

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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SHENZHEN TUOZHU TECHNOLOGY CO., LTD.,  
Petitioner,

v.

STRATASYS, INC.,  
Patent Owner.

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IPR2025-00531  
Patent 9,168,698 B2

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Before MITCHELL G. WEATHERLY, CHRISTOPHER L. OGDEN, and  
LILAN REN, *Administrative Patent Judges*.

WEATHERLY, *Administrative Patent Judge*.

DECISION  
Granting Institution of *Inter Partes* Review  
*35 U.S.C. § 314*

I. INTRODUCTION

A. Background

Shenzhen Tuozhu Technology Co., Ltd. (“Petitioner”) filed a petition (Paper 2, “Pet.”) to institute an *inter partes* review of claims 1–15 (the “challenged claims”) of U.S. Patent No. 9,168,698 B2 (Ex. 1001, “the ’698 patent”). 35 U.S.C. § 311. Stratasys, Inc. (“Patent Owner”) timely

filed a Preliminary Response. Paper 8 (“Prelim. Resp.”). Institution of an *inter partes* review is authorized by statute when “the information presented in the petition filed under section 311 and any response filed under section 313 shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a). Based on our review of the record,<sup>1</sup> we conclude that Petitioner is reasonably likely to prevail with respect to at least one of the challenged claims.

Petitioner challenges the patentability of claims as follows:

<b>Claim(s) challenged</b>	<b>35 U.S.C. §<sup>2</sup></b>	<b>Reference(s)</b>
1–6, 8–15	103	Warren <sup>3</sup>

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<sup>1</sup> The panel strongly prefers that all text within an evidentiary exhibit that is filed in a PDF should be capable of being (1) found using a search feature and (2) copied as text. As of the date of this Decision, many of the exhibits filed by Petitioner, including the ’698 patent, fail to comply with this preference. In their papers, the parties should cite evidence by exhibit number in every instance; a short form name may also be used, but not as a substitute for the exhibit number. Submissions not meeting these expectations may be refused.

<sup>2</sup> The Leahy-Smith America Invents Act (“AIA”) included revisions to 35 U.S.C. §§ 102 and 103 that became effective March 16, 2013. The application for the ’698 patent was filed on October 29, 2013. Although the ’698 patent claims priority to applications filed before March 16, 2013, Patent Owner has not shown that the written description of the earlier applications supports the challenged claims. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378–80 (Fed. Cir. 2015); *Tech. Licensing Corp. v. Videotek, Inc.*, 545 F.3d 1316, 1327 (Fed. Cir. 2008). Therefore, we apply the post-AIA versions of 35 U.S.C. §§ 102 and 103.

<sup>3</sup> In this proceeding, Petitioner filed U.S. Pat. 6,986,739 B2 to Warren as Exhibit 1004. However, it also identified U.S. Pat. Pub. No. 2003/0100824

Claim(s) challenged	35 U.S.C. § <sup>2</sup>	Reference(s)
3, 7, 9	103	Warren, Eshed <sup>4</sup>
1–5, 7–10, 12–15	103	Calderon, <sup>5</sup> RepRap20208 <sup>6</sup>
11	103	Calderon, RepRap20208, Napadensky <sup>7</sup>

## B. Related Proceedings

The parties identified as related proceedings the co-pending district court proceedings of *Stratasys, Inc. v. Shenzhen Tuozhu Technology Co. Ltd.*, 2:24-cv-00644 (E.D. Tex.), filed August 8, 2024, and *BambuLab USA, Inc. et al v. Stratasys, Inc.*, 1:24-cv-01511 (W.D. Tex.), filed December 9, 2024. Pet. 77; Paper 3, 2. Patent Owner also identifies as related the proceedings stemming from petitions filed at the PTAB in IPR2025-00257, IPR2025-00311, IPR2025-00321, IPR2025-00354, IPR2025-00438, IPR2025-00532, IPR2025-00585, IPR2025-00611. Paper 3, 2.

## C. The '698 Patent

The '698 patent provides “pressure-sensing extruders” for a “three-dimensional printer.” Ex. 1001, 1:13–20. “An extruder or other tool head of

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A1 as “Warren,” Pet. iii, and cited to paragraph numbers throughout its discussion of Warren, *id. passim*. Only the publication version of Warren bears such paragraph numbers. Throughout this Decision, and unless otherwise indicated, when we cite Ex. 1004 or discuss “Warren,” we refer to U.S. Pat. Pub. No. 2003/0100824 A1. *See infra* Part II.C.1.

<sup>4</sup> U.S. Pat. Pub. No. 2007/0179656 A1 (Ex. 1008, “Eshed”).

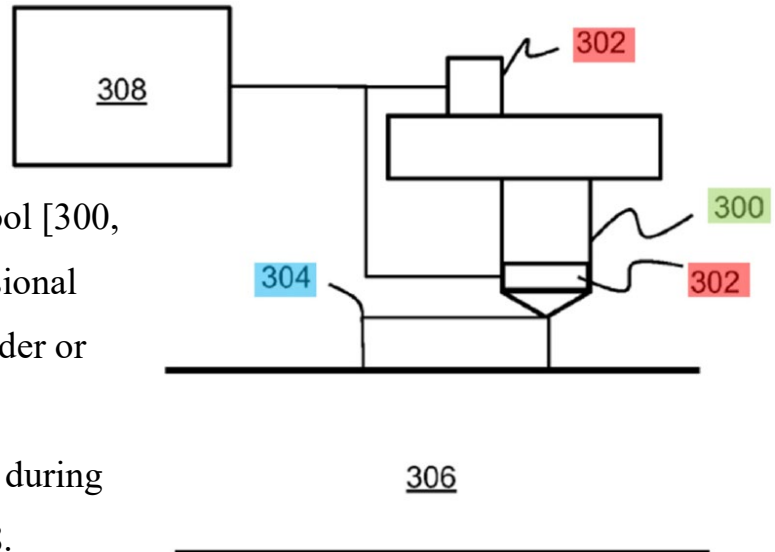
<sup>5</sup> U.S. Pat. No. 6,629,011 B1 (Ex. 1009, “Calderon”).

<sup>6</sup> RepRap Discussion Thread “Genetic Algorithm” (available at <https://reprap.org/forum/read.php?1,20208,page=1>) (Ex. 1010, “RepRap20208”).

<sup>7</sup> U.S. Pat. No. 9,031,680 B2 (Ex. 1005, “Napadensky”).

a three-dimensional printer is instrumented to detect contact force against the extruder, such as by a build platform or an object being fabricated.” *Id.* at code (57), 1:23–30. “The resulting feedback data can be used . . . to control operation of the three-dimensional printer.” *Id.*

The annotated version of Figure 3 from the ’698 patent reproduced at right illustrates “a fabrication tool [300, green] for use in a three-dimensional printer,” that includes “an extruder or other tool operable to add build material to an object 304 [blue] during a build process.” *Id.* at 8:39–48.



“[S]ensors 302 [red] may be mechanically coupled or otherwise included in the fabrication tool 300 [green] . . . to sense a contact force between the fabrication tool 300 [green] and a separate structure, such as the object 304 [blue], the build platform 306, or some other structure.” *Id.* Additionally, a “controller may . . . control the three-dimensional printer in a manner responsive to the detected forces.” *Id.* at 9:9–23. According to the ’698 patent, “sensors that are collectively operable to sense any force or displacement of the fabrication tool and separate structure, or any related properties such as compression or strain, may be used as sensors 302 [red], so long as the contact force(s) described above may be calculated from the sensed physical characteristics.” *Id.* at 8:49–61.

**Fig. 3**

Claim 1, which is directed to a method and is the only independent claim among the challenged claims, recites:

1[pre]. A method comprising:

[a] identifying build instructions for fabricating an object;

[b] initiating a build using a three-dimensional printer comprising a fabrication tool and one or more sensors mechanically coupled to the fabrication tool, the one or more sensors configured to detect a current contact force between the fabrication tool and a separate structure;

[c] detecting the current contact force based on a sensor signal from the one or more sensors; and

[d] creating a control signal to control at least one component of the three-dimensional printer in response to the current contact force while depositing material during the build.

*Id.* at 12:37–49 (with Petitioner’s bracketed labels added to ease discussion).

## II. ANALYSIS

### A. Claim Interpretation

We interpret claims in the same manner used “in a civil action under 35 U.S.C. § 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b). When applying that standard, we interpret the claim language as it would have been understood by one of ordinary skill in the art in light of the specification. *Wasica Fin. GmbH v. Cont’l Auto. Sys., Inc.*, 853 F.3d 1272, 1279–80 (Fed. Cir. 2017). Thus, we give claim terms their ordinary and customary meaning as understood by an ordinarily skilled artisan. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc). Only terms that are in controversy need to be construed,

and then only to the extent necessary to resolve the controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

Neither party contends that any claim language requires express interpretation at this stage, and we agree. Accordingly, we interpret the claims consistent with the principles set forth above.

#### B. Legal Standards

The Supreme Court in *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398 (2007), reaffirmed the framework for determining obviousness as set forth in *Graham v. John Deere Co.*, 383 U.S. 1 (1966). The *KSR* Court summarized the four factual inquiries set forth in *Graham* that we apply in determining whether a claim is reasonably likely to be unpatentable as obvious under 35 U.S.C. § 103(a) as follows: (1) determining the scope and content of the prior art, (2) ascertaining the differences between the prior art and the claims at issue, (3) resolving the level of ordinary skill in the pertinent art, and (4) considering objective evidence indicating obviousness or nonobviousness. *KSR*, 550 U.S. at 406. With these standards in mind, we address each challenge below.

#### C. Claims 1–6 and 8–15: Obviousness in View of Warren

Petitioner argues that the teachings of Warren render claims 1–6 and 8–15 unpatentable as obvious. Pet. 6–37. Patent Owner argues that Petitioner’s challenge fails for three reasons including: (1) the Petition fails to meet the requirements of 35 U.S.C. § 312 and 37 C.F.R. § 42.104 by not “identifying specific portions of the evidence that support the challenge” (2) Petitioner has failed to establish that an ordinarily skilled artisan would have been motivated to combine teachings from various embodiments of

Warren, and (3) Warren fails to describe certain aspects recited in limitations 1b and 1c. Prelim. Resp. 16–27. We address each argument below.

1. Alleged Deficiencies in the Petition Under 35 U.S.C.  
§ 312(a)(3)(A) and 37 C.F.R. § 42.104(b)(5)

Patent Owner argues that we should deny the Petition in its entirety for “failing to satisfy the basic requirements of requesting *inter partes* review” under 35 U.S.C. § 312(a)(3)(A) and 37 C.F.R. § 42.104(b)(5). Prelim. Resp. 16–18. More specifically, Patent Owner contends that the Petition does not “identify[] specific portions of the evidence that support the challenge” based on Warren. *Id.* at 6. Patent Owner’s argument stems from Petitioner’s submission of U.S. Patent No. 6,986,739 B2 to Warren as Exhibit 1004, while also citing to portions of Exhibit 1004 by paragraph numbers that do not appear in the issued patent version of Warren. *Id.* at 17. As noted *supra*, Petitioner has confusingly referred to Warren as both a U.S. patent and a U.S. Patent Publication (i.e., US 2003/0100824 A1). *See* Pet. iii. We further note that Petitioner has submitted the published application version of Warren as Exhibit 1004 in the closely related proceeding of IPR2025-00532. IPR2025-00532, Ex. 1004. Petitioner also asserts that “Warren” is prior art based on its “published” date of May 29, 2003, a date which is reflected on both the issued patent and the published application. *See* Ex. 1004 as originally filed, code (65) (issued patent); *see also* IPR2025-00532, Ex. 1004, code (43) (published application); Pet. 2. We further note that Petitioner’s expert witness, Dr. Andrew Wolfe, analyzes the published application version of Warren, which is apparent from a cursory review of his testimony. Ex. 1003 ¶ 25.

Although we sympathize with Patent Owner regarding the undue confusion and burden stemming from Petitioner’s erroneous submission of

the issued patent version of Warren as evidence and Petitioner’s ambiguous references to “Warren,” we do not find that this initial burden justifies denying the Petition. The specifications in both versions of Warren are substantively identical. *Compare* Ex. 1004 as originally filed code (21), *with* IPR2025-00532, Ex. 1004, code (21) (reflecting that both documents arose from the same application). Petitioner must, however, correct its error. Therefore, Petitioner shall replace the originally filed version of Exhibit 1004 (the issued patent version of Warren) with a copy of U.S. Pat. Pub. No. 2003/0100824 A1 and designate that filing as Exhibit 1004 (corrected). Petitioner shall promptly correct this error after entry of this Decision.

## 2. Motivation to Combine Teachings within Warren

Warren generally relates to a broad spectrum of methods and systems for three-dimensional printing of items in “biological, medical, bioengineering, and tissue-engineering.” Ex. 1004 ¶¶ 13–14. Warren describes various types of “dispensers” for depositing materials onto a target structure that include through-nozzle dispensers, *id.* ¶¶ 230–252, and capillary vibro-sensor dispensers, *id.* ¶¶ 283–318.

Petitioner identifies four motives for adding a transducer 3740 and vibration sensor 3730 used in connection with Warren’s vibro-capillary dispenser 3700 to Warren’s through-nozzle dispenser 100.<sup>8</sup> Pet. 13–16.

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<sup>8</sup> Because claim 1 does not limit the “tool” to any particular type beyond one that can be a “fabrication tool” in a “three-dimensional printer,” we consider the “tool” of limitation 1b to encompass Warren’s capillary vibro-sensor dispenser without any modification. For this reason, we invite Petitioner to clarify the extent to which it relies on its showing of motive to modify Warren’s through-nozzle tool with the sensor from the capillary dispenser for its challenge to claim 1.

Petitioner cites portions of Warren and Dr. Wolfe’s testimony to support these reasons. *Id.* (citing Ex. 1004 ¶¶ 93, 226–252, 283–318, 331, 332; Ex. 1003 ¶¶ 65–71). Patent Owner has yet to submit expert testimony, so Dr. Wolfe’s testimony relating to the motivations of an ordinarily skilled artisan is largely unrebutted.

Nevertheless, Patent Owner implies that Dr. Wolfe’s testimony is inconsistent with Warren largely because Warren lacks an “express motivation” or “express suggestion” to modify its through-nozzle dispenser with the force sensor from Warren’s capillary dispenser and that added precision is not required for Warren’s through-nozzle dispenser. *See* Prelim. Resp. 18–21. Patent Owner also argues that Warren’s through-nozzle dispensers are sufficiently controlled to avoid damage to the target without incorporating a contact force sensor. *Id.* at 21–22. None of these arguments rebuts Dr. Wolfe’s testimony, which Petitioner relies on heavily. Patent Owner also contends that Petitioner fails to explain how Warren’s through-nozzle dispenser could work with a force sensor that vibrates in the z-direction when Warren’s valve in that dispenser moves in the same direction. *Id.* at 22–23 (citing Ex. 1004 ¶¶ 289, 300, 301)<sup>9</sup>. We find this last argument to be unsupported by evidence because none of the cited portions of Warren reveals either that Warren’s transducer “moves the dispenser vertically” (i.e., in the z-direction) or that Warren’s valve in its through-nozzle dispenser moves in the same direction.

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<sup>9</sup> Patent Owner actually cites the patent version of Warren at 45:63–46:10, 47:22–24, and 47:38–41, which we find to correspond to the paragraph numbers that we provide.

Based on the current state of the record, we find that Petitioner has sufficiently demonstrated that an ordinarily skilled artisan would have been motivated to combine teachings of Warren’s through-nozzle and capillary dispensers and would have been reasonably successful doing so. Our finding is largely based on Dr. Wolfe’s un rebutted testimony. We consider the issue to remain open, however, and expect the parties to more fully develop the record on these issues during the trial.

### 3. Independent Claim 1

Petitioner identifies the portions of Warren that teach or suggest the limitations set forth in claim 1. Pet. 16–23 (citing Ex. 1004 ¶¶ 7–14, 58–63, 93, 230–324, 390–446, Figs. 18, 22A, 23A; Ex. 1003 ¶¶ 72–92). Patent Owner counters that “*Warren* does not teach one or more sensors configured to detect a current contact force.” Prelim. Resp. 25. The “current contact force” is detected by “one or more sensors” as recited in limitation 1b and limitation 1c requires “detecting the current contact force based on a sensor signal from the one or more sensors.” Ex. 1001, 12:40–45. Patent Owner does not currently contest Petitioner’s showing relating to Warren’s teaching of the other limitations recited in the method of claim 1. *See* Prelim. Resp. 25–27.

Petitioner identifies the combination of Warren’s vibration sensor 3730 and transducer 3740 as the sensor recited in limitation 1b and used to detect contact force in limitation 1c. Pet. 18–21. Warren’s system includes “a vibration oscillator 3720 . . . for imparting vibration to the dispenser 3700” and a “vibration sensor 3730 and a transducer 3740 . . . for sensing the A [amplitude] and f [frequency] of vibration of the dispenser 3700.” Ex. 1004 ¶ 300. “The vibration imposed on the dispenser 3700 is

changed, e.g., modulated, by the contact of the 3700 [sic] dispenser with the substrate 3710” such that the “transducer 3740 senses and transfers the changed vibration signal to an amplifier.” *Id.* ¶ 302. Warren explains that a “change in the amplitude of vibration of the dispenser and/or the substrate is detected” and that “this change in amplitude is proportional to the force of contact between the dispenser and the substrate.” *Id.* ¶ 313 (Fig. 22A).

Based on these teachings from Warren, Petitioner contends that an ordinarily skilled artisan would have understood or found it obvious that the “***contact force*** can be readily calculated from the detected ‘change in the amplitude.’” Pet. 20 (citing Ex. 1004 ¶¶ 301–307, 313; Ex. 1003 ¶ 86).

Patent Owner argues that Warren fails to explain how changes in the amplitude of a vibration translate to “detecting” a contact force. Prelim. Resp. 26. However, Patent Owner reproduces Warren’s Figure 21, which explicitly illustrates how the amplitude of vibration changes with contact force. *Id.* Also, the Specification broadly describes the sensors as follows:

The sensors 302 may collectively or individually sense the contact force along one, two, three, or more pairwise nonparallel axes. For example, a normal force (e.g., instantaneous contact force) between the fabrication tool 300 and the build platform 306 may be sensed; a direction and magnitude of deflection of the tip of the fabrication tool (including displacement and/or force) may be sensed in any positions or directions, etc. More generally, sensors that are collectively operable to sense any force or displacement of the fabrication tool and separate structure, or any related properties such as compression or strain, may be used as sensors 302, *so long as the contact force(s) described above may be calculated from the sensed physical characteristics.*

In some implementations, sensors 302 may include one or more of capacitive sensors, optical sensors, potentiometric sensors, *piezoelectric sensors*, or other electromechanical,

electromagnetic (e.g., those relying on inductance, the Hall effect, electromagnetic eddy currents, linear variable differential transformers, etc.), *acoustical*, or other sensors, as well as other sensors or combinations of the foregoing.

Ex. 1001, 8:49–9:1 (emphases added). Piezoelectric sensors and acoustical sensors are among the types of “force” sensors contemplated in the Specification. Neither of these types of sensors appear to measure force directly. Additionally, the Specification appears to contemplate that any sensor providing data that allows contact force “may be calculated” meets the sensor of claim 1. *Id.* at 8:59–61. Therefore, we see no reason to limit the claimed sensor to one that measures contact force directly as implied by Patent Owner’s argument.

Patent Owner also apparently advances other arguments that Warren fails to teach the claimed contact force sensor or modifying Warren’s through-nozzle dispenser to include such a sensor. Prelim. Resp. 27 (citing *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015); Ex. 1003 ¶ 82). Patent Owner provides no persuasive analysis of *Belden* and cites no evidence to support its apparent criticism of Dr. Wolfe’s testimony. If desired, Patent Owner should clarify these additional arguments in its Patent Owner Response.

Petitioner persuades us that Warren teaches the contact force sensor recited in limitation 1b and used in the detecting step of limitation 1c. Based on our review of the current record, we find that Petitioner has established a reasonable likelihood of proving that the teachings Warren render claim 1 unpatentable as obvious.

4. Dependent Claims 2–6 and 8–15

Patent Owner does not currently proffer any separate argument for the continued patentability of any dependent claim. *See* Prelim. Resp. 10–27 (proffering arguments only for independent claim 1). We have reviewed Petitioner’s argument and supporting evidence that claims 2–6 and 8–15 are unpatentable as obvious over Warren. Based on that review, we find that Petitioner has demonstrated a reasonable likelihood of proving that the teachings of Warren render dependent claims 2–6 and 8–15 unpatentable as obvious.

D. Prior Art Status of RepRap20208

At this stage, we do not comment on Petitioner’s showing that the combined teachings of Calderon and RepRap20208 render claims 1–5, 7–10, and 12–15 unpatentable as obvious because we have determined that Petitioner’s showing relating to Warren warrants instituting an *inter partes* review.

However, Patent Owner argues that Petitioner has failed to establish that RepRap20208 is a prior art printed publication. Prelim. Resp. 29–33. We understand Patent Owner’s argument to be two-pronged.

First, that Petitioner fails to establish that RepRap20208 was publicly available because Petitioner’s showing impermissibly incorporates argument by reference. *Id.* at 29–30. Although Petitioner’s showing is somewhat brief, *see* Pet. 2, we have no concerns about the sufficiency of that showing, which is based on direct testimony from a witness with undeniable personal knowledge of the history of the RepRap online forum in which RepRap20208 appears, Adrian Bowyer. Nor do we find it necessary to “piece together” arguments based on Mr. Bowyer’s testimony, which we

find to be clear, concise, and probative on the nature of the RepRap forum and who frequented that forum during the relevant time period. Patent Owner is entitled to test the probative value of Mr. Bowyer's testimony at trial if it desires.

Second, Patent Owner argues that Petitioner provides "no evidence of which subject matter of keywords would have been used to find *RepRap20208* with reasonable diligence." Prelim. Resp. 31–33.

Mr. Bowyer testifies that "the forums were (and still are) fully keyword searchable, allowing users to search for and readily identify relevant discussion threads. The search functionality allowed users to search for posts based on the author, the headings and the content of the posts." Ex. 1014 ¶ 6.

Based on our review of Mr. Bowyer's testimony, we find that Petitioner has sufficiently demonstrated that RepRap20208 was a printed publication as of its purported creation date in 2009. *See* Ex. 1014 ¶ 4 (explaining that the RepRap forum directly relates to three-dimensional printing and was frequented by "around 1,000 regular monthly users" who were "interested in 3D printing [as] both professionals and hobbyists" that was "often discussed in various print and web media and on social media" from the inception of the forum through today). Mr. Bowyer also testifies about the manner in which content is dated in the forum, *id.* ¶ 5, and the search functionality of the forum, *id.* ¶ 6. Despite Patent Owner's focus on statements lifted out of context from various cases, Prelim. Resp. 29–33, we discern no persuasive reason for rejecting the sufficiency of Petitioner's showing that RepRap20208 was sufficiently and publicly accessible by those

interested in three-dimensional printing as of 2009 to qualify as a prior art printed publication.

We have not made a final determination that RepRap20208 is a prior art printed publication, and the parties are invited to further develop the record on this issue during the trial.

### III. CONCLUSION

For the reasons expressed above, we determine that Petitioner has demonstrated a reasonable likelihood of showing that claims 1–6 and 8–15 of the '698 patent are unpatentable as obvious over Warren. In accordance with the Court's decision in *SAS Institute, Inc. v. Iancu*, 584 U.S. 357, 371 (2018) and 37 C.F.R. § 42.108(a), we institute an *inter partes* review of all challenged claims of the '698 patent on all grounds alleged by Petitioner.

Nevertheless, this Decision does not reflect a final determination on the patentability of any claim. We further note that the burden remains on Petitioner to prove unpatentability of each challenged claim. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

### IV. ORDER

For the reasons given, it is:

ORDERED that *inter partes* review of claims 1–15 of U.S. Patent No. 9,168,698 B2 is *instituted* with respect to all grounds of unpatentability set forth in the Petition;

FURTHER ORDERED that Petitioner shall replace the originally filed version of Exhibit 1004 (the issued patent version of Warren) with a copy of U.S. Pat. Pub. No. 2003/0100824 A1 and designate that filing as Exhibit 1004 (corrected); and

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FURTHER ORDERED that pursuant to 35 U.S.C. § 314(a), *inter partes* review of U.S. Patent No. 9,168,698 B2 is instituted commencing on the entry date of this Order, and pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is given of the institution of a trial.

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