

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.

PACKERS PLUS ENERGY SERVICES, INC.,
Patent Owner.

Case IPR2016-00650
Patent 6,907,936 B2

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

DEFRANCO, *Administrative Patent Judge*.

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

I. INTRODUCTION

Packers Plus Energy Services Inc. (“Packers Plus”) is the owner of U.S. Patent No. 6,907,936 B2 (“the ’936 patent”) and Rapid Completions LLC (“Rapid Completions”)¹ is the exclusive licensee of the ’936 patent. Baker Hughes Incorporated and Baker Hughes Oilfield Operations, Inc. (collectively, “Baker Hughes”) filed a Petition (Paper 1, “Pet.”) seeking *inter partes* review of claims 14 and 17–26 of the ’936 patent. We instituted *inter partes* review of all the challenged claims (Paper 9, “Inst. Dec.”) because Baker Hughes demonstrated a reasonable likelihood of prevailing on “at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a).

After institution, Rapid Completions filed a Patent Owner Response (Paper 29, “PO Resp.”), and Baker Hughes followed with a Reply (Paper 34, “Pet. Reply”). Each party had an opportunity to present its case in a hearing conducted on May 18, 2017, a transcript of which is in the record. Paper 46 (“Tr.”).

We have jurisdiction over these proceedings under 35 U.S.C. § 6(b). After considering the evidence and arguments of the parties, we determine that Baker Hughes has not proven by a preponderance of the evidence that claims 14 and 17–26 of the ’936 patent are unpatentable. See 35 U.S.C. § 316(e). We issue this Final Written Decision pursuant to 35 U.S.C. § 318(a).

II. BACKGROUND

A. *The Related District Court Action*

The ’936 patent is involved in a concurrent district court case, *Rapid*

¹ Rapid Completions is a subsidiary of Acacia Research Group LLC, which in turn is a subsidiary of Acacia Research Corporation. Paper 5.

Completions LLC v. Baker Hughes Incorporated, No. 6:15-cv-00724 (E.D. Tex.), which was filed July 31, 2015. Paper 5. The district court action is presently stayed pending resolution of this proceeding and several related proceedings.

B. The '936 Patent

The '936 patent describes a tubing string for isolating and stimulating flow from a particular segment of an oil or gas well formation. Ex. 1001, 1:8–11. Typically, a tubing string is run into a wellbore as a conduit for oil and gas products to flow to the surface. *Id.* at 1:25–30. But when natural formation pressure is insufficient, a well “stimulation” technique is employed, which involves injecting fracturing fluids into the formation to enlarge existing channels and thereby improve inflow into the wellbore. *Id.* at 1:20–24. And, because a wellbore may cross multiple zones within an oil or gas formation, only some of which contain desirable products, the ability of the tubing string to isolate and stimulate certain zones within the formation is key to controlling and optimizing production from the well. Ex. 1009, 5–9, Figs. 7 and 11.

As described, the tubing string includes a series of ports along its length, with a ball-actuated sliding sleeve mounted over each port for selectively permitting fracturing fluid to flow from certain segments of the tubing string into the wellbore. Ex. 1001, 2:26–62, 5:66–6:7, 6:31–64. Special sealing devices, called “packers,” are mounted upstream and downstream of each port along the length of the tubing string. *Id.* at 1:26–34, 6:8–30. The packers seal the annulus between the tubing string and the borehole wall, thereby dividing the wellbore into a series of isolated segments. *Id.* at 6:12–18. When the sliding sleeve over a particular port is

activated to an open position, fluid can pass into one segment of the wellbore but is prevented from passing into adjacent segments by the packers positioned on each side of the port. *Id.* at 6:44–51.

C. The Challenged Claims

Of the challenged claims, two are independent—claims 14 and 25. Although claim 14 is directed to an “apparatus” and claim 25 to a “method,” they recite essentially the same elements “for fluid treatment of a borehole.” The common elements include:

- a “tubing string,”
- a “first port” and a “second port” in the wall of the tubing string,
- a “sliding sleeve” mounted over at least one of the ports,
- a “first packer,” “second packer,” and “third packer” mounted between and on either side of the ports,
- a “first sleeve” that “has engaged and moved the sliding sleeve away from the first port,”
- a “second sleeve” moveable relative to the second port,
- and
- “sleeve shifting means for moving the second sleeve . . . to create a seal in the tubing string.”

Ex. 1001, 15:56–16:19 (claim 14), 16:66–18:12 (claim 25). And, as described in the specification of the ’936 patent, the “sleeve shifting means” comprises a ball being driven by pressurized fluid against an integral seat on the interior of the sliding sleeve. *Id.* at 6:53–7:9, Figs. 1b, 3a–3b.

D. The Instituted Grounds

In its Petition, Baker Hughes challenges the claims on six grounds, one based on anticipation under 35 U.S.C. § 102 and five based on obviousness under 35 U.S.C. § 103. Pet. 5. We instituted *inter partes*

review on all the asserted grounds and challenged claims. Inst. Dec. 12.

The grounds on which we granted *inter partes* review are as follows.

Reference(s)	Basis	Claims Challenged
Thomson ²	§ 102	14, 17–26
Thomson and Echols ³	§ 103	14, 17–26
Thomson and Hartley ⁴	§ 103	19
Thomson and Brown ⁵	§ 103	22, 23
Thomson, Echols, and Hartley	§ 103	19
Thomson, Echols, and Brown	§ 103	22, 23

In further support of the asserted grounds, Baker Hughes proffers the declaration of Ali Daneshy, Ph.D. Ex. 1006.

III. ANALYSIS

A. *Claim Construction*

In an *inter partes* review, we give claim terms in an unexpired patent their broadest reasonable construction in light of the specification of the patent in which they appear. *Cuozzo Speed Techs. LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016). Under that standard, we ascribe claim terms their ordinary and customary meaning, as understood by a skilled artisan in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Our construction of claim terms “cannot be divorced from the specification and the record evidence.” *Microsoft Corp. v.*

² D.W. Thomson et al., *Design and Installation of a Cost-Effective Completion System for Horizontal Chalk Wells Where Multiple Zones Require Acid Stimulation*, SPE (Society for Petroleum Engineering) 37482 (1997) (Ex. 1002, “Thomson”).

³ U.S. Patent No. 5,375,662, iss. Dec. 27, 1994 (Ex. 1003, “Echols”).

⁴ U.S. Patent No. 5,449,039, iss. Sep. 12, 1995 (Ex. 1004, “Hartley”).

⁵ U.S. Patent No. 4,018,272, iss. Apr. 19, 1977 (Ex. 1005, “Brown”).

Proxyconn, Inc., 789 F.3d 1292, 1298 (Fed. Cir. 2015) (quoting *In re NTP, Inc.*, 654 F.3d 1279, 1288 (Fed. Cir. 2011)).

In its Petition, Baker Hughes proposes a construction for seven different claim terms. Pet. 17–24. In our institution decision, we construed expressly only one of the terms—“has engaged and moved”—as recited in independent claims 14 and 25. Inst. Dec. 5. Specifically, claims 14 and 25 begin by reciting that the tubing string has a “first port” with a “sliding sleeve mounted thereover.” Later, the claims recite a “first sleeve” for moving the sliding sleeve and permitting fluid flow through the first port: “wherein the first sleeve *has engaged and moved* the sliding sleeve away from the first port.” Emphasis added.

At the institution stage, we construed the term “engaged” according to its plain and ordinary meaning as defined in the dictionary—“involved in activity.” See *Merriam-Webster’s Dictionary*, 383 (10th ed. 2000) (Ex. 3001). Thus, in the context of the claims, we found that the first sleeve must be actively involved in moving the sliding sleeve, as distinguished from standing simply in physical contact with the sliding sleeve. In other words, as used in the claims, the term “engaged” connotes some sort of dynamic action on the part of the first sleeve relative to the sliding sleeve. Neither party disputes that construction. Indeed, both parties agree that our construction is consistent with “a process of two events that are temporally linked,” *first*, “the physical relationship between the first sleeve and the sliding sleeve changes to one of engagement,” and *second*, “the first sleeve moves the sliding sleeve.” Pet. 19; see also PO Resp. 2 (agreeing that the Board’s construction is consistent with the petitioner’s proposed construction of “engaged and moved”).

B. Anticipation by Thomson (Claims 14 and 17–26)

Baker Hughes proffers Thomson as anticipating claims 14 and 17–26. Pet. 5, 51. Baker Hughes maintains this ground in the event Packers Plus seeks a construction of “has engaged and moved” that is “unreasonably broad.” Reply 11; *see also* Pet. 51 (“[s]hould Patent Owner seek a construction of ‘has engaged and moved’ . . . in this proceeding that is as broad as the one implicitly asserted in the Litigation . . . Thomson alone anticipates all of the Challenged Claims”).

As construed above, and agreed to by the parties, the term “engaged and moved” as used in claims 14 and 25 requires that the first sleeve act independently of the sliding sleeve to move the sliding sleeve away from the port. In contrast, the sliding sleeve arrangement of Thomson—shown in figure 5—includes an internal first sleeve (light grey) that acts as a “ball seat” for the sliding sleeve. Ex. 1002, 1, 2, Fig. 5. Rather than actuating sliding sleeve, Thomson’s internal first sleeve is “threaded” permanently within the sliding sleeve, and thus cannot act to engage and move the sliding sleeve away from the port, as required by claims 14 and 25. With that distinction in mind, we are not persuaded that Thomson anticipates claims 14 and 25.⁶

C. Obviousness Over Thomson and Hartley (Claim 19) and Thomson and Brown (Claims 22 and 23)

Baker Hughes combines Thomson with Hartley as an additional challenge to dependent claim 19, and combines Thomson with Brown as an

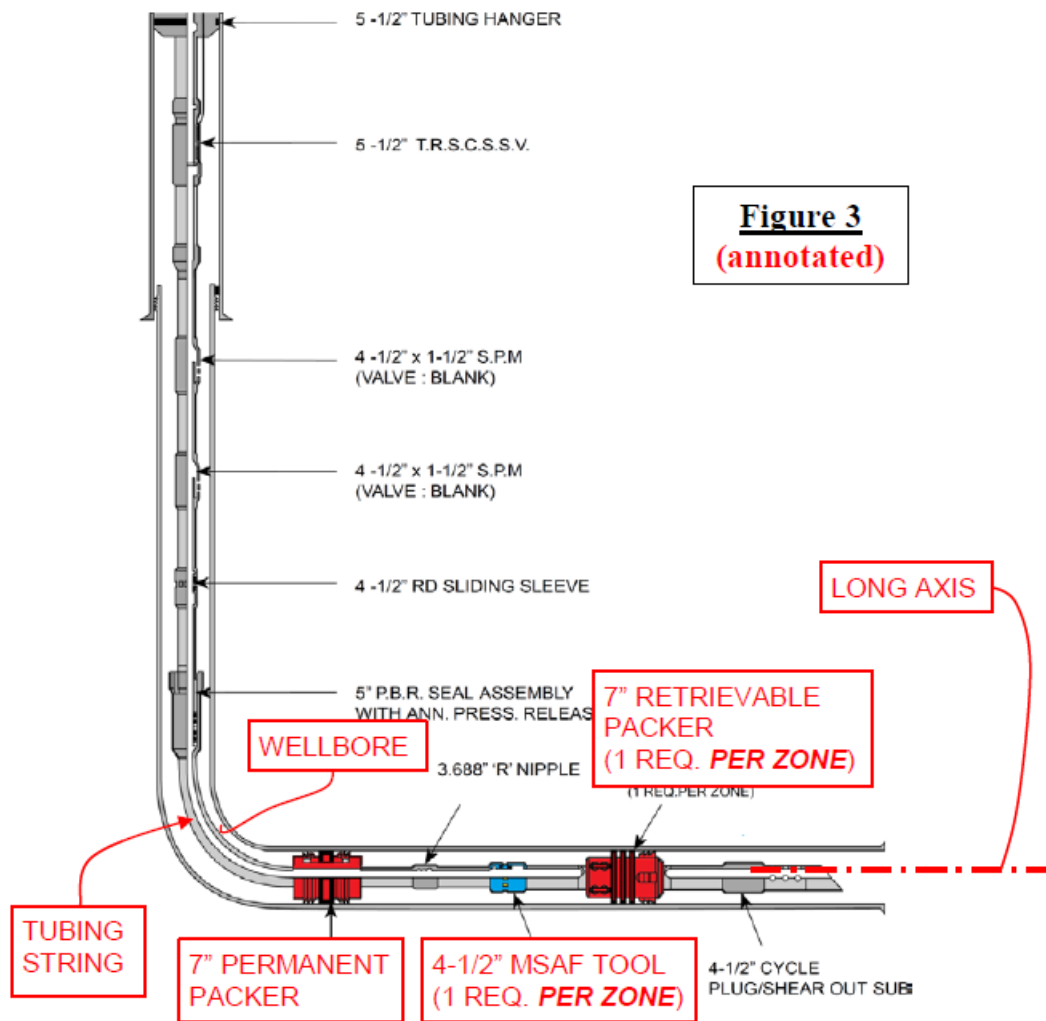
⁶ Indeed, Baker Hughes concedes that under our construction of the term “has engaged and moved,” they “do not dispute that Ground 4 fails.” Reply 11–12.

additional challenge to claims 22 and 23. Pet. 51–52; Reply 9–11. Neither Hartley nor Brown cures the deficiency of Thomson insofar as satisfying the claim limitation that the first sleeve “has engaged and moved” the sliding sleeve. Nor does Baker Hughes attempt such an argument. Instead, Hartley and Brown are proffered for the purpose of meeting other claim elements (e.g., “plug” and “packer”), separate and apart from the “first sleeve” element for which Thomson is proffered. *See id.* As such, we are not persuaded that claim 19 would have been obvious over Thomson and Hartley, nor are we persuaded that claims 22 and 23 would have been obvious over Thomson and Brown.

D. Obviousness Over Thomson and Echols (Claims 14 and 17–26)

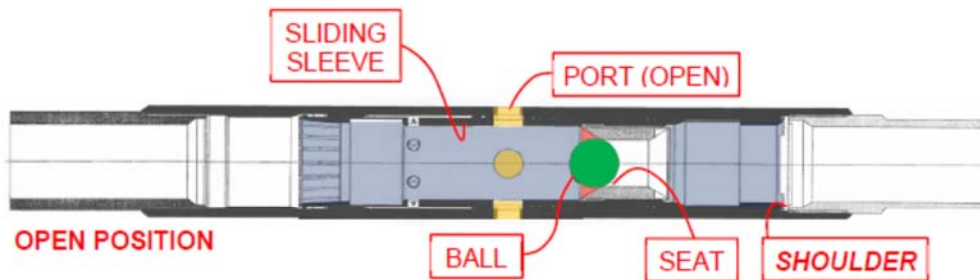
Baker Hughes further contends that claims 14 and 17–26 are unpatentable for obviousness over Thomson and Echols. Pet. 24–45. Our analysis focuses on the two independent claims under challenge, claims 14 and 25.

For the most part, Baker Hughes relies on Thomson as disclosing the elements of claims 14 and 25—the tubing string, the ports and sliding sleeves for opening the ports, and the packers mounted along the tubing string on either side of the ports. *Id.* at 27–30, 34–44. More specifically, Baker Hughes proffers annotated Figure 3 of Thomson, reproduced below, illustrating how Thomson’s tubing string meets the recited “port,” “packer,” and “sliding sleeve” elements of claims 14 and 25. *Id.* at 25.



Annotated figure 3 depicts a tubing string within a borehole of an oil well. The tubing string is equipped with solid body packers (shown in red) on each side of a so-called “MSAF tool” (shown in blue), which Thomson describes expressly as a “sliding sleeve.” Ex. 1002, 1–2. Although figure 3 shows only a single sliding sleeve between two packers, Thomson states that “[u]p to 9 MSAF tools can be run in the [tubing system] with isolation of each zone being achieved by hydraulic-set retrievable packers that are positioned on each side of an MSAF tool.” *Id.* at 1 (“Abstract”); see also *id.* at 4.

Thomson further describes that the MSAF tool, or sliding sleeve, “allow[s] communication between the tubing and the annulus once the sleeve is moved to the open position.” *Id.* at 2. Annotated figure 5 of Thomson, reproduced below, depicts the sliding sleeve (shown in blue) as moveable between a closed and open position relative to the port (shown in yellow).



Excerpt of Figure 5
(annotated)

As for the claimed “sleeve shifting means,” annotated figure 5 depicts a ball (green) that sits within a ball seat (grey) for actuating the sliding sleeve (blue). According to Thomson, “the ball seat is threaded on the bore of [the] sleeve, and when the correct size ball lands on the ball seat, applied pressure from above moves the sleeve to the down/open position.” *Id.* at 2. Furthermore, each “ball and seat form a seal that prevents pumped fluid from entering lower zones” of the tubing string. *Id.* On this record, we find that Thomson discloses the “tubing string,” “port,” “sliding sleeve,” “slide shifting means,” and “packer” elements in the manner called for by claims 14 and 25.

Baker Hughes acknowledges that Thomson lacks the “first sleeve” limitation of claims 14 and 25. Pet. 32–37. In that regard, Baker Hughes explains that “when in use, Thomson’s [ball] seat is in a fixed relationship

Annotated figures 7 and 8 of Echols depict a dual-sleeve arrangement for injecting completion fluid through a port in a tubing string. Ex. 1003, 5:52–6:56. In annotated figure 7, drop ball 66 (green) is in sealing engagement with C-ring (i.e., first sleeve) 52 (red). *See id.* at 6:14–16, Fig. 7. To expose port 28 (orange) in the tubing string, “hydraulic pressure is increased until the hollow shear screws 74 separate, thus opening the setting port 28 and permitting [sliding] sleeve 26 to be shifted along the smooth bore of the guide tube 36 to the uncovered position as shown in Fig. 8.” *Id.* at 6:16–21. “When the setting port 28 is opened, hydraulic fluid is pumped into the pressure chamber 76.” *Id.* at 6:22–23. Hydraulic pressure also causes separation of shear pins 81, allowing first sleeve 52 and shear collar 56 to be moved into counterbore 58 of sliding sleeve 26. *Id.* at 6:30–33. This allows drop ball 66 to flow through sliding sleeve 26 and into another completion zone for actuating another sliding sleeve (not shown) downhole of sliding sleeve 26. *Id.* at 6:30–37.

Baker Hughes asserts a skilled artisan would have been motivated “to add Echols’s dual-sleeve arrangement to Thomson’s system to increase the number of points from which treatment fluid can be injected.” Pet. 32 (citing Ex. 1006 ¶¶ 78–79) (emphasis added). To that end, Baker Hughes proffers “Figure A,” reproduced below, to illustrate how a skilled artisan would have modified Thomson’s system to add Echols’ dual-sleeves.

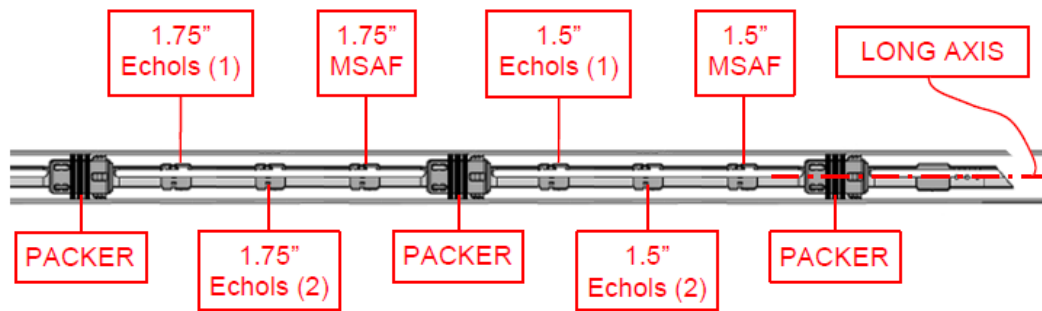


Figure A
(Thomson-Echols)

“Figure A” illustrates Thomson’s system as modified to add Echols’s dual-sleeves. *Id.* at 34. Baker Hughes argues that a skilled artisan “would have been motivated to include multiple ones of Echols’ dual-sleeve arrangement . . . to provide additional injection points above Thomson’s MSAF tools in each of these zones.” *Id.* at 32 (citing Ex. 1006 ¶¶ 78–79). According to Baker Hughes, Echols suggests such a modification by disclosing that its dual-sleeve arrangement “may also be used for injecting completion chemicals through the exposed port into the annulus surrounding the tubing string.” *Id.* (citing Ex. 1003, 6:45–53). Furthermore, Baker Hughes argues, a skilled artisan “would have expected this modified Echols-Thomson system to be beneficial for treating zones with larger thicknesses, to provide additional fractures or porosity at both sleeves to improve porosity and thus production from the formation.” *Id.* at 33.

Packers Plus takes issue with Baker Hughes’s assertion that a skilled artisan would have modified Thomson’s system “by adding” Echols’s sleeves in front of Thomson’s sliding sleeves (i.e., MSAF tools). PO Resp. 2–5. Specifically, Packers Plus disputes Baker Hughes’s reason for the addition of Echols’s sleeves to Thomson’s system—“to provide additional injection points above Thomson’s MSAF tools in each of the[] zones” shown in annotated Figure A above. PO Resp. 3–4 (citing Pet. 49).

According to Packers Plus, because Thomson describes a completion system where the wellbore is cemented and cased, the “the number of sleeves per zone does not dictate the number of injection points into the formation. Rather, the number of perforations in the casing dictates the number of injection points, whether there is a single sleeve per zone or multiple sleeves per zone.” *Id.* at 4. As such, Packers Plus argues, there is no reason to employ more sleeves in each of Thomson’s perforated zones, when the single sleeve per zone already disclosed by Thomson suffices to do the job. *Id.* We agree.

As shown and described in Thomson, the wellbore is lined with cement, and perforations are made in the cement casing for each zone to be treated. Ex. 1002, 3 (“Before running the completion, each well was perforated with tubing-conveyed perforating (TCP) guns.”); Fig. 3 (showing cement-lined wellbore). The tubing string is then run into the perforated, cased wellbore, “with isolation of each zone being achieved by hydraulic-set packers positioned on each side of an MSAF tool,” which Thomson describes as “a sliding sleeve device” that is “the ‘heart’ of the completion system.” *Id.* at 1, 2. Fracturing fluid is pumped into the tubing string, and “once the sleeve is moved to an open position,” it is ejected “into the tubing liner annulus” between the tubing string and the cased wellbore. *Id.* at 2 (emphasis added). But to ultimately reach the formation, the fracturing fluid in the annulus must pass through the perforations in Thomson’s cased wellbore.

Given that fracturing fluid can only escape from the annulus and into the formation through the perforations in the cement casing, increasing the number of sleeves in each zone, as Baker Hughes suggests, would not equate

to an increase of injection points into the formation. Instead, that is dictated by the number of perforations in the casing, as evidenced by the testimony of Packers Plus's expert, Mr. McGowen,

[i]t would be immediately clear to a POSITA the use of multiple Echols sleeves in a Thomson zone would not provide additional injection points into the formation. The only injection points into the casing are through perforations. If a POSITA wanted to modify Thomson to add additional injection points, he or she could add additional perforations in the casing, but there would be no reason to add additional sliding sleeves in a particular zone.

Ex. 2003, 15:4–8 We find this testimony persuasive. With the perforations in the casing dictating the number of points where fluid can enter the formation, we find that a skilled artisan would not have considered that additional sleeves in a particular zone would translate to a benefit of additional injection points.

Baker Hughes contends that neither the challenged claims nor the modified Thomson system require a cased wellbore. Reply 1. We find this argument unpersuasive. Regardless of what the claims require, we are persuaded that Thomson discloses using its tubing string in a cased wellbore. For example, Thomson discloses that “[b]efore running the completion, each well was perforated with tubing-conveyed perforating (TCP) guns.”

Ex. 1002, 3. Thomson also discusses “installation into the horizontal section of the liner,” and admonishes that “[t]he well in general and liner in particular needs to be properly cleaned and conditioned. This is essential for running ten packers in a horizontal liner.” These disclosures indicate that Thomson's system includes a cement liner in the wellbore. Figure 3 of Thomson, reproduced above, appears to show the wellbore with a cement liner. Consistent with these disclosures, Packers Plus's expert, Mr.

McGowen, testifies that “Thomson describes fracturing through perforations in *cemented casing*.” Ex. 2003, 15:1 (emphasis added). Baker Hughes does not dispute this testimony by Packer’s Plus’s expert.

Given this, Baker Hughes does not persuade us that a skilled artisan would have thought adding Echols’s sleeves inside a cased and perforated wellbore would improve fracturing. Baker Hughes does not dispute that the number of perforations discharging fluid from a particular zone dictates how and where that fluid flows into the surrounding formation. See Reply 1–3. As such, we reject Baker Hughes’ argument that adding sleeves inside a cased wellbore that limits fluid discharge to a predetermined number of perforations would somehow “provide additional fractures or porosity at both sleeves to improve porosity and thus production from the formation.” Pet. 33; see also Reply 2–3. In sum, we determine that Baker Hughes has not provided rational underpinning for its contention that a skilled artisan would have added multiple of Echols’ sleeves to Thomson’s zones that already have a sliding sleeve.

Baker Hughes alternatively argues that, even if Thomson is limited to a cased-hole, then the cased-hole approach of “limited entry,” which reduces the number of perforations in a wellbore casing to create excess pressure in a given zone, would have motivated a skilled artisan to increase the number of sleeves in Thomson’s system. Reply 2–3. But, when asked at the oral hearing why reducing the number of perforations would have prompted a skilled artisan to increase the number of sleeves, Baker Hughes posited that the primary reason would have been to increase flow rate into the casing. Tr. 18:3–21. Nowhere, however, does Baker Hughes point to supporting evidence for its assertion that increasing flow rate within a perforated zone

would have motivated a skilled artisan to include additional sleeves. See Pet. 32–33; Reply 2–3. If anything, the evidence indicates that Thomson’s single sleeve arrangement suffices for flow rate. For example, figure 3 of Thomson states expressly that only one sliding sleeve (i.e., MSAF tool) is required per zone—“1 REQ PER ZONE”—which indicates that additional sleeves, as Baker Hughes proposes, would be superfluous to increasing flow rate. Ex. 1002, Fig. 3. Notably, Thomson adds that this single sleeve arrangement “proved that the system was not only feasible but highly efficient, both from an operational standpoint and from a reservoir treatment standpoint.” *Id.* at 5. Those descriptions suggest that Thomson’s system already operates efficiently and effectively with a single sliding sleeve, thereby counseling against Baker Hughes’s rationale of adding Echols’s sleeves to provide the benefit of an increased flow rate in Thomson’s system.

At the oral hearing, Baker Hughes also contended that “it’s also true that if you wanted you could attempt to line up the injection points with the perforations. That’s not something that we discussed in the papers, but it’s something that would be clear to an operator.” Tr. 18:22–25. Here again, Baker Hughes does not provide any supporting evidence for this belated contention.

We also find unpersuasive Baker Hughes’s argument that adding Echols’s sleeves to Thomson’s system would allow multiple sleeves in a particular zone to be actuated by a single-sized ball. Pet. 32–33; Reply 2. That argument fails because Thomson already allows actuation of all sleeves in each zone with a single-sized ball. Specifically, each of Thomson’s zones includes one sliding sleeve (i.e., MSAF tool) per zone, and that sleeve is

actuated by a single-sized ball. *See* Ex. 1002, 1, 3, Fig. 3. Accordingly, a desire to actuate all sleeves in a given zone with a single-sized ball would not appear to provide any reason to modify Thomson's system.

In sum, Baker Hughes does not persuade us that a skilled artisan would have had reason to combine the disclosures of Echols and Thomson in the manner asserted. Accordingly, we conclude that Baker Hughes has not demonstrated by preponderant evidence that claims 14 and 17–26 would have been obvious over the combination of Thomson and Echols.

E. Obviousness Over Thomson, Echols, and Hartley (Claim 19) and Thomson, Echols, and Brown (Claims 22 and 23)

As an alternative challenge to dependent claim 19, Baker Hughes adds Hartley to the combination of Thomson and Echols. Pet. 45–46. Likewise, as an alternative challenge to claims 22 and 23, Baker Hughes adds Brown to the combination of Thomson and Echols. *Id.* at 46–50; Reply 9–11. Neither Hartley nor Brown cures the deficiency in Baker Hughes's arguments of an adequate reason to combine Thomson and Echols. Instead, Baker Hughes proffers Hartley and Brown for purposes other than to support a reason to combine. As such, we are not persuaded that claim 19 would have been obvious over Thomson, Echols, and Hartley, nor are we persuaded that claims 22 and 23 would have been obvious over Thomson, Echols, and Brown.

IV. CONCLUSION

After considering the evidence and arguments presented in the Petition and Response, as well as the Reply, we determine that Baker Hughes fails to demonstrate by a preponderance of the evidence that challenged claims 14 and 17–26 of the '936 patent are unpatentable.

V. ORDER

Accordingly, it is hereby:

ORDERED that Baker Hughes has not carried its burden to show that claims 14 and 17–26 of the '936 patent are unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, any party to the proceeding seeking judicial review of the Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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