

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HALLIBURTON ENERGY SERVICES, INC.

Petitioner

v.

U.S. WELL SERVICES, LLC

Patent Owner

Case No. IPR2023-00557

Patent 9,650,871

PETITION FOR *INTER PARTES* REVIEW OF CLAIMS 1-19 OF

U.S. PATENT NO. 9,650,871

TABLE OF CONTENTS

	Page
I. MANDATORY NOTICES	1
II. STANDING AND FEES	3
III. OVERVIEW OF THE '871 PATENT	4
A. Subject Matter of the '871 Patent.....	4
B. Prosecution History of the '871 Patent	4
C. Priority Date of the '871 Patent.....	6
IV. SUMMARY OF PRIOR ART.....	7
A. Payne (Ex.1004).....	8
B. Toshiba (Ex.1005).....	9
C. Broussard (Ex.1007).....	10
D. Feller (Ex.1008).....	10
E. Wiemers (Ex.1009)	12
F. Carlson (Ex.1010)	14
G. Randle (Ex.1011).....	15
H. Summary of Grounds	16
V. DISCRETIONARY DENIAL WOULD BE INAPPROPRIATE.....	17
A. Discretionary Denial Under Fintiv factors is not appropriate.....	17
B. Discretionary Denial Under 35 U.S.C. § 325(d) Is Not Appropriate.....	18
VI. LEVEL OF ORDINARY SKILL IN THE ART	20
VII. CLAIM CONSTRUCTION	20
VIII. A REASONABLE LIKELIHOOD EXISTS THAT THE CHALLENGED CLAIMS ARE UNPATENTABLE	21
A. Grounds 1-2: Claims 1-4, 6-7, 9-12, 15-17, 19 Are Anticipated by Payne (Ground 1) and Claims 1-19 Are Rendered Obvious by Payne (Ground 2)	21

B.	Ground 3A: Claims 1-19 Are Rendered Obvious by Payne and Toshiba	51
C.	Ground 3B: Claims 1-19 Are Rendered Obvious by Payne and Broussard.....	59
D.	Ground 4: Claims 2-4, 11-12, 17 Are Rendered Obvious by Payne and Feller	61
E.	Grounds 4A and 4B: Claims 2-4, 11-12, 17 Are Rendered Obvious by Payne, Toshiba, and Feller (4A) and by Payne, Broussard, and Feller (4B)	67
F.	Ground 5: Claims 5, 13, 16 Are Rendered Obvious by Payne and Wiemers.....	67
G.	Grounds 5A and 5B: Claims 5, 13, 16 Are Rendered Obvious by Payne, Toshiba, and Wiemers (5A) and by Payne, Broussard, and Wiemers (5B)	71
H.	Ground 6: Claims 8, 14 Are Rendered Obvious by Payne and Carlson.....	72
I.	Grounds 6A and 6B: Claim 8, 14 Are Obvious Over Payne, Toshiba, and Carlson (6A) and Payne, Broussard, and Carlson (6B).....	75
J.	Ground 7: Claims 13, 16 Are Rendered Obvious by Payne and Randle.....	76
K.	Grounds 7A and 7B: Claims 13, 16 Are Rendered Obvious by Payne, Toshiba, and Randle (7A) and by Payne, Broussard, and Randle (7B)	78
IX.	SECONDARY CONSIDERATIONS	79
X.	CONCLUSION.....	80
XI.	APPENDIX: CLAIM LIMITATIONS.....	81

LIST OF EXHIBITS

Ex.	Description
1001	U.S. Patent No. 9,650,871 by Jared Oehring <i>et al.</i> entitled “Safety Indicator Lights for Hydraulic Fracturing Pumps” (the “’871 Patent”)
1002	Declaration of Dr. Robert Durham
1003	File History for U.S. Patent No. 9,650,871
1004	U.S. Patent Publication No. 2016/0258267, Payne, <i>et al.</i> , “Well Fracturing Systems with Electrical Motors and Methods of Use,” (“Payne”) filed on March 3, 2016, and published on September 8, 2016
1005	Toshiba International Corporation, “G7 Adjustable Speed Drive Operation Manual,” Document No. 51546-009 (March 2005) (“Toshiba”), available at: https://web.archive.org/web/20101207173900/http://www.toshiba.com/ind/data/tag_files/GX7%20Operation%20Manual_3886.pdf
1006	Declaration of Nathaniel E. Frank-White, custodian of records for Internet Archive regarding Toshiba documents (May 27, 2022)
1007	U.S. Patent Publication No. 2014/0138079, Broussard, <i>et al.</i> , “System for Pumping Hydraulic Fracturing Fluid Using Electric Pumps,” (“Broussard”) filed on November 16, 2012 and published on May 22, 2014
1008	U.S. Patent Publication No. 2015/0198316 by Feller <i>et al.</i> , “Stack Light with Modular Function Generator,” (“Feller”) filed on January 13, 2014 and published on July 16, 2015
1009	U.S. Patent Publication No. 2015/0001161 by Wiemers <i>et al.</i> , “Liquid Treatment Station Including Plural Mobile Units and Methods for Operation Thereof,” (“Wiemers”) filed on July 1, 2013 and published on January 1, 2015
1010	U.S. Patent No. 6,006,227 by Carlson, “Blender Control System,” (“Carlson”) issued on December 28, 1999
1011	U.S. Patent Publication No. 2014/0290768 by Randle <i>et al.</i> , “Frac Pump Isolation Safety System,” (“Randle”) filed on March 27, 2013 and published on October 2, 2014
1012	U.S. Provisional Application No. 62/196,350 (“’350 Provisional”)
1013	U.S. Patent No. 9,410,410 by Broussard <i>et al.</i> entitled “System for Pumping Hydraulic Fracturing Fluid Using Electric Pumps” (the “’410 Patent”)

1014	U.S. Patent No. 5,865,247 by Paterson <i>et al.</i> entitled “Cellulose Injection System and Method” (“ <i>Paterson</i> ”) issued on Feb. 2, 1999
1015	U.S. Patent Publication No. 2008/0137266 by Jensen <i>et al.</i> , “Motor Control Center with Power and Data Distribution Bus,” (“ <i>Jensen</i> ”) filed on Sept. 29, 2006 and published on June 12, 2008
1016	U.S. Patent No. 8,789,601 by Broussard <i>et al.</i> entitled “System for Pumping Hydraulic Fracturing Fluid Using Electric Pumps” (“’610 Patent”) issued on July 29, 2014
1017	File History for U.S. Patent No. 9,410,410
1018	Lionel B. Roe, PRACTICES AND PROCEDURES OF INDUSTRIAL ELECTRICAL DESIGN (McGraw-Hill, New York: 1972), ISBN: 0-07-053390-3 (“ <i>Roe</i> ”)
1019	John A. Camera, ELECTRICAL ENGINEERING REFERENCE MANUAL, 6th ed. (Professional Publications, Inc., Belmont: 2002), ISBN: 1-888577-56-8 (“ <i>Camera</i> ”)
1020	Donald G. Fink, STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS, 13 th ed. (McGraw-Hill, New York: 1993), ISBN: 0-07-020984-7 (“ <i>Fink</i> ”)
1021	U.S. Patent Publication No. 2011/0241590, Horikoshi, <i>et al.</i> , “Motor driving apparatus having fault diagnostic function,” (“ <i>Horikoshi</i> ”) filed on February 11, 2011 and published on October 6, 2011.
1022	National Electrical Manufacturers Association (NEMA) Standards Publication ICS 61800-4-2004, <i>Adjustable Speed Electrical Power Drive Systems, Part 4: General Requirements—Rating Specifications for a.c. Power Drive Systems above 1000 V a.c. and Not Exceeding 35 kV</i> (National Electrical Manufacturers Association: 2004) (“ICS-61800-4”)
1023	Turner P. Northern, “Automatic Lease Operations,” <i>Journal of Petroleum Technology</i> , vol. 6, no. 01, pp. 21-24, 1954, doi: 10.2118/283-g (“ <i>Northern</i> ”)
1024	Eugene C. Campbell, “Isolated Waterflood,” <i>PE Production Automation Symposium</i> , 1964, vol. All Days, SPE-856-MS, doi: 10.2118/856-ms (“ <i>Campbell</i> ”)
1025	H.J. Fitzgibbon, “Gas Well Automation,” <i>Journal of Petroleum Technology</i> , vol. 16, no. 08, pp. 873-876, 1964, doi: 10.2118/858-pa (“ <i>Fitzgibbon</i> ”)
1026	R.A. Hinchliffe, “The Solid State Pipeline Gauger,” <i>Journal of Canadian Petroleum Technology</i> , vol. 5, no. 04, pp. 171-174, 1966, doi: 10.2118/66-04-03 (“ <i>Hinchliffe</i> ”)

1027	Millard E. Owens & Bret R. Allard, “Installation and Operation Of Hydraulic Pumping Systems On Cook Inlet,” <i>Offshore Technology Conference</i> , 1970, vol. All Days, OTC-1194-MS, doi: 10.4043/1194-ms (“Owens”)
1028	M.P. Cleary, A.M. Burharali, A.R. Crockett, & I.A. Salehi, “Computerized Field System for Real-Time Monitoring and Analysis of Hydraulic Fracturing Operations,” in <i>International Meeting on Petroleum Engineering</i> , 1986, vol. All Days, SPE-14087-MS, doi: 10.2118/14087-ms (“Cleary”)
1029	H.L. Tomlinson, A.C. Byrd, & C.F. VanBerg, Jr., “Fracturing process control and automation,” in <i>Permian Basin Oil and Gas Recovery Conference</i> , 1988 (“Tomlinson”)
1030	S.O. Norris & K.S. Capps, “Reservoir Simulation with Simultaneous Graphic Display on the Macintosh II PC,” <i>SPE Computer Applications</i> , vol. 2, no. 06, pp. 24-27, 1990, doi: 10.2118/20362-pa (“Norris”)
1031	S.V. Stephenson, E.L. Woodall, C.D Donaghe, & R.E Dant, “Fracturing process control and automation: Phase 2,” <i>Petroleum Computer Conference</i> , 1993 (“Stephenson”)
1032	D.L. Purvis, R.J Novotny, & B.T Carlson, “Field-Applied Computerized Tracking System: A Practical Approach to On-Site Quality Control,” <i>SPE Computer Applications</i> , vol. 3, no. 05, pp. 22-28, 1991 (“Purvis”)
1033	Stephen Rassenfoss, “The Keywords for Blowout Preventers Are Trust But Verify,” <i>Journal of Petroleum Technology</i> , vol. 64, no. 08, pp. 40-48, 2012, doi: 10.2118/0812-0040-JPT (“Rassenfoss”)
1034	IEC 60073 (International Standard), Basic and Safety Principles for Man-Machine Interface, Marking and Identification – Coding Principles for Indicators and Actuators, 6th ed., 2002-05 (“IEC 60073”)
1035	NFPA 79, “Electrical Standard for Industrial Machinery” National Fire Protection Association, Quincy, Mass, 1962-2007 (“NFPA”)
1036	J. Pearson, “Proposed HSE guidelines on emergency shutdown systems,” 1989 A First International Conference on the Use of Programmable Electronic Systems in Safety Related Applications Computers and Safety, 1989, pp. 55-58 (“Pearson”)

1037	Bill Gilson, “Fast Response System for Large-Volume Acid Stimulation,” Paper presented at the Offshore Technology Conference, Houston, Texas, May 1996. doi: https://doi.org/10.4043/8096-MS (“ <i>Gilson</i> ”)
1038	Rex Burgos; Marc Allcorn; Robin Mallalieu; Jorge Vicens “Eliminating Human Error during Coiled Tubing Operations,” <i>SPE Production & Operations</i> 22 (03) (June 2006): 335–338. DOI: 10.2118/100164-PA (“ <i>Burgos</i> ”)
1039	J. J. Sammarco, “Programmable electronic and hardwired emergency shutdown systems: a quantified safety analysis,” Fortieth IAS Annual Meeting. Conference Record of the 2005 Industry Applications Conference, 2005., 2005, pp. 210-217 Vol. 1, doi: 10.1109/IAS.2005.1518312 (“ <i>Sammarco</i> ”)
1040	Kurz, Rainer, and Robert C. White, “Modeling Emergency Shutdowns of Centrifugal Compressors,” Paper presented at the PSIG Annual Meeting, Galveston, Texas, May 2009 (“ <i>Kurz</i> ”)
1041	[Intentionally Left Blank]
1042	K. Vidal, Memorandum Regarding Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation (June 21, 2022)
1043	<i>Halliburton Energy Servs., Inc. v. U.S. Well Servs., LLC</i> , No. 6:22-cv-00905-ADA, Dkt. 50 (W.D. Tex. Feb. 8, 2023) (Joint Motion for Entry of Scheduling Order)
1044	<i>Halliburton Energy Servs., Inc. v. U.S. Well Servs., LLC</i> , No. 6:22-cv-00905-ADA, Dkt. 50-1 (W.D. Tex. Feb. 8, 2023) (Scheduling Order)
1045	Onyx Industries, Command Tower Standard Configurations, available at https://web.archive.org/web/20150503091137/http://www.onyx-industries.com:80/Products.aspx (last accessed on Feb. 9, 2023)
1046	Onyx Industries, Stack Light Engineering Reference Guide, (Sept. 23, 2012), available at https://web.archive.org/web/20160304080801/http://www.onyx-industries.com/downloads/StackLightEngineeringReferenceGuide.pdf

I. MANDATORY NOTICES

Real Party in Interest: Halliburton Energy Services, Inc. (“Halliburton” or “Petitioner”), Halliburton Co., and Halliburton Holdings LLC are the real parties in interest.

Related Matters: The ’871 Patent is involved in a pending lawsuit entitled *Halliburton Energy Services, Inc. v. U.S. Well Services, LLC*, 6:22-cv-00905-ADA (W.D.Tex.) (“Halliburton Litigation”). Petitioner is concurrently filing a Petition for IPR against U.S. Patent No. 11,136,870, which is asserted in a related pending lawsuit (Case No. 6:22-cv-00906-ADA (W.D.Tex.)).

The ’871 Patent was involved in a lawsuit entitled *U.S. Well Services, LLC v. Tops Well Services, LLC*, 3-19-cv-00225 (S.D.Tex.), which was filed on July 3, 2019 and dismissed without prejudice on July 23, 2019. The ’871 Patent was also involved in a lawsuit entitled *U.S. Well Services, LLC v. Tops Well Services, LLC*, 3-19-cv-00237 (S.D.Tex.), which was filed on July 22, 2019 and dismissed without prejudice on September 21, 2021 following a settlement.

In addition, Petitioner has filed Petitions for IPR against other patents held by Patent Owner, including: IPR2021-01032 against U.S. Patent No. 9,410,410 (“410 Patent”); IPR2021-01033 against U.S. Patent No. 8,789,601 (“601 Patent”); IPR2021-01034 against U.S. Patent No. 10,337,308; IPR2021-01035 against U.S. Patent No. 9,970,278; IPR2021-01036 against U.S. Patent No. 9,611,728; IPR2021-

01037 against U.S. Patent No. 9,745,840; IPR2021-01038 against U.S. Patent No. 10,408,030; IPR2021-01065 against U.S. Patent No. 9,840,901; IPR2021-01065 against U.S. Patent No. 9,840,901; IPR2021-01066 against U.S. Patent No. 10,020,711; IPR2021-01238 against U.S. Patent No. 10,526,882; IPR2021-01315 against U.S. Patent No. 9,893,500; IPR2021-01316 against U.S. Patent 10,280,724; IPR2021-01538 against U.S. Patent No. 10,408,031; and IPR2021-01539 against U.S. Patent No. 10,648,311; IPR2022-00074 against U.S. Patent No. 10,254,732; IPR2022-00610 against U.S. Patent No. 10,934,824. Aside from IPR2021-01539, each of these Petitions resulted in decisions to institute and were assigned to the same three-judge panel.¹ In the Final Written Decisions on IPR2021-01032, IPR2021-01033, IPR2021-01034, IPR2021-01035, IPR2021-01036, IPR2021-010378, and IPR2021-01038, all but one of the challenged claims from the seven patents at issue were found unpatentable.

Lead Counsel and Request for Authorization: Petitioner designates lead and back-up counsel as noted below. A Power of Attorney is filed concurrently herewith under 37 C.F.R. § 42.10(b).

¹ Judges Browne, Hoskins, and O’Hanlon comprised this panel.

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II. STANDING AND FEES

Standing: Petitioner certifies under 37 C.F.R. § 42.104(a) that the '871 Patent is eligible for *inter partes* review and that Petitioner is not barred or estopped from requesting *inter partes* review on the grounds set forth herein.

Fees: The Office is authorized to charge the fee in 37 C.F.R. § 42.15(a) to Deposit Account No. 02-0384 as well as any additional fees that might be due in connection with this Petition.

III. OVERVIEW OF THE '871 PATENT

Petitioner challenges claims 1-19 of U.S. Patent No. 9,650,871 by Jared Oehring (“the ’871 Patent”), entitled “Safety Indicator Lights for Hydraulic Fracturing Pumps.” Ex.1001.

A. Subject Matter of the '871 Patent

The ’871 Patent relates to operations for hydraulic fracturing in subterranean formations.

The ’871 Patent describes a hydraulic fracturing system that includes “a plurality of electric pumps” that are “powered by at least one electric motor.” *Id.*, 2:14-20. The system also includes “a variable frequency drive connected to the electric motor to control the speed of the motor” and “a signal assembly” that emits visual signals indicative of an “operational state” of the system. *Id.*, 2:20-27. The signal assembly may be a stack of light assemblies emitting different colored lights. *Id.*, 2:27-31.

B. Prosecution History of the '871 Patent

The application leading to the ’871 Patent—U.S. Patent App. No. 15/217,040 (“the ’040 Application”)—was filed July 22, 2016. Ex.1002, 1. The ’871 Patent

claims priority to U.S. Provisional Application No. 62/196,350 (“’350 Provisional”). Ex.1012.

The Patent Office issued an Office Action on November 29, 2016, allowing claims 1-14, rejecting claims 15, 16, and 19 as unpatentable under 35 U.S.C. § 102, and rejecting claims 17 and 18 as unpatentable under 35 U.S.C. § 103. *Id.*, 82-87. In allowing claims 1-14, the Examiner noted that the prior art did not disclose “all the claimed subject matter including the variable frequency drive performing electrical motor diagnostics.” *Id.*, 87. The Examiner commented, however, that the prior art disclosed emitting a visual signal regarding the operational state. *Id.*, 85-86; *see* Ex.1014 (Paterson), 7:62-65; Ex.1015 (Jensen), ¶¶ 20, 37. In response, Patent Owner amended independent claim 15 to recite a variable frequency drive that performs electric motor diagnostics. *Id.*, 117-26. The Examiner allowed claims 15-19 as amended on March 28, 2017. *Id.*, 128-30.

Thus, the point of purported novelty of independent claims 1, 9, and 15 lies in the diagnostic capabilities of the variable frequency drives (“VFDs”). VFDs and these diagnostic capabilities, however, were well known when the ’871 Patent was filed.²

² The Final Written Decisions relating to Patent Owner’s other patents confirm this. *See, e.g.*, IPR2021-01032, Paper 41 at 20-30 (PTAB Jan. 4, 2023).

C. Priority Date of the '871 Patent

The '040 Application that issued as the '871 Patent was filed July 22, 2016. The '040 Application purports to claim priority to the '350 Provisional, which was filed July 24, 2015. Ex.1002, 12; Ex.1012.

However, the '871 Patent cannot claim priority to the '350 Provisional. To do so, “the specification of the *provisional* must ‘contain a written description of the invention ... in such full clear, concise, and exact terms,’ 35 U.S.C. § 112 ¶ 1, to enable an ordinarily skilled artisan to practice the invention *claimed* in the *non-provisional* application.” *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). In other words, the *claims* of the '871 Patent must be fully supported by the '350 Provisional. *Id.* at 1381-82. Every claim of the '871 Patent requires “a variable frequency drive” that “control[s] the speed of the [electric] motor” and “perform[s] electric motor diagnostics.” Ex.1001, 9:10-14, 9:55-57, 10:37-39. The '350 Provisional, however, fails to disclose even a VFD, let alone a VFD performing diagnostics (the purportedly-novel limitation).³ Ex.1012. Therefore, '350 Provisional does not contain written-description support for the '871 Patent claims.

³ The claims were allowed specifically based on their disclosure of VFDs that perform electric motor diagnostics. *Supra* §III.B.

The '871 Patent specification also states that it claims priority to App. No. 13/679,689 (“’689 Application”), which issued as the '410 Patent; however, a claim must be fully supported by a single application and not a “combination of several distinct patent applications.” *See Studiengesellschaft Kohle, M.B.H. v. Shell Oil Co.*, 112 F.3d 1561, 1564 (Fed. Cir. 1997). The '689 Application does not disclose the “signal assembly” of the '871 Patent’s independent claims or any of the features of that assembly in the dependent claims. Ex.1004. The '350 Provisional also contains no reference to that application. Moreover, the '689 Application and '871 Patent share no common inventors. *See* 37 C.F.R. §1.78. Thus, the '689 Application cannot support a priority claim for the '871 Patent.⁴

Accordingly, the '871 Patent is only entitled to priority as of its filing date of July 22, 2016. Petitioner relies on prior art that pre-dates that date.

IV. SUMMARY OF PRIOR ART

Because the application that issued as the '871 Patent has an effective filing date that is after March 16, 2013, it was examined under the provisions of the AIA. Ex.1003, 84.

⁴ Nor is this cross-reference in the specification a proper priority claim. 37 C.F.R. §1.78; *see* Ex.1002 at 3-9 (Application Data Sheet).

A. Payne (Ex.1004)

Payne refers to U.S. Patent Publication No. 2016/0258267, filed on March 3, 2016 and published on September 8, 2016.⁵ Ex.1004. *Payne* is prior art to the '871 Patent at least under AIA 35 U.S.C. § 102(a)(2) (post-AIA).

Payne involves “a system for stimulating oil or gas production” that “includes a hydraulic fracturing pump unit having two or more fluid pumps,” where each pump is “driven by an alternating current (AC) electrical pump motor coupled to the fluid pump, and a variable frequency drive (VFD) controlling the electrical pump motor.” Ex.1004, [0014]. *Payne*’s VFD may be a “Toshiba GX7 Rig Drive 1750 HP,” among other options, and in a “preferred embodiment, there is one (1) Toshiba GX7 VFD per pump system.” *Id.* [0122]. The fracturing system also includes additional units, such as a blender unit and a system control unit. *Id.* [0014].

Like the '871 Patent’s signal assembly, *Payne*’s hydraulic fracturing pump unit “may be supplied with a multi-color light tower for each pump,” in which the individually-colored beacon lights illuminate based on different states of the pump and/or motor. *Id.* [0058], Fig. 10.

⁵ *Payne* claims priority to its provisional application, filed March 4, 2015. Ex.1004.

B. Toshiba (Ex.1005)

Toshiba refers to “G7 Adjustable Speed Drive Operation Manual,” Document No. 51546-009, published by Toshiba International Corp. (“Toshiba”) with the cover containing a copyright date of March 2005. Ex.1005. *Toshiba* contains information regarding operation and setup of the G7 family of drives, which includes the GX7 drive used in *Payne. Id.*; Ex.1002, ¶124. As of 2016, Toshiba was a well-known manufacturer of motors and drives for the oil and gas industry. Ex.1002, ¶¶122-124. A POSITA would have reviewed the Toshiba website and product listings to learn about products and VFD functionality. *Id.*

Toshiba is an Operations Manual for a VFD that was publicly accessible from the Toshiba website by December 7, 2010, the date it was archived by the Internet Archive Wayback Machine. Ex.1006, (Internet Archive Decl.) at 1, 25 (sponsoring Ex.1005). *See Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039, Paper 29 at 18 (P.T.A.B. Dec. 20, 2019) (precedential) (public accessibility based on Wayback Machine webpages, a declaration from the Internet Archive office manager including the site’s archival records, and expert testimony asserting its public accessibility). Accordingly, *Toshiba* is prior art under 35 U.S.C. §102(a)(1).

Similar to *Payne*, *Toshiba* describes how the VFD controls an electric motor—by “deliver[ing] unparalleled motor control and reliability.” Ex.1005 at 2 (Introduction). *Toshiba* discloses performing electric motor diagnostics to prevent

damage to the motor, including protecting against overload, overcurrent, overtorque, short circuit, and earth faults. Ex.1005 at 19, 22, 160-63, 165. Several diagnostics are performed with “every run” or “every power up.” *Id.* at 162.

C. Broussard (Ex.1007)

Broussard refers to U.S. Patent Publication No. 2014/0138079, which published on May 22, 2014. Ex.1007. *Broussard* is prior art to the ’871 Patent under 35 U.S.C. §§ 102(a)(1)-(a)(2).⁶ *Broussard* names Patent Owner as applicant.

Broussard describes “pumping fracturing fluid into an oil or gas well using pumps powered by electric motors.” *Id.* [0002].

Those electric motors are powered with electricity from electric generators, and VFDs control the speed of the motors, and therefore, the speed of the pumps. *See id.* [0008]-[0009], [0019], [0024]. The VFDs “can frequently perform electric motor diagnostics to prevent damage to [an] electric motor if it becomes grounded or shorted.” *Id.*, [0011]; *see id.*, [0021], claim 15.

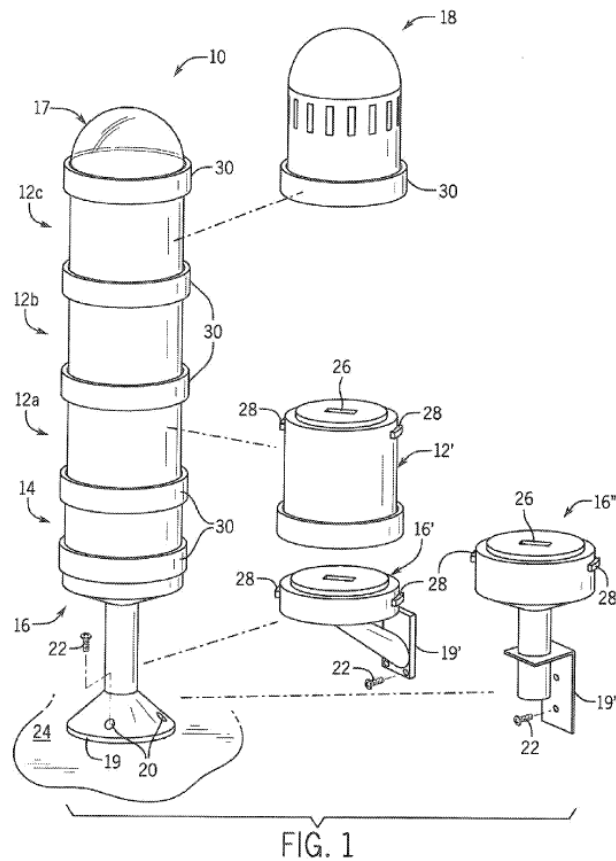
D. Feller (Ex.1008)

Feller refers to U.S. Patent Publication No. 2015/0198316, filed on January 13, 2014 and published on July 16, 2015. Ex.1008. *Feller* is prior art to the ’871

⁶ Because the ’871 Patent claims are not entitled to priority based on the ‘689 Application, *supra* §III.C, *Broussard* is prior art to them.

Patent at least under 35 U.S.C. §§ 102(a)(1)-(a)(2).

Feller discloses “stack lights” may be used as “visual display” to “convey operation and warning information in an industrial environment.” Ex.1008, [0001]. These stack lights may comprise “a short tower of different colored lamps” that are “attached to, or placed in close proximity to, operating industrial equipment to provide a *visible indication of the equipment operating status.*” *Id.* [0002]-[0003], Fig.1.



Ex.1008, Fig.1.

The different colors of *Feller*’s lights “allow multiple types of information to

be communicated at a distance in a possibly noisy environment.” *Id.* [0002]. For these reasons, *Feller* is analogous art even though it is not in the fracturing context because it is “reasonably pertinent” to the particular problem at issue in the ’871 Patent—visibly indicating equipment operating status in a noisy environment. *Donner Tech., LLC v. Pro Stage Gear, LLC*, 979 F.3d 1353, 1359 (Fed. Cir. 2020). The ’871 Patent uses the same kinds of lights to indicate operating status.

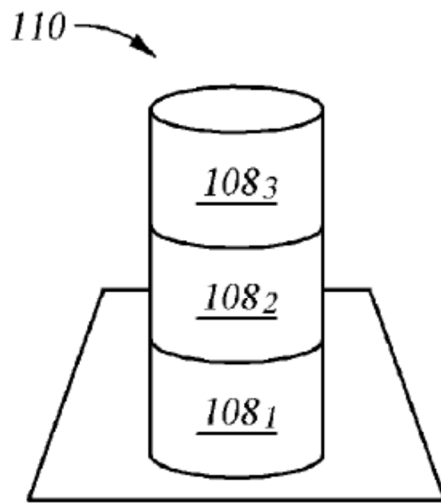


Fig. 4A

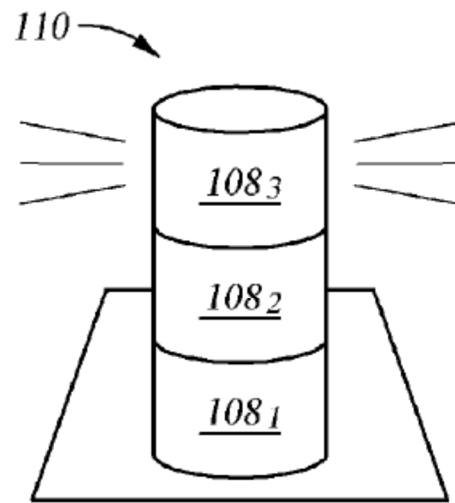


Fig. 4B

Ex.1001, Figs. 4A-4B, 2:25-27, 6:27 (“light assembly 108₁₋₃”); Ex.1002, ¶¶143-144.

E. Wiemers (Ex.1009)

Wiemers refers to U.S. Patent Publication No. 2015/0001161, filed on July 1, 2013 and published on January 1, 2015. Ex.1009. *Wiemers* is prior art to the ’871 Patent at least under 35 U.S.C. § 102(a)(1)-(a)(2).

Wiemers describes components for treating flowback liquid at hydraulic

fracturing sites. Ex.1009, Abstract, [0001], [0003]-[0005]. Its process control can sense “attributes of liquid to be treated at the treatment unit” and “operational functioning of unit components, such as speed and state attributes.” *Id.* [0011], [0103].

Figure 30 (below) illustrates a “software controller and training simulator.” *Id.* [0062]. The simulator teaches what an actual controller would do in a deployed system. *Id.* [0107] (“This simulation software is an exact duplication of the process control software programming onboard at management unit 39....”); Ex.1002, ¶147. As shown, “there are status lights, start/stop buttons and speed control potentiometers for each variable frequency drive (VFD) motor in the system.” *Id.* [0110]. The lights “show if a VFD motor is currently energized” and it contains “switches for each VFD motor that simulate an overheating signal or any other kind of fault.” *Id.*

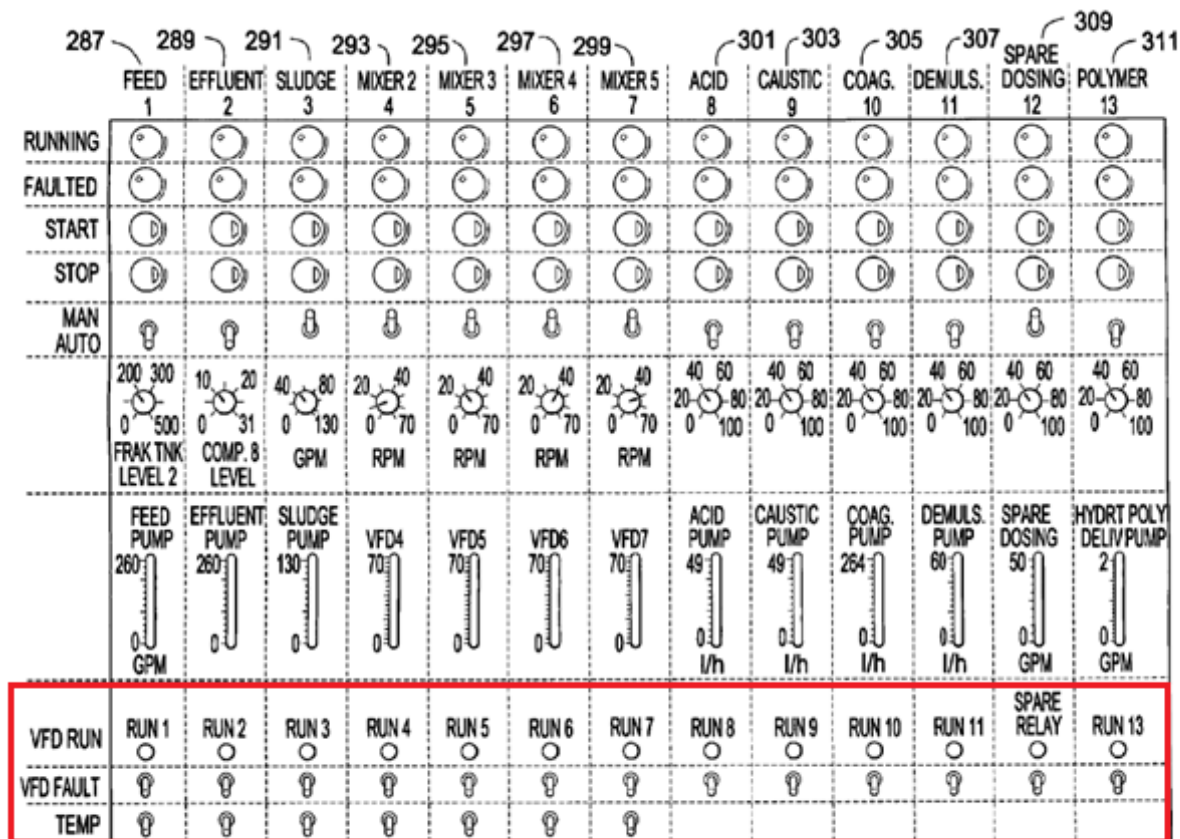


FIG.30

Ex.1009, Fig.30 (annotated).

Wiemers is analogous art because it is “reasonably pertinent” to the oil and gas context, including monitoring and controlling components in the ’871 Patent (e.g., VFDs). *Donner Tech., LLC v. Pro Stage Gear, LLC*, 979 F.3d 1353, 1359 (Fed. Cir. 2020); Ex.1009, [0001]; Ex.1002, ¶149.

F. Carlson (Ex.1010)

Carlson refers to U.S. Patent No. 6,006,627 that issued December 28, 1999. Ex.1010. *Carlson* is prior art to the ’871 Patent at least under 35 U.S.C. § 102(a)(1)-(a)(2).

Carlson describes a blender system used to “prepar[e] fluid mixtures for fracturing and propping” oil-bearing formations. Ex.1010, 1:15-27. The system includes “control devices,” “sensing devices,” “a programmable system controller,” and “control pendants...to receive input commands from an operator and display status conditions of the control devices and sensing devices.” *Id.* The control pendants include “light emitting diode (LED) drivers 1255, communication bus 1260, and LED indicators 1265.” *Id.*, 15:9-15. The control pendants may be used “virtually anywhere”, *e.g.*, on top of or beside the blender , “in any remote control location, or from two sites simultaneously.” *Id.*, 3:5-10. “This increased mobility enhances the safety of the operator” for several reasons, *e.g.*, by “eliminat[ing] the need for a second person to operate the blender system 100 while the technician performs the service.” *Id.*, 3:5-10, 3:55-60.

G. Randle (Ex.1011)

Randle refers to U.S. Patent Publication No. 2014/0290768, filed on March 27, 2013 and published on October 2, 2014. Ex.1011. *Randle* is prior art to the '871 Patent at least under 35 U.S.C. § 102(a)(1)-(a)(2).

Randle discloses a “hydraulic fracturing pump isolation safety system.” Ex.1011, [0017]. The fracturing pumps may “include a pump condition determining means that generates a signal that reflects the condition or operational status of the pump.” *Id.*, [0029]. Several different conditions are disclosed, including “current

flow through the motor windings, fluid end pressure, temperature, sound, and/or vibration.” *Id.* The safety system includes a remote operator control panel with a programmable logic controller, which can “accept[] as inputs the valve condition and the pump condition, and present[] the monitored conditions to the operator control panel for display on the operator graphical interface.” *Id.* [0032].

Because *Broussard*, *Feller*, *Wiemers*, *Carlson*, and *Randle* each published more than one year before the ’871 Patent’s effective filing date, the exceptions of § 102(b) (post-AIA) cannot apply to those references.

H. Summary of Grounds

Petitioner requests cancellation of the claims on the following anticipation (35 U.S.C. § 102) and obviousness (§ 103) grounds:

Ground	Claims	Prior Art
1	1-4, 6-7, 9-12, 15-17, 19	Anticipated by Payne
2	1-19	Obvious in view of Payne
3A	1-19	Obvious in view of Payne and Toshiba
3B	1-19	Obvious in view of Payne and Broussard
4	2-4, 11-12, 17	Obvious in view of Payne and Feller
4A	2-4, 11-12, 17	Obvious in view of Payne, Toshiba, and Feller
4B	2-4, 11-12, 17	Obvious in view of Payne, Broussard, and Feller
5	5, 13, 16	Obvious in view of Payne and Wiemers
5A	5, 13, 16	Obvious in view of Payne, Toshiba, and Wiemers
5B	5, 13, 16	Obvious in view of Payne, Broussard, and Wiemers
6	8, 14	Obvious in view of Payne and Carlson
6A	8, 14	Obvious in view of Payne, Toshiba, and Carlson
6B	8, 14	Obvious in view of Payne, Broussard, and Carlson
7	13, 16	Obvious in view of Payne and Randle

Ground	Claims	Prior Art
7A	13, 16	Obvious in view of Payne, Toshiba, and Randle
7B	13, 16	Obvious in view of Payne, Broussard, and Randle

V. DISCRETIONARY DENIAL WOULD BE INAPPROPRIATE

A. Discretionary Denial Under *Fintiv* factors is not appropriate⁷

The factors described in *Apple, Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB March 20, 2020) (Precedential) (“*Fintiv-I*”) favor institution.

To date, discovery has not commenced in the Halliburton Litigation and, although a stay motion has not yet been filed in that case, Petitioner intends to promptly file a stay motion with respect to this patent if IPR is instituted. The Board has treated related factors as neutral after declining to speculate on the outcome of a stay motion. *See, e.g., HP Inc. v. Slingshot Printing LLC*, IPR2020-01084, Paper 13 at 9 (PTAB Jan. 14, 2021).

Petitioner filed this Petition against all claims of the ’871 Patent promptly after Patent Owner filed a counterclaim of infringement of the ’871 Patent against Petitioner in the Halliburton Litigation on November 7, 2022. Due to Petitioner’s diligence, it would be premature to argue the timing of respective milestones in this proceeding versus the Halliburton Litigation. Thus, if Patent Owner raises §314(a)

⁷ Petitioner reserves its rights to contest denial of institution based on the *Fintiv* framework.

arguments in a Preliminary Response, Petitioner respectfully requests the opportunity to reply to address expected schedules and whether a *Sand Revolution* stipulation would be appropriate.

Nevertheless, the parties have invested minimal resources in the Halliburton Litigation as fact discovery has not yet commenced and the parties have jointly moved to extend the litigation schedule. *See* Ex.1043, Ex.1044. Further, the court's work in the Halliburton Litigation has thus far consisted of administrative oversight and preliminary case management. The court has not issued any substantive orders related to the '871 Patent. This factor weighs against discretionary denial.

Additionally, this Petition presents a "compelling unpatentability challenge," (*see* Ex.1042 at 3-5) at least because, as noted above, the purported point of novelty on which the Examiner relied is clearly disclosed in several prior-art references. *Supra* §III.B.

B. Discretionary Denial Under 35 U.S.C. § 325(d) Is Not Appropriate

In considering its discretion under §325(d), "the Board uses the following two-part framework: (1) whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented the Office; and (2) if the first part of the framework is satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of the challenged claims." *Advanced Bionics, LLC v.*

MED-EL Elektromedizinische Geräte GmbH, IPR2019-01469, Paper 6 at 8 (PTAB, Feb. 13, 2020) (precedential).

The Board has found that the *Becton, Dickinson & Co. v. B. Braun Melsungen AG* factors favor institution in situations where even a single non-cumulative secondary reference distinguished the prior-art ground regardless of other overlapping references. *Oticon Medical AB et al. v. Cochlear Limited*, IPR2019-00975, Paper 15 at 9-20 (PTAB Oct. 16, 2019) (precedential). In its Institution Decision on the '410 Patent, the Board found that, even though *Coli* was of record during prosecution, the first part of the *Advanced Bionics* framework was not satisfied “because the particular combinations set forth in the petition were not considered by the examiner.” IPR2021-01032, Paper 12 at 17. Specifically, the petition in that case did not assert *Coli* alone but rather in combination with art that was not of record. *Id.* at 18. Thus, the Board concluded that the petition’s combination of references was not presented previously and that, based on this fact alone, denial of the petition under §325(d) was not warranted.

A similar analysis applies here. *Payne* and *Broussard* are among the references cited on the face of the '871 Patent, but the Examiner did not rely on or

substantively discuss them.⁸ Moreover, the Petition sets forth obviousness grounds based on *Payne* in combination with prior art not considered by the Examiner, including *Toshiba*, *Feller*, *Wiemers*, *Carlson*, and *Randle*. Thus, the first part of the *Advanced Bionics* framework is not satisfied, and denying the Petition under §325(d) is unwarranted.

VI. LEVEL OF ORDINARY SKILL IN THE ART

At the time of the claimed invention, a POSITA would have either (1) a Bachelor of Science in Mechanical Engineering, Electrical Engineering, Petroleum Engineering or an equivalent field and at least two years of academic or industry experience in the oil and gas industry, including well drilling, completion, or production; or (2) at least four years of industry experience in the oil and gas industry, including well drilling, completion, or production.

VII. CLAIM CONSTRUCTION

Claim terms in IPR are construed according to their “ordinary and customary meaning” to those of skill in the art. *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc); 37 C.F.R. § 42.100(b).

⁸ It is unclear whether the Examiner considered *Payne* as prior art or disregarded it based on the '871 Patent's (improper) priority claims.

For purposes of this proceeding, Petitioner proposes “frequently performs” should be construed to include “*e.g.*, on the application of power, or with each start.” At least the ’689 Application, which the ’871 Patent incorporates by reference, Ex.1001, 1:10-13, supports this construction. *See* Ex.1013, 3:66-4:1 (“[M]otor diagnostics can be **performed frequently (e.g., on the application of power, or with each start)**, to prevent damage to a grounded or shorted electric motor 14.”); *see* Ex.1016, 4:43-45 (same); IPR2021-01033, Paper 41, at 4-5 (PTAB Jan. 4, 2023) (quoting ’601 Patent).

All other terms are given their plain and ordinary meaning in this Petition.

VIII. A REASONABLE LIKELIHOOD EXISTS THAT THE CHALLENGED CLAIMS ARE UNPATENTABLE

Pursuant to 37 C.F.R. § 42.104(b)(4)-(5), all Challenged Claims are unpatentable for the reasons set forth below.

A. Grounds 1-2: Claims 1-4, 6-7, 9-12, 15-17, 19 Are Anticipated by *Payne* (Ground 1) and Claims 1-19 Are Rendered Obvious by *Payne* (Ground 2)

Claims 1-4, 6-7, 9-12, 15-17, 19 are anticipated by *Payne* for the reasons below. Should the Board or Patent Owner take the position that some of these claim limitations are not disclosed in *Payne*, a POSITA still would have understood those limitations to be rendered obvious by *Payne*. Ex.1002, ¶156; *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983) (“a disclosure that anticipates under § 102 also renders the claim invalid under § 103 for anticipation is the epitome

of obviousness.”); *Realtime Data, LLC v. Iancu*, 912 F.3d 1368 (Fed. Cir. Jan. 2019) (affirming *Connell* in an IPR). Claims 1-19 are also rendered obvious by *Payne* for the reasons below. Ex.1002, ¶156.

1. Claim 1

a. 1[pre] A hydraulic fracturing system for fracturing a subterranean formation comprising:

To the extent the preamble is limiting, *Payne* discloses “a system for stimulating oil or gas production for a wellbore” that includes a “hydraulic fracturing pump unit having one or more hydraulic fracturing pumps driven by one or more electrical fracturing motors.” Ex.1004, Abstract; *see id.* [0015]-[0016]; Ex.1002, ¶¶157.

b. 1[a] a plurality of electric pumps fluidly connected to the formation, and powered by at least one electric motor, and configured to pump fluid at high pressure into a wellbore that intersects the formation, so that the fluid passes from the wellbore into the formation, and fractures the formation;

Payne discloses “one or more hydraulic fracturing pumps driven by one or more **electrical fracturing motors**.” Ex.1004, Abstract, [0051]. Specifically, *Payne*’s fracturing pump unit includes “two or more fluid pumps,” where each pump is “driven by an alternating current (AC) **electrical pump motor**.” *Id.*, claim 1; *see id.* Fig. 6, [0052] (“hydraulic fracturing pump unit 700 includes one or more electric motor-driven fracturing pumps 710, for example two fracturing pumps 710a, 710b”).

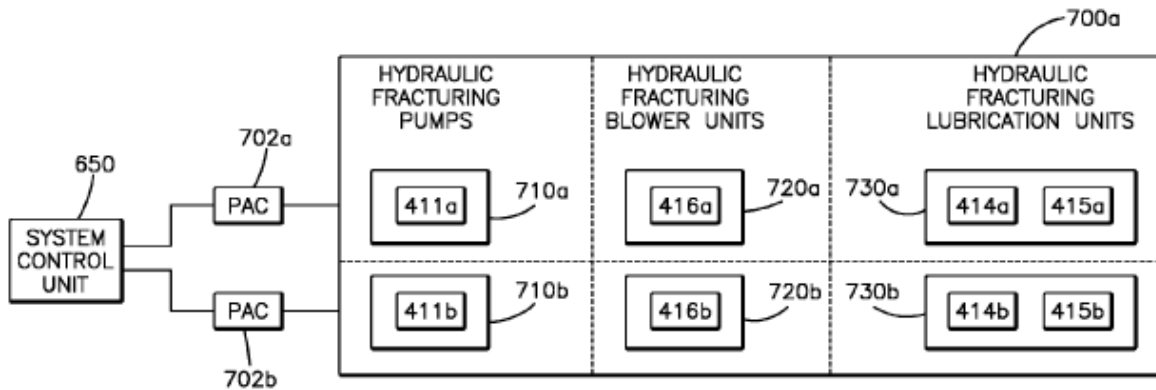


Fig. 6

Ex.1004, Fig.6.

The fracturing pumps are fluidly connected to the wellbore, in that they “inject[] treatment fluids at **high pressures** into existing oil or gas wells in order to stimulate oil or gas production.” *Id.* [0005], [0015]. This injection then “create[s] cracks in the deep-rock formations,” *i.e.*, fractures the formation. *Id.*

c. 1[b] a variable frequency drive connected to the electric motor to control the speed of the motor,

Payne discloses a “variable frequency drive (VFD)” that “provides ac current which turns the mechanically coupled motor and fracturing pump.” Ex.1004, [0039]. The “operating mechanisms for the fracturing pump unit include a variable frequency drive housing that houses a **first frac motor [VFD] 410a** for driving a first frac motor 411a [and] a **second frac motor VFD 410b** for operating a second frac motor 411b.” *Id.* [0047]. In other words, “the frac motor 411a of a fracturing pump 710a is controlled by a frac VFD 410a.” *Id.* [0053]. Moreover, the fracturing unit control system “provides a speed request signal to the VFD 410a,” allowing the

VFD “**to control the speed of the frac motor 411a.**” *Id.* *Payne* discloses the Toshiba GX7 Rig Drive as an example of a VFD. *Id.* [0122].

- d. **1[c] wherein the variable frequency drive frequently performs electric motor diagnostics to prevent damage to the at least one electric motor; and**

Payne’s fracturing unit control system “provides a speed request signal to the VFD 410a,” allowing the VFD “to control the speed of the frac motor 411a.” Ex.1004, [0053]. VFDs control the frequency (speed) and torque (acceleration and deceleration) to the motor, thus regulating power delivery to the motor. Ex.1002, ¶163. A POSITA would have understood that controlling these motor input parameters is an example of performing electric motor diagnostics to prevent damage to the motor caused by “over driving” it. *Id.* ¶¶163-164.

The VFD can “provide a VFD FAULT contact to the control system to indicate if a **fault condition** is present.” Ex.1004, [0056]. The fault condition may relate to operating parameters, such as “currents and frequency, temperatures, power, percent of rated load, torque and percent of torque, **output voltage and motor load**, and system status.” *Id.* [0109]. If a “fault condition” is present and the control system indicates “VFD FAULT,” the “VFD FAULT” can be “reset based on predefined intervals of time,” or “more frequently than the predefined interval.” Ex.1004, [0056]. A POSITA would, therefore, have understood that the VFD determines “if a fault condition is present,” *id.*, at least on the application of power,

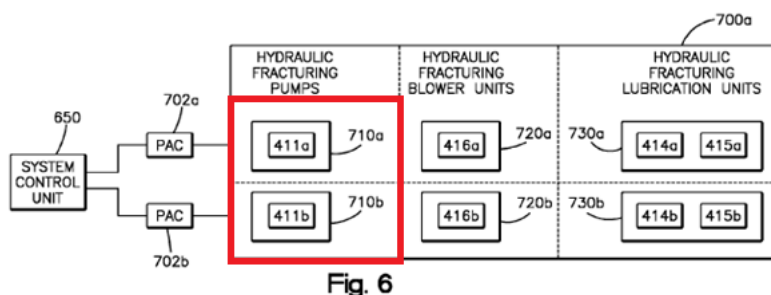
or with each start (*i.e.*, frequently), Ex.1002, ¶¶165-167. This discloses a VFD that frequently performs electric motor diagnostics.

Toshiba describes operation of the Toshiba GX7 used in *Payne*, which describes the performance of additional motor diagnostics. *Infra* §VIII.B; *Monsanto Tech. LLC v. E.I. DuPont de Nemours & Co.*, 878 F.3d 1336, 1345 (Fed. Cir. 2018) (“Extrinsic evidence ‘may be used to interpret the allegedly anticipating reference and [to] shed light on what it would have meant to [a POSITA].’” (alteration in original)).

Payne also renders the claim obvious. Because the VFD “controls the acceleration and deceleration of the **motors/pumps**,” a POSITA would have understood that the VFD frequently performs electric motor diagnostics to prevent damage to an electric motor in light of *Payne*’s disclosure that the VFD can indicate if a “fault condition is present”—particularly when the fault condition relates to “output voltage and motor load.” Ex.1004, [0056], [0109], [0112]; Ex.1002, ¶¶168-170.

- e. **1[d] a signal assembly that selectively emits a visual signal that is indicative of an operational state of the hydraulic fracturing system.**

Payne discloses that the fracturing pump unit “may be supplied with a **multi-color light tower for each pump 710a, 710b,”** (*i.e.*, signal assembly). Ex.1004, [0058].



Id., Fig.6.

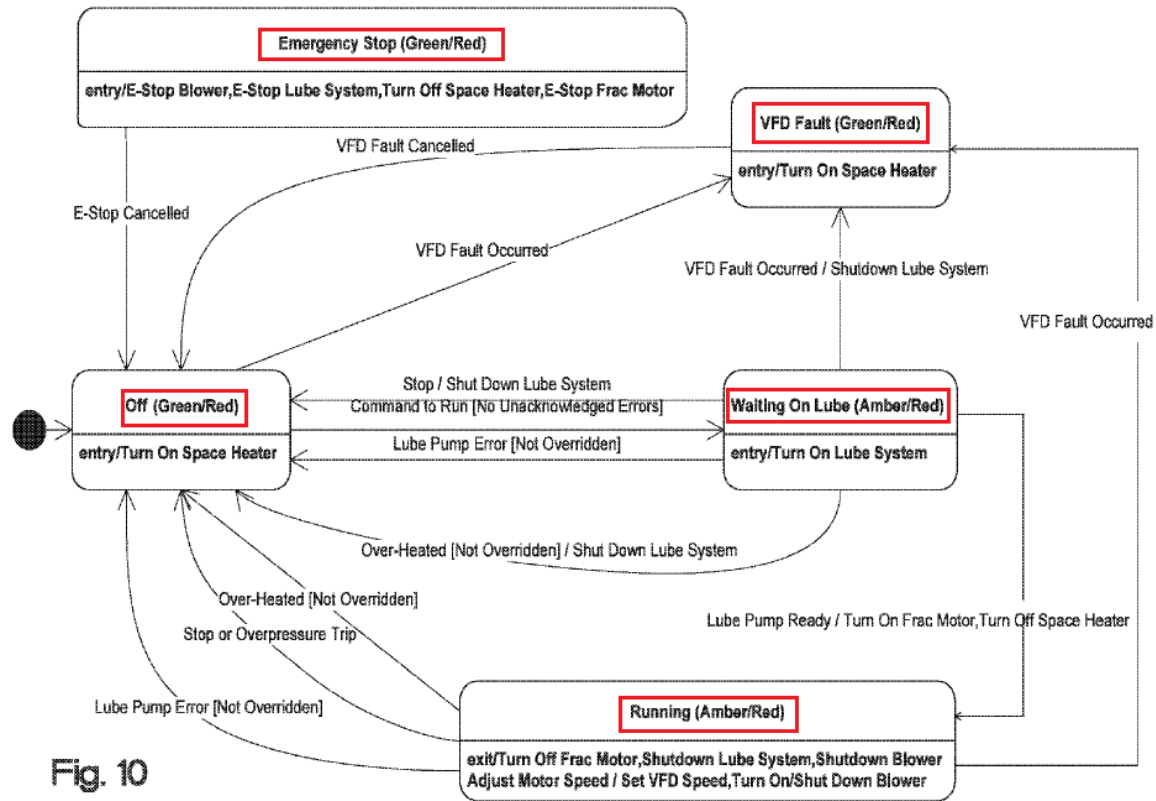
The lights illuminate different colors (*i.e.*, visual signal) based on different operational states of the fracturing system.⁹ For example, the lights may be “Color 1” if the frac motor “is not running and is not enabled to run,” “Color 2” if the frac motor “is running OR has been enabled to run,” or “Color 3” if the “pump discharge pressure for the frac motor 411a is greater than a pre-defined psig setpoint.” *Id.*; *see*

⁹ Petitioner takes no position on whether 1[d] requires a visual signal for operational states of each of the pump, the motor, and the VFD. *Payne* discloses them, but to the extent 1[d] only requires a visual signal indicative of an operational state of fewer components, the same analysis below would apply.

id. [0103] (“The beacon light turns red whenever the pump discharge pressure is greater than a pre-defined setpoint.”).

Payne’s Figure 10 (reproduced and annotated below) discloses that the beacon lights also may signal an operational state of the fracturing system. Figure 10 illustrates “all states” of operation of a fracturing pump unit. *Id.*, Fig.10, [0102]-[0103]. A POSITA would have understood that Figure 10 discloses the states of the system, which colors of lights are illuminated to indicate such a state, the actions taken when the state is entered, the actions taken when the state is exited, and events that would occur to move to a different state. Ex.1002, ¶173.

A green light represents electricity to some electrically powered equipment (*e.g.*, space heater, sensors, light tower); an amber light represents electricity supplied to all systems including the motor; and a red light represents the pump discharge pressure greater than a “pre-defined psig setpoint.” Ex.1004, Fig.10, [0058]; Ex.1002, ¶174.



Ex.1004, Fig. 10 (annotated).

To the extent *Payne* does not disclose 1[d], *Payne* renders claim 1 obvious. Signal assemblies using lights to emit a visual signal to indicate an operational state were well-known in the art long before 2016. *See* Ex.1002, ¶¶102-109 (citing Exs.1033-1034, Exs.1045-1046). Because *Payne* discloses a “light tower” that emits different colors based on different conditions of components of the fracturing system, including the frac motor, the pump, and the VFD, a POSITA would have understood that this light tower may selectively emit a visual signal “that is indicative of an operational state of the hydraulic fracturing system.” Ex.1004, [0058], [0102]-[0103], Figs. 10-12; Ex.1002, ¶179.

2. Claim 2

- a. **The hydraulic fracturing system of claim 1, wherein the signal assembly comprises a plurality of light assemblies arranged in a stack.**

Payne discloses a “**light tower** for each pump.” Ex.1004, [0058]. The light tower contains beacon lights of multiple colors, which are used to indicate different operational states of the fracturing system. *See id.* [0058], [0103], Figs. 10-12.

A POSITA would also find it obvious that *Payne*’s “light tower” would comprise a plurality of light assemblies arranged in a stack. Ex.1002, ¶180.

3. Claim 3

- a. **The hydraulic fracturing system of claim 2, wherein each of the light assemblies selectively emit visual light of a color different from visual light emitted by other light assemblies.**

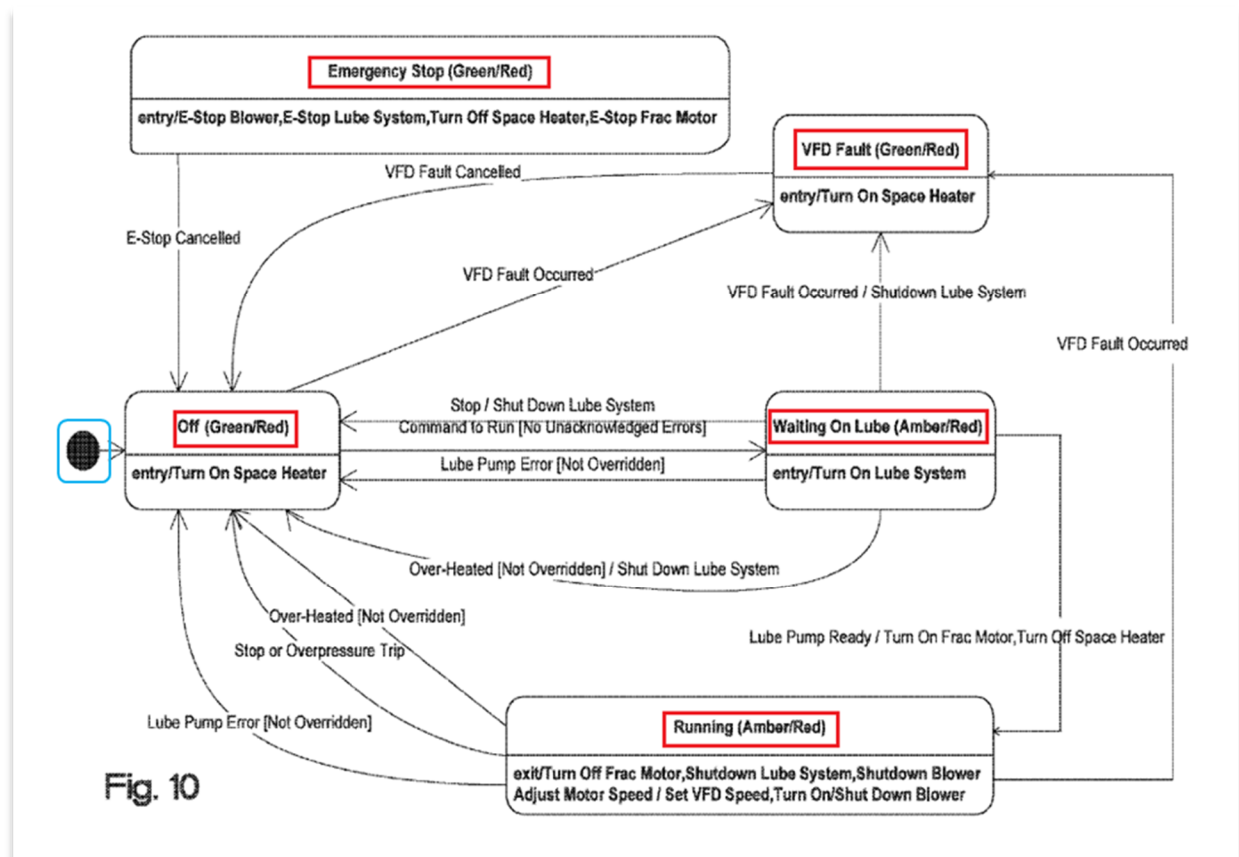
Each light in *Payne*’s “multi-color light tower” can emit visual light of a color different from the visual light emitted by other lights in the tower (*e.g.*, Color 1, Color 2, Color 3). Each color, alone and in combination, indicates a different operational state of the fracturing system. *See id.* [0058], [0103], Fig.10.

4. Claim 4

- a. **The hydraulic fracturing system of claim 2, wherein a distinctive operational state of the system is indicated by illumination of a combination of the light assemblies.**

Payne discloses claim 4. Ex.1004, [0058]. The state chart in Figure 10 of *Payne* discussed above discloses illuminating lights in different color combinations.

For example, illumination of amber and red lights indicates that the motor/pump is in a running state, and the pressure in the discharge pressure is above the designated setpoint. *Id.* The combination of green illuminated and red not illuminated would indicate a condition where electricity was only supplied to some of the electrically operated components of the unit (*e.g.* heaters), but the motor is not enabled to run, as well as pressure in the discharge piping being low (*i.e.* below a designated setpoint). *Id.* The combination of red, green, and amber lights being in the “off” condition would indicate that no electricity was being delivered to the electrically driven components. Ex.1004, Fig.10; Ex.1002, ¶¶183-184.



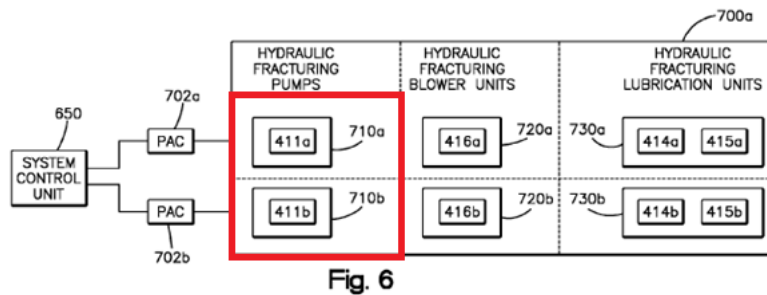
Ex.1004, Fig. 10 (annotated).

5. Claim 5

- a. The hydraulic fracturing system of claim 1, wherein the operational states of the hydraulic fracturing system comprise, [(i)] no electricity to the system, [(ii)] a supply of electricity to all electrically powered devices in the system, [(iii)] a supply of electricity to some of the electrically powered devices in the system, and [(iv)] a pressure in a discharge line of the pump having a magnitude that is at least that of a designated pressure.

Payne discloses and/or renders obvious several operational states of the hydraulic fracturing system, rendering claim 5 obvious.

Payne's fracturing pump unit “may be supplied with a **multi-color light tower for each pump 710a, 710b,**” (*i.e.*, signal assembly). Ex.1004, [0058].



Id., Fig.6.

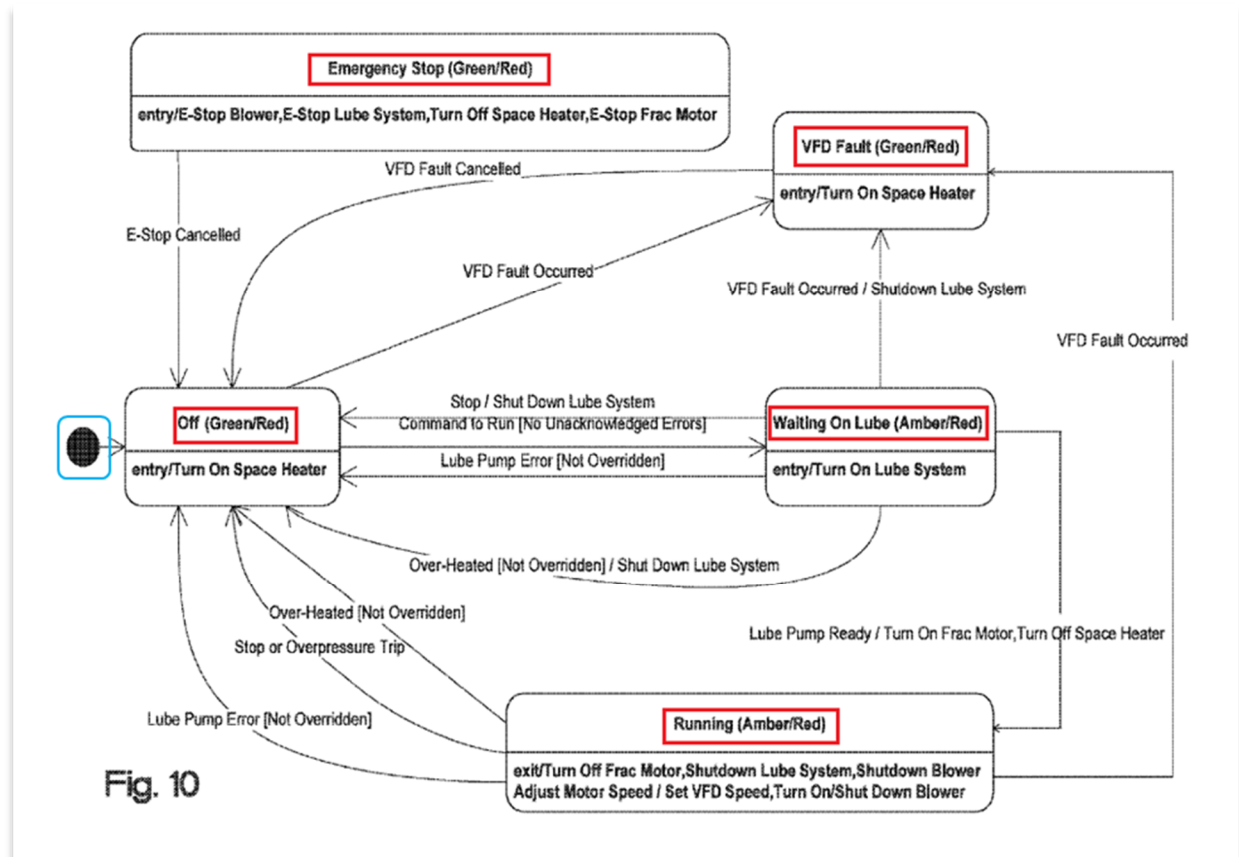
The different operational states for each pump, as described in Figure 10 of *Payne* are summarized in the following table and described in greater detail below.

Light Color	Condition	State
Red	Off	Discharge Pressure less than setpoint
Red	On	Discharge Pressure greater than setpoint

Green	Off	No electricity to system
Green	On	Electricity to some components of system, but not all (motor/pump not running)
Amber	Off	Motor / pump not running
Amber	On	Motor / pump running or enabled to run

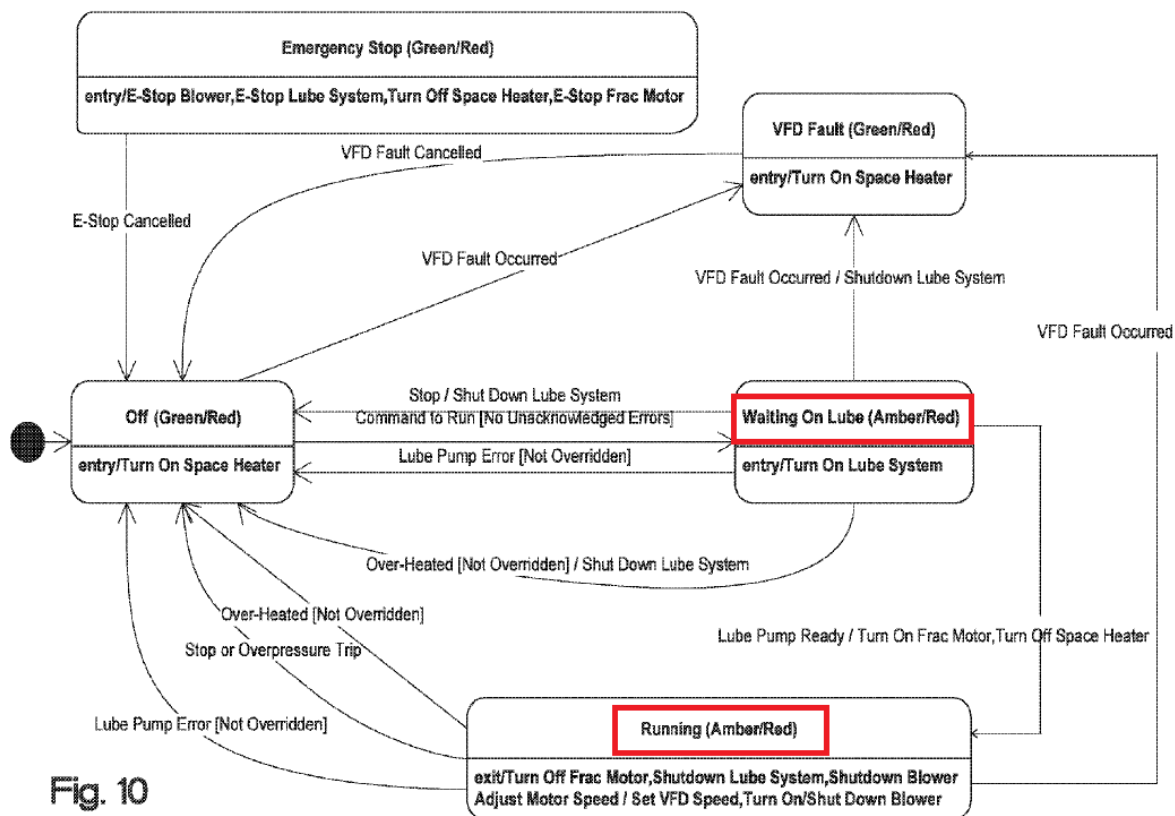
Ex.1002, ¶183.

The operational state of (i) “no electricity to the system” is indicated by all three colors of light being in the “off” (not illuminated) condition. *See* Ex.1004, Fig.10 (annotated in blue).



Id., Fig.10 (annotated).

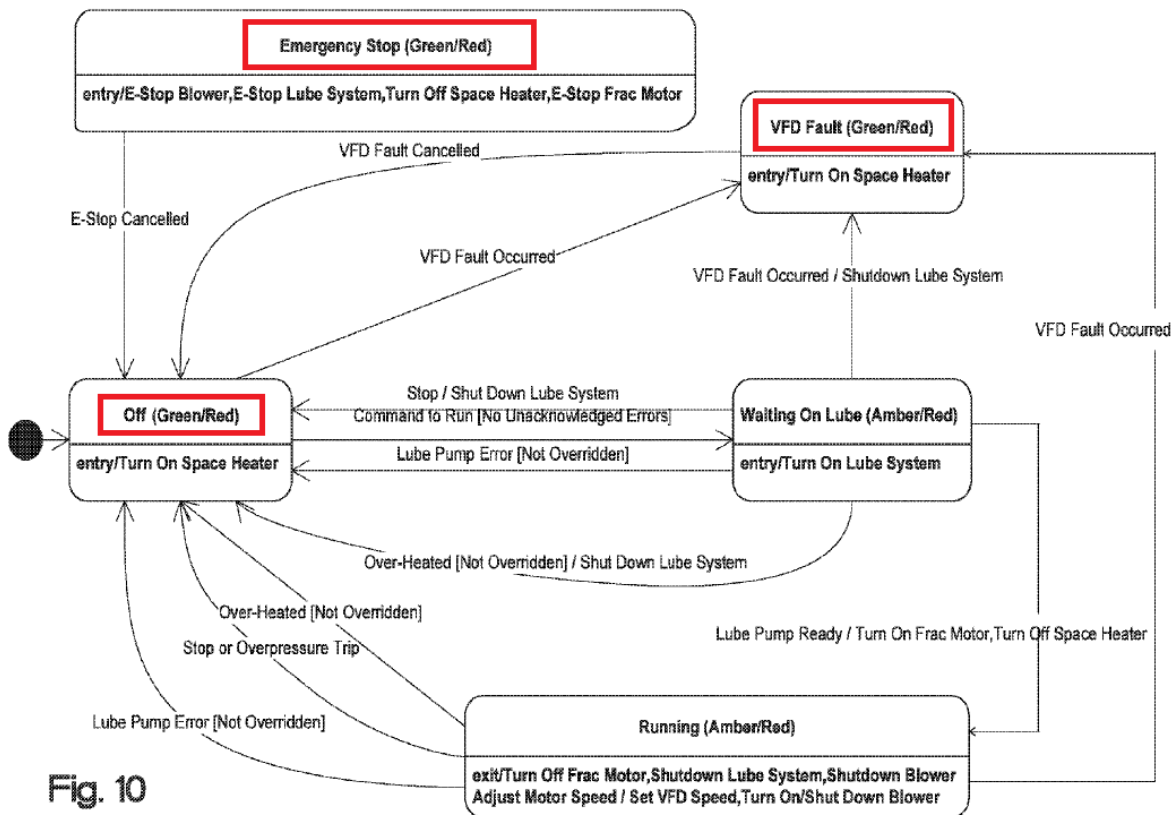
“Color 2” in *Payne* may signal that “frac motor 411a is running OR has been enabled to run,” which is an example of an operational state comprising (ii) “a supply of electricity to all electrically powered devices in the system” as claimed. *Id.* A POSITA would also have understood this operational state from Figure 10. *See id.* Fig. 10; Ex.1002, ¶189 (amber indicates motor/pump running or enabled to run).



In addition to its express disclosure, *Payne* also renders operational state (ii) obvious. *Payne* discloses a “master e-stop” operational state that shuts down electricity to the system, which a POSITA would have understood to include an operational state in

which electricity is supplied to **all** electrically powered devices in the system (e.g., when the master e-stop is not engaged). Ex.1002, ¶189.

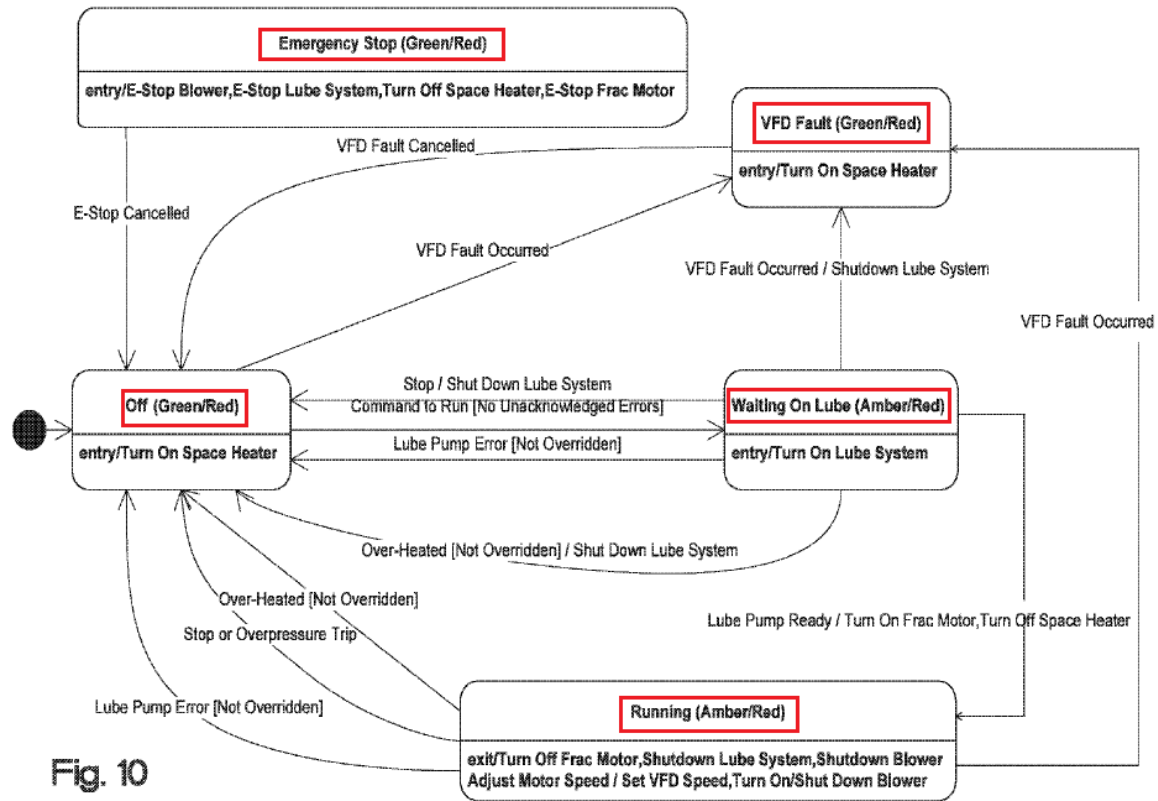
Payne also discloses operational states comprising (iii) “a supply of electricity to some of the electrically powered devices in the system. This includes when some lights are amber (one pump is energized), but other lights are not amber (other pumps are not energized). This operational state also includes when the green light (Color 1) is illuminated as shown in Figure 10.



In this state, electricity is supplied to electrically powered devices such as sensors, the light tower, space heaters, but is not supplied to all electrically powered devices

in the system (*e.g.*, lube pumps, blowers, motor/pump). “Color 1” in *Payne* may signal that “frac motor 411a is not running and is not enabled to run.” *Id.* As another example of operational state (iii), an “e-stop” may be supplied to “stop an entire fracturing pump unit” or a “master e-stop” can “shut down all deployed fracturing pump units 700a-700 (*i.e.* all VFDs and all motors on all trailers, trucks, or skids 20a-20h are shut down).” *Id.* In either instance, electricity is still supplied to some of the electrically powered equipment, such as the sensors and light tower. Ex.1002, ¶191-192; Ex.1004, Fig.10 (“emergency stop (Green/Red)”).

Finally, *Payne* discloses an operational state comprising (iv) “a pressure in a discharge line of the pump having a magnitude that is at least that of a designated pressure,” as claimed. For example, *Payne*’s light tower may display “Color 3” (red) to signal that “the pump discharge pressure for the frac motor 411a is greater than pre-defined psig setpoint.” Ex.1004, [0058], [0062]; *see id.* [0103] (“The beacon light turns red whenever the pump discharge pressure is greater than a pre-defined setpoint.”); Ex.1002, ¶193. This state may be indicated because the current motor/pump unit is running or because other pumps are supplying pressure without the current motor/pump running. Ex.1004, Fig.10 (annotated).



To the extent claim 5 requires visual signals indicative of each of the recited operational states and to the extent *Payne* does not expressly disclose a visual signal indicative of one or more of these operational states, a POSITA would have found it obvious to modify *Payne* to include them. Ex.1002, ¶194. Because *Payne* discloses illuminating lights on the light tower to indicate certain of these operational states, a POSITA would have found it obvious to apply this already-disclosed technique to other operational states. *Id.*; *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007) (“the predictable use of prior art elements according to their established functions” is obvious).

6. Claim 6

- a. **The hydraulic fracturing system of claim 1, further comprising a controller in communication with the variable frequency drive, a pressure indicator that senses pressure in a discharge line of a one of the pumps, and the signal assembly.**

Payne discloses a “programmable automation controller (PAC) configured to receive commands from the system control unit” where “at least one PAC is configured to autonomously monitor operating parameters of the associated system unit.” Ex.1004, claims 7, 11, 20. The PAC and the system control unit, either alternatively or in combination, are a controller. Ex.1002, ¶195; *see* Ex.1004, [0016], [0039], Figs.6-8 (showing communication between control unit and PAC).

At least one PAC and the system control unit are in communication with the claimed VFD. Ex.1002, ¶196. As *Payne* explains, the “VFD process data...can be collected [and] **communicated by a communications channel to the system control unit** to raise an alarm to the user...” Ex.1004, [0109]. Each of the PACs can “receive monitoring data concerning the[se] operating parameters...and [] communicate said monitoring data to the system control unit.” *Id.*, claim 20. Additionally, the PACs communicate with the VFD by “relay[ing] the speed set point from the operator at the HMI to a [VFD].” *Id.* [0039]. A POSITA also would have understood *Payne*’s reference to Toshiba GX7 Rig Drive as a VFD that

includes a controller in communication with the VFD based on *Toshiba's* disclosures regarding the GX7 VFD. *Infra* §VIII.B.3; *see Monsanto*, 878 F.3d at 1345.

Additionally, at least one PAC and the system control unit are in communication with the “pressure sensor that senses pressure in a discharge line of a one of the pumps.” *Payne* discloses that “a pressure transmitter...provides a signal for the pump discharge pressure,” which is “displayed locally [at the PAC] and remotely **at the system control unit.**” *Id.* [0062]; Ex.1002, ¶197. *Payne* further describes that “if the pump discharge pressure exceeds the Overpressure setpoint, the control system stops the frac motor 411a via the RUN/STOP control to the frac VFD 410a,” and “the control system should activate/indicate a shutdown.” Ex.1004, [0062]. A POSITA would have understood that the pressure transmitter must be in communication with one or both of the PAC and the system control unit in order for the control system to perform these functions. Ex.1002, ¶197.

Finally, at least one PAC and the system control unit are in communication with the signal assembly. *Payne's* “light tower” can display colors indicating a particular operational state. Ex.1004, [0058]. This light indication is part of the “control operations” for the fracturing pump units and is driven by the communication with the pressure sensor as described above. *See id.*

A POSITA also would have found it obvious for the controller to be in communication with a signal assembly, because the “light tower” can indicate

different operational states, including power to a motor. *See id.* [0058]; Ex.1002, ¶198. It would be obvious for the PAC to perform the control function of the light tower since the PAC is in communication with both the VFD and pressure sensor and other components of the fracturing unit. Ex.1004, [0052]. Accordingly, the PAC would contain information regarding the various operational states indicated by the light tower, and a POSITA would have found it an obvious choice of devices to control illumination of the light tower. Ex.1002, ¶198.

7. Claim 7

- a. The hydraulic fracturing system of claim 6, wherein the controller selectively activates the signal assembly in response to a communication signal from one of the variable frequency drive or the pressure indicator.**

For the same reasons that *Payne* discloses and/or renders obvious communication between the pressure sensor, VFD, light tower, and PAC (claim 6), *Payne* discloses and/or renders obvious claim 7. *Supra* §VII.A.6.

Payne's beacon light will illuminate "Color 3: the pump discharge pressure the frac motor 411a is greater than a pre-defined psig setpoint." Ex.1004, [0058]; see *id.*, [0103]. A POSITA would have understood that the pressure sensor is in communication with the controller, and that the controller would activate Color 3 (red) in response to the pressure sensor communicating a pressure which was above a pre-defined setpoint. Ex.1002, ¶199.

A POSITA would also have understood *Payne*'s reference to Toshiba GX7 Rig Drive as a VFD to disclose [7] based on what *Toshiba* discloses that VFD to include. *Infra* §0; see *Monsanto*, 878 F.3d at 1345.

8. Claim 8

- a. **The hydraulic fracturing system of claim 1, wherein the visual signal comprises light in the visible spectrum, and that is optically detectable by operations personnel disposed in a zone that is potentially hazardous due to fluid in piping that is pressurized by at least one of the pumps.**

Payne renders this claim obvious.

The beacon lights on *Payne*'s light tower illuminate colors (red, green, and amber) that are in the visible spectrum and are optically detectable. See Ex.1004, [0058], [0103], Fig. 10; Ex.1002, ¶200. *Payne*'s system allows "an operator to focus on primary objectives, that is, **pumping rates and pressures, while ensuring safe operation across multiple pumping units.**" Ex.1004, [0055], [0103] ("The beacon light turns red whenever the **pump discharge pressure** is greater than a pre-defined setpoint."). In other words, the beacon lights signal to operations personnel from a safe distance that there is a "potentially hazardous zone" due to "fluid in piping that is pressured by at least one of the pumps." Ex.1002, ¶¶200-201.

9. Claim 9

- a. **9[pre] A hydraulic fracturing system for fracturing a subterranean formation comprising:**

See 1[pre]. Ex.1002, ¶203.

- b. 9[a] a pump having a discharge in communication with a wellbore that intersects the formation;**

See 1[a]. Ex.1002, ¶204.

- c. 9[b] an electric motor coupled to and that drives the pump;**

See 1[a]. 1002, ¶205 (citing Ex.1004, [0039]).

- d. 9[c] a variable frequency drive connected to the electric motor that controls a speed of the motor and performs electric motor diagnostics;**

See 1[b]-1[c]. Ex.1002, ¶206.

- e. 9[d] a signal assembly that selectively emits different visual signals that are distinctive of an operational state of the system; and**

See 1[d]. Ex.1002, ¶207.

- f. 9[e] a controller in communication with the signal assembly, and that selectively transmits a command signal to the signal assembly in response to a monitoring signal received by the controller and transmitted from a device in the system.**

See Claims 6-7. Ex.1002, ¶208.

10. Claim 10

- a. The hydraulic fracturing system of claim 9, wherein the device in the system that transmits the monitoring signal to the controller comprises one of the variable frequency drive, and a pressure monitor in fluid communication with the discharge of the pump.**

See Claim 6. Ex.1002, ¶209.

11. Claim 11

- a. **The hydraulic fracturing system of claim 9, wherein the signal assembly comprises a stack of light assemblies.**

See Claim 2. Ex.1002, ¶210.

12. Claim 12

- a. **The hydraulic fracturing system of claim 11, wherein the light assemblies each comprise an electrically powered light source, and that each emit light of a color that is different from a color of a light emitted by the other light assemblies.**

See Claim 3. Ex.1002, ¶211.

13. Claim 13

Payne renders this claim obvious. Ex.1002, ¶¶212-219.

- a. **13[a] The hydraulic fracturing system of claim 9 further comprising a pump controller and auxiliary equipment, and**

Payne discloses that a PAC and the system control unit, either alternatively or in combination, are a controller. *See* [6]. *Payne*'s PAC controls the VFD, which controls the pump. Specifically, the PAC communicates with and can shut off the VFD. Ex.1004, [0039]. The VFD controls the pump by “provid[ing] the ac current” for the “mechanically coupled motor and fracturing pump.” *Id.*; Ex.1002, ¶212. *Payne* further explains that a PAC receives commands from the system control unit. Ex.1004, cls. 7, 11, 20. A POSITA would therefore have understood that the PAC and system control unit, either alternatively or in combination, are a pump controller.

Ex.1002, ¶212. *Payne* also discloses a “hydraulic fracturing pump unit controller” as a pump controller. Ex.1004, [0016]; Ex.1002, ¶212.

Payne also discloses auxiliary equipment, such as the frac motor’s space heater. *Id.* [0057]. Other examples include an “**auxiliary trailer, truck or skid**” that houses the “blender/hydration transformer units,” and “blender/hydration control systems.” Ex.1004, [0044]; *see id.* [0045], [0048], Fig. 4.

- b. **13[b] wherein the operational state of the system comprises, [(i)] the system being isolated from electricity, [(ii)] a fluid pressure of the discharge having a value at least as great as a designated value, [(iii)] the pump drive being energized, and [(iv)] the auxiliary equipment being energized but without a one of the motors being energized.**

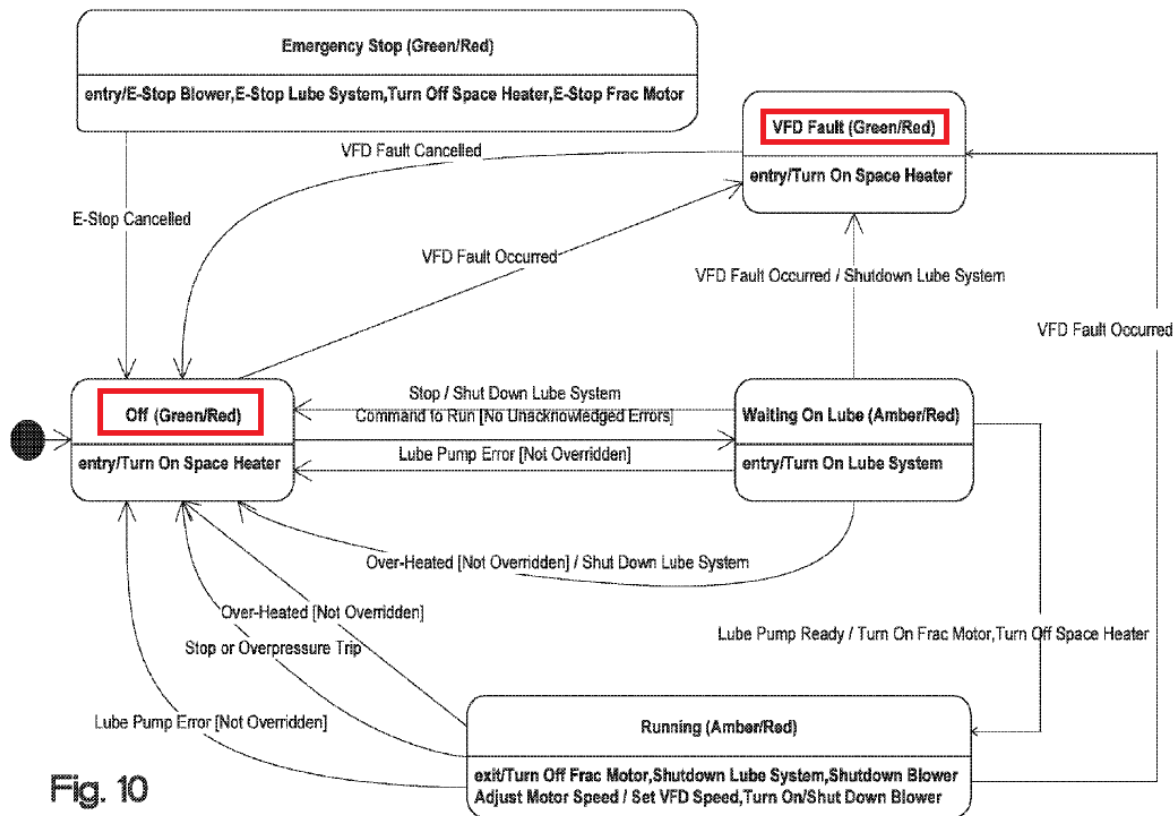
Payne discloses an operational state of the system comprising (i) the “system being isolated from electricity.” *Supra* §VIII.A.5.

Payne also discloses an operational state comprising (ii) “a fluid pressure of the discharge having a value at least as great as a designated value.” *Supra* §VIII.A.5. *Payne* explains that the “pump discharge pressure is displayed...at the system control unit” and “Color 3” on the light tower signals that “the pump discharge pressure for the frac motor 411a is greater than pre-defined psig setpoint.” *Id.* [0058], [0062]; *see id.* [0103] (“the beacon light turns red whenever the pump discharge pressure is greater than a pre-defined setpoint”).

A POSITA would have found it obvious given *Payne*'s disclosures that the operational state may comprise (iii) "the pump drive being energized". A POSITA would have recognized that *Payne*'s VFD controls the motor and pump, *i.e.*, a "pump drive." Ex.1002, ¶218; Ex.1004 [0014], [0039], [0053] ("[T]he frac motor 411a of a fracturing pump 710a is controlled by a frac VFD 410a. The control system provides a RUN/STOP signal to the VFD 410a to control the status of the frac motor 411a."). The pump drive is energized, as indicated by illumination of the amber light (Color 2), which indicates the "frac motor 411a is running OR has been enabled to run." Ex.1004, [0058]. The amber light would also indicate that the control system sent a control signal to the VFD to start the frac motor and the mechanically-coupled pump. Ex.1002, ¶218 (citing Ex.1004, Figs.10-12). Additionally, *Payne* discloses that a "normal stop (RUN/STOP) will control each fracturing pump unit 700a independently (for example, a first fracturing pump 710a and a second fracturing pump 710b on the same frac trailer, truck, or skid 20a will each be controlled independently)." Ex.1004, [0054].

Finally, *Payne* discloses an operational state comprising (iv) "the auxiliary equipment being energized but without a one of the motors being energized". *Payne*'s space heaters are "energized for at least 24-hours before running the motor." Ex.1004, [0057]. When the heater is in AUTO mode, "the heater is turned on when

the control system is energized and the pump-motor is OFF.” *Id.*; *see id.* Fig.10 (annotated, green light illuminated); Ex.1002, ¶219.



14. Claim 14

- a. The hydraulic fracturing system of claim 9, wherein the visual signals selectively indicate when the system is safe for operations personnel, when the system is potentially unsafe for operations personnel, and when the system is currently unsafe for operations personnel.

Payne renders claim 14 obvious. For example, *Payne*’s automated alarm management system operates to overlay an indicator at the system control unit to alert an “operator” if “any operating parameters exceeds its normal range.” Ex.1004,

[0055]. This alarm management system allows the “operator to focus on primary objectives, that is, pumping rates and pressures, **while ensuring safe operation** across multiple pumping units.” *Id.*

The lights in *Payne*’s “light tower” can indicate a distinctive operational state of the system by illuminating a specific combination of lights in that assembly. Ex.1004, [0058]. For example, the combination of amber and red lights illuminated indicates that the motor/pump is in a running state, and the discharge pressure is above the designated setpoint. Ex.1002, ¶¶221-222. This would indicate maximum danger to personnel in the area, corresponding to a condition where “the system is currently unsafe.” Ex.1002, ¶222. If all lights are off signals personnel in the area that the system was in a “safe” state, *i.e.*, no electricity present and no pressure in the discharge piping. Ex.1002, ¶223.

Payne’s light tower indicates several other operational states that are potentially unsafe for operations personnel, including a condition where the motor/pump systems are not running, but there is still an elevated pressure trapped in the discharge piping system (indicated by combination of green and red lights), and electricity is being delivered either to all or some of the electrical components, but that pressure in the discharge piping had not yet exceeded the psig setpoint (indicated by combination of a green or amber light with red light being “off”). Ex.1002, ¶¶224-225.

In view of these disclosures, a POSITA would have found it obvious that *Payne*'s light tower also could visually indicate to an operator whether the system is safe, potentially unsafe, or currently unsafe for operations personnel—particularly in light of *Payne*'s stated objective of “**ensuring safe operation across multiple pumping units.**” *Id.* [0058]; *see id.* [0039] (“[T]he PAC also acts as a safety device. If an unsafe condition is detected...the PAC can independently override the remote operator's command and take whatever action is appropriate....”); Ex.1002, ¶226.

15. Claim 15

- a. 15[pre] A method of fracturing a subterranean formation comprising:**

See 1[pre]; Ex.1002, ¶228.

- b. 15[a] pressurizing fracturing fluid with a pump;**

See 1[a]; Ex.1002, ¶229.

- c. 15[b] driving the pump with a motor that is powered by electricity;**

See 1[a]; Ex.1002, ¶230.

- d. 15[c] controlling the speed of the motor with a variable frequency drive,**

See 1[b]; Ex.1002, ¶231.

- e. 15[d] the variable frequency drive further performing electric motor diagnostics;**

See 1[c]; Ex.1002, ¶232.

f. **15[e] monitoring an operational state of a hydraulic fracturing system that comprises the pump and motor; and**

Payne discloses “monitoring operating parameters of the individual electrical motors” of a fracturing system. Ex.1004, claim 36. *Payne* also discloses that a programmable automation controller (PAC) is configured to “autonomously **monitor operating parameters** of [its] associated system unit,” referring to the “**hydraulic fracturing pump unit**, hydraulic blender unit and hydration unit.” *Id.*, claims 7, 11. Although the pump unit includes “fluid pumps” driven by a motor and a VFD to control the motor, *see id.*, claim 1, *Payne* specifies that “multiple processes and subsystems on each pumping unit can be monitored autonomously,” which gives the operator information on “**pumping rates and pressures.**” *Id.* [0054]. A POSITA would have understood *Payne*’s reference to Toshiba GX7 Rig Drive as a VFD to disclose 15[e] based on what *Toshiba* discloses that VFD to include. *Infra* §VIII.B.6.c; *see Monsanto*, 878 F.3d at 1345.

Additionally, *Payne* discloses or renders obvious a signal assembly that emits a visual signal indicative of an operational state of the fracturing system. *See* 1[d]. A POSITA would have understood that the signal assembly could not emit such visual signals without first “monitoring an operational state.” Ex.1002, ¶234.

Finally, a POSITA would have understood from *Payne*’s Figures 10-12 (state charts) that “the automatic and/or manual control operations of one or more of the

hydraulic fracturing pump units...may be controlled accordingly.” Ex.1004, [0102]-[0103], Figs.10-12. A POSITA would have understood that the control system therefore monitors the operational state of the system to determine, for example, what action to take next or what light color to illuminate. Ex.1002, ¶235.

- g. 15[f] selectively emitting a visual signal that is indicative of the monitored operational state.**

See 1[d]; Ex.1002, ¶236.

16. Claim 16

- a. The method of claim 15, wherein the operational state comprises the system being isolated from electricity, a fluid pressure of discharge of the pump having a value at least as great as a designated value, a pump controller being energized, and auxiliary equipment being energized but without a one of the pump motors being energized.**

See 13[b]; Ex.1002, ¶237 (“A POSITA would understand in this context a ‘pump drive’ and a ‘pump controller’ to be equivalent....”) (citing Ex.1004, [0039], [0053]). Alternatively, *Payne* discloses a “hydraulic fracturing pump unit controller” as a pump controller. Ex.1004, [0016].

17. Claim 17

- a. The method of claim 15, wherein the step of selectively emitting a visual signal comprises emitting a light from one or more of a stack of light assemblies, where light from one of the stack of light assemblies is different from lights emitted from other light assemblies.**

See claim 3; Ex.1002, ¶235. Further, as with claim 5, *Payne* discloses a light assembly associated with each pump/motor/VFD. *Id.* Accordingly, a POSITA would have recognized that, when one motor/pump is operating and another is “off”, the color of light emitted by the associated light towers would be different (*i.e.*, “amber” and “green”). *Id.*

18. Claim 18

a. 18[a] The method of claim 15, further comprising monitoring electricity to a variable frequency drive,

Payne renders this limitation obvious. *Payne*’s VFD “provides ac current” (*i.e.*, electricity), “which turns the mechanically coupled motor and fracturing pump.” Ex.1004, [0039]. *Payne*’s light tower may emit one color when a frac motor is running or has been enabled to run and another color when a frac motor is not running and has not been enabled to run. *Id.* [0058], Fig. 10. A POSITA would have found it obvious to monitor electricity to a VFD to determine whether the VFD is running in order to signal whether the frac motor (which receives electricity from the VFD) is running. See *id.* [0039] (“The PAC relays the speed set point from the operator at the HMI to a variable frequency drive (VFD).”); [0054] (e-stop is used to stop the VFDs); Ex.1002, ¶¶239-240.

A POSITA also would have understood *Payne*’s reference to Toshiba GX7 Rig Drive to disclose 18[a] based on what *Toshiba Manual* discloses that VFD to include. *Infra* §VIII.B.7.a; see *Monsanto*, 878 F.3d at 1345.

- b. 18[b] wherein the variable frequency drive controls electricity to the motor.**

Payne discloses or renders obvious that the VFD is “connected to the electric motor to control the speed of the motor.” *See* 1[b]. *Payne* further discloses that the ac current “**turns the mechanically coupled motor** and fracturing pump.” Ex.1004, [0049]; *see id.* [0047], [0053] (“[T]he **frac motor** 411a of a fracturing pump 710a is **controlled by a frac VFD** 410a.”). In other words, the VFD also controls electricity to the motor.

19. Claim 19

- c. The method of claim 15, further comprising monitoring a fluid pressure of discharge of the pump.**

See claims 6 and 10. Ex.1002, ¶244.

B. Ground 3A: Claims 1-19 Are Rendered Obvious by *Payne* and *Toshiba*

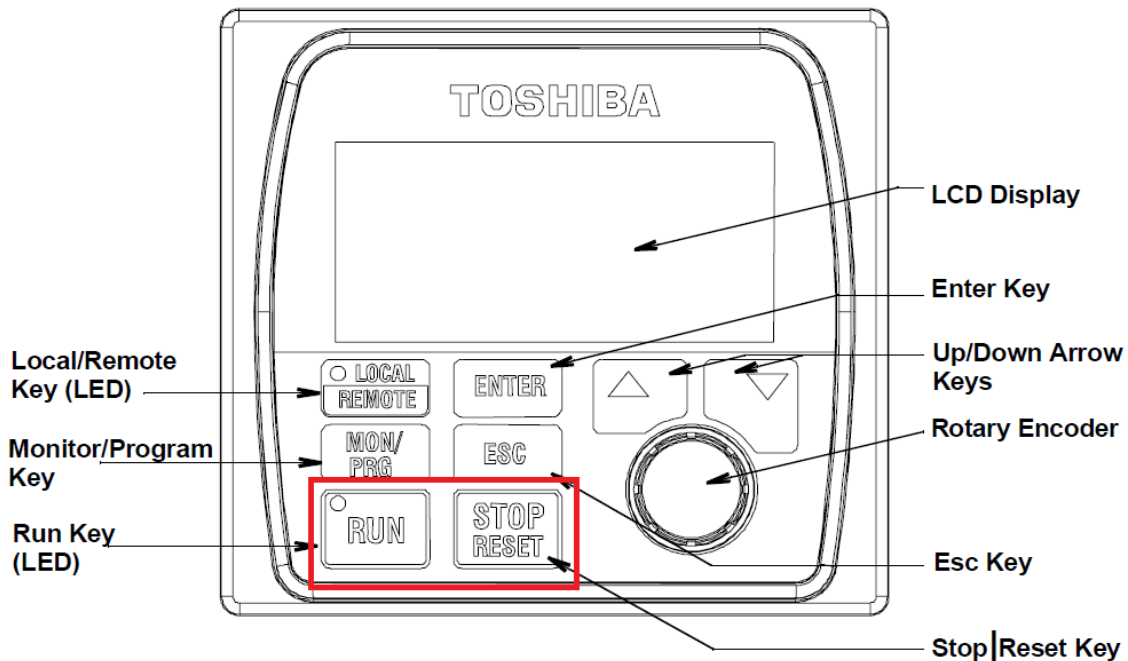
The combination of *Payne* and *Toshiba* discloses and/or suggests all limitations of claims 1-19, thereby rendering these claims obvious. Ex.1002, ¶245. To the extent *Payne* alone does not anticipate or render obvious claims 1-19, this ground is presented as an alternative to Grounds 1-2. The relevant limitations disclosed by *Toshiba* are presented below. All other elements of claims 1-19 are disclosed or rendered obvious by *Payne* as described above in Grounds 1-2.

1. Payne Provides an Express Motivation to Combine with *Toshiba*

Payne's fracturing pump unit includes a VFD for driving a frac motor. *See* Ex.1004, [0047]. *Payne* lists several brands and models of VFDs to use in its fracturing system. *Payne* lists the "Toshiba GX7 Rig Drive 1750HP, 600V, 1700 AMP 6-pulse Variable Frequency Drive" as an example of the VFD for the fracturing pump units. Ex.1004, [0122]; *see id.* [0123], [0125].

Toshiba is the manual for the G7 and GX7 drives, the latter of which is the specific model at issue in *Payne*. Ex. 1005; Ex. 1002, ¶¶246-247. *Toshiba* describes how the GX7 VFD controls an electric motor. Ex.1005 at 2; *see id.* at 65 ("ability to allow the user direct access to the motor control functions."). Therefore, *Payne* provides an express motivation for a POSITA to combine it with *Toshiba*. Ex.1002, ¶¶248-249.

Additionally, a POSITA would have been motivated to combine *Toshiba* with *Payne* because *Payne* discusses a "RUN/STOP" feature to control the individual pumps. Ex.1002, ¶¶248-249; Ex.1004, [0053]-[0054], [0062]. *Toshiba*'s Figure 19 depicts the Electronic Operator Interface (EOI) with a "RUN" button and a "STOP" button, which the manual refers to as Run/Stop. Ex.1005, 37. This is further evidence that *Payne* incorporated features from the GX7.



Ex.1005, Fig.19 (annotated).

Likewise, a POSITA would have a reasonable expectation of success in combining *Payne* with *Toshiba* because VFD technology was well-known before the '871 Patent and *Payne* directly refers to the GX7 drive that is the subject of *Toshiba*. Ex.1002, ¶250. *Toshiba* dates back to 2005 (see Ex.1006) and expressly teaches basic features that a POSITA would have already implemented in *Payne*. The results of the combination would have been predictable and obvious to a POSITA. Ex.1002, ¶250.

2. Claim 1

a. 1[b]

See §VIII.A.1.c.

Toshiba discloses an “Adjustable Speed Drive” or VFD, Ex.1005 at 2; Ex.1002, ¶252 that controls a motor, such as those that drive a pump. *See* Ex. 1005 at 13 (“[t]he output terminals of the ASD...must be connected to the motor that is to be controlled”); *id.* at 71 (describing prevention of “motor overload trips when used on fans, blowers, pumps, and other centrifugal loads which require less torque at lower frequencies”). As the term suggests, the “Adjustable Speed Drive” is used to control the speed of the motor. *Id.* at 2; Ex.1002, ¶252.

b. 1[c]

As discussed above, it would have been obvious to a POSITA (and indeed *Payne* discloses) to use the *Toshiba* VFD as the VFD in *Payne* so that the VFD controlling the motor that powers the pump would perform motor diagnostics to prevent damage to the motor. *Supra* §VIII.A.1.d; Ex.1002, ¶253.

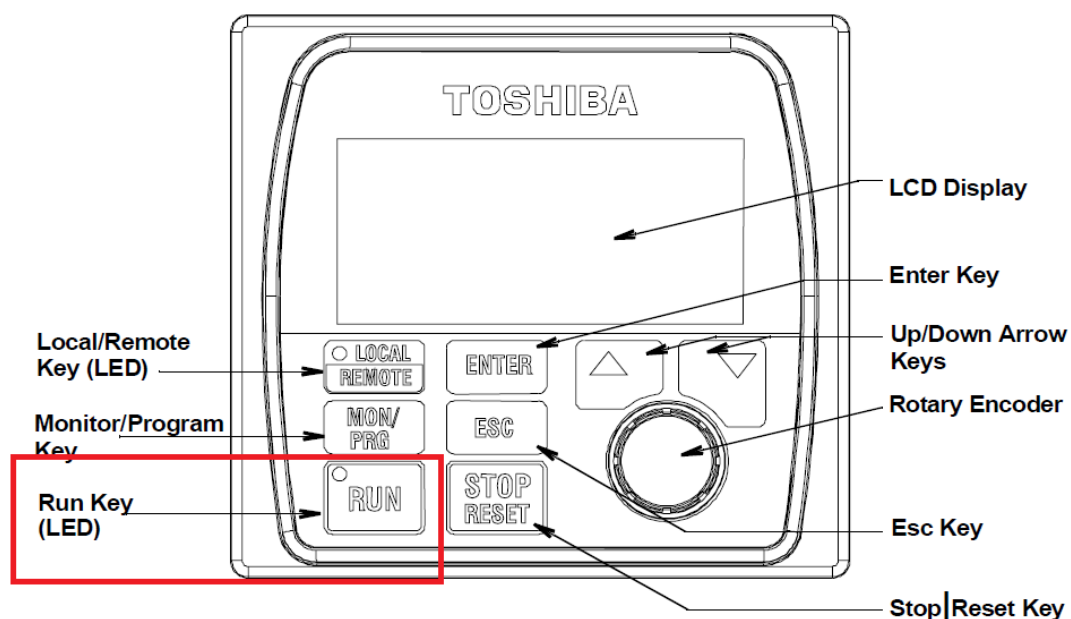
Toshiba discloses operating a VFD that can “perform diagnostics.” Ex.1005 at 43. The diagnostics includes a “fault screen” that “identifies the active Fault.” *Id.* at 182-86 (Table 12, containing a list of 5 pages of faults that are diagnosed). The VFD performs electric motor diagnostics to prevent damage to the electric motor, including protecting against overload, overcurrent, overtorque, short circuit, and earth faults. *Id.* at 19, 22, 160-63, 165; Ex.1002 ¶254.

c. 1[d]

See §VIII.A.1.e.

Toshiba discloses an “Electronic Operator Interface (EOI)” that includes “an LCD display, two LEDs, a rotary encoder, and eight keys.” Ex.1005, 42. The EOI’s “Run Key” LED “illuminates green while stopped or red while running.” *Id.* at 42, Fig.19. In other words, the “Run Key” LED emits a visual signal indicating whether the electric motor (and thus a pump connected to it) is running. *Id.*; Ex.1002, ¶255.

Figure 19. The G7 Electronic Operator Interface.



Ex.1005, Fig.19 (annotated).

3. Claim 6

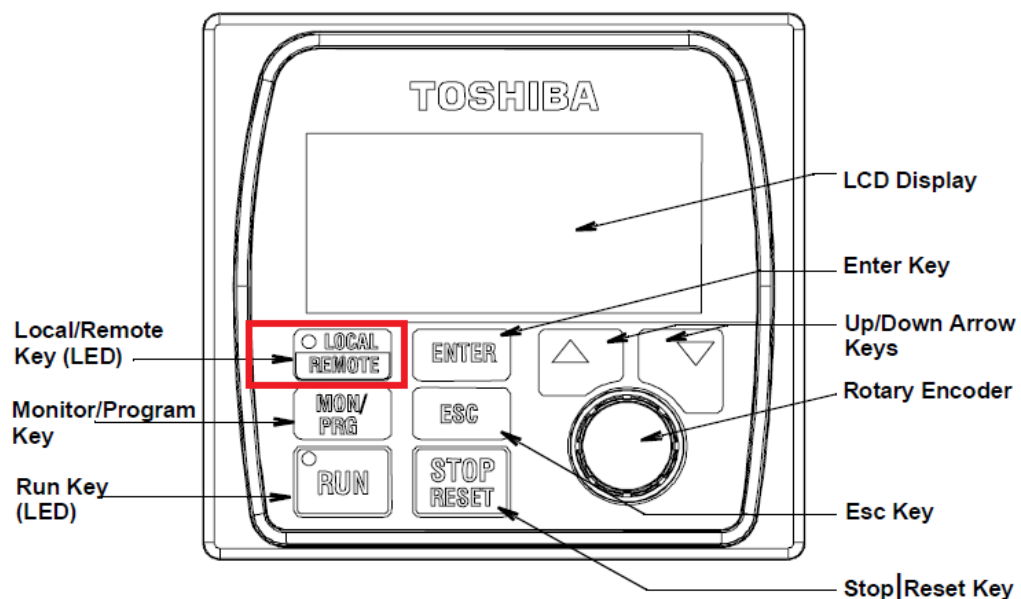
See §VIII.A.6.

Toshiba discloses a “**communications network**” that includes other ASDs and Host/Control computers (a controller) that “**monitor the status of the ASD(s)**, transfer commands, and loads or modifies the parameter settings of the ASD.” Ex.1005 at 73. Because the Host/Control computers “monitor the status of the

ASD(s)” and form a communications network with the ASDs, a POSITA would have understood *Toshiba* to disclose “a controller in communication with the variable frequency drive” as claimed. Ex.1002, ¶257.

Toshiba discloses operating a VFD remotely and from a local controller. Ex.1005, 22 (“Local/Remote Operation”), 42-43.

Figure 19. The G7 Electronic Operator Interface.



Id., Fig.19 (annotated).

A POSITA would have understood that this remote control could be used with the VFD of *Payne*, which describes “a data van or system control center 50 [for] an operator to remotely control all systems from one location.” Ex.1004, [0044].

4. Claim 7

Payne discloses that the controller selectively activates the signal assembly in response to a communication signal from the pressure indicator. See §VIII.A.7.

Toshiba further discloses that a communication signal may come from the VFD. *See* §VIII.B.3 (claim 6); Ex.1005 at 65 (“The G7 ASD allow[s] the user direct access to the motor control functions.”). Thus, a POSITA would have found it obvious to incorporate *Toshiba*’s communication signal from the VFD into *Payne*’s controller that selectively activates the signal assembly in response to a communication signal, at least to reduce and/or coordinate the hardware needed for the system. Ex.1002, ¶259. *Payne*’s alarm management system, like a signal assembly, can “ensur[e] safe operation” of the fracturing system. *See* Ex.1004, [0058]. Allowing the controller to activate the signal assembly in response to a VFD communication signal furthers *Payne*’s goal of promoting safe operations. Ex.1002, ¶260. For example, *Toshiba* explains that the VFD controls the motor, and *Payne*’s signal assembly can indicate whether the motor is or is not running, which can indicate whether operating conditions are safe. *See* Ex. 1005 at 13; Ex.1004, [0058], [0103]; §VIII.A.14.

5. Claim 9

a. 9[c]

See 1[b]-1[c]; Ex.1002, ¶262.

6. Claim 15

a. 15[c]

See 1[b]; Ex.1002, ¶264.

b. 15[d]

See 1[c]; Ex.1002, ¶265.

c. 15[e]

See §VIII.A.15.f.

Toshiba further discloses that the VFD’s “Monitor mode” “allows the user to **monitor motor performance variables, control settings, and configuration data during motor operation**”. Ex.1005 at 51. Additionally, *Toshiba*’s Electronic Operator Interface (EOI) “may be used to **monitor system functions**” for the VFD, which controls the motor. *Id.* at 43. Further, *Toshiba*’s EOI includes a “Run Key Status LED” that “Illuminates green while stopped or red while running.” Ex.1005, 42. To display the motor’s “stopped” or “running” state, the motor’s operational state must be monitored. Ex.1002, ¶267.

As explained in §VIII.A.13.b, the VFD controls electricity to the motor and the mechanically-coupled fracturing pump. By monitoring the “system functions”, “motor performance variables, control settings and configuration data,” and “stopped” or “running” state of the motor, the VFD monitors the operational state of the motor and the mechanically-coupled pump, and consequently, the fracturing system. Ex.1002, ¶¶268-269.

7. Claim 18

a. 18[a]

See §VIII.A.18.a.

The “Monitor Mode” of Toshiba’s VFD “allows the user to **monitor motor performance variables, control settings, and configuration data during motor operation.**” Ex.1005 at 51. Among the variables that may be monitored are “Input Power” and “Output Power,” (*i.e.*, electricity). *Id.*; Ex.1002, ¶271.

C. Ground 3B: Claims 1-19 Are Rendered Obvious by *Payne* and *Broussard*

The combination of *Payne* and *Broussard* discloses and/or suggests all limitations of claims 1-19, thereby rendering these claims obvious. Ex.1002, ¶272. To the extent *Payne* alone does not anticipate or render obvious claims 1-19, this ground is presented as an alternative to Grounds 1-2. The relevant limitations disclosed by *Broussard* (a VFD that is “connected to the electric motor to control the speed of the motor” and “frequently performs electric motor diagnostics”) are discussed below. All other elements of claims 1-19 are disclosed or rendered obvious by *Payne* as described above in Grounds 1-2.

1. A POSITA Would Have Been Motivated to Combine *Payne* and *Broussard*

Payne discloses a fracturing pump unit driven by an electrical fracturing motor, where a VFD controls the motor. *See* Ex.1004, [0014]-[0015], [0047]. Specifically, *Payne*’s VFD controls the speed of the motor. *Id.* [0053]. *Broussard* discloses further details about these features. *See* Ex.1007.

Like *Payne*, *Broussard* relates to hydraulic fracturing systems and describes that fracturing pumps driven by electric motors are well-known in the art. Ex.1007, 1:9-11, 1:35-37. *Broussard* further describes that the speed of those electric motors are controlled by VFDs. *See id.* 1:54-56, 2:2-4, 3:39-42, 4:26-32.

A POSITA would have been motivated to use the VFD of *Broussard* as the VFD in *Payne*, or to enhance the *Payne* VFD with the features taught by *Broussard*. Ex.1002, ¶¶273-275. Both *Payne* and *Broussard* disclose similar functions of a VFD (e.g., controlling the speed of electric motors) in the same field (i.e., hydraulic fracturing pumps). A POSITA would have recognized that combining *Payne* and *Broussard* is a simple substitution of one known element for another to obtain predictable results. *See, e.g., Agrizap*, 520 F.3d at 1344 (“The asserted claims simply substitute a resistive electrical switch for the mechanical pressure switch employed by the Gopher Zapper.”). A POSITA would have had a reasonable expectation of success in combining *Payne* with *Broussard* for the same reason. Ex.1002, ¶¶273-275.

2. Claim 1

a. 1[b]

See §VIII.A.1.c. *Broussard* also discloses a VFD “connected to the electric motor to control the speed of the motor.” Ex.1007, [0009], [0012], cls. 8, 19.

b. 1[c]

See §VIII.A.1.d. *Broussard* also discloses that the “variable frequency drive frequently performs electric motor diagnostics to prevent damage to the at least one electric motor.” Ex.1007, cl. 15; *see id.*, [0011], [0021].

3. Claim 9

a. 9[c]

See 1[b]-1[c]; Ex.1002, ¶281.

4. Claim 15

a. 15[c]

See 1[b]; Ex.1002, ¶283.

b. 15[d]

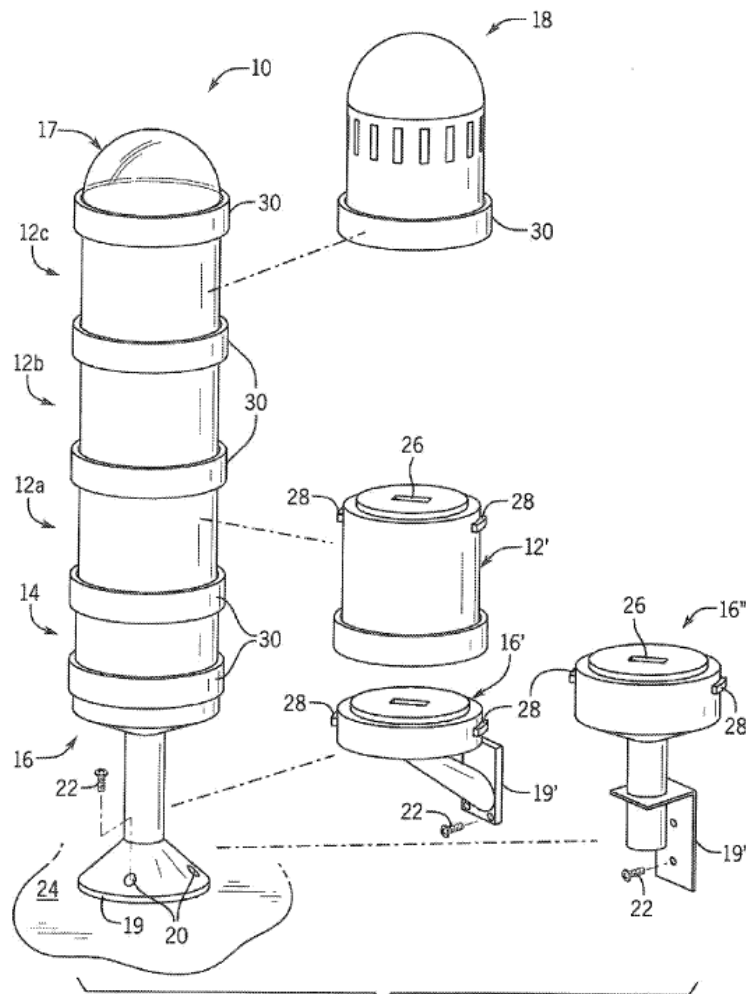
See 1[c]; Ex.1002, ¶284.

D. Ground 4: Claims 2-4, 11-12, 17 Are Rendered Obvious by *Payne* and *Feller*

The combination of *Payne* and *Feller* discloses and/or suggests all limitations of claims 2-4, 11-12, 17, thereby rendering these claims obvious. Ex.1002, ¶285. To the extent *Payne* alone does not anticipate or render obvious these claims, this ground is presented as an alternative to Grounds 1-2. The relevant limitations disclosed by *Feller* (a “signal assembly”) are discussed below. All other elements of the claims are disclosed or rendered obvious by *Payne* as described above in Grounds 1-2.

1. A POSITA Would Have Been Motivated to Combine *Payne* and *Feller*

Payne's "light **tower**" for each pump in its fracturing pump unit includes "**beacon** lights" that emit different colors based on different conditions of the pump, motor, or VFD. Ex.1004, [0058], [0103], Fig. 10. Like *Payne*, *Feller* discloses "stack lights" made of "**beacon** modules" that "may comprise a short **tower** of different colored lamps." Ex.1008, [0001]-[0003], [0039], Fig. 1.



Ex.1008, Fig.1.

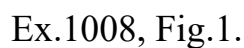
Feller's stack lights are attached or in close proximity to the equipment "to provide a visible indication of the equipment operating status." Ex.1008, [0002].

A POSITA would have been motivated to modify *Payne* by substituting *Payne*'s light tower with *Feller*'s stack lights. Ex.1002, ¶¶286-288. Both *Payne* and *Feller* disclose a signal assembly with similar functions, *i.e.*, to visually signal the operational status of industrial equipment using a tower of lights. Combining *Feller* with *Payne* also furthers *Payne*'s purpose to "**ensur[e] safe operation**" of the fracturing system. Ex.1004, [0055]. *Feller*'s "stack lights" can be used to convey "**warning information**," which may be related to the safety of the industrial equipment. Ex.1008, [0001]-[0002]; *see* Ex.1004, [0055], [0103]; *supra* §VIII.A.14. A POSITA would, therefore, be motivated to combine *Payne* with *Feller* with a reasonable expectation of success, because the combination represents nothing more than the substituting one known element (*Payne*'s light tower) with another (*Feller*'s stack lights) to obtain predictable results. *See, e.g., Agrizap*, 520 F.3d at 1344; *see also* Ex.1002, ¶288 (noting *Feller*'s stack lights work with voltages provided by *Payne*'s transformers, citing Ex.1004, Figs.3-4 and Ex.1008, [0058]).

2. Claim 2

See §VIII.A.2.

Feller's Figure 1 (below) depicts a short tower of lights in a stack, "assembled of multiple interlocking beacon modules 12a, 12b, 12c." Ex.1008, [0039], Fig.1



See §VIII.A.2.

Ex.1008, [0002]. Additionally, the beacon modules “may be offered in different colors (e.g. green, red, amber, blue, clear, and yellow),” that “allow multiple types of information to be communicated....” *Id.* [0002], [0007]; Ex.1002, ¶292.

4. Claim 4

See §VIII.A.2.

Feller’s stack lights may be used to “provide a visible indication of the **equipment operating status.**” Ex.1008, [0002]; *see id.* [0001] (stack lights “convey **operation and warning information** in an industrial environment”). Moreover, “[d]ifferent colors of the lights allow multiple types of information to be communicated at a distance in a possibly noisy environment.” *Id.* [0002]. “For example, a red light may indicate a machine failure or emergency, a yellow light may indicate a warning such as over-temperature or over-pressure and green may indicate machine operation, etc.” *Id.* A POSITA would have understood that *Feller* discloses a signal assembly that indicates a distinctive operational state of the system using the light assemblies. Ex.1002, ¶294.

Additionally, *Feller* discloses illuminating a combination of the light assemblies. The signals to the stack lights in *Feller* may be modulated “according to a desired pattern set by [a] user.” Ex.1008, [0062]; *see id.* [0063] (modulation pattern “provide[s] synchronized flashing of any active beacon modules 12.”). For example, Figures 5a and 5b illustrate how the lights may be activated in “a round-robin

‘marquee’ pattern” or “a ‘stacked’ pattern”, creating different combinations to indicate different states. *Id.* [0065]-[0066], Figs.5a-b; Ex.1002, ¶¶295-296.

FIG. 5a

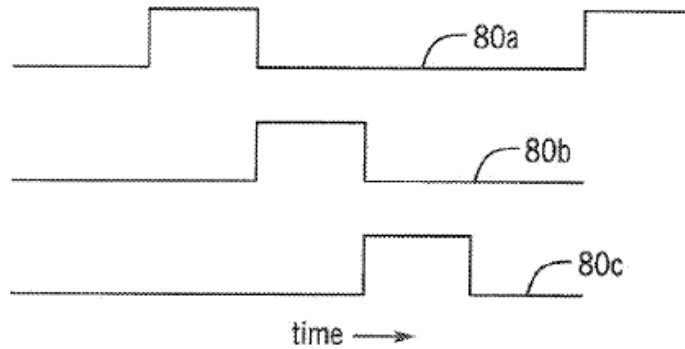
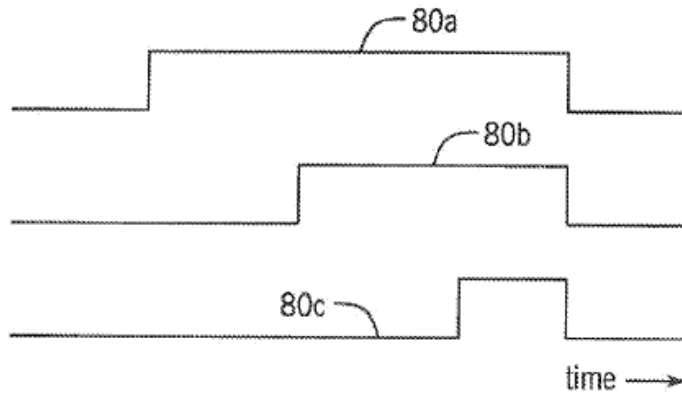


FIG. 5b



Ex.1008, Figs.5a-5b.

5. Claim 11

See Claim 2; Ex.1002, ¶297.

6. Claim 12

See Claim 3; Ex.1002, ¶298.

7. Claim 17

See Claim 3; Ex.1002, ¶299.

E. Grounds 4A and 4B: Claims 2-4, 11-12, 17 Are Rendered Obvious by *Payne, Toshiba, and Feller* (4A) and by *Payne, Broussard, and Feller* (4B)

The combination of *Payne* and *Feller* discloses and/or suggests all limitations of claims 2-4, 11-12, 17, thereby rendering these claims obvious. Ex.1002, ¶300. To the extent Grounds 3A and 3B do not render these claims obvious, these grounds are presented as alternatives.

1. A POSITA Would Have Been Motivated to Combine *Payne, Toshiba, and Feller* or *Payne, Broussard, and Feller*

A POSITA would have been motivated to combine *Feller* with *Payne* and *Toshiba* or *Payne* and *Broussard* for the same reasons a POSITA would have been motivated to combine *Feller* with *Payne* and/or *Payne-Toshiba*. *Supra* §§VIII.D.1, VIII.C.1, VIII.B.1; Ex.1002, ¶¶301-302. The addition of *Toshiba* or *Broussard*, each of which disclose use of a VFD, would not affect a POSITA's motivation to combine *Feller* with *Payne*, because *Feller*'s signal assembly does not affect the use of a VFD. *Id.*

2. Claims 2-4, 11-12, 17

See §VIII.D (addressing claims); Ex.1002, ¶303.

F. Ground 5: Claims 5, 13, 16 Are Rendered Obvious by *Payne* and *Wiemers*

The combination of *Payne* and *Wiemers* discloses and/or suggests all limitations of claims 5, 13, and 16, thereby rendering those claims obvious. Ex.1002,

¶304. To the extent *Payne* alone does not anticipate or render obvious these claims, this ground is presented as an alternative to Grounds 1-2.

1. A POSITA Would Have Been Motivated to Combine *Payne* and *Wiemers*

Payne's fracturing pump unit includes a VFD for controlling an electrical motor. *See* Ex.1004, [0047]. Those motors may be taken "off line" if certain "operating parameters exceed predetermined thresholds." *Id.*, cl. 36; *see id.* [0055] ("bringing the affected unit offline"). *Payne* touts this "benefit" of its system as allowing "multiple processes and subsystems on each pumping unit [to] be monitored autonomously." *Id.* [0055].

Like *Payne*, *Wiemers* discloses that the motors used to drive pumps in its systems are controlled by VFDs. Ex.1009, [0078]; *see id.* [0093], [0110], Figs.30-32. Each of *Wiemers*' VFD motors can be taken offline individually in the event of a "fault." *Id.* [0110], Fig.30.

A POSITA would have been motivated to combine *Wiemers* with *Payne* with a reasonable expectation of success, because it simply involves incorporating the known practice of using a controller to control individual VFD motors to further a stated benefit of *Payne*'s system: allowing "multiple processes and systems on each pumping unit," including the VFDs, to "be monitored autonomously." Ex.1002, ¶¶305-307; Ex.1004, [0055]. By incorporating the functionality of *Wiemers*'s controller to control and monitor the state of each VFD, the operator has more

information and flexibility in “choos[ing] what action to take,” including “bringing the affected unit” like the VFD “offline.” Ex.1002, ¶307; Ex.1004, [0055]. The results of this combination would have been predictable and obvious to a POSITA. Ex.1002, ¶307.

2. Claim 5

Payne discloses or renders obvious that an operational state may comprise states (i)-(iv) of this claim. *Supra* §VIII.A.5. To the extent *Payne* does not disclose operational state (iii), the combination of *Payne* and *Wiemers* renders it obvious.

Wiemers discloses that the control for its mobile liquid treatment unit includes “sensing attributes,” such as “state attributes (on/off, for example),” and includes “electronic outputs indicative thereof to controller 271.” Ex.1009, [0103]. *Wiemers*’s Figure 30 depicts a “columnar and operations display” that includes “status lights, **start/stop buttons** and speed control potentiometers **for each variable frequency drive (VFD) motor** in the system.” *Id.* [0110]. In particular, Figure 30 depicts status lights to “show if a VFD motor is currently energized” and “switches for each VFD motor that simulate an overheating signal or any other kind of fault.” *Id.* A POSITA would have understood *Payne*’s VFD to be a “pump drive” as it controls (drives) *Payne*’s fracturing pump motors and the mechanically-coupled pumps. *See* VIII.A.5; Ex.1002, ¶¶310-312.

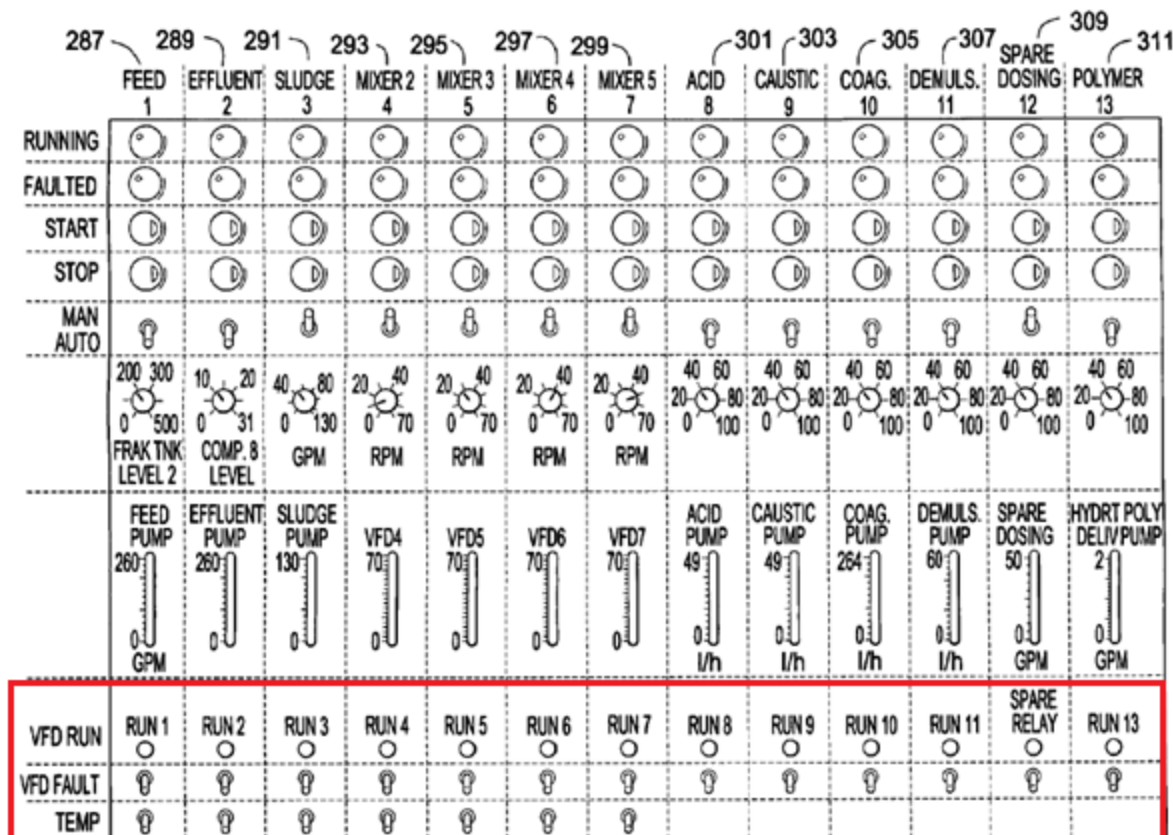


FIG.30

Ex.1009, Fig.30 (annotated).

Accordingly, a POSITA would have found it obvious to incorporate *Wiemers'* controller for each VFD motor into *Payne*, which aims to share VFD workload when an operating parameter exceeds a certain threshold value to “minimiz[e] the number of VFD faults and thermal shut down events caused by over driving particular pieces of fracturing equipment.” Ex.1002, ¶313; Ex.1004, [0109]. Specifically, a POSITA would employ the software or control of *Wiemers* in *Payne's* “RUN/STOP” for each pump. See Ex.1004, [0054] (“A normal stop (RUN/STOP) will control each fracturing pump unit 700a independently”); Ex.1002, ¶313. By allowing an operator

to take individual VFD motors offline and providing status lights indicative of that state, a POSITA would have understood *Wiemers* to disclose indicating that the operational state of the fracturing system may comprise a supply of electricity to some of the electrically powered devices in the system. Ex.1002, ¶313.

3. Claim 13

Supra §VIII.A.13.

To the extent *Payne* does not disclose that an operational state may comprise 13[iii] “the pump drive being energized”, the combination of *Payne* and *Wiemers* renders it obvious for the same reasons as described in §VIII.F.2. Ex.1002, ¶315.

4. Claim 16

Supra §VIII.A.16.

To the extent *Payne* does not disclose that an operational state may comprise the operational state of “the pump drive being energized” as claimed, the combination of *Payne* and *Wiemers* renders it obvious for the same reasons as described in §VIII.F.2. Ex.1002, ¶317.

G. Grounds 5A and 5B: Claims 5, 13, 16 Are Rendered Obvious by *Payne, Toshiba, and Wiemers* (5A) and by *Payne, Broussard, and Wiemers* (5B)

The combination of *Payne* and *Wiemers* discloses and/or suggests all limitations of claims 5, 13, 16, thereby rendering those claims obvious. Ex.1002, ¶318. To the extent Grounds 3A and 3B do not render these claims obvious, these grounds are presented as an alternatives.

1. A POSITA Would Have Been Motivated to Combine *Payne, Toshiba, and Wiemers* or *Payne, Broussard, and Wiemers*

A POSITA would have been motivated to combine *Wiemers* with *Payne* and *Toshiba* or *Payne* and *Broussard* for the same reasons a POSITA would have been motivated to combine *Wiemers* with *Payne*. *Supra* §VIII.F.1; Ex.1002, ¶¶319-320; §§VIII.B.1, VIII.C.1. The addition of *Toshiba* or *Broussard*, each of which relate to use of a VFD, would not affect a POSITA's motivation to combine *Wiemers* with *Payne*, because *Wiemers*'s disclosure of a VFD is consistent with that of *Toshiba* and *Broussard*, *i.e.*, the VFD controls the motor. Ex.1002, ¶¶319-320; Ex.1004, [0047]; Ex.1009, [0078], [0093], [0110].

2. Claims 5, 13, 16

See §VIII.F (addressing claims); Ex.1002, ¶321.

H. Ground 6: Claims 8, 14 Are Rendered Obvious by *Payne* and *Carlson*

The combination of *Payne* and *Carlson* discloses and/or suggests all limitations of claims 8 and 14, rendering these claims obvious. Ex.1002, ¶322. To the extent *Payne* alone does not anticipate or render these claims obvious, this ground is presented as an alternative to Grounds 1-2. The relevant limitations disclosed by *Carlson* (the use of a signal assembly for safety purposes) are presented below. All other elements of the claims are disclosed or rendered obvious by *Payne* as described in Grounds 1-2.

1. A POSITA Would Have Been Motivated to Combine *Payne* and *Carlson*

One objective of *Payne*'s alarm management system is to "ensur[e] safe operation" of its fracturing system. Ex.1004, [0055]. The programmable automation controller (PAC) on each fracturing unit also "acts as a safety device," to independently override the remote operator's command and take whatever action is appropriate if an unsafe condition (*e.g.*, an over-pressure event) is detected. *Id.* [0039].

Carlson discloses "control pendants" that include LED indicators to "display status conditions of the control devices and sensing devices" of the blender control system, which is used in oilfield-fracturing operations. Ex.1010, 1:15-27; *see id.* 2:59-61. This may "enhance[] the safety of the operator." *Id.* at 3:5-10, 3:55-60, 15:9-15.

Both *Carlson* and *Payne* disclose a signal assembly with similar functions, *i.e.*, to visually signal the operational state of associated equipment. Applying *Carlson*'s teachings regarding the safety benefits of its control pendants to *Payne*'s signal assembly furthers the safe operation of *Payne*'s fracturing system. *See* Ex.1004, [0055]; Ex.1010, 3:5-10; Ex.1002, ¶323-325. Thus, a POSITA would have been motivated to combine *Payne* with the teachings of *Carlson* with a reasonable expectation of success, because the combination represents nothing more than using one known element (*Payne*'s light tower) for the same purpose as another similar

element (*Carlson*'s control pendants) to predictably increase safety. *See, e.g., KSR*, 550 U.S. at 417 (“arrang[ing] old elements with each performing the same function it had been known to perform” to “yield[] no more than one would expect from such an arrangement” is obvious); Ex.1002, ¶¶323-325.

2. Claim 8

Payne discloses a visual signal that comprises optically detectable light in the visible spectrum. *Supra* §VIII.A.8. *Carlson*'s control pendants contain “light emitting diode (LED) drivers” and “LED indicators.” Ex.1010, 15:9-15. A POSITA would have understood *Carlson* to disclose that same element.

Carlson discloses that the mobility of these control pendants within the system “enhances the safety of the operator.” *Id.* For instance, “the size and weight of the control pendants 240 and 250 allow a person servicing a mechanical portion of the system to move a control pendant to the location being serviced,” which “eliminates the need for a second person to operate the blender system 100 while the technician performs service.” *Id.* 3:55-60. A POSITA would have understood that the visual signals from *Carlson*'s pendants are optically detectable by operations personnel disposed in a zone that is potentially hazardous, *e.g.*, due to hazards caused by fluid in piping that is pressured by at least one of the pumps, as described in *Payne*. Ex.1002, ¶¶327-328; *supra* §VIII.A.8.

3. Claim 14

Supra §VIII.A.14.

To the extent *Payne* does not disclose claim 14, a POSITA would have found it obvious in view *Carlson*. Ex.1002, ¶330. One purpose of *Carlson*'s control pendants is to provide visual signals to “**enhance[] the safety of the operator.**” Ex.1010, 3:5-10, 3:55-60, 15:9-15; Ex.1002, ¶330. In light of these teachings and *Payne*'s disclosure of signal assemblies that emit visual signals indicative of operational states, *supra* §VIII.A.1.e, a POSITA would have found it obvious to emit visual signals that are indicative of an operational state related to when the system is potentially unsafe for operations personnel and currently unsafe for operations personnel. Ex.1002, ¶331.

I. Grounds 6A and 6B: Claim 8, 14 Are Obvious Over *Payne*, *Toshiba*, and *Carlson* (6A) and *Payne*, *Broussard*, and *Carlson* (6B)

The combination of *Payne* and *Carlson* discloses and/or suggests all limitations of claims 8 and 14, thereby rendering those claims obvious. Ex.1002, ¶332. To the extent Grounds 3A and 3B do not render these claims obvious, these grounds are presented as alternatives.

1. A POSITA Would Have Been Motivated to Combine *Payne*, *Toshiba*, and *Carlson* or *Payne*, *Broussard*, and *Carlson*

A POSITA would have been motivated to combine *Carlson* with *Payne* and *Toshiba* or *Payne* and *Broussard* for the same reasons a POSITA would have been motivated to combine *Carlson* with *Payne*. *Supra* §VIII.H.1; Ex.1002, ¶¶333-334;

supra §§VIII.B.1, VIII.C.1. The addition of *Toshiba* or *Broussard*, each of which relates to use of a VFD, would not affect a POSITA's motivation to combine *Carlson* with *Payne*, because *Carlson*'s disclosure relates to the signal assembly and does not preclude the use of a VFD. Ex.1002, ¶¶333-334.

2. Claims 8, 14

See §VIII.H (addressing claims); Ex.1002, ¶335.

J. Ground 7: Claims 13, 16 Are Rendered Obvious by *Payne* and *Randle*

The combination of *Payne* and *Randle* discloses and/or suggests all limitations of claims 13 and 16, thereby rendering these claims obvious. Ex.1002, ¶336. To the extent *Payne* alone does not anticipate or render obvious these claims, this ground is presented as an alternative to Grounds 1-2. The relevant limitations disclosed by *Randle* (a controller that monitors certain conditions of a fracturing pump) are presented below. All other elements of the claims are disclosed or rendered obvious by *Payne* as described above in Grounds 1-2.

1. A POSITA Would Have Been Motivated to Combine *Payne* and *Randle*

Payne discloses a “programmable automation controller (PAC) configured to receive commands from the system control unit” and autonomously monitor operating parameters of the associated system unit,” Ex.1004, cls. 7, 11, 20.

Randle's hydraulic fracturing pump isolation safety system includes a controller. Ex.1011, [0017]. The controller may “accept[] as inputs the valve

condition and the pump condition, and present[] the monitored conditions to the operator control panel for display on the operator graphical interface.” *Id.* [0032]. Among the conditions that may be monitored include “the current flow through the motor windings, fluid end pressure, temperature, sound, and/or vibration, which can also give an indication of the overall health and operation of the frac pump.” *Id.*

To the extent not already taught by *Payne*, a POSITA would have been motivated to add to *Payne* additional visual signals to indicate “current flow through the motor windings, fluid end pressure, temperature, sound and/or vibration,” Ex.1011, [0029], to obtain *Randle*’s benefit of indicating to the operator the operational health of the frac pump and motor. *Id.*, [0032]; Ex.1002, ¶¶337-339. Both *Randle* and *Payne* disclose a controller that performs similar functions, *i.e.*, monitors certain operating parameters related to the pump. A POSITA, therefore, would have been motivated to enhance the functionality of *Payne*’s controller (*supra* §VIII.A.6) using *Randle*’s teachings with a reasonable expectation of success, because the combination represents nothing more than adding the operating parameters monitored and displayed by *Randle*’s controller to the operating parameters already monitored by *Payne*’s controller, which would generate predictable results. Ex.1002, ¶339; *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007) (“the predictable use of prior art elements according to their established functions”).

2. Claim 13

Payne discloses that the operational state of the system may comprise states (i)-(iv). *Supra* §VIII.A.13.b.

To the extent *Payne* does not disclose that the operational state may comprise (iii) the pump drive being energized, *Randle* does. Each of *Randle*'s frac pumps "include a pump condition determining means that generates a signal that reflects the **condition or operational status** of the pump." Ex.1011, [0029]. *Randle* also discloses that certain "monitored conditions" such as "**the current flow through the motor windings**" may be presented to the operator control panel. *Id.* [0029], [0032]. A POSITA would have understood this as an operational state in which "the pump drive [is] energized." Ex.1002, ¶341.

3. Claim 16

See 13[b]; Ex.1002, ¶342.

K. Grounds 7A and 7B: Claims 13, 16 Are Rendered Obvious by *Payne, Toshiba, and Randle* (7A) and by *Payne, Broussard, and Randle* (7B)

The combination of *Payne* and *Randle* discloses and/or suggests all limitations of claims 13 and 16, thereby rendering those claims obvious. Ex.1002, ¶343. To the extent Grounds 3A and 3B do not render obvious these claims, these grounds are presented as alternatives.

1. A POSITA Would Have Been Motivated to Combine *Payne, Toshiba, and Randle* or *Payne, Broussard, and Randle*

A POSITA would have been motivated to combine *Randle* with *Payne* and *Toshiba* or *Payne* and *Broussard* for the same reasons a POSITA would have been motivated to combine *Randle* with *Payne*. *Supra* §VIII.J.1; Ex.1002, ¶¶344-345; §§VIII.B.1, VIII.C.1. The addition of *Toshiba* or *Broussard*, each of which relate to use of a VFD, would not affect a POSITA’s motivation to combine *Randle* with *Payne*, because *Randle*’s disclosure relates to the operational state of the fracturing system monitored and indicated by a signal assembly and does not preclude the use of a VFD. Ex.1002, ¶¶344-345.

2. Claims 13, 16

See §VIII.J (addressing claims); Ex.1002, ¶346.

IX. SECONDARY CONSIDERATIONS

Patent Owner has not identified any evidence of secondary considerations of non-obviousness tied to the ’871 Patent claims in the Halliburton Litigation or this proceeding. Relying on an employee declaration, Patent Owner advanced “secondary indicia” arguments during prosecution of the ’410 Patent, to which the ’871 Patent refers. Ex.1017, 149-164. Petitioner does not know if Patent Owner will advance the same arguments for the ’871 Patent. Even if Patent Owner did so, those arguments would fail because they lack the requisite “nexus.” *Fox Factory, Inc. v. SRAM, LLC*, 944 F.3d 1366, 1373 (Fed. Cir. 2019) (patentee must establish “‘a legally and factually sufficient connection’ between the evidence and the patented

invention.”). The application that issued as the ’410 Patent (*Broussard*) is prior art to the ’871 Patent, and so secondary considerations relating to it cannot have nexus to the ’871 Patent claims.

Moreover, Petitioner has not been able to depose the declarant from the ’410 Patent prosecution to test the facts alleged therein, and cannot be expected to address secondary considerations without an opportunity to do so. Finally, even if Patent Owner could establish secondary considerations and nexus, they would be insufficient to overcome the strong case of obviousness presented here. *Leapfrog Enters., Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1162 (Fed. Cir. 2007).

X. CONCLUSION

Petitioner respectfully requests that *inter partes* review of the ’871 Patent be instituted and that the Challenged Claims be cancelled as unpatentable under 35 U.S.C. §318(b).

Respectfully submitted,

BAKER BOTTS L.L.P.

A handwritten signature in black ink, appearing to read "Elizabeth Durham Flannery", with a long horizontal flourish extending to the right.

Elizabeth Durham Flannery (Reg. No. 59,509)
LEAD COUNSEL FOR PETITIONER

February 10, 2023
Date

XI. APPENDIX: CLAIM LIMITATIONS

Claim Element	Claim Language from '871 Patent
1[pre]	1. A hydraulic fracturing system for fracturing a subterranean formation comprising
1[a]	a plurality of electric pumps fluidly connected to the formation, and powered by at least one electric motor, and configured to pump fluid at high pressure into a wellbore that intersects the formation, so that the fluid passes from the wellbore into the formation, and fractures the formation
1[b]	a variable frequency drive connected to the electric motor to control the speed of the motor,
1[c]	wherein the variable frequency drive frequently performs electric motor diagnostics to prevent damage to the at least one electric motor; and
1[d]	a signal assembly that selectively emits a visual signal that is indicative of an operational state of the hydraulic fracturing system.
2	2. The hydraulic fracturing system of claim 1, wherein the signal assembly comprises a plurality of light assemblies arranged in a stack.
3	3. The hydraulic fracturing system of claim 2, wherein each of the light assemblies selectively emit visual light of a color different from visual light emitted by other light assemblies.
4	4. The hydraulic fracturing system of claim 2, wherein a distinctive operational state of the system is indicated by illumination of a combination of the light assemblies.
5	5. The hydraulic fracturing system of claim 1, wherein the operational states of the hydraulic fracturing system comprise,

Claim Element	Claim Language from '871 Patent
	[i] no electricity to the system, [ii] a supply of electricity to all electrically powered devices in the system, [iii] a supply of electricity to some of the electrically powered devices in the system, and [iv] a pressure in a discharge line of the pump having a magnitude that is at least that of a designated pressure.
6	6. The hydraulic fracturing system of claim 1, further comprising a controller in communication with the variable frequency drive, a pressure indicator that senses pressure in a discharge line of a one of the pumps, and the signal assembly.
7	7. The hydraulic fracturing system of claim 6, wherein the controller selectively activates the signal assembly in response to a communication signal from one of the variable frequency drive or the pressure indicator.
8	8. The hydraulic fracturing system of claim 1, wherein the visual signal comprises light in the visible spectrum, and that is optically detectable by operations personnel disposed in a zone that is potentially hazardous due to fluid in piping that is pressurized by at least one of the pumps.
9[pre]	9. A hydraulic fracturing system for fracturing a subterranean formation comprising:
9[a]	a pump having a discharge in communication with a wellbore that intersects the formation;
9[b]	an electric motor coupled to and that drives the pump;

Claim Element	Claim Language from '871 Patent
9[c]	a variable frequency drive connected to the electric motor that controls a speed of the motor and performs electric motor diagnostics;
9[d]	a variable frequency drive connected to the electric motor that controls a speed of the motor and performs electric motor diagnostics;
9[e]	a controller in communication with the signal assembly, and that selectively transmits a command signal to the signal assembly in response to a monitoring signal received by the controller and transmitted from a device in the system.
10	10. The hydraulic fracturing system of claim 9, wherein the device in the system that transmits the monitoring signal to the controller comprises one of the variable frequency drive, and a pressure monitor in fluid communication with the discharge of the pump.
11	11. The hydraulic fracturing system of claim 9, wherein the signal assembly comprises a stack of light assemblies.
12	12. The hydraulic fracturing system of claim 11, wherein the light assemblies each comprise an electrically powered light source, and that each emit light of a color that is different from a color of a light emitted by the other light assemblies.
13[a]	13. The hydraulic fracturing system of claim 9 further comprising a pump controller and auxiliary equipment, and
13[b]	wherein the operational state of the system comprises, [i] the system being isolated from electricity, [ii] a fluid pressure of the discharge having a value at least as great as a designated value,

Claim Element	Claim Language from '871 Patent
	[iii] the pump drive being energized, and [iv] the auxiliary equipment being energized but without a one of the motors being energized.
14	14. The hydraulic fracturing system of claim 9, wherein the visual signals selectively indicate when the system is safe for operations personnel, when the system is potentially unsafe for operations personnel, and when the system is currently unsafe for operations personnel.
15[pre]	15. A method of fracturing a subterranean formation comprising:
15[a]	pressurizing fracturing fluid with a pump;
15[b]	driving the pump with a motor that is powered by electricity;
15[c]	controlling the speed of the motor with a variable frequency drive,
15[d]	the variable frequency drive further performing electric motor diagnostics;
15[e]	monitoring an operational state of a hydraulic fracturing system that comprises the pump and motor; and
15[f]	selectively emitting a visual signal that is indicative of the monitored operational state.
16	16. The method of claim 15, wherein the operational state comprises [i] the system being isolated from electricity, [ii] a fluid pressure of discharge of the pump having a value at least as great as a designated value,

Claim Element	Claim Language from '871 Patent
	[iii] a pump controller being energized, and [iv] auxiliary equipment being energized but without a one of the pump motors being energized.
17	17. The method of claim 15, wherein the step of selectively emitting a visual signal comprises emitting a light from one or more of a stack of light assemblies, where light from one of the stack of light assemblies is different from lights emitted from other light assemblies.
18[a]	18. The method of claim 15, further comprising monitoring electricity to a variable frequency drive,
18[b]	wherein the variable frequency drive controls electricity to the motor.
19	19. The method of claim 15, further comprising monitoring a fluid pressure of discharge of the pump.

CERTIFICATE OF SERVICE

The undersigned hereby certifies on this 10th day of February 2023, that true and correct copies of the foregoing PETITION FOR *INTER PARTES* REVIEW OF CLAIMS 1-19 OF U.S. PATENT NO. 9,650,871 and Exhibits 1001-1046, and Petitioner's power of attorney were served in their entirety to Patent Owner via FedEx Express® or Express Mail:

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A handwritten signature in black ink, appearing to read "E. D. Flannery", with a long horizontal flourish extending to the right.

February 10, 2023
Date

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**CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME
LIMITATION, TYPEFACE REQUIREMENTS, AND TYPE STYLE
REQUIREMENTS**

1. This Petition complies with the type-volume limitation of 14,000 words, comprising 13,990 words, excluding the parts exempted by 37 C.F.R. § 42.24(a).
2. This Petition complies with the general format requirements of 37 C.F.R. § 42.6(a) and has been prepared using Microsoft® Word in 14-point Times New Roman.

Respectfully submitted,

BAKER BOTTS L.L.P.

A handwritten signature in black ink, appearing to read 'Elizabeth Durham Flannery', written over a horizontal line.

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