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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

WEATHERFORD U.S., L.P.,
Petitioner,

v.

HALLIBURTON ENERGY SERVICES, INC.,
Patent Owner.

Case No. IPR2024-00990
U.S. Patent No. 11,333,007

**PETITIONER'S OPPOSITION TO
PATENT OWNER'S MOTION TO AMEND**

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TABLE OF EXHIBITS

Exhibit No.	Description
1001	U.S. Patent No. 11,333,007 (“’007 Patent”)
1002	File History for U.S. Patent No. 11,333,007
1003	Declaration of Michael R. Chambers Sr. (“Chambers Decl.”)
1004	CV of Michael R. Chambers Sr.
1005	U.S. Patent No. 9,797,226 (“Yeh”)
1006	IPTC 12549 (“Yeh2”)
1007	U.S. Patent No. 4,945,991 (“Jones”)
1008	U.S. Patent No. 5,113,935 (“Jones2”)
1009	L.G. Jones et al., <i>Alternate Path Gravel Packing</i> , Society of Petroleum Engineers, SPE 22796 (Oct. 1991)
1010	U.S. Patent No. 7,661,476
1011	<i>ExxonMobil Awards Alternate Path Technology License to Weatherford</i> , ExxonMobil Press Release (Aug. 27, 2013)
1012	U.S. Patent No. 5,588,487
1013	G. Hurst et al., <i>Alternate Path Completions: A Critical Review and Lessons Learned From Case Histories With Recommended Practices for Deepwater Applications</i> , Society of Petroleum Engineers, SPE 86532 (Feb. 2004) (“Hurst”)
1014	K.W. Lagrone et al., <i>A New Development in Completion Methods The Limited Entry Technique</i> , Society of Petroleum Engineers, SPE 530 (July 1963) (“Lagrone”)
1015	M.T. Hecker et al., <i>Extending Openhole Gravel Packing Capability: Initial Field Installation of Internal Shunt Alternate Path Technology</i> , Society of Petroleum Engineers, SPE 135102 (Sept. 2010) (“Hecker”)
1016	A. Bonner et al., <i>Design and Validation of an Improved Shunt Tube System</i> , Society of Petroleum Engineers, SPE-169440-MS (2014) (“Bonner”)

Exhibit No.	Description
1017	API Technical Report 5C3, published in December 2008 with an Addendum in October 2015 (excerpts)
1018	ASTM A554-16: Standard Specification for Welded Stainless Steel Mechanical Tubing (2016) (excerpts)
1019	Declaration of Christine Diedrich of the Society of Petroleum Engineers
1020	Complaint for Patent Infringement, <i>Halliburton Energy Servs. v. Weatherford U.S. L.P.</i> , Case No. 24-cv-00090 (W.D. La. Jan. 22, 2024)
1021	U.S. District Courts – Combined Civil and Criminal Federal Court Management Statistics (March 31, 2023), available at https://www.uscourts.gov/statistics-reports/federal-court-management-statistics-march-2023
1022	Shahryar Saebi, <i>The Evolution of Completion Designs Using Alternate Path (Shunt-Tubes) Technology</i> , Society of Petroleum Engineers SPE 155129 (Mar. 2012)
1023	U.S. Patent No. 5,476,143
1024	U.S. Patent No. 7,938,184
1025	Larry G. Myers et al., <i>Case History in Achieving High Rate Producers in Sub Sea Gravel Packed Completions</i> , Society of Petroleum Engineers, SPE 39433 (Feb. 1998)
1026	Raymond Tibbles, et al., <i>Design and Execution of a 3000-ft Horizontal Gravel-Packed Completion (A Kazakhstan Case History)</i> , Society of Petroleum Engineers, SPE 64410 (Oct. 2000)
1027	M.D. Barry et al., <i>Openhole Gravel Packing With Zonal Isolation</i> , Society of Petroleum Engineers, SPE 110460 (Nov. 2007)
1028	U.S. Patent No. 5,890,533
1029	ASTM A500/A500M-13: Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes (2013) (excerpts)
1030	U.S. Patent No. 4,629,218
1031	Declaration of Stephen McNamee
1032	Fischer Stainless Steel Tubing - Part Number List

Exhibit No.	Description
1033	L.G. Jones et al., <i>Gravel Packing Horizontal Wellbores with Leak-Off Using Shunts</i> , Society of Petroleum Engineers, SPE 38640 (Oct. 1997)
1034	D.W. Bryant & L.G. Jones, <i>Completion and Production Results from Alternate-Path Gravel-Packed Wells</i> , SPE Drilling & Completion, SPE 27359 (Sept. 1995)
1035	U.S. Patent No. 6,588,506
1036	Halliburton Cementing Tables (1979) (excerpts)
1037	Introduction to Otis Multi-Position Gravel Pack System, Otis Engineering Corporation, Technical Manual 2004/88 (excerpts)
1038	Johnson Oil and Gas Well Screens Catalog (1991) (excerpts)
1039	U.S. Patent No. 2,905,245
1040	U.S. Patent No. 8,839,861
1041	U.S. Patent No. 5,842,516
1042	Order granting stay, <i>Halliburton Energy Servs. v. Weatherford U.S. L.P.</i> , Case No. 24-cv-00090 (W.D. La. June 17, 2024)
1043	Transcript of May 15, 2025 Deposition of Dr. Robert A. Durham
1044	Second Declaration of Michael R. Chambers Sr. (“Second Chambers’ Decl.”)

LISTING OF SUBSTITUTE CLAIMS

Claim 24 (Substitute for Claim 3)	
24[preamble]	The completion assembly of claim 1,
24[a]	wherein the first sand screen assembly further comprises a junction block from which the transport tube and the packing tube extend, the plurality of nozzles being spaced apart from the junction block;
24[b]	wherein the second sand screen assembly further comprises a junction block from which the transport tube and the packing tube extend, the plurality of nozzles being spaced apart from the junction block;
24[c]	wherein the distance between the first sand screen assembly junction block and the packing tube nozzles is greater in the first sand screen assembly than the distance between the second sand screen assembly junction block and the packing tube nozzles in the second sand screen assembly;
24[d]	<u>and wherein shunt tube assemblies of the second sand screen assembly have different spacing between the nozzles.</u>
Claim 25 (Substitute for Claim 6)	
25[preamble]	The completion assembly of claim 1,
25[a]	wherein the second end of the first sand screen assembly base pipe is connected to the first end of the second sand screen assembly base pipe forming a joint therebetween;
25[b]	the completion assembly further comprising a coupling interconnecting one end of a jumper tube to the transport tube of the first sand screen assembly, the other end of the jumper tube in fluid communication with the junction block of the second sand screen assembly whereby the jumper tube straddles the joint between the first and second sand screen assemblies;
25[c]	<u>and wherein the cross-sectional flow area of the first transport tube is less than the cross-sectional flow area of the second transport tube.</u>
Claim 26 (Substitute for Claim 8)	
26[preamble]	The completion assembly of claim 1,

26[a]	wherein the shunt tube assembly of the first sand screen assembly has a pressure rating of between 5000 and 10000 psi
26[b]	<u>and the packing tube of the first sand screen assembly is interconnected to a junction block of the second sand screen assembly.</u>
Claim 27 (Substitute for Claim 9)	
27[preamble]	The completion assembly of claim 1,
27[a]	wherein the shunt tube assembly of the first sand screen assembly has a pressure rating of over a select threshold and the shunt tube assembly of the second sand screen assembly has a pressure rating of no more than the select threshold;
27[b]	<u>and wherein the first sand screen assembly and the second sand screen assembly are eccentric assemblies.</u>
Claim 28 (Substitute for Claim 11)	
28[preamble]	A completion assembly for deployment in a wellbore, the completion assembly comprising:
28[a]	a source of pressurized working fluid;
28[b]	a first <u>eccentric</u> sand screen assembly attached to a second <u>eccentric</u> sand screen assembly,
28[c]	wherein the first <u>eccentric</u> sand screen assembly comprises a shunt tube assembly with a first burst pressure and the second <u>eccentric</u> sand screen assembly comprises a shunt tube assembly with a burst pressure less than the first burst pressure, and
28[d]	wherein the shunt tube assembly with the first burst pressure is fluidly coupled between the source of pressurized working fluid and the shunt tube assembly with the burst pressure less than the first burst pressure.
Claim 29 (Substitute for Claim 12)	
29[preamble]	The completion assembly of claim <u>28</u> ,
29[a]	wherein the shunt tube assembly of the first <u>eccentric</u> sand screen assembly is disposed to operate at pressures between 5000 psi and 10000 psi and the shunt tube assembly of the second <u>eccentric</u> sand screen assembly is disposed to operate at pressures of no more than 5000 psi;

29[b]	<u>and wherein a cross-sectional flow area of a packing tube of the high pressure shunt tube system is less than the cross-sectional flow area of a packing tube of the low pressure shunt tube system.</u>
Claim 30 (Substitute for Claim 13)	
30[preamble]	The completion assembly of claim <u>28</u> , further comprising:
30[a]	a plurality of first sand screen assemblies forming a lower portion of the completion assembly and attached to a plurality of second sand screen assemblies forming an upper portion of the completion assembly,
30[b]	wherein the first sand screen assemblies each comprises a shunt tube assembly having an operating pressure rating between 5000 psi and 10000 psi, and the second sand screen assembly has a shunt tube assembly having an operating pressure rating of no more than 5000 psi;
30[c]	<u>and wherein a packing tube of the first eccentric sand screen assembly is interconnected to a shunt tube junction block of the second eccentric sand screen assembly.</u>
Claim 31 (Substitute for Claim 14)	
31[preamble]	A method of installing a completion assembly in a wellbore, the method comprising:
31[a]	identifying an elongated production zone having an upstream proximal end and a downstream distal end with respect to a source of pressurized working fluid;
31[b]	determining a shunt tube system operating pressure associated with the proximal end of the production zone and selecting a high pressure shunt tube system based on the proximal end determined pressure;
31[c]	determining a shunt tube system operating pressure associated with the distal end of the production zone and selecting a low pressure shunt tube system based on the distal end determined pressure;
31[d]	installing a first <u>eccentric</u> sand screen assembly in a wellbore adjacent the distal downstream end of the elongated production zone;
31[e]	attaching a second <u>eccentric</u> sand screen assembly to the first

	eccentric sand screen assembly at the proximal upstream end of the elongated production zone, wherein the first eccentric sand screen assembly has the low pressure shunt tube system and the second eccentric sand screen assembly has the high pressure shunt tube system, such that a downstream end of the high pressure shunt tube system is coupled to an upstream end of the low pressure shunt tube system; and
31[f]	coupling the source of pressurized working fluid to an upstream end of the high pressure shunt tube system.
Claim 32 (Substitute for Claim 15)	
32[preamble]	The method of claim 31 , further comprising:
32[a]	installing a plurality of interconnected first eccentric sand screen assemblies in a wellbore adjacent the production zone;
32[b]	and attaching a plurality of second eccentric sand screen assemblies to an uppermost first eccentric sand screen assembly upstream of the first sand screen assemblies.
Claim 33 (Substitute for Claim 16)	
33[preamble]	The method of claim 31 ,
33[a]	further comprising introducing a working fluid into the shunt systems, wherein the working fluid is pressurized in accordance with the operating pressure of the high pressure shunt tube system
33[b]	and a packing tube of the high pressure shunt tube system is interconnected to a shunt tube junction block of the high pressure shunt tube system.
Claim 34 (Substitute for Claim 17)	
34[preamble]	The method of claim 31 ,
34[a]	further comprising injecting the working fluid into the annulus adjacent the shunt tube system so as to form a gravel pack in the annulus,
34[b]	wherein a cross-sectional flow area of a packing tube of the high pressure shunt tube system is less than a cross-sectional flow area of a packing tube of the low pressure shunt tube system.
Claim 35 (Substitute for Claim 18)	
35[preamble]	The method of claim 31 ,

35[a]	wherein the high pressure shunt tube system is disposed to operate at pressures of 5000 psi and the low pressure shunt tube system is disposed to operate at pressures of no more than 5000 psi .
Claim 36 (Substitute for Claim 19)	
36[preamble]	The method of claim 31 ,
36[a]	wherein the high pressure shunt tube system is disposed to operate at pressures above a select threshold and the low pressure shunt tube system is disposed to operate at pressures of no more than the select threshold.
Claim 37 (Substitute for Claim 20)	
37[preamble]	The method of claim 31 ,
37[a]	wherein installing the first eccentric sand screen assembly and attaching the second eccentric sand screen assembly include disposing the first eccentric sand screen assembly and the second eccentric sand screen assembly in a horizontal portion of the wellbore.
Claim 38 (Substitute for Claim 21)	
38[preamble]	A completion assembly for deployment in a wellbore, the completion assembly comprising:
38[a]	a source of pressurized working fluid;
38[b]	a first, eccentric sand screen assembly comprising a base pipe having perforations therein and extending between a first end and a second ends, a sand screen disposed around a portion of the base pipe, and a shunt tube assembly disposed outwardly of the sand screen, the shunt tube assembly having a transport tube and a packing tube, where each of the tubes has a passageway defined therein, the packing tube further including a plurality of nozzles spaced apart from each other, wherein each of the tubes and each nozzle has a cross-sectional flow area; and
38[c]	a second, eccentric sand screen assembly comprising a base pipe having perforations therein and extending between a first end and a second ends, a sand screen disposed around a portion of the base pipe, and a shunt tube assembly disposed outwardly of the sand screen, the shunt tube assembly having a transport tube and a packing tube, the packing tube including a plurality of nozzles spaced apart from each other, wherein each of the tubes and each

	nozzle has a cross-sectional flow area;
38[d]	wherein the first and second eccentric sand screen assemblies are arranged end to end relative to one another so that the base pipes are in fluid communication with one another and the transport tubes are in fluid communication with one another and the source of pressurized working fluid, the transport tube of the second eccentric sand screen assembly fluidly coupled to the source of pressurized working fluid downstream of the transport tube of the first eccentric sand screen assembly; and
38[e]	wherein the transport tube of the first eccentric sand screen assembly is formed of a first material and the transport tube of the second eccentric sand screen assembly is formed of a second material, the first material having a greater tensile strength than the second material.
Claim 39 (Substitute for Claim 22)	
39[preamble]	The completion assembly of claim 38 ,
39[a]	wherein the transport tube of the first sand screen assembly has a first wall thickness and the transport tube of the second sand screen assembly has a second wall thickness, the first wall thickness being greater than the second wall thickness;
39[b]	and wherein a cross-sectional flow area of the packing tube of the first, eccentric sand screen assembly is less than a cross-sectional flow area of the packing tube of the second, eccentric sand screen assembly.
Claim 40 (Substitute for Claim 23)	
40[preamble]	The completion assembly of claim 38 ,
40[a]	wherein the first sand screen assembly has a shunt tube assembly with a first pressure rating and the second sand screen assembly has a shunt tube assembly with a second pressure rating less than the first pressure rating;
40[b]	and a packing tube of the first eccentric sand screen assembly is interconnected to a shunt tube junction block of the second eccentric sand screen assembly.

I. INTRODUCTION

Petitioner Weatherford respectfully requests that Patent Owner Halliburton's Motion to Amend ("MTA") be denied. Halliburton's amendments do not overcome the Petition, and its additions of first and second sand screens having eccentric orientations are obvious over Halliburton's own 2014 Bonner publication. Additionally, Halliburton inappropriately requests amendment of Claim 13, which was not challenged and thus should not be considered.

II. SUBSTITUTE CLAIM 30 IS IMPROPERLY PROPOSED

Halliburton proposed Substitute Claim 30 to replace original Claim 13, MTA, App. 3-4; however, Weatherford did not challenge Claim 13, Pet., 30. Thus, Substitute Claim 30 should not be considered, as the Board does "not consider amendments to claims that are not challenged in [the IPR] proceeding." *See Lyft, Inc. v. Rideshare Displays, Inc.*, IPR2021-01598, Paper 20 at 3 (P.T.A.B. Oct. 20, 2022) (citing 35 U.S.C. § 316(d)(1); *Lectrosonics, Inc. v Zaxcom, Inc.*, IPR2018-01129, Paper 15 at 5 (P.T.A.B. Feb. 25, 2019) (precedential)).

III. HALLIBURTON'S SUBSTITUTE CLAIMS ARE OBVIOUS

Halliburton's Substitute Claims 24-26 are obvious for the same reasons discussed in Ground 1 of the Petition. Halliburton's Substitute Claims 27-40 are obvious for the same reasons discussed in Grounds 1-4 of the Petition and in view of Halliburton's own prior art printed publication, SPE-169440 ("Bonner,"

EX1016); EX1044 ¶¶23-26:

Ground	Substitute Claim(s)	Prior Art
MTA 1a	24-26	Yeh optionally in view of Yeh2
MTA 1b	27-29	Yeh in view of Bonner and optionally Yeh2
MTA 2	31-37	Yeh in view of Yeh2, Bonner, and optionally Jones2
MTA 3	38-39	Yeh in view of Jones and Bonner
MTA 4	40	Yeh in view of Jones, Yeh2, and Bonner

A. Bonner (EX1016)

Bonner is §102(a)(1) (AIA) prior art because it was published in May 2014, before the June 22, 2018 priority date. EX1016; EX1001. Bonner disclosed an “improved version of the traditional” eccentric 2×2 shunt tube system design for “gravel packing in long production intervals” that was “functionally the same as existing industry-proven designs, in order to enjoy the empirical evidence of years of successful application of shunt tube gravel-packing technology.” See EX1016, 1, 2; Pet., 27-28 (citing EX1016; EX1003 ¶¶153-56). Bonner disclosed that its rectangular shunt tubing met its “goal rating of 5000 psi burst pressure,” and “typical test data” from its “Shunt Tubing Pressure Test” indicated shunt tube failure occurred at around 6,400 psi. EX1016, 12 & Fig. 23. EX1044 ¶¶9-22.

B. MTA Ground 1a: Substitute Claims 24-26 Are Obvious over Yeh in View of Yeh2

Substitute Claims 24-26 are obvious over Yeh and optionally Yeh2 for the

same reasons discussed in the Petition for original Claims 1, 3, and 6-8, and also as discussed below. *See* Pet., 32-43 (cl. 1), 47-51 (cl. 3), 53-58 (cl. 6-8).

Claim 24 (Sub. for Cl. 3): Obvious Over Yeh in view of Yeh2	
24[preamble]	<i>See</i> Claim 1. Pet., 32-43; EX1003 ¶¶256-97; EX1044 ¶¶27-28.
24[a]	<i>See</i> Claims 1[a] and 3. Pet., 33-34, 47-51; EX1003 ¶¶260-70, 308-22; EX1044 ¶29.
24[b]	<i>See</i> Claims 1[b] and 3. Pet., 34-37, 47-51; EX1003 ¶¶271-77, 308-22; EX1044 ¶30.
24[c]	<i>See</i> Claim 3. Pet., 47-51; EX1003 ¶¶308-22; EX1044 ¶31.
<u>24[d]: and wherein shunt tube assemblies of the second sand screen assembly have different spacing between the nozzles.</u>	Yeh in view of Yeh2 taught or suggested this limitation. EX1044 ¶32. Nozzle spacing selection was a result-effective variable because “the general conditions of [the] claim are disclosed in the prior art,” and optimal nozzle spacing was achievable through “routine experimentation.” <i>See In re Applied Materials</i> , 692 F.3d. 1289, 1295 (Fed. Cir. 2012); EX1044 ¶33. All the parameters associated with nozzle spacing were known, including pressure drop, leak-off rate, annular packing length, etc. <i>See, e.g.</i> , Pet., 49-51; EX1003 ¶¶110, 312-22; EX1006, 4-5 & Figs. 14-15 (EX1006, 4: “[A] single shunt porthole could successfully pack up to an 8-10 ft annular void.”); EX1043, 134:19-135:1, 138:12-19 (agreeing that a skilled artisan in 2018 would have known that gravel slurry flow could be manipulated by adjusting nozzle frequency). Hurst, which is referenced by Yeh, EX1005, 3:27-31, taught: “For a given fluid composition and gravel concentration, friction and thus the pressure applied to each zone can be controlled through ... the nozzle diameter and frequency .” EX1013, 3-4 ¹ ; EX1044 ¶¶34, 37. Jones2’s Figure 3 illustrated varied nozzle spacing along a single shunt tube and disclosed its invention, which provided for “a good distribution of gravel over the entire interval,” comprised “a plurality of conduits, each of which is perforated along a length which is different from the perforated lengths of the other

¹ All emphasis in this brief is added unless otherwise noted.

	conduits.” EX1008, 2:20-25, 2:55-59, Fig. 3; <i>see also</i> EX1009 at 2, 5, Table 1; EX1044 ¶¶35-36. As demonstrated by Yeh2, flow through nozzles decreased over the length of a packing tube. <i>See</i> EX1006, Fig. 7; EX1044 ¶34. Thus, it would have been obvious to a skilled artisan to make nozzle spacing in the second sand screen assembly packing tube different, for example, by lessening the spacing toward the downhole end of the packing tube to provide the same flow to a shorter annular space to ensure adequate gravel slurry flow and an adequate gravel pack. EX1044 ¶38. One of skill would understand that this problem can be addressed with nozzle frequency. EX1013, 3-4; EX1044 ¶39; EX1043, 140:15-20. The problem persists even with Yeh2’s closed-end packing tubes, resulting in the desirability of increasing nozzle frequency toward the end of a packing tube. EX1043, 140:15-20. This modification would have had more than a reasonable probability of success because the performance characteristics of adjusting nozzle spacing were well understood and documented, rendering the result entirely predictable. <i>See Applied Materials</i>, 692 F.3d at 1297-98 (affirming Board’s result-effective variable finding that the “prior art taught that the [claimed] dimensions could be modified and that modification would affect [] performance... [and that] the prior art did not need to disclose the result with any greater specificity than the [patent owner] already did”). <i>See, e.g., General Electric v. United Techs.</i>, IPR2016-00952, Paper 36, 30-33 (P.T.A.B. Oct. 26, 2017) (Board finding petitioner’s “modifications with known benefits and negative effects” to a prior art reference rendering the challenged claim unpatentable); <i>R.J. Reynolds v. Philip Morris</i>, IPR2021-00585, Paper 36 at 46-51, 56-58 (P.T.A.B. Sept. 8, 2022) (finding the claimed pore size range obvious even though the prior art range was not overlapping because pore size was a result-effective variable) (citing <i>In re Huang</i>, 100 F.3d 135, 136-39 (Fed. Cir. 1996) (finding the non-overlapping prior art range rendered the claimed polyurethane/textile ratio an unpatentable result-effective variable)); EX1044 ¶39.
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	Indeed, the Petition’s prior art and obviousness argument for Claim 4 and Mr. Chambers’ initial opinion confirm this understanding. <i>See</i> Pet., 12, 14-16, 25, 51-52; EX1003 ¶¶66, 107-08, 161, 189, 323-36; EX1044 ¶33.
Claim 25 (Sub. for Cl. 6): Obvious Over Yeh in view of Yeh2	
25[preamble]	<i>See</i> Claim 1. Pet., 32-43; EX1003 ¶¶256-97; EX1044 ¶¶40-41.
25[a]	<i>See</i> Claim 6. Pet., 53-55; EX1003 ¶¶334-40; EX1044 ¶42.
25[b]	<i>See</i> Claim 6. Pet., 53-55; EX1003 ¶¶334-40; EX1044 ¶43.
25[c]: and wherein the cross-sectional flow area of the first transport tube is less than the cross-sectional flow area of the second transport tube.	Yeh suggested this limitation. EX1044 ¶44. It would have been obvious for the first transport tube of a concentric sand screen assembly to have a smaller cross-sectional flow area than the second transport tube of an eccentric sand screen assembly. A skilled artisan would understand that an eccentric arrangement can provide more annular space for shunt tubes while maintaining the same primary flow path diameter and overall sand screen assembly diameter, permitting the use of larger cross-sectional area shunt tubes than are typically used in a concentric sand screen assembly. EX1044 ¶45. A skilled artisan seeking to reduce pressure drop in the transport tubes of the second sand screen assemblies would use larger cross-sectional area shunt tubes in the eccentric screen for the same reasons the skilled artisan would use a thinner shunt tube wall in the eccentric screens as explained in Claim 1[e]. Pet., 41-43; EX1003 ¶¶290-97; <i>compare</i> EX1005, Fig. 9A, <i>with</i> EX1005, Fig. 8C (showing larger inside diameter in eccentric tubes); EX1044 ¶¶46, 49-50. A skilled artisan would also understand from Yeh that concentric screens could be designed to have fewer transport tubes to equate the same number of transport tubes as a conventional eccentric screen. <i>See</i> EX1005, 16:26-37. This modification would be routine, and a skilled artisan would expect success, as this was taught by Yeh and Hurst’s “concentric entrance” design. <i>See</i> EX1013, 3, Fig. 7. EX1044 ¶¶47-48. Moreover, shunt tube diameter and cross-sectional area were result-effective variables with understood benefits and

	detriments. Hurst, referenced in Yeh, EX1005, 3:27-31, confirms that “[f]or a given fluid composition and gravel concentration, <i>friction and thus the pressure applied to each zone can be controlled through the shunt tube dimensions (diameter and length)....</i> ” EX1013, 3-4; EX1044 ¶¶51-52.
Claim 26 (Sub. for Cl. 8): Obvious Over Yeh in view of Yeh2	
26[preamble]	See Claim 1. Pet., 32-43; EX1003 ¶¶256-97; EX1044 ¶¶53-54.
26[a]	See Claims 7-8. Pet., 55-58; EX1003 ¶¶341-50; EX1044 ¶55.
<u>26[b] and the packing tube of the first sand screen assembly is interconnected to a junction block of the second sand screen assembly.</u>	Yeh in view of Yeh2 disclosed or suggested this limitation, which adds only routine experimentation for the reasons discussed in the Petition for Claims 3 and 6 relating to using junction blocks and jumper tubes to achieve fluid connectivity between the secondary flow paths of sand screens connected end-to-end. See Pet., 47-49, 53-55; EX1003 ¶¶308-11, 334-40. Yeh and Yeh2 disclosed a junction block. EX1005, Fig. 4A; EX1006, 3, Fig. 6a; EX1003 ¶310; EX1044 ¶¶56-57. Yeh and Yeh2’s concentric screens would have used a junction block for the reasons explained in Claim 3. Pet., 47-49; EX1003 ¶¶310-11. A junction block is a manifold, which distributes slurry between the packing tube and transport tube of a sand screen. EX1003 ¶¶309-11. Yeh also disclosed that the packing tube of the first sand screen assembly is interconnected (and even fluidly connected) to a junction block of the second sand screen assembly as explained with respect to Claims 1[d] and 6 using a crossover tool. Pet., 39-40, 53-55; EX1005, 26:25-32, 28:66-29:2, 30:13-14, Figs. 10A-C; EX1003 ¶¶285-89, 334-40; EX1044 ¶¶58-59.

C. MTA Ground 1b: Substitute Claims 27-29 Are Obvious over Yeh in View of Bonner and Optionally Yeh2

The original limitations in Substitute Claims 27-29 are taught or suggested by Yeh in view of Yeh2 for the same reasons discussed in the Petition for original

Claims 1, 7, 9, 11, and 12. *See* Pet., 32-43 (cl. 1), 55-57 (cl. 7), 58 (cl. 9), 59-60 (cl. 11), 61 (cl. 12). The Substitute Claims 27-29 are obvious over Yeh in view of Yeh2 and Bonner for the additional reasons discussed below.

Claim 27 (Sub. for Cl. 9): Obvious Over Yeh in view of Bonner and Yeh2	
27[preamble]	<i>See</i> Claim 1. Pet., 32-43; EX1003 ¶¶256-97; EX1044 ¶¶60-61.
27[a]	<i>See</i> Claims 7 and 9. Pet., 55-58; EX1003 ¶¶341-47, 351-52; EX1044 ¶62.
<u>27[b]: and wherein the first sand screen assembly and the second sand screen assembly are eccentric assemblies.</u>	Yeh in view of Yeh2 and Bonner disclosed or suggested this limitation. EX1044 ¶63. It would have been obvious to substitute Bonner’s high-pressure eccentric sand screen for Yeh’s high-pressure concentric sand screen. Additionally, Yeh disclosed using eccentric screens in lower-pressure, or distal regions, of the interval. EX1005, 30:21-23; EX1043, 81:7-83:8; EX2002 ¶170 (Dr. Durham opining: “<i>Yeh</i> teaches using an eccentric screen in the lower pressure sections of the wellbore (near the toe) because the eccentric screens are less expensive, easier to acquire, and lower friction.”). One of skill would understand that Yeh recommended using concentric sand screens near the heel because of their higher-pressure rating. EX1005, 28:18-24, 30:13-26, 30:44-45; Pet. at. 41; EX1003 ¶¶291-92; EX1044 ¶64. However, Bonner later disclosed an eccentric screen with a pressure rating of 5,000 psi, which is higher than the 3,000-psi pressure ratings of the known eccentric screens of the time. EX1016, 12 (“The overall testing substantiated the goal rating of 5000 psi burst pressure.”), 16 (“All jumper tube system testing failures were above 5000 psi, easily supporting the shunt tube system pressure rating of 5000 psi...”), Fig. 23. As Hecker explained: “In-house best practices limit the shunt friction pressure [in eccentric screens] to 3,000 psi to maintain reliability in the shunt packing system.” EX1015, 2. Bonner explained that its new eccentric sand screen design “improved pressure sealing, erosion resistance, ruggedness,

	improved rig assembly times, and system qualification,” such that one of skill would be motivated to substitute Bonner’s eccentric screen for Yeh’s concentric screen to obtain the benefit of these design improvements where the 5,000 psi pressure rating would suffice. <i>Uber Techs. v. X One</i>, 957 F.3d 1334, 1341-42 (Fed. Cir. 2020) (reversing the Board’s non-obvious finding because the prior art were two known, predictable solutions and a skilled artisan would have “faced a simple design choice between the two, and therefore would have been motivated to combine” their teachings); see EX1016, 1; EX1044 ¶¶65-67. Substituting Bonner’s eccentric sand screen for Yeh’s concentric sand screen would: (1) provide for a larger primary flow path both because eccentric screens provide for a larger primary flow path and because of the removal of Yeh’s crossover tool restriction in the primary flow path when transitioning from a concentric to an eccentric primary flow path and (2) be more easily and quickly installed due to Bonner’s improvements. EX1005, 27:62-28:24 (“The axis-offset and curvature of a crossover joint 1000 are important considerations.... Another way to mitigate the curvature impact on the primary flow path is to increase the internal diameter of the crossover joint.”); EX1013, 3 (“The key advantage of the eccentric design is the increased base-pipe size...”); EX1016, 1; EX1044 ¶68; EX1043, 56:21-57:6 (agreeing that Yeh’s crossover tool creates a restriction in the primary flow path). Such a simple substitution of one known element for another known in the field to achieve predictable results, such as a larger base pipe, would have been obvious. Because there was a known design need for a higher-pressure shunt tube system, selecting one of the two identified, predictable solutions (Yeh’s concentric or Bonner’s eccentric screen) was at least obvious to try. <i>In re Copaxone Consol. Cases</i>, 906 F.3d 1013, 1026 (Fed. Cir. 2018) (affirming obvious-to-try conclusion because “[t]his is not a situation where the prior art gave no direction in how to reach a successful result”); EX1043, 148:12-149:8 (a skilled artisan in 2018 would have understood that there were two basic types of sand screens, concentric and eccentric, and that there were
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	advantages and disadvantages of each). A skilled artisan would have expected substituting Bonner's eccentric screen to be successful because of Bonner's extensive testing. EX1016, 1; EX1044 ¶¶65-66, 69. Bonner's 5,000-psi pressure rating would not achieve the 6,500-psi pressure needed to entirely gravel pack a 5,000-foot-long interval, according to Yeh. See EX1005, 28:18-20; EX1044 ¶71. However, Bonner's eccentric sand screen would have been useful for intervals of more than 3,000 feet and almost up to 5,000 feet, according to Yeh2's Figure 15. See EX1006, Fig. 15; EX1044 ¶70. Moreover, increasing wall thickness of Bonner's shunt tube assembly would have easily accomplished the desired increased pressure rating to achieve even longer intervals while only slightly decreasing the internal cross-sectional area of the transport and packing tubes. Pet., 41-43 (Claim 1[e]); EX1003 ¶¶290-97; EX1044 ¶¶70-72; EX1043, 93:18-94:6 (agreeing that a skilled artisan in 2018 would have understood that increasing rectangular tube wall thickness increased burst pressure), 123:7-14 (agreeing that Bonner disclosed an eccentric screen with a 5,000-psi pressure rating that exceeded the 3,000 psi expected of conventional eccentric screens). The decreased cross-sectional flow area was a well-understood and predictable tradeoff for increased pressure containment, and one of skill would have readily understood how to optimize cross-sectional area and tubing wall thickness to meet an engineering requirement as explained by Yeh and Yeh2. EX1005, 28:17-30; EX1006, 5 ("Burst strength of shunt tubes must therefore be capable of accommodating this high hydraulic pressure."); EX1044 ¶71. Consequently, one of skill seeking to improve Bonner's system to pack a 5,000-foot production zone would increase Bonner's rectangular shunt tube wall thickness to accomplish the needed higher pressure rating. EX1044 ¶73. One of skill thus would understand that Bonner's eccentric sand screen would be improved with thicker-walled shunt tubes and substituted for Yeh's concentric screen in the first sand screen and used together with a conventional 2×2 eccentric screen with rectangular shunt tubing, which was widely known and
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	available as taught by Yeh, in the second sand screen. EX1005, Fig. 8A; EX1044 ¶71. This combination would result in a transport tube of a first sand screen having a first wall thickness greater than the second wall thickness of the second sand screen as required by Claim 1[e], as well as all the other requirements of Claim 1. EX1044 ¶74. Ultimately, this substitution would result in using eccentric screens with rectangular tubes for both the first and second sand screens. EX1044 ¶¶67-68.
Claim 28 (Sub. for Cl. 11): Obvious Over Yeh in view of Bonner and Yeh2	
28[preamble]	See Claim 1[preamble]. Pet., 32; EX1003 ¶¶256-59; EX1044 ¶¶75-76.
28[a]	See Claims 1[c] and 11[a]. Pet., 38-39, 59; EX1003 ¶¶278-84, 357; EX1044 ¶77. Halliburton does not contest that original Claim 11 is invalid over Yeh optionally in view of Yeh2. Pet., 59-60 (challenging Claim 11); <i>see generally</i> POR (providing no response on Claim 11).
28[b]: a first <u>eccentric</u> sand screen assembly attached to a second <u>eccentric</u> sand screen assembly,	Yeh in view of Yeh2 and Bonner disclosed this limitation for the same reasons discussed in the Petition for Claims 1[d] and 11[b]. Pet., 39-40, 59; EX1003 ¶¶285-89, 358; EX1044 ¶78. Additionally, for the same reasons discussed for Claim 27[b], it would have been obvious to substitute Bonner's high-pressure eccentric screen for Yeh's high-pressure concentric screen and optionally even increase the wall thickness of Bonner's high-pressure eccentric screen shunt tubes to gravel pack a 5,000-foot production zone. EX1044 ¶¶79-80. The result would be a first eccentric sand screen assembly (Bonner's eccentric screen original or modified) attached to a second eccentric sand screen assembly (Yeh's conventional eccentric screen).
28[c]: wherein the first <u>eccentric</u> sand screen assembly comprises a shunt tube assembly with a first burst	Yeh in view of Yeh2 disclosed or suggested this limitation for the same reasons discussed in the Petition for Claims 1[e], 7, 10, and 11[d]. Pet., 41-43, 55-60; EX1003 ¶¶290-97, 341-47, 353-54, 360-61; EX1044 ¶81. Also, for the same reasons discussed for Claim 27[b], the first eccentric sand screen (Bonner screen) would have a first burst

pressure and the second eccentric sand screen assembly comprises a shunt tube assembly with a burst pressure less than the first burst pressure, and	pressure (5,000 psi) that is greater than the burst pressure of the second sand screen (conventional eccentric screen with maximum working pressure of 3,000 psi). EX1044 ¶¶82-83; EX1043, 123:7-14 (agreeing that Bonner disclosed an eccentric screen with a 5,000-psi pressure rating that exceeded the 3,000 psi expected of conventional eccentric screens). However as discussed for Claim 27[b], it would have been obvious to increase the pressure rating of Bonner’s eccentric screen by increasing wall thickness of the first shunt tube assembly to account for the higher-pressure needs of longer gravel packs, like the 6,500 psi needed by Yeh’s 5,000-foot-long example, resulting in an even greater difference in burst pressure. <i>See</i> EX1005, 28:18-20; EX1044 ¶¶84.
28[d]	Yeh in view of Yeh2 disclosed or suggested this limitation for the same reasons discussed in the Petition for Claim 11[d], and substituting Bonner’s screen would result in an eccentric first shunt assembly. Pet., 60; EX1003 ¶¶360-61; EX1044 ¶85.
Claim 29 (Sub. for Cl. 12): Obvious Over Yeh in view of Bonner and Yeh2	
29[preamble]	<i>See</i> Claim 28. EX1044 ¶¶75-85. Halliburton does not contest that original Claim 12 is invalid over Yeh in view of Yeh2. Pet., 61 (challenging Claim 12); <i>see generally</i> POR (providing no response); EX1044 ¶¶86-87.
29[a]: wherein the shunt tube assembly of the first eccentric sand screen assembly is disposed to operate at pressures between 5000 psi and 10000 psi and the shunt tube assembly of the second eccentric sand screen	Yeh in view of Yeh2 disclosed or suggested this limitation for the same reasons discussed in the Petition for Claims 7 and 12. Pet., 55-57, 61; EX1003 ¶¶341-47, 362-64; EX1044 ¶88. Also, for the same reasons discussed for Claim 27[b], the first eccentric sand screen (Bonner screen) would be modified to operate at 6,500 psi per Yeh’s recommendation, which is between 5,000 psi and 10,000 psi. <i>See</i> EX1016, 12, Fig. 23; EX1044 ¶89. Additionally, given that the conventional eccentric sand screens would be installed in the interval at locations in which their maximum operating pressure would be 3,000 psi or less (i.e., somewhere between the 3,000-psi operating pressure and the toe of the well), the conventional eccentric screens would be

assembly is disposed to operate at pressures of no more than 5000 psi;	disposed to operate at pressures of no more than 5,000 psi. EX1044 ¶90. One of skill would understand there was an almost linear pressure drop from friction along the horizontal interval as illustrated by Yeh’s Figure 15. <i>See</i> EX1006, Fig. 15 (blue line); EX1044 ¶91. As such, one of skill would also understand that lower-pressure-rated eccentric screens could begin to be used along the horizontal at any location where the gravel slurry pressure dropped below the pressure capacity of conventional eccentric screens. EX1044 ¶¶91-92. According to Yeh2’s Figure 15, this transition point would occur at about 2,000 feet from the heel (or 3,000 feet from the toe), where the required operating pressure would be about 2800 psi. EX1006, Fig. 15; EX1044 ¶91; EX1043, 81:14-83:8. Indeed, Hecker, which was referenced in Yeh, EX1005, 3:37-41, taught the “[m]aximum [conventional eccentric screen] shunt system working pressure of 3,000 psi which limits the packable length to ~3,200 ft pumping at 5 barrels per minute (bpm),” EX1015, 1, which confirms this understanding of a skilled artisan, <i>see</i> Pet., 65-67; EX1003 ¶¶384-88; EX1044 ¶93.
<u>29[b]: and wherein a cross-sectional flow area of a packing tube of the high pressure shunt tube system is less than the cross-sectional flow area of a packing tube of the low pressure shunt tube system.</u>	For the same reasons discussed for Claim 27[b], Yeh in view of Yeh2 and Bonner disclosed or suggested this limitation. EX1044 ¶94. <i>Supra</i> Claim 27[b]. As explained, the first eccentric (Bonner) sand screen would be modified to operate at 6,500 psi, which is between 5,000 psi and 10,000 psi. <i>See</i> EX1016, 12, Fig. 23; EX1044 ¶96. One of skill would also have been motivated to use thicker-walled packing tubes because of the high-pressure gravel slurry flowing through these tubes at the heel. EX1044 ¶95. Such high pressures would result in higher velocities of slurry as well as higher rates of erosion. <i>See</i> EX1003 ¶¶189, 206 (discussing nozzle erosion); EX1044 ¶95. One of skill would be motivated to increase the wall thickness of packing tubes to address erosion concerns in the packing tubes toward the heel in this high-pressure scenario. EX1044 ¶¶96. It would have been obvious to a skilled artisan to use greater packing tube wall thickness in the high-pressure shunt tube

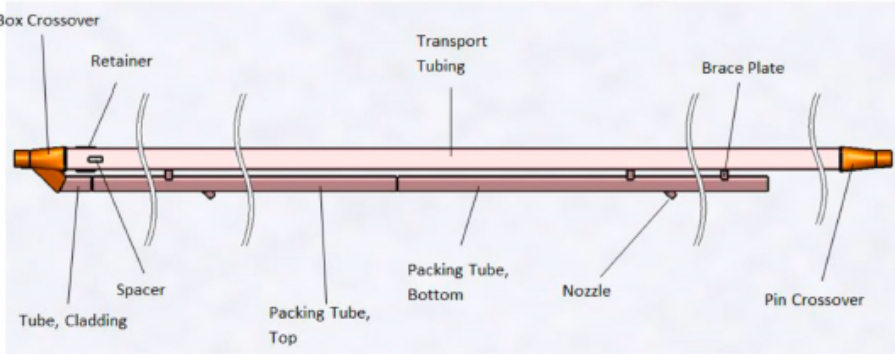
	system to help maintain the pressure integrity of the packing tube despite far more significant erosion. <i>See</i> EX1003 ¶¶189, 206 (discussing nozzle erosion); EX1044 ¶95. While increasing the wall thickness would decrease the cross-sectional area of the packing tube and consequently increase slurry velocity to a limited extent, it would provide enhanced pressure containment and increased life of the packing tube during gravel packing operations, making such a modification a predictable change with well-understood benefits and tradeoffs. EX1044 ¶96. Indeed, a skilled artisan would have expected success with increasing tube thickness because the worst-case scenario would be that once the packing tube had eroded to its original cross-sectional area, the velocity and erosion rate would be the same as the original design from that point forward, meaning that such a change has an undisputed overall benefit. EX1044 ¶96. Moreover, the packing tube cross-sectional area was a result-effective variable because all design parameters had known effects on the design, such that optimization of the packing tube cross-sectional area was within the skill of an ordinary artisan and cannot be patentable. <i>See General Electric</i>, IPR2016-00952, Paper 36 at 30-33; <i>R.J. Reynolds</i>, IPR2021-00585, Paper 36 at 46-51, 56-58; <i>Huang</i>, 100 F.3d at 135, 136-39.
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D. MTA Ground 2: Substitute Claims 31-37 Are Obvious over Yeh in View of Yeh2 and Bonner and Optionally Jones2

The original limitations in proposed Substitute Claims 31-37 are taught or suggested by Yeh in view of Yeh2 and optionally Jones2 for the reasons discussed in the Petition for original Claims 14-20. *See* Pet., 61-76; EX1003 ¶¶365-407. The Substitute Claims 31-37 are obvious over Yeh in view of Yeh2, Bonner, and optionally Jones2 for the additional reasons discussed below.

Claim 31 (Sub. for Cl. 14): Obvious Over Yeh in view of Yeh2, Bonner and Optionally Jones 2	
31[preamble]	<i>See</i> Claim 14[preamble]. Pet., 61; EX1003 ¶¶365-67; EX1044 ¶¶97-98.
31[a]	<i>See</i> Claim 14[a]. Pet., 62-64; EX1003 ¶¶368-79; EX1044 ¶99.
31[b]	<i>See</i> Claim 14[b]. Pet., 64-65; EX1003 ¶¶380-83; EX1044 ¶100.
31[c]	<i>See</i> Claim 14[c]. <i>See</i> Pet., 65-67; EX1003 ¶¶384-88. A skilled artisan would be motivated by Yeh’s teachings to use conventional low-pressure eccentric sand screens toward the distal end or toe based on the pressures expected at the distal end or toe as conceded by Dr. Durham. EX1043, 81:7-83:8; EX2002 ¶170 (Dr. Durham opining: “ <i>Yeh</i> teaches using an eccentric screen in the lower pressure sections of the wellbore (near the toe) because the eccentric screens are less expensive, easier to acquire, and lower friction.”); EX1044 ¶¶101-103.
31[d]: installing a first <u>eccentric</u> sand screen assembly in a wellbore adjacent the distal downstream end of the elongated production zone;	Yeh disclosed or suggested installing conventional eccentric screens in the lower-pressure or downstream end of an interval for the same reasons discussed in the Petition for Claim 14[d] and as discussed <i>supra</i> for Claim 31[c]. Pet., 67; EX1003 ¶¶389-92; EX1005, 30:21-23; EX1044 ¶104.
31[e]: attaching a second <u>eccentric</u> sand screen assembly to the first <u>eccentric</u> sand screen assembly at the proximal upstream end of the elongated production zone,	Yeh disclosed or suggested this limitation for the same reasons discussed in the Petition for Claims 14[a]-[b], 14[e], except that the second screen be eccentric. Pet., 62-64, 67-68; EX1003 ¶¶368-83, 393-96; EX1044 ¶105. The requirement that the second sand screen be eccentric was disclosed by Yeh in view of Bonner for the same reasons discussed <i>supra</i> for Claim 27[b]. EX1044 ¶106.

wherein the first eccentric sand screen assembly has the low pressure shunt tube system and the second eccentric sand screen assembly has the high pressure shunt tube system, such that a downstream end of the high pressure shunt tube system is coupled to an upstream end of the low pressure shunt tube system; and	
31[f]	<i>See</i> Claim 14[f]. Pet., 69-72; EX1003 ¶¶397-407; EX1044 ¶107.
Claim 32 (Sub. for Cl. 15): Obvious Over Yeh in view of Yeh2, Bonner and Optionally Jones 2	
32[preamble]	<i>See</i> Claim 31. EX1044 ¶¶108-109.
32[a]: installing a plurality of interconnected first eccentric sand screen assemblies in a wellbore adjacent the production zone;	Yeh in view of Yeh2 and optionally Jones2 disclosed or suggested this limitation for the same reasons discussed in the Petition for Claim 15. Pet., 72-73; EX1003 ¶¶408-11; EX1044 ¶110.
32[b]: and attaching a plurality of second eccentric sand screen	Yeh in view of Yeh2 and optionally Jones2 disclosed or suggested this limitation for the same reasons discussed in the Petition for Claim 15, except that the second screen be

assemblies to an uppermost first eccentric sand screen assembly upstream of the first sand screen assemblies.	eccentric. Pet., 72-73; EX1003 ¶¶408-11; EX1044 ¶111. The requirement that the second sand screen be eccentric was disclosed by Yeh in view of Bonner for the same reasons discussed <i>supra</i> for Claim 27[b]. EX1044 ¶112.
Claim 33 (Sub. for Cl. 16): Obvious Over Yeh in view of Yeh2, Bonner and Optionally Jones 2	
33[preamble]	See Claim 31. EX1044 ¶¶113-14.
33[a]	See Claim 16. Pet., 73; EX1003 ¶¶412-14; EX1044 ¶115.
33[b]: and a packing tube of the high pressure shunt tube system is interconnected to a shunt tube junction block of the high pressure shunt tube system.	Yeh and Yeh2 disclosed a junction block. EX1005, Fig. 4A; EX1006, 3, Fig. 6a; EX1003 ¶310; EX1044 ¶¶116; <i>supra</i> Claim 26[b]. Bonner also disclosed using a junction block, or “box crossover,” to couple the packing and transport tube of its high-pressure shunt tube system of its eccentric screen, as shown below:  Figure 8—Shunt system tubing weldment with its components EX1016, Fig. 8; EX1044 ¶117.
Claim 34 (Sub. for Cl. 17): Obvious Over Yeh in view of Yeh2, Bonner and Optionally Jones 2	
34[preamble]	See Claim 31. EX1044 ¶¶118-19.
34[a]	See Claim 17. Pet., 73-74; EX1003 ¶¶415-19; EX1044 ¶120.

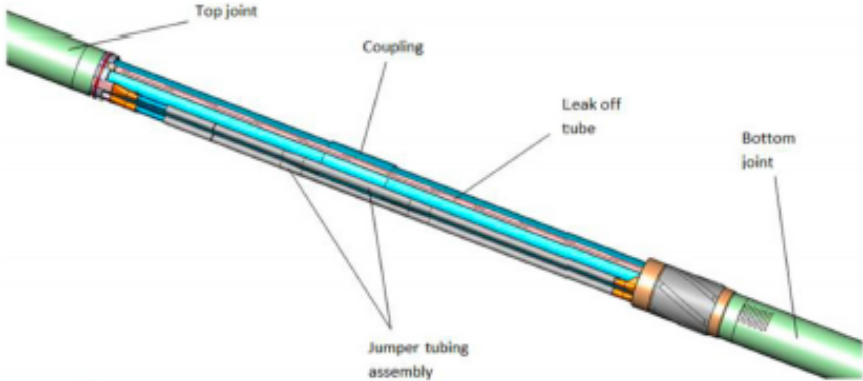
34[b]: wherein a cross-sectional flow area of a packing tube of the high pressure shunt tube system is less than a cross-sectional flow area of a packing tube of the low pressure shunt tube system.	<i>See supra</i> Claim 29[b]; EX1044 ¶121.
Claim 35 (Sub. for Cl. 18): Obvious Over Yeh in view of Yeh2, Bonner and Optionally Jones 2	
35[preamble]	<i>See</i> Claim 31. EX1044 ¶¶122-23.
35[a]	<i>See</i> Claims 18 and 29[a]. Pet., 74-75; EX1003 ¶¶420-23; EX1044 ¶124-26; <i>supra</i> Claim 29[a]. Bonner’s eccentric screens would take the place of Yeh’s concentric screens and thus would operate at pressures of 5,000 psi.
Claim 36 (Sub. for Cl. 19): Obvious Over Yeh in view of Yeh2, Bonner and Optionally Jones 2	
36[preamble]	<i>See</i> Claim 31. EX1044 ¶¶127-28.
36[a]	<i>See</i> Claims 18, 19, 29[a], and 35[a]. Pet., 74-75; EX1003 ¶¶420-25; EX1044 ¶129; <i>supra</i> Claims 29[a], 35[a].
Claim 37 (Sub. for Cl. 20): Obvious Over Yeh in view of Yeh2, Bonner and Optionally Jones 2	
37[preamble]	<i>See</i> Claim 31. EX1044 ¶¶130-31.
37[a]: wherein installing the first eccentric sand screen assembly and attaching the second eccentric sand screen	Yeh in view of Yeh2 and optionally Jones2 disclosed or suggested this limitation for the same reasons discussed for Claim 20. Pet., 75-76; EX1003 ¶¶426-27; EX1044 ¶132. This limitation’s requirement that the first and second sand screens be eccentric screens was also disclosed by Bonner for the same reasons discussed <i>supra</i> for Claim 27[b]. EX1044

assembly include disposing the first eccentric sand screen assembly and the second eccentric sand screen assembly in a horizontal portion of the wellbore.	¶133. Bonner also disclosed installing its eccentric sand screens in a horizontal interval: “While used in a variety of scenarios, shunt systems tend to have more recognized value in long openhole horizontal completions and deviated wells due to the increased problems deploying the pack, as premature annuli bridging, voids, and thief zones are all working against success.” EX1016, 2; EX1044 ¶134.
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E. MTA Ground 3: Substitute Claims 38-39 Are Obvious over Yeh in View of Jones and Bonner

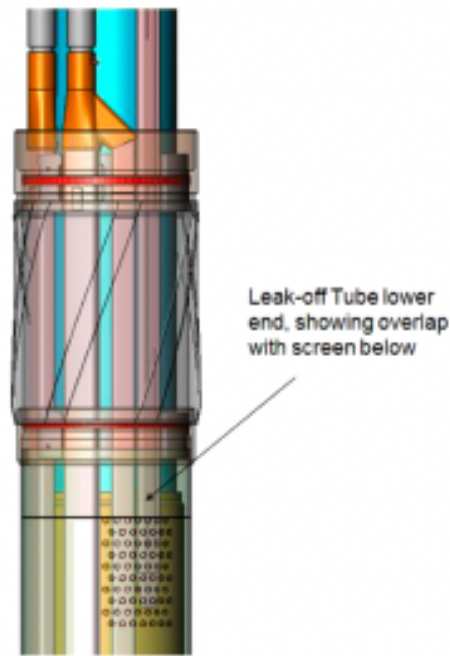
The original limitations in proposed Substitute Claims 38-39 are taught or suggested by Yeh in view of Jones for the same reasons discussed in the Petition for original Claims 21-22. *See* Pet. 76-79; EX1003 ¶¶428-42. The Substitute Claims 38-39 are obvious over Yeh in view of Jones and Bonner for the additional reasons discussed below.

Claim 38 (Sub. for Cl. 21): Obvious Over Yeh in view of Jones and Bonner	
38[preamble]	<i>See</i> Claim 21[preamble]. Pet., 76; EX1003 ¶¶428-29; EX1044 ¶¶135-36.
38[a]	<i>See</i> Claim 21[a]. Pet., 76; EX1003 ¶430; EX1044 ¶137.
38[b]: a first eccentric sand screen assembly comprising a base pipe having perforations therein and extending between a first end and a second ends, a	Yeh disclosed or suggested aspects of this limitation other than “eccentric” for the same reasons discussed for Claims 1[a] and 21[b]. Pet., 33-34, 76; EX1003 ¶¶260-70, 431; EX1044 ¶138. It would have been obvious to substitute Bonner’s eccentric high-pressure sand screen for Yeh’s concentric screen and even to modify that sand screen to handle Yeh’s higher pressure of 6,500 psi for the reasons discussed in Claim 27[b]. EX1044 ¶139. Bonner’s eccentric sand screen design sought to use a

sand screen disposed around a portion of the base pipe, and a shunt tube assembly disposed outwardly of the sand screen, the shunt tube assembly having a transport tube and a packing tube, where each of the tubes has a passageway defined therein, the packing tube further including a plurality of nozzles spaced apart from each other, wherein each of the tubes and each nozzle has a cross-sectional flow area; and	conventional eccentric sand screen with some modifications: “The main basis of design for the new system was to keep it functionally the same as existing industry-proven designs, in order to enjoy the empirical evidence of years of successful application of shunt tube gravel-packing technology.” EX1016, 2; EX1044 ¶139. Thus, Bonner’s eccentric screen has a base pipe having perforations therein and extending between a first end and a second end, as was conventional. EX1016, 2 (“The mounting of the shunt tube system to each sand screen joint was designed in a common eccentric configuration, with the transport tubes brought into alignment at each joint connection via the use of an ‘oriented’ premium thread.”), 9 (referring to the “sand screen filter media underlying” the shunt tube system); EX1044 ¶140. One of skill would understand that sand screen base pipes were perforated to receive production fluids as taught by Yeh and others. EX1005, 2:37-39, 2:55-61, 16:1-8, 24:4-8; EX1010, 2:20-28; EX1007, 3:24-26, Fig. 1. The screen covers the base pipe perforations to prevent sand from entering the base pipe. EX1005, 2:37-41, 2:55-61, Figs. 2, 4A; EX1044 ¶141. Because sand screens are joints of tubing, they each have a first and second end as shown in the figure below from Bonner’s Figure 11 showing top and bottom sand screen joints joined at a coupling. EX1044 ¶140. The figure below shows the second end of the top joint and the first end of the bottom joint:  EX1016, Fig. 11; <i>see also, e.g., id.</i>, 1 (“joints of screen”), 2
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(“each sand screen joint”).

Additionally, Bonner’s screen (yellow, below) covered only a portion of the base pipe (blue, below):



EX1016, Fig. 12; *see also id.*, 6 (“The lower end of the [leak off] tube slides under the bottom joint centralizer, ***all the way to the screen section*** (see Figure 12).”); EX1044 ¶141.

Bonner’s Figure 5 below shows each of the claimed features including a base pipe and a shunt tube assembly disposed outwardly of the sand screen. The shunt tube assembly has transport tubes and packing tubes, where each of the tubes has a passageway defined therein, and wherein each of the tubes has a cross-sectional area:

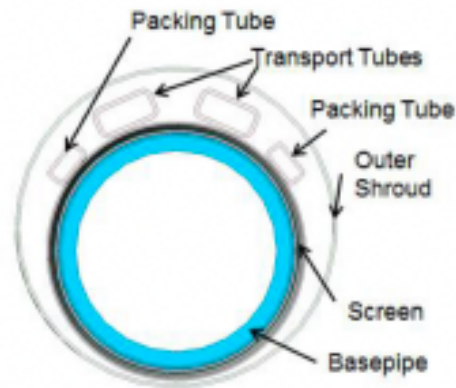
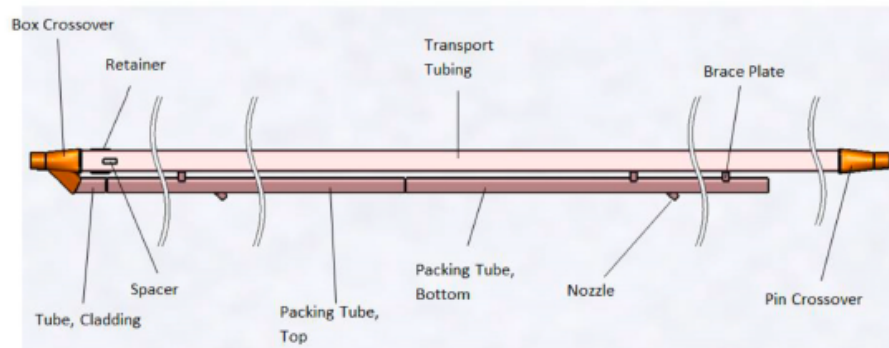


Figure 5—Cross section of shunt tube system

EX1016, Fig. 5; EX1044 ¶141. Bonner also explained that its design was intended to “keep it functionally the same as existing industry-proven designs,” which included “the location and size of exit ports for flow to [sic: and] exit from the packing tubes were essentially the same.” EX1016, 2, 3 (“the same exit port spacing and arrangement”); EX1044 ¶143.

Bonner’s shunt tube assembly is also shown in Figure 8, reproduced below:



EX1016, Fig. 8. Spaced apart nozzles are shown in Figure 8. Nozzles inherently have a cross-sectional flow area. EX1044 ¶143.

38[c]: a second eccentric sand screen assembly comprising a base pipe having

Yeh disclosed or suggested this limitation for the same reasons discussed for Claims 1[b] and 21[c]. Pet., 34-37, 77; EX1003 ¶¶271-77, 432; EX1044 ¶144.

perforations therein and extending between a first end and a second ends, a sand screen disposed around a portion of the base pipe, and a shunt tube assembly disposed outwardly of the sand screen, the shunt tube assembly having a transport tube and a packing tube, the packing tube including a plurality of nozzles spaced apart from each other, wherein each of the tubes and each nozzle has a cross-sectional flow area;	
38[d]: wherein the first and second <u>eccentric</u> sand screen assemblies are arranged end to end relative to one another so that the base pipes are in fluid communication with one another and the transport tubes are in fluid communication with	Yeh disclosed or suggested this limitation for the same reasons discussed for Claims 1[d] and 21[d] except that the first sand screen be eccentric. Pet., 39-40, 77; EX1003 ¶¶285-89, 433. The requirement that the first sand screen be eccentric was disclosed or suggested by Yeh in view of Bonner for the same reasons discussed <i>supra</i> for Claim 27[b]. EX1044 ¶¶145-46.

one another and the source of pressurized working fluid, the transport tube of the second <u>eccentric</u> sand screen assembly fluidly coupled to the source of pressurized working fluid downstream of the transport tube of the first sand screen assembly; and	
38[e]: wherein the transport tube of the first <u>eccentric</u> sand screen assembly is formed of a first material and the transport tube of the second <u>eccentric</u> sand screen assembly is formed of a second material, the first material having a greater tensile strength than the second material.	Yeh in view of Jones disclosed or suggested this limitation for the same reasons discussed for Claims 1[e] and 21[e] except that the first screen be eccentric. Pet., 41-43, 77-78; EX1003 ¶¶290-97, 434-39; EX1044 ¶147. The requirement that the first sand screen be eccentric was disclosed by Yeh in view of Bonner for the same reasons discussed <i>supra</i> for Claim 27[b]. EX1044 ¶148. Although the eccentric screens in the Bonner example use rectangular tubes, one of skill would understand that the same basic principles of pressure containment applied to these tubes, including that tubing wall thickness, tubing dimensions, and tubing tensile strength determined the pressure containment capacity of the tubes. <i>E.g.</i>, EX1003 ¶¶103-04, 133-34, 139-40, 155-88, 291-97, 434-38; EX1044 ¶149. Dr. Durham conceded as much. EX1043, 93:18-94:6, 104:6-11. Thus, one of skill would have readily looked to tubing material as one option to save cost in lower-pressure tubing or to save cross-sectional area in higher-pressure tubing as taught by Yeh and Jones and expected success, as these modifications would have been understood by a skilled artisan. EX1044 ¶¶150-52.

Claim 39 (Sub. for Cl. 22): Obvious Over Yeh in view of Jones and Bonner	
39[preamble]	<i>See</i> Claim 38. EX1044 ¶¶153-54.
39[a]	Yeh in view of Bonner and Jones disclosed or suggested this limitation. <i>See</i> Claim 22. Pet., 79; EX1003 ¶¶440-42. In addition to being the few available options for changing tubing design pressure (external tubing dimensions, material tensile strength, and wall thickness) and thus being obvious to try, selecting tubing material based on tensile strength and other parameters as well as tubing wall thickness based on pressure containment needs were result-effective variables that would have been obvious to a skilled artisan to optimize as needed. Given the higher-pressure needs in the upstream Bonner eccentric screens versus the downstream conventional eccentric screens, a skilled artisan would readily select the appropriate tubing material and tubing wall thickness as needed to meet the particular job requirements with a complete understanding of the advantages and disadvantages of the available options and understood these modifications would likely be successful. EX1044 ¶¶155-57; EX1043, 93:18-94:6, 104:6-11.
39[b]: <u>and wherein a cross-sectional flow area of the packing tube of the first, eccentric sand screen assembly is less than a cross-sectional flow area of the packing tube of the second, eccentric sand screen assembly.</u>	For the same reasons discussed <i>supra</i> in Claim 29[b], the cross-sectional flow area of the packing tube of the first (Bonner) eccentric sand screen assembly would be less than the cross-sectional flow area of the packing tube of the second (conventional low-pressure) eccentric sand screen assembly. EX1044 ¶158.

F. MTA Ground 4: Substitute Claim 40 Is Obvious over Yeh in View of Jones, Yeh2, and Bonner

The original limitations in Substitute Claim 40 are taught or suggested by Yeh

in view of Jones and Yeh2 for the same reasons discussed in the Petition for original Claim 23. See Pet., 79; EX1003 ¶443. Substitute Claim 40 is obvious over Yeh in view of Jones, Yeh2, and Bonner for the additional reasons discussed below.

Claim 40 (Sub. for Cl. 23): Obvious Over Yeh in view of Jones, Yeh2, and Bonner	
40[preamble]	See Claim 38. EX1044 ¶¶159-60.
40[a]	See Claim 23. Pet., 79; EX1003 ¶443; EX1044 ¶161.
40[b]: and a packing tube of the first eccentric sand screen assembly is interconnected to a shunt tube junction block of the second eccentric sand screen assembly.	The requirement that the first sand screen be eccentric was disclosed or suggested by Yeh in view of Bonner for the same reasons discussed <i>supra</i> for Claim 27[b]. EX1044 ¶162. Yeh and Yeh2 disclosed a packing tube of an upstream sand screen interconnected to a junction block of a downstream sand screen. EX1005, Fig. 4A; EX1006, 3, Fig. 6a; EX1003 ¶310; <i>supra</i> Claim 26[b]. Bonner also disclosed a packing tube of an upstream sand screen interconnected to a shunt tube junction block of a downstream sand screen. EX1016, Fig. 8; EX1044 ¶163; <i>supra</i> Claim 33[b]. Thus, in the scenario of Claim 38, Bonner’s eccentric screen packing tubes would all be interconnected to the shunt tube junction blocks of the low-pressure conventional eccentric screens in one continuous interconnection.

IV. SECONDARY CONSIDERATIONS OF NON-OBVIOUSNESS

There are no relevant secondary considerations regarding the ’007 Patent. EX1044 ¶164.

V. CONCLUSION

Weatherford requests the Board deny Patent Owner’s Motion to Amend.

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CERTIFICATE OF SERVICE

The undersigned certifies that pursuant to 37 C.F.R. § 42.6(e), a true copy of the foregoing **PETITIONER’S OPPOSITION TO PATENT OWNER’S MOTION TO AMEND** is being served electronically on May 30, 2025 to the following counsel for Patent Owner to the following email addresses:

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