complete and entire copy of PATENT OWNER'S RESPONSE UNDER 37 C.F.R. §42.107 and related documents were served on Petitioner via electronic mail to counsel for Petition at the following addresses:

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