UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SHENZHEN TUOZHU TECHNOLOGY CO., LTD.,
Petitioner

v.

STRATASYS, INC.
Patent Owner.

IPR2025-00438
U.S. PATENT NO. 10,569,466

PATENT OWNER'S RESPONSE

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I. INTRODUCTION

Stratasys, Inc. ("Patent Owner") submits this Response to the Petition for *inter partes* review ("Petition" or "Pet.") filed by Shenzhen Tuozhu Technology Co., Ltd. ("Petitioner"), challenging claims 1-5, 7-13, 16-20 ("challenged claims") of U.S. Patent No. 10,569,466 ("the '466 Patent") (EX1001).

Petitioner has failed to show that any of the challenged claims are unpatentable because each of the asserted grounds has fatal defects.

The challenged claims of the '466 Patent are directed to solutions that include providing data that includes a property of a build material from a tag to a client over a network, determining an operational parameter that is based on the property stored on the tag, receiving the operational parameter from the client, and fabricating an object with build material according to the operational parameter.

The primary reference in Grounds 1A and 1B (Loughran) discloses a system that, unlike the '466 Patent, automatically and dynamically adjusts its use without interacting with a client. That reference also has fundamental differences with the secondary reference in Grounds 1A and 1B (Dubois) that Petitioner failed to address. Additionally, the Loughran-Dubois combination fails to teach several elements of claim 1.

The additional reference in Grounds 1B and 3B (Jazayeri) is improper as it is not analogous art. Further, multiple claim elements of the independent claims are not taught by the corresponding combinations.

The reference in Ground 2 (Devos) discloses a powder-based system that fails to teach or render obvious a support structure requirement.

The primary reference for Grounds 3A and 3B (Menchik) fails to teach numerous elements of claims 1 and 19, including receiving a request from a client over a network to fabricate an object, providing data from the tag to the client, receiving operational parameter(s) from the client for fabrication of an object with the build material having a property stored in the tag.

In summary, each of Petitioner's grounds are deficient and thus Petitioner cannot satisfy its burden to prove unpatentability.

II. THE '466 PATENT AND THE CHALLENGED CLAIMS

A. The '466 Patent (EX1001)

The '466 Patent relates to "three-dimensional printers" that "use build material of various type and configuration to print three-dimensional objects." (EX1001, 1:16-18; EX2013, ¶¶59–67). As the patent explains, "at least a basic set of characteristics of the build material to determine operation" may be needed "[i]n order to properly process the build material through the three-dimensional printer extruder for the fabrication of an object." (*Id.*, 1:18-22). Thus, there is "a need for methods and systems for the automatic detection and acquiring of three-dimensional printer build material characteristics." (*Id.*, 1:23-25).

Figure 3 of the '466 Patent shows a three-dimensional printer system 300 that includes a three-dimensional printer 306 with a tag sensor 310 to read a data tag 304 included on a supply 302 of build material 312.

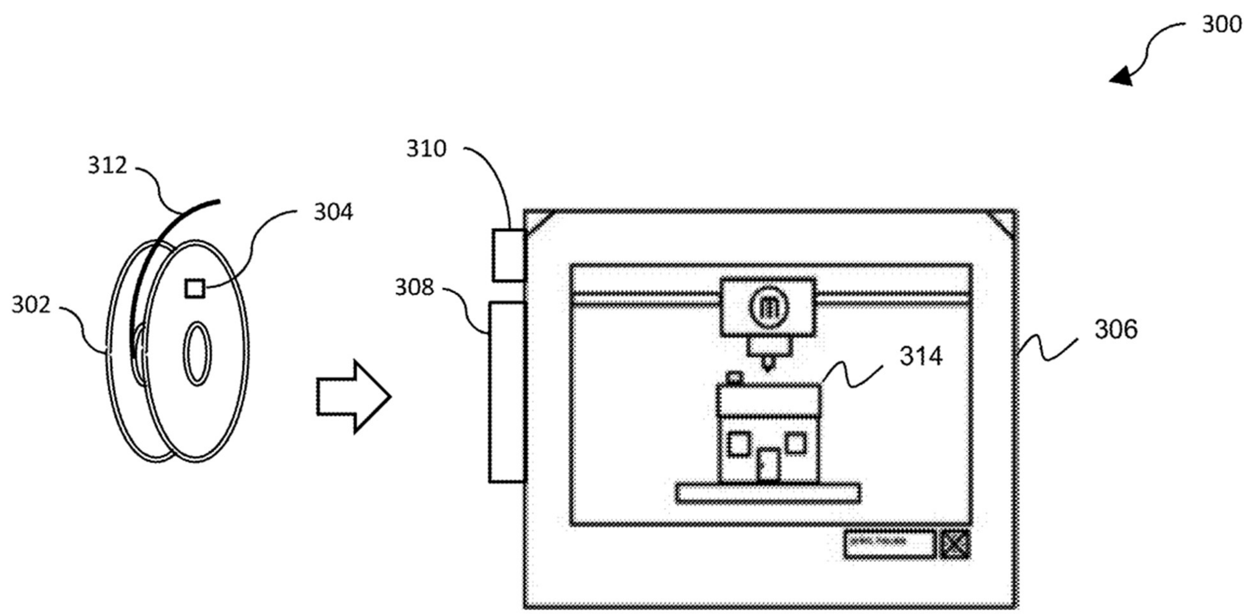


Fig. 3

(*Id.*, 13:65-67, 14:30-35, 14:56-59, Fig. 3). As shown, the supply of material can be coupled via 308 to the three-dimensional printer 306 for the fabrication of an object 314. (*Id.*, 14:9-23, 15:11-17, Fig. 3; *see also* Figs. 4A-4C).

A diagram of a three-dimensional printer 100 is shown below in Figure 1 with a build platform 102, extruder 106, and controller 110 that cooperate "to fabricate an object 112 within a working volume 114 …." (*Id.*, 2:25-29, Fig. 1).

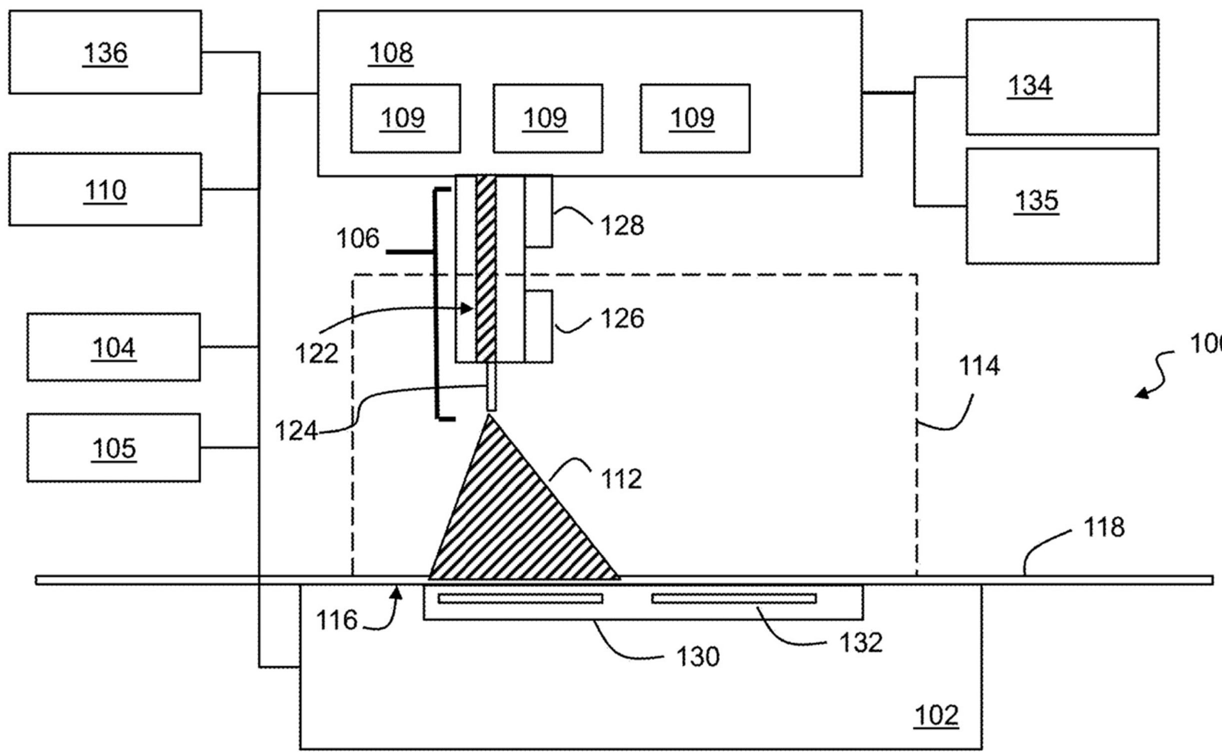


Fig. 1

To read build material tag data and fabricate an object, the '466 Patent illustrates a flowchart in Figure 6. (*Id.*, 1:50-52).

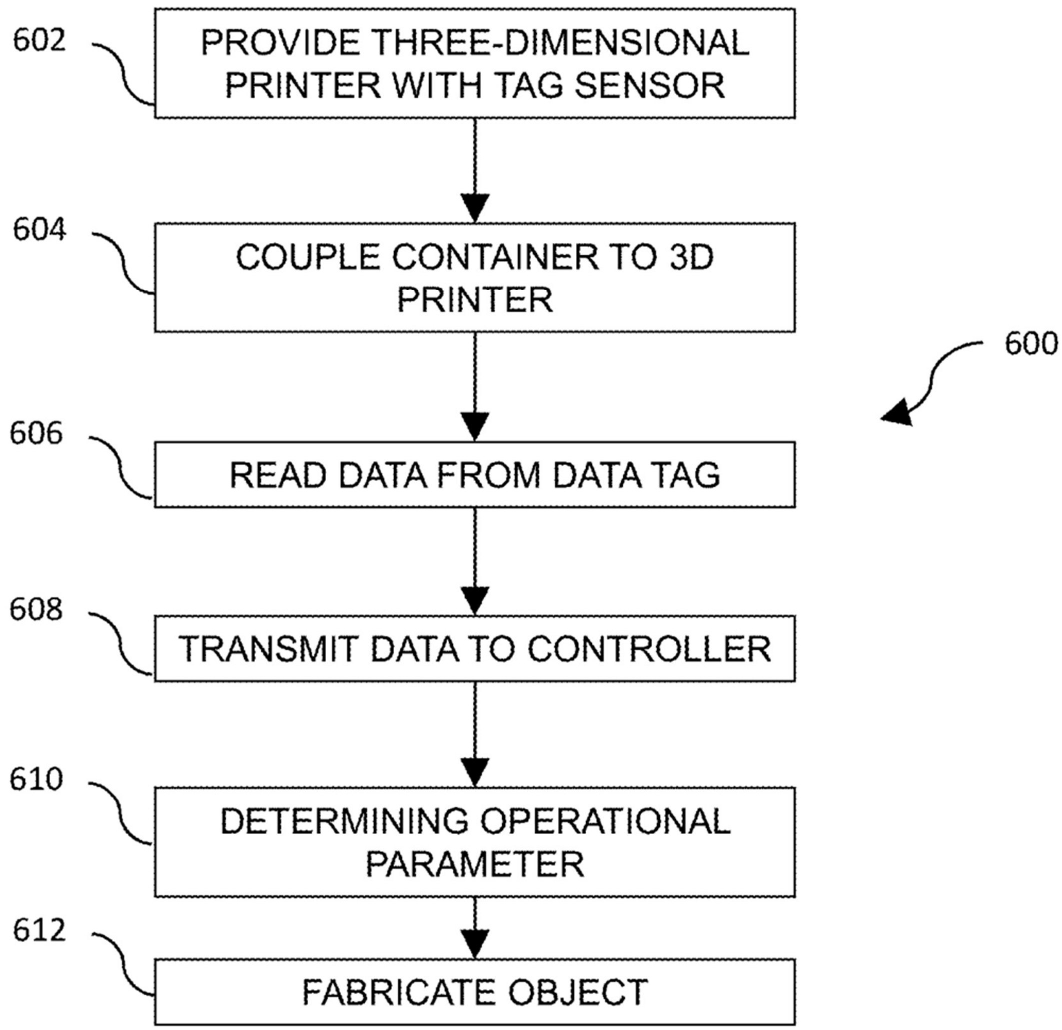


Fig. 6

At step 606, the data on the data tag is read using the tag sensor. (*Id.*, 21:39-41). And then, at step 608, the data read from the tag sensor may be transmitted to a controller. (*Id.*, 21:44-45).

At step 610, an operational parameter for fabrication of the object may be determined based on data from the data tag. (*Id.*, 21:50-56). For instance, a controller associated with the three-dimensional printer may use the type of build material to determine "an extruder temperature, a feed rate, a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, an extruder movement speed, and a cooling requirement." (*Id.*, 21:56-61). The determined operational parameter may be transmitted from a remote resource to the three-dimensional printer to fabricate an object. (*Id.*, 16:34-55).

At step 612, the object is fabricated while using the operational parameter to control operation of the three-dimensional printer. (*Id.*, 22:21-24). As a result, "a user may simply load a build materially from a suitably instrumented container and select an object to print without specifying various configuration details that might otherwise be required." (*Id.*, 22:27-31).

The claims capture the core workflow: reading tag data for build material, providing tag-derived build-material property data to a client over a network, receiving client-selected operational parameters to control printer operation during fabrication, and fabricating using those parameters. *See* (EX1001, claims 1, 19; *see also* 21:39-22:24). The asserted grounds fail to teach the elements of claims 1 and 19, as well as dependent claims 5, 10, and 17.

B. Prosecution History of the '466 Patent (EX1002)

During prosecution, the applicant explained that the claimed operational parameter(s), which are based on information read from a tagged container, must be used to control fabrication of the object (a deficiency the cited art did not address). (EX1002, 120-121, 158-160). The examiner allowed the claims explaining that the prior art fails to teach or suggest the claimed method. (*Id.*, 176, 202). The references in the Petition suffer from similar deficiencies as the art cited during prosecution. (EX2013, ¶¶68–69).

III. LEVEL OF ORDINARY SKILL

A personal of ordinary skill in the art (a "POSITA") in relation to the subject matter of the '466 Patent would have had a bachelor's degree in Mechanical Engineering, Computer Engineering, Electrical Engineering, Chemical Engineering, Materials Science, or a comparable field and at least two years of experience related to 3D printing, with additional experience potentially being a substitute for a formal degree or training (and vice versa). (EX2013, ¶¶21-26). Petitioner advances a similar level of skill in the art. *See* (Inst., 6-7).

The Petition has failed to show that the claims of the '466 Patent are unpatentable irrespective of the level of skill of a skilled artisan. (EX2013, ¶¶21-26).

IV. CLAIM CONSTRUCTION

Patent Owner submits that the Board does not need to construe any claim terms to conclude that the Petition is deficient. *See Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011).

V. APPLICABLE LEGAL STANDARDS

Petitioner's grounds rely on obviousness under 35 U.S.C. § 103. A claim cannot be considered obvious if even one element of the claim is absent from the prior art. *CFMT, Inc. v. YieldUp Int'l Corp.*, 349 F.3d 1333, 1342 (Fed. Cir. 2003).

Obviousness is resolved based on factual determinations including the scope and content of the prior art, any differences between the claimed subject matter and the prior art, and the level of ordinary skill in the art. *See Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). IPR petitions "must address the *Graham* factors." *Eizo Corp. v. Barco N.V.*, IPR2014-00358, Paper 11 at 29-30 (PTAB July 23, 2014) (faulting Petitioner for its failure to identify differences between the claimed subject matter and the prior art and its conclusory assertions about the teachings of the prior art).

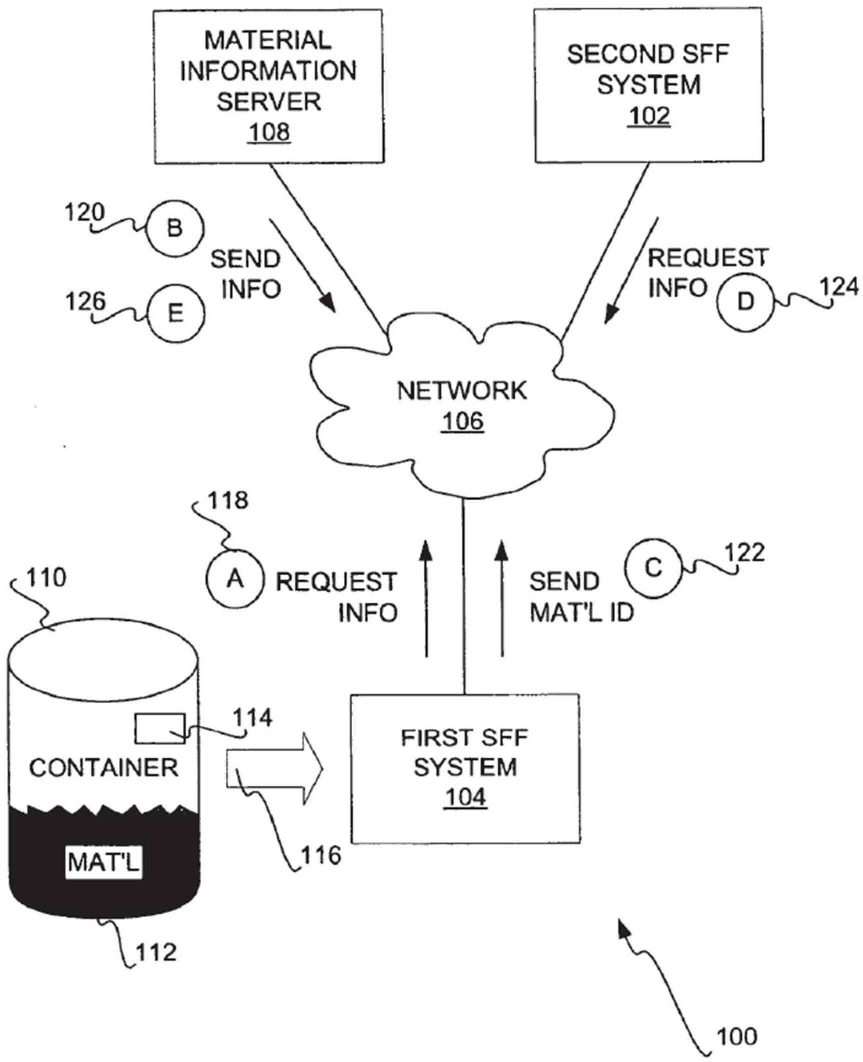
The conclusion of obviousness based on the combination of references must be supported by an explicit analysis of a reason to combine such references. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007). Mere conclusory statements are insufficient. Instead, "there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006).

Anticipation requires a single reference to disclose every claimed element, arranged as in the claim; it is insufficient that a POSITA could combine distinct teachings to assemble the claim. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369, 1371 (Fed. Cir. 2008).

VI. THE CHALLENGED CLAIMS ARE NOT UNPATENTABLE UNDER GROUND 1A

A. Overview of *Loughran* (EX1004)

Loughran describes SFF systems that read a material identifier from a tag and, if needed, request material information from a material information server, enabling automatic/dynamic adjustment of fabrication based on the retrieved material information. (EX1004, ¶¶[0012], [0020]-[0025], [0027]-[0028], [0037], Fig. 1).



These adjustments can occur while the SFF system is running, without having to reboot the system and can also occur without user intervention and involvement. (*Id.*, ¶¶[0024]–[0025], [0037]; EX2013, ¶¶72–75).

B. Overview of *Dubois* (EX1005)

Dubois describes ink-jet printing of multi-material 3D objects, using a printer-side data processing unit/database to determine print layers and printing parameters. (EX1005, ¶¶[0001]-[0002], [0048]-[0049], [0149]-[0150], Figs. 5-6; EX2013, ¶76).

C. There Is No Motivation to Combine *Loughran* and *Dubois*

Petitioner modifies Loughran's networked SFF system to "employ[] Dubois's suggestion" of "sending the fabrication job from the CAD client using CAD information that includes printing parameters concerning the state or characteristics of the materials," allegedly enabling fabrication "with the optimal set of material parameters." (Pet., 10; EX1003, ¶45). Petitioner further asserts a POSITA would have combined the references so that Loughran's printer uses, "for each individual fabrication job," Dubois's "optimum values of printing parameters as a function of the nature of the materials, the characteristics of the printer and deposition conditions." (Pet., 11; EX1005, ¶[0148]; EX1003, ¶46). Petitioner additionally relies on Dubois's statement that "it is important to control the nature of the materials in the printer … and to use the various functions of the printer optimally," and argues this purportedly motivates the combination so that "various functions" of Loughran's printer "are optimally utilized for each individual fabrication job." (Pet., 12; EX1005, ¶[0011]; EX1003, ¶47). Finally, Petitioner contends that combining Loughran and Dubois "would have been merely the application of known techniques to a known system ready for improvement to yield predictable results." (Pet., 12; EX1003, ¶48).

The Board credited Petitioner's rationale on the preliminary record and concluded that combining Loughran and Dubois was "no more than a combination of familiar elements according to known methods … [which] does no more than yield predictable results." (Inst., 17). However, the full record shows Petitioner's asserted "send printing parameters in the job" rationale conflicts with Loughran's disclosed architecture, which relies on printer-side automatic and dynamic adjustment based on information retrieved from a material-information server. (EX1004, ¶¶[0024]–[0026], [0037]; EX2013, ¶¶77–78). Loughran explains that the material-information server can provide information (including in machine-readable form) "by which the second SFF system … is automatically and dynamically adjusted," including process parameters tied to fabrication with the particular material. (EX1004, ¶[0024]). Loughran further teaches that the printer-side system "parses the retrieved information regarding the material … [to] extract parameters" and then "dynamically adjusts its own parameters" for fabrication with that material. (EX1004, ¶[0037]).

Petitioner's motivation theory, by contrast, depends on redesigning Loughran so the CAD client sends the printer a fabrication job "including CAD information with operational parameters as suggested by Dubois," i.e., shifting parameter-setting into the client-generated job. (Pet., 10–12; EX1003, ¶¶45–47). That proposed shift is not a "reason to combine" grounded in a technical need identified in Loughran, because Loughran already discloses the printer obtaining the relevant material-linked parameters from the server and dynamically adjusting itself accordingly. (EX1004, ¶¶[0024]–[0026], [0037]; EX2013, ¶79).

Nor does Dubois supply the missing motivation for Petitioner's particular modification, because Dubois's "optimum values" framework is implemented through a printer-side "computation unit" and "data processing unit" that determine print layers, trajectories, and printing parameters as a function of input data and information (including the state of materials, printer characteristics, and deposition conditions). (EX1005, ¶¶[0148]–[0156]; EX2013, ¶80). Dubois emphasizes that quality depends on parameters "representative of the nature of the [materials] used, the properties of the printer and the computer-aided design," and cautions about "problems associated with computer-aided design," including that "computer-aided design … does not allow optimum definition" of the patterns to be printed. (EX1005, ¶¶[0016]–[0017]).

Petitioner never explains how Loughran's remote CAD client would possess (or be provided) the printer-characteristics and deposition-condition inputs that Dubois identifies as necessary to determine "optimum values," particularly where Loughran's disclosed solution is to place the material-linked parameter retrieval and dynamic adjustment on the printer side via the material-information server workflow. (Pet., 11; EX1005, ¶[0148]; EX1004, ¶¶[0024], [0037]; EX2013, ¶81).

1. Petitioner's ***KSR*****-based "predictable results" theory does not supply the required motivation to combine**

Petitioner invokes *KSR* to argue that importing Dubois's parameter-determination concepts into Loughran would be the application of known techniques yielding predictable results. (Pet., 12; EX1003, ¶48). However, *KSR* does not eliminate the requirement for a reasoned explanation grounded in the prior art as to why a POSITA would have made the particular modification proposed, and Petitioner's *KSR* invocation is conclusory where it does not identify any specific deficiency in Loughran that Dubois's approach purportedly addresses. (Pet., 10–12; EX1004, ¶¶[0024]–[0026], [0037]; EX1005, ¶¶[0148]–[0156]; EX2013, ¶82).

a) <u>This is not a simple "combination of familiar elements according to known methods."</u>

Petitioner's theory requires shifting parameter-setting into the client-generated job, even though Loughran teaches that the printer is "automatically and dynamically adjusted" based on server-provided material information parsed on the printer side. (Pet., 10–12; EX1004, ¶[0024]; EX1004, ¶[0037]). That architecture-level reallocation of where parameters are determined and applied is not shown to be a "known method" in the asserted art, and Petitioner never explains how the redesign preserves Loughran's disclosed operating principle of printer-side dynamic adjustment. (Pet., 10–12; EX1004, ¶¶[0024]–[0026], [0037]). Indeed, Dr. Hickner testified that he did not propose any specific data flow or architecture for the asserted combination—no schematic, no information path—relying instead only on generalized POSITA "routine" modification, which he could not explain. (EX2015, 68:10–79:15; EX2013, ¶83).

b) <u>"Obvious to try" is not established.</u>

Petitioner does not identify a finite set of identified options for improving Loughran's system that would have predictably led a POSITA to adopt Dubois's printer-side "optimum values" framework while also moving parameter-selection into the CAD client job as Petitioner proposes. (Pet., 10–12; EX1003, ¶¶45–48; EX1005, ¶¶[0148]–[0156]; EX1004, ¶¶[0024]–[0026], [0037]; EX2013, ¶84).

c) <u>Dubois's "known technique" is not directed to Petitioner's proposed client-side parameter selection.</u>

Dubois teaches a printer-centric framework in which a data processing unit/database selects optimum parameters as a function of materials, printer characteristics, and deposition conditions, which is inconsistent with Petitioner's asserted modification that the CAD client sends the parameters in the fabrication job. (EX1005, ¶¶[0148]–[0156]; Pet., 10–12; EX1003, ¶¶45–47). Petitioner's *KSR* rhetoric therefore does not supply the missing explanation for why a POSITA would re-architect Loughran to move parameter-setting to the CAD client when Dubois itself emphasizes printer-side computation dependent on printer/deposition-condition inputs. (EX1005, ¶¶[0016]–[0017], [0148]–[0156]). Indeed, Dr. Hickner conceded that Dubois "doesn't really talk about clients and networks," and he further admitted Dubois "doesn't address tags"—the very mechanisms that drive the tag to client workflow in the '466 Patent. (EX2015, 61:13–22; 105:13–22; EX2013, ¶85).

d) Hindsight concerns underscore the lack of a non-conclusory rationale.

Petitioner's *KSR* reliance functions as a high-level justification for filling perceived gaps by hindsight, rather than identifying a concrete, record-grounded reason a POSITA would have modified Loughran's disclosed server-driven, printer-side dynamic-adjustment system in the specific manner Petitioner proposes. (Pet., 10–12; EX1003, ¶48; EX1004, ¶¶[0024]–[0026], [0037]). Petitioner's remaining "predictable results" / KSR rationale is thus conclusory as applied to the specific change Petitioner proposes—importing Dubois's parameter-determination concepts into Loughran's networked, server-driven dynamic-adjustment system—because Petitioner ties "predictable results" to high-level generalities rather than identifying a concrete, compatible integration path that preserves Loughran's disclosed operating principle of printer-side dynamic adjustment based on server-provided material information. (Pet., 10–12; EX1003, ¶¶45–48; EX1004, ¶¶[0024]–[0026], [0037]; EX2013, ¶86).

Accordingly, the intrinsic teachings of Loughran and Dubois confirm that Petitioner's asserted motivation depends on an architecturally inconsistent, expert-driven redesign—rather than a reason a POSITA would have had to modify Loughran in the manner Petitioner proposes. *Adidas AG v. Nike, Inc.*, 963 F.3d 1355, 1359 (Fed. Cir. 2020) ("The obviousness inquiry does not merely ask whether a skilled artisan could combine the references, but instead asks whether they would have been motivated to do so."); (EX2013, ¶87).

e) <u>Petitioner's combination renders Loughran inoperable for its intended purpose.</u>

Petitioner's proposed combination would displace Loughran's server-driven, printer-side retrieval and dynamic adjustment of material-linked parameters by shifting parameter-setting into the client-generated job, undermining Loughran's mechanism for material-appropriate fabrication and risking omission of printer-side inputs Dubois associates with generating/validating "optimum values." (Pet. 10-12; EX1003, ¶¶45-47; EX1004, ¶¶[0024]-[0026], [0037]; EX1005, ¶¶[0016]-[0017], [0148]-[0156]; EX2013, ¶88). Forcing the CAD client to embed and "select" those parameters in the job would undermine Loughran's server-based safeguard because the client may not have the most current material database or the printer-specific constraints needed to set correct process parameters, increasing the risk of fabrication defects that Loughran is designed to avoid. (EX2013, ¶88). This alteration is inconsistent with Loughran's intended purpose and supports the absence of a motivation to combine. *Adidas*, 963 F.3d at 1359-60.

D. Ground 1A Does Not Render Claim 1 Unpatentable

Claim 1 requires a networked architecture in which the printer reads tag data from a tag on the build material supply and provides "the data from the tag to the client over the network." (EX1001, 23:41-43). Claim 1 then requires that the printer "receiv[e] one or more operational parameters from the client selected for use in controlling operation of the three-dimensional printer when fabricating the object with the build material" and that the printer fabricate the object "according to the one or more operational parameters." (EX1001, 23:44–50; EX2013, ¶¶89–90).

1. Petitioner's element 1[f] theory fails because Loughran teaches printer-side dynamic adjustment based on server-provided material information, not the claimed receipt of client-selected operational parameters used to control the printer during fabrication.

For element 1[f], Petitioner relies on Loughran's disclosure that client devices running CAD software need "information regarding the material" so that SFF fabrication jobs can be "accurately generate[d]," and that the client "parses" the retrieved material information "for using it in SFF fabrication job generation." (Pet., 23–24; EX1004, ¶[0002], ¶[0027], ¶[0043]; EX1003, ¶63). Petitioner further relies on Loughran's disclosure that CAD software "generat[es] SFF fabrication jobs … for fabrication from a specific material based on the information regarding that material which has been received," and then "sends the SFF fabrication job to the second SFF system 104 over the network." (Pet., 24; EX1004, ¶[0055], ¶[0052],

¶[0049]; EX1003, ¶64). Petitioner then relies on Dubois's description of "determining" printing characteristics and "establishing a set of printing parameters" for each print layer/trajectory and treats those "printing parameters" as the claimed client-selected "operational parameters." (Pet., 24–26; EX1005, ¶[0057]–¶[0059], ¶[0027], ¶[0148], ¶[0150], Claim 79; EX1003, ¶¶65–67; EX2013, ¶91).

Loughran teaches that information retrieved from the material information server may be in machine-readable form "by which the second SFF system 104 is automatically and dynamically adjusted for utilization with the material 112," including process parameters such as operating/melting temperature, storage temperature, and inter-layer delay time. (EX1004, ¶[0024]). Loughran further teaches that the "second SFF system 104 parses the retrieved information regarding the material … [to] extract parameters … and dynamically adjusts its own parameters" based on the extracted parameters. (EX1004, ¶[0037]). Loughran's disclosure of the printer being "automatically and dynamically adjusted" based on server-provided material information reflects printer-side selection and application of process settings, not receipt of client-selected operational parameters as recited in element 1[f]. (EX2013, ¶92).

That printer-side "automatically and dynamically adjust[ed]" architecture is inconsistent with Petitioner's element 1[f] premise that the printer instead "receiv[es]" from the client selected operational parameters for controlling printer operation during fabrication. (EX1004, ¶[0024], ¶[0037]; Pet., 23–26; EX2013, ¶93). Indeed, Dr. Hickner agreed that Loughran's dynamic adjustment occurs during the run and that the SFF system "just does its own thing in dynamically adjusting," i.e., adjustment is printer side and not contained in any fabrication job sent by a client. (EX2015, 53:16–54:10). When Dr. Hickner was pressed to identify a passage in Loughran where "a client transmits to the printer a set of parameters selected for use in controlling printer operation," he offered no such disclosure and instead speculated that doing so "would have been obvious." (EX2015, 48:15–51:3). Dr. Hickner's testimony confirms that Petitioner's theory requires re-architecting Loughran away from its server-driven, printer-side parameter control—not merely combining familiar elements for "predictable results." (EX2013, ¶93).

Loughran expressly teaches that the printer itself has its own set of information about the material. (EX1004, Fig. 1, ¶¶[0038], [0049]). And as discussed above, it also explains that using such information, the printer is designed to adjust its operation automatically and dynamically for a material. *Supra* § VI.C; (EX1004, ¶¶[0024], [0025], [0035], [0037], [0045], [0048], Fig. 3 at 336). Thus, rather than receiving parameters from a client, Loughran teaches the opposite approach. (EX2013, ¶93).

Accordingly, Petitioner's mapping does not identify where Loughran discloses the specific step of the printer receiving from the client "operational parameters" that are "selected for use in controlling operation" of the printer during fabrication, as recited in element 1[f]. (EX2013, ¶94).

2. Dubois does not cure the defect because Dubois's "optimum values of printing parameters" are determined within the printer-side data processing unit/database, not received from a client as selected operational parameters

Dubois describes a device including a printer controlled by a "data processing unit" and a database that "contains … the choice of optimum values of printing parameters as a function of the nature of the materials, the characteristics of the printer and the deposition conditions." (EX1005, ¶[0148]–¶[0149]). Dubois's framework is printer-centric and does not disclose that a remote CAD client selects printer-control operational parameters and transmits them to the printer for use in controlling printer operation during fabrication as claim 1 requires. (*Id.*). Dr. Hickner admitted as much during his deposition: Dubois "doesn't really talk about clients and networks" and Dubois "doesn't address tags." (EX2015, 61:13–22, 105:13–22; EX2013, ¶95).

Petitioner's theory that Loughran's CAD job would include Dubois-style parameter selections is therefore an expert-driven overlay that does not identify an actual teaching in Dubois (or Loughran) of the claimed receipt of client-selected operational parameters used to control the printer during fabrication. (Pet., 23–26; EX1003, ¶¶64–67; EX2013, ¶96); *supra* § VI.C. Thus, the combination fails to teach receiving one or more operational parameters from the client selected for use in controlling operation of the three-dimensional printer when fabricating the object with the build material having the at least one property stored in the tag.

* * *

Accordingly, Petitioner has not met its burden to prove claim 1 unpatentable under Ground 1A. (EX2013, ¶97).

E. Ground 1A Does Not Render Dependent Claims 2-5, 7-13, 16, 18, and 20 Unpatentable

Dependent claims 2-5, 7-13, 16, 18, and 20 all depend from claim 1, and therefore Ground 1A does not render those dependent claims unpatentable for the reasons discussed above. For the additional reasons discussed below, Ground 1 further fails to teach or suggest the additional limitations of dependent claim 5. (EX2013, ¶98).

1. Claim 5

Claim 5 further requires "receiving a selection of one of the first build material and the second build material from the client for use in fabricating the object using the three-dimensional printer." (EX1001, 23:64-67). Claim 5 depends from claim 4 (and claim 3), and therefore requires (i) a printer coupled to first and second supplies of different build materials with tags, (ii) providing the data from both tags to the client, and then (iii) "receiving a selection of one of the first build material and the second build material from the client for use in fabricating the object." (EX1001, 23:53–67; EX2013, ¶99).

a) <u>Petitioner's Ground 1A theory does not show "receiving" a client selection of one of the two tagged build materials.</u>

Petitioner's claim 5 theory is that (i) multi-material printing divides a model into "slices," (ii) slices "specify a selection of build material," and therefore (iii) it would have been obvious for Loughran's fabrication job "received from the client" to include "a selection of the build material." (Pet., 29–30). Petitioner asserts that it would have been "obvious to include, in Loughran's SFF fabrication job received from the client, a selection of the build material for use in fabricating the object and treats that as meeting claim 5's 'receiving a selection … from the client' requirement. (*Id.*). Dr. Hickner likewise opines that CAD information in Loughran "would have included a selection of one of the materials for use in fabricating specific portions of the object," without identifying a disclosure in Loughran or Dubois that the printer receives a client selection between two tagged supplies after providing tag data for both. (EX1003, ¶79; EX2013, ¶100).

b) <u>Petitioner's theory fails because "slice-level material assignment" is not the claimed step of receiving from the client a selection of one of the two tagged supplies</u>

Claim 5 requires that the printer receive from the client a selection of one of the first and second build materials in the context of claims 3–4's two-supply/two-tag workflow (tag data for both supplies is provided to the client, then a selection is returned). (EX1001, 23:52–67). Petitioner does not identify any disclosure in Loughran or Dubois where the printer provides tag data for two supplies to the client and then receives back a client instruction selecting one of the two tagged supplies for use in fabricating the object. (Pet., 29–30). Instead, Petitioner's "obvious to include" assertion is an expert-driven addition to Loughran's job file, not a teaching in the asserted Ground 1A references of the claimed client-to-printer selection exchange. See *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1361–65 (Fed. Cir. 2016) (reversing Board where it used "common sense"/general expert testimony to supply a key claim limitation missing from the prior art without record evidence or a reasoned explanation); (EX2013, ¶101).

c) **<u>Petitioner's "slice" premise is supported by Napadensky (EX1006), which is not part of Ground 1A's asserted combination</u>**

Petitioner supports its "slices specify a selection of build material" proposition by citing Napadensky (EX1006), not by identifying a Loughran or Dubois disclosure teaching the claimed client-received selection between two tagged supplies. (Pet., 30 (citing EX1006, ¶¶[0039]–[0040], [0193]–[0194])). During his deposition, Dr. Hickner admitted that he relied on Napadensky to explain material assignment at the slice level, even though Napadensky is not part of Grounds 1A/1B. (EX2015, 105:6–12). Because Ground 1A is asserted as Loughran in view of Dubois, Petitioner cannot rely on Napadensky to supply the missing claim 5 limitation. (EX2013, ¶102).

d) Dubois does not supply the missing limitation because Dubois's slicing/parameter determination is printer-centric, not a client-selection step returned to the printer

Dubois describes slicing a CAD representation into print layers and determining printing parameters through a device-side data processing unit/database as a function of material nature, printer characteristics, and deposition conditions. (EX1005, ¶¶[0112]–[0116], [0149]–[0150]). Nothing in Dubois teaches that the printer receives from a client a selection between two tagged build-material supplies after the printer provides tag data for both supplies to the client. Indeed, Dr. Hickner confirmed that Dubois "doesn't really talk about clients and networks" and that Dubois "doesn't address tags," confirming that Dubois cannot provide the tag→client→selection workflow required by claims 3–5. (EX2015, 61:13–22; 105:13–22; EX2013, ¶103). Dr. Hickner also admitted that "in general … within [a] slicer program … there's information about the build material in that slicer program," and that "it's entirely possible to … transmit a data about a build material over a network in the absence of [a] tag." (EX2015, 25:17–26:11).

e) Conclusion

For the foregoing reasons, Petitioner has not met its burden to prove claim 5 unpatentable under Ground 1A. (EX2013, ¶104).

VII. THE CHALLENGED CLAIMS ARE NOT UNPATENTABLE UNDER GROUND 1B

A. Overview of *Jazayeri* (EX1010)

Jazayeri describes a cloud print service for two-dimensional document printers, with user-selected print characteristics (e.g., paper size, orientation, number of copies) and a workflow of a network print request leading to a print job. (EX1010, ¶¶[0024], [0027], [0036], Fig. 1; EX2013, ¶¶105–106).

B. Jazayeri Is Not Analogous Art

Jazayeri (asserted in Grounds 1B, 1D, 1F, 3B, 3D, 3F, and 3H) is not a proper reference for Petitioner's obviousness theories because it is not analogous art to the claimed invention. *In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004). Under *Bigio*, a reference is analogous only if it is either (1) in the same field of endeavor or (2) reasonably pertinent to the particular problem the inventor faced. *Id.* Jazayeri is neither. (EX2013, ¶¶107–113).

a) Petitioner's reliance on Jazayeri shows why the analogous-art inquiry is dispositive here

Ground 1B is "substantively identical" to Ground 1A except for Petitioner's reliance on Jazayeri to supply claim 1's "request" requirement (element 1[b]). (Pet., 33; EX1003, ¶93). Petitioner expressly invokes Jazayeri's cloud-print workflow—print request→print dialog→selected printer→print job—to create a "request prior to receiving the SFF fabrication job." (Pet., 33–34; EX1010, ¶[0036]).

Thus, Petitioner's Ground 1B theory turns on the premise that a POSITA addressing networked three-dimensional printing with tagged build material and material-dependent control parameters would have looked to Jazayeri's cloud/document-printing paradigm for guidance. (Pet., 33–35; EX2013, ¶108).

b) <u>Jazayeri is outside the '466 Patent's field of endeavor</u>

The '466 Patent is directed to three-dimensional printing using tagged build materials and using tag-derived build-material information/properties to determine operational parameters for fabrication. (EX1001, 1:23-33, 20:61–22:33); *see also Airbus S.A.S. v. Firepass Corp.*, 941 F.3d 1374, 1380-81 (Fed. Cir. 2019) ("To determine the applicable field of endeavor, the factfinder must consider explanations of the invention's subject matter in the patent application[.]"). A POSITA working on tagged build materials and material-dependent fabrication control in 3D printing would not reasonably consult a cloud-based 2D print-service reference centered on printer registration and paper/ink settings, because it does not speak to melt/curing behavior, support/infill generation, or other 3D process controls. (EX2013, ¶109).

The '466 Patent's networked environment is described in the context of three-dimensional printers, tag sensors reading tag data, and a controller that may be associated with a remote resource within a networked three-dimensional printing environment. (EX1001, 1:23-33, 20:61–22:33). By contrast, Jazayeri describes a cloud-based print service/print server paradigm in which an application manager receives print requests and manages print jobs in a conventional printing environment. (EX1010, ¶[0008]–[0010], ¶[0019]–[0021]). Jazayeri's print-job construct focuses on conventional "print characteristics" such as paper size, orientation, and number of copies. (EX1010, ¶[0036]). Petitioner itself acknowledges this field mismatch by stating that "Jazayeri describes a networked printing environment with respect to 2D printers." (Pet., 36). Dr. Hickner likewise admitted that Jazayeri "doesn't explicitly say three dimensional printing" and is focused on 2D printing (paper size, orientation, copies), and that that Jazayeri's "request" is received at a server, not by any three-dimensional printer. (EX2015, 88:7–89:3, 91:19–92:1; EX2013, ¶110).

c) **<u>Jazayeri is not reasonably pertinent to the problem the '466 Patent addresses</u>**

The '466 Patent addresses problems tied to material-dependent fabrication in three-dimensional printing—using tag data/identifiers to obtain build-material information and determine operational parameters for fabrication, including by using that build material. (EX1001, 20:61–22:33). Jazayeri is instead directed to issues associated with "conventional printers and printing paradigms," and proposes a cloud-based print-service solution to improve that user experience. (EX1010, ¶¶[0007], [0019]–[0021]; Inst., 22). Jazayeri's teachings (print dialogs, registered-printer selection, and paper/ink print characteristics) are not directed to—and do not address—the '466 Patent's tagged-build-material problem of selecting/deriving operational parameters for control of three-dimensional fabrication based on build-material identity/properties. (EX1010, ¶¶[0019]–[0021], [0036]). Petitioner's reliance confirms the disconnect because Petitioner uses Jazayeri primarily to add a pre-job "request" layer rather than for any material-tag or fabrication-parameter teachings pertinent to the '466 Patent's problem. (EX2013, ¶111).

d) **Petitioner's "POSITA is not an automaton" rhetoric does not establish analogous art**

Petitioner asserts that although Jazayeri concerns 2D printing, a POSITA "was not an automaton" and would have had ample skill to incorporate Jazayeri into Loughran's system. (Pet., 36). That assertion goes to capability (what a POSITA could do), not to the analogous-art inquiry (whether a POSITA would have consulted Jazayeri when addressing the '466 Patent's tagged-build-material and fabrication-parameter-control problem). Petitioner's claimed "benefits" likewise track Jazayeri's cloud-print paradigm (platform-independent printing to registered printers via a cloud service), which is a different problem set than the '466 Patent's build-material tagging and operational-parameter control for fabrication. (Pet., 34–36; EX1010, ¶[0008]–[0011]; EX2013, ¶112).

e) <u>The full record supports finding that Jazayeri is not analogous art</u>

The Board found that Petitioner had sufficiently established analogous art "at this stage." (Inst., 23). On the full record, the documents themselves underscore the field and problem disconnect—Jazayeri's cloud/document-printing focus on print dialogs, registered printers, and paper/ink print characteristics versus the '466 Patent's focus on tagged build materials and operational-parameter control for three-dimensional fabrication. (EX1010, ¶¶[0019]–[0021], [0036]). Because Ground 1B depends on importing Jazayeri's cloud-print request paradigm to supply claim 1[b], and because that paradigm is not directed to the '466 Patent's problem, Jazayeri is not the type of reference a POSITA would reasonably consult in this context. (EX2013, ¶113).

C. No motivation to combine references in Grounds 1A (*Loughran* and *Dubois*) and 1B (*Jazayeri*)

1. Petitioner's asserted motivation

Petitioner presents Ground 1B as an alternative theory that adds Jazayeri "to the extent that Loughran's SFF fabrication job … is not considered a request." (Pet., 33). Petitioner asserts a POSITA would modify Loughran so the SFF printer receives a "request prior to receiving the SFF fabrication job" by importing Jazayeri's cloud-print workflow (print request → print dialog → selected printer → print job). (Pet., 42–43; EX1010, ¶[0036]; EX1003, ¶¶94–95). Petitioner further asserts the combination would provide benefits such as increased printing options, platform independence, and reduced cost/complexity of printer-driver paradigms. (Pet., 34–46; EX1010, ¶¶[0008]–[0010], [0019]–[0021]; EX1003, ¶¶96–100). As Dr. Cormier explained, adding Jazayeri's GUI/account-driven printer-selection workflow to Loughran would introduce layers that are irrelevant to Loughran's SFF job exchange and would not improve—and would potentially complicate—the material-parameter control that is central to Loughran. (EX2013 ¶114).

2. Loughran already provides the "networked job submission" concept Petitioner attributes to Jazayeri

Loughran discloses a networked system in which a first SFF system (with CAD software) and a second SFF system are connected via a network, and the first system sends SFF fabrication jobs to the second system for fabrication. (EX1004, ¶¶[0049]–[0052]). Because Loughran already discloses networked submission of fabrication jobs, Petitioner's asserted "need" to add Jazayeri's cloud-print request layer is not tied to any deficiency in Loughran's disclosed job-submission architecture. (EX2013, ¶115).

3. Jazayeri targets a different printing paradigm than Loughran's SFF fabrication-job workflow

Jazayeri is directed to a cloud print service addressing conventional-printing paradigms and relies on user-interface printer selection and print-job characteristics such as paper settings. (EX1010, ¶¶[0019]–[0021], [0036]). Loughran's workflow, by contrast, is centered on SFF fabrication jobs exchanged between SFF systems and on printer-side use of material information to enable and control fabrication. (EX1004, ¶¶0024]–[0026], [0037], [0049]–[0052]). Petitioner's rationale does not explain why a POSITA would graft Jazayeri's UI-driven cloud-print request framework onto Loughran's SFF fabrication-job workflow merely to add a pre-job "request." (Pet., 34–36; EX1010, ¶[0036]; EX1004, ¶¶[0049]–[0052]; EX2013, ¶116).

4. The proposed overlay is in tension with the printer-side parameter-control teachings of Loughran and Dubois

Loughran teaches printer-side, automatic/dynamic adjustment of fabrication parameters based on material information retrieved (including process parameters such as melting temperature and inter-layer delay time). (EX1004, ¶¶[0024]–[0026], [0037]). Dubois teaches selecting "optimum values of printing parameters" as a function of the material and the characteristics of the printer, implemented through device-side processing and a database. (EX1005, ¶¶[0148]–[0149]; EX2013, ¶117).

Petitioner's asserted benefits for adding Jazayeri emphasize "platform-independent" and "not printer specific" cloud printing, which is in tension with Dubois's printer-characteristics-dependent parameter selection and Loughran's printer-side dynamic adjustment. (Pet., 34–36; EX1010, ¶¶[0008]–[0010], [0019]–[0021]; EX1005, ¶¶[0148]–[0149]; EX1004, ¶¶[0024]–[0026], [0037]). Petitioner does not explain why a POSITA would be motivated to introduce Jazayeri's printer-agnostic cloud-print paradigm into a system whose combined teachings rely on printer-specific and printer-side parameter determination. (EX2013, ¶118).

5. Petitioner's stated "benefits" are generic to cloud printing and do not provide a reason to modify Loughran's SFF system in the manner proposed

Petitioner ties the alleged benefits (increased printing options/abilities, platform-independence, reduced cost of drivers) to Jazayeri's cloud print service enabling applications on devices to print to printers in communication with the cloud service. (Pet., 34–36; EX1010, ¶¶[0008]–[0010], [0019]–[0021]). Those benefits are described in Jazayeri as improvements to conventional printing paradigms and are implemented through cloud-print workflows involving print dialogs, registered printers, and user accounts, rather than through Loughran's SFF job exchange and printer-side dynamic process-parameter adjustment. (EX1010, ¶¶[0019]–[0021], [0036]; EX1004, ¶¶[0024]–[0026], [0049]–[0052]). Accordingly, Petitioner's Ground 1B motivation relies on general cloud-printing advantages, but those asserted advantages do not supply a reason—grounded in the teachings of Loughran and Dubois—to graft Jazayeri's cloud-print request and UI selection framework onto Loughran's SFF fabrication-job workflow as Petitioner proposes. (EX2013, ¶119).

D. Ground 1B Does Not Render Claim 1 Unpatentable

Ground 1B "incorporates" Ground 1A "in all but one respect," and relies on the "additional disclosure of Jazayeri" only to address element 1[b]'s "request" requirement. (Pet., 33; EX1003, ¶¶93-100). Accordingly, Ground 1B fails at the outset for the same independent reason Ground 1A fails—Petitioner's incorporated Ground 1A showing does not establish element 1[f]'s requirement of "receiving one or more operational parameters from the client selected for use in controlling operation of the three-dimensional printer when fabricating the object with the build material having the at least one property stored in the tag." *See supra* § VI.D; (EX2013, ¶120).

Independently, Ground 1B fails because Petitioner's only asserted basis for satisfying element 1[b] is to import Jazayeri's cloud/document-printing "print request" paradigm into the Loughran–Dubois system. (Pet., 33–34; EX1010, ¶[0036]; EX1003, ¶¶75–76). As explained supra § VI.B, Jazayeri is not analogous art to the '466 Patent's tagged-build-material and operational-parameter-control framework, and Petitioner therefore cannot rely on Jazayeri as the sole "fix" for element 1[b]. *See supra* § VII.B; (EX2013, ¶121).

Finally, as explained supra § VII.C, Petitioner's asserted motivations for combining rest on generic cloud-printing benefits and are not anchored to any deficiency in Loughran's disclosed networked SFF fabrication-job submission or printer-side parameter-control architecture (as further shaped by Dubois's printer-characteristics-dependent optimization), such that Petitioner fails to establish the requisite motivation to combine. *See supra* § VII.C; (EX2013, ¶122).

Accordingly, for at least the foregoing reasons, Petitioner has not met its burden to prove claim 1 unpatentable under Ground 1B. (EX2013, ¶123).

E. Ground 1B Does Not Render Dependent Claims 2-5, 7-13, 16, 18, and 20 Unpatentable

Petitioner states that, other than claim element 1[b], "the analysis of all other claim elements is identical" to Ground 1A. (Pet., 33). Accordingly, Ground 1B does not render Dependent Claims 2-5, 7-13, 16, 18, and 20 unpatentable for the reasons discussed previously for Ground 1A. *Supra* VI; (EX2013, ¶124).

VIII. THE CHALLENGED CLAIMS ARE NOT UNPATENTABLE UNDER GROUND 2

A. Overview of *Devos* (EX1008)

Devos describes powder-based 3D printing in which a thin powder layer is spread in a build bin and a print head ejects binder/adhesive to solidify a cross-section, repeating layer-by-layer to form the object within the powder bed. (EX1008, ¶¶[0001], [0013]-[0015], [0019], [0035], Figs. 2-3 (below, supply bin 110, build bin 102), 6).

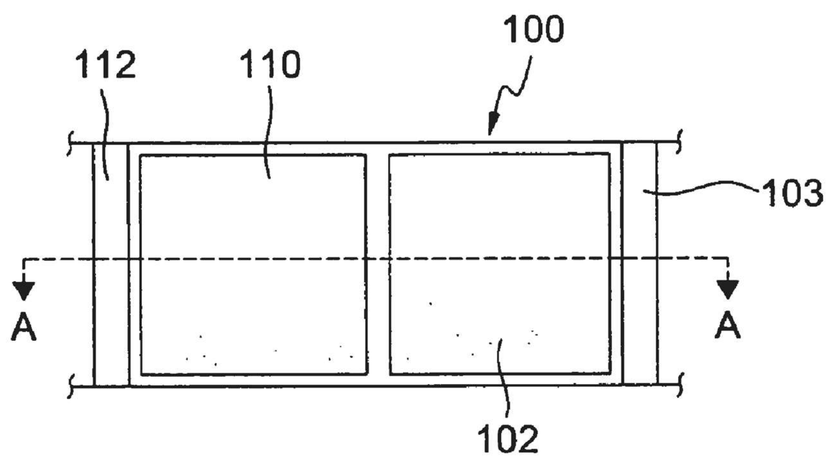


FIG. 2

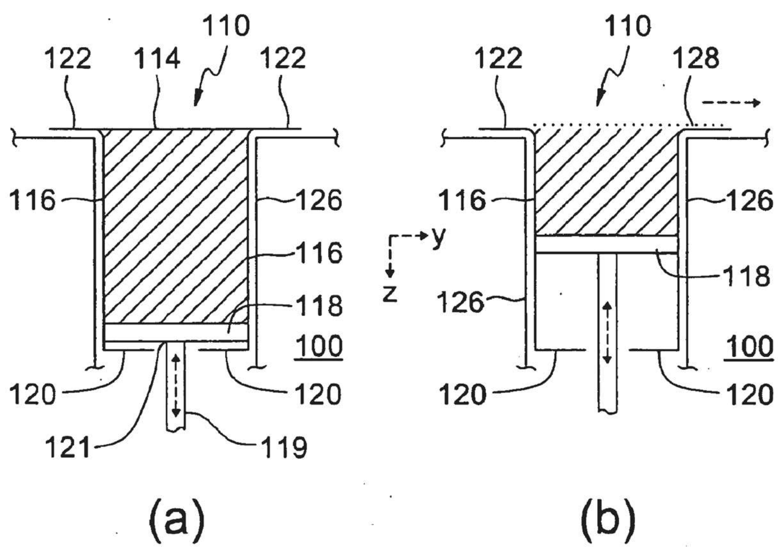


FIG. 3

Figure 6 shows the operations for powder-based printing:

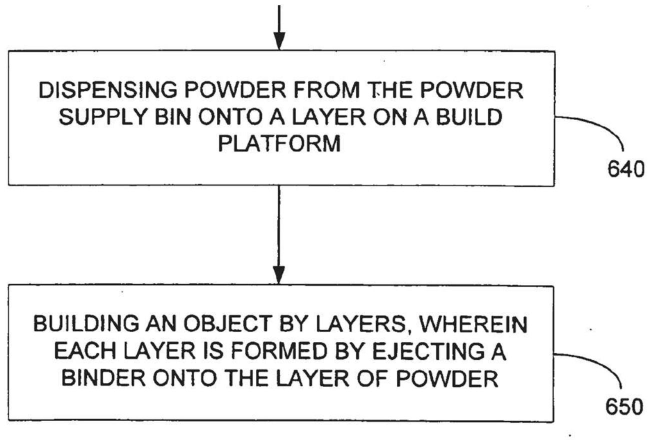


FIG. 6

(*Id.*, Fig. 6 (excerpt); EX2013, ¶¶125-130).

B. Ground 2 Does Not Render Claim 19 Unpatentable

Claim 19 expressly requires "determining an operational parameter … the operational parameter including at least one of a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement." (EX1001, claim 19; *see also id.*, 21:56–61; EX2013, ¶¶131–132).

1. Petitioner's element 19[e] theory hinges on recharacterizing Devos's "powder settling coefficients" as the claimed "support structure requirement"

For element 19[e], Petitioner cites Devos's example of "powder settling coefficients (e.g., to determine whether powder supports need to be included, and if so, how much support)," (EX1008, ¶[0032]), and asserts that a POSITA "would have been motivated to implement Devos's system to determine an operating parameter specifying whether and how much powder supports are needed (a support structure requirement)." (Pet., 49). Petitioner's expert repeats this same theory, opining that Devos's parenthetical reference to "how much support" would have "indicated to a POSITA that the system would need to generate a parameter indicating 'how much support' material to use," and that this purportedly "provides the claimed support structure requirement." (EX1003, ¶113). However, a POSITA would understand that Devos's generic reference to "powder settling coefficients" that may be used to decide whether "powder supports" are needed does not teach a "support structure requirement" as claimed. (EX2013, ¶133).

2. Petitioner's theory fails because Devos does not disclose any claimed "support structure requirement," nor any other element-19[e] enumerated parameter

Devos's cited passage lists example "operating parameters" such as "print speed," "drop volume per voxel," "color maps," "dry time needed after build completion," "shrink or expansion size," "adjustment factors," "powder settling coefficients," and "minimum allowable layer thickness." (EX1008, ¶[0032]). None of Devos's listed operating parameters is a "build platform temperature," "build volume temperature," "infill requirement," "rafting requirement," "support structure requirement," or "cooling requirement," as required by claim 19. Accordingly, Petitioner's satisfaction of element 19[e] depends entirely on its attempt to equate Devos's "powder settling coefficients" (and a parenthetical about "powder supports") with claim 19's "support structure requirement." (Pet., 49; EX1008, ¶[0032]; EX1003, ¶113; EX2013, ¶134).

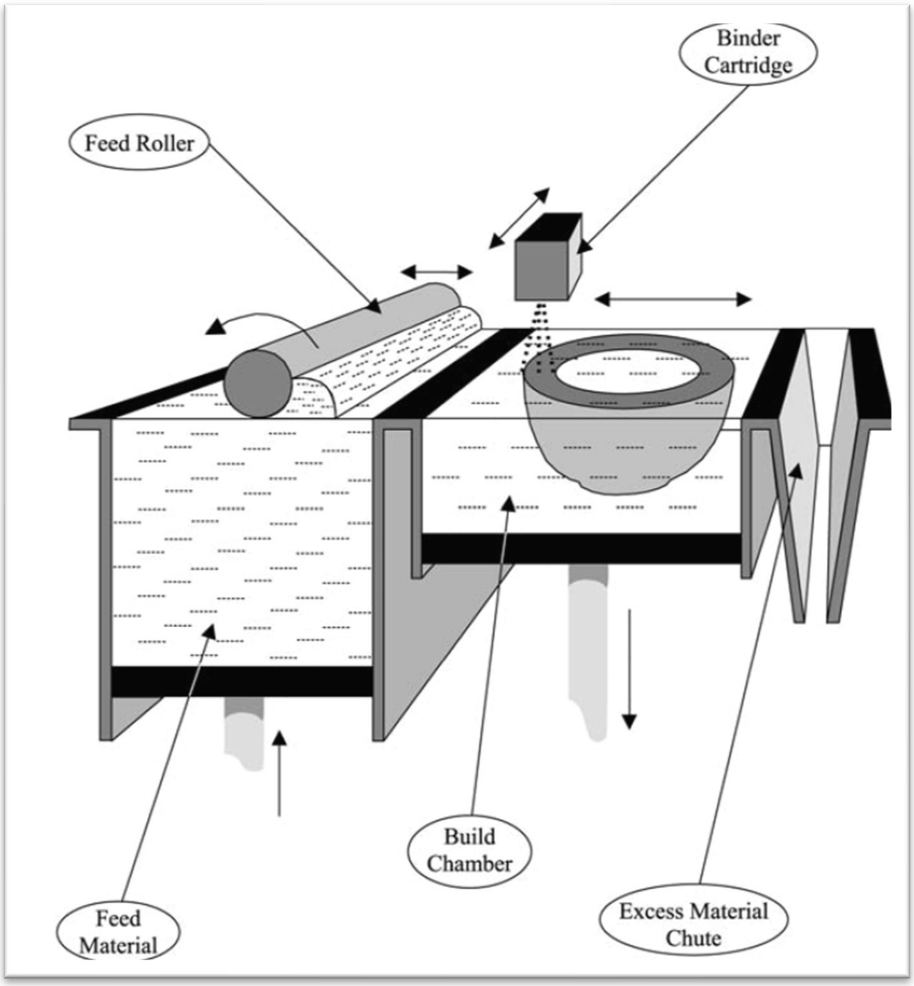
However, Devos never discloses determining (from the tag/memory data) a support-structure setting/requirement that configures the printer to fabricate support structures (or to require them) as part of the build—Devos discloses only a "powder settling coefficient," offered as one example among many parameters. (EX1008, ¶[0032]; EX2013, ¶135). Devos's "supports" parenthetical is, at most, an explanatory aside about how a settling coefficient might be used to inform decisions about thermal post-processing support requirements that could take place after printing—Devos still does not disclose that the system determines (from the memory mechanism) an operational parameter that is a "support structure requirement," much less one that configures the printer to generate "support structures" as a distinct operational requirement. (EX2013, ¶135).

3. Petitioner's "implement Devos to generate a support-structure parameter" theory is an expert-driven redesign untethered to Devos

Petitioner's theory is not that Devos discloses a claimed "support structure requirement," but rather that a POSITA "would have been motivated to implement Devos's system" to "determine an operating parameter specifying whether and how much powder supports are needed." (Pet., 49; EX2013, ¶136).

Dr. Hickner's declaration confirms this is an added-to-Devos construct—he asserts the POSITA "would need to generate a parameter indicating 'how much support' material to use," and that the POSITA would do so "to prevent portions of the object from collapsing during fabrication." (EX1003, ¶113). But Devos describes a powder-bed process in which each cross-section is formed by depositing binder into successive powder layers until "the entire object is formed within the powder bed in the build bin 102." (EX1008, ¶¶[0013]–[0015]). Because Devos forms the entire object within the powder bed, Devos neither identifies an unsupported-geometry collapse problem nor teaches generating any "support-structure parameter" to address it—Petitioner supplies that missing requirement only through expert say-so. (EX2013, ¶137).

As Dr. Cormier explained, in the binder jetting process employed by Devos a thin layer of powder is first spread out, then an inkjet print head selectively jets droplets of binder, or "glue", over regions of the powder layer that need to be solidified. Areas outside of regions where binder is printed remain in loose powder form. A second layer of powder is spread on top of the first layer, and the process is repeated until the final layer is completed. (EX2013, ¶138; EX1008, ¶¶[0013]-[0015]; EX2014, pp.325-327). A POSITA would have understood that in Devos' binder jetting process, components being printed are surrounded and supported by the bed of powder where no binder was printed. (EX2013, ¶138). This process is shown in the following image:



(EX2014, p.327). Thus, a POSITA would understand that printing rigid support structures is not needed because the powder surrounding the part provides the necessary support. (EX2013, ¶138). Indeed, one of the "advantages" of Devos's type of additive manufacturing is that "[n]o support structures allow complex geometry to be created." (EX2014, p.326).

Dr. Hickner's attempt to equate powder supports with the need to "prevent portions of the object from collapsing during fabrication," (EX1003, ¶114), misunderstands the physics underlying Devos's method. As Dr. Cormier explained, the potential for "collapse" is associated with an entirely different manufacturing process (thermal processing in a furnace) that can optionally be performed on metallic parts in a different machine after the three-dimensional binder jet printing process has been completed. (EX2013, ¶138). Parts fabricated via Devos's methods do not collapse during the 3D printing fabrication process, and a POSITA would understand that the "support structure requirement" implicated in fused filament fabrication as described in the '466 Patent is not taught or suggested by the printing described in Devos. (EX2013, ¶138).

Devos makes one single mention of a "powder settling coefficient" in connection with binder jetting. A powder settling coefficient is a characteristic of the powder that indicates how much a given powder will settle down, or compact, when it is spread out and/or when droplets of liquid binder are jetted onto it. (EX2013, ¶139). The powder settling coefficient by itself is insufficient to determine whether or not support structures are needed for thermal post-processing after three-dimensional printing is completed, and it is not "a support structure requirement." Furthermore, any use of a powder settling coefficient together with other information, such as part geometry and the strength of the material, to compute a post-processing support structure requirement would involve expert level knowledge that would be well beyond the knowledge base of a POSITA. (EX2013, ¶139). Indeed, Dr. Hickner admitted that Devos provides "no technical detail" on how any support structure requirement would be derived from a settling coefficient. (EX2015, 121:2–10; 122:1-3). Further, when asked whether a "powder settling coefficient" is an "operational parameter," he refused to commit, stating: "we're talking about, you know, complicated details of additive manufacturing and powders…. It's not a simple yes or no answer … I could do that analysis, but I haven't done it." (EX2015, 117:8–120:19; EX2013, ¶139).

Devos does not explain what a "support structure requirement" would be in its system, how it would be derived from the memory-mechanism data, or how the printer would be configured to fabricate "support structures" based on that derived requirement. (Pet., 49; EX1008, ¶[0032]; EX1003, ¶113; EX2013, ¶140). Invoking "common sense" or POSITA knowledge to supply this missing limitation is improper absent a reasoned, evidence-based showing. *Arendi*, 832 F.3d at 1361-62 ("common sense is typically invoked to provide a known motivation to combine, not to supply a missing claim limitation").

Furthermore, because Ground 2 relies on Devos alone, Petitioner must also show that Devos—together with any proven background knowledge—would have enabled a POSITA to make and use the claimed "support structure requirement" without undue experimentation. *Raytheon Techs. Corp. v. Gen. Elec. Co.*, 993 F.3d 1374, 1381 (Fed. Cir. 2021) ("In the absence of such other supporting evidence to enable a skilled artisan to make the claimed invention, a standalone § 103 reference must enable the portions of its disclosure being relied upon."). However, as discussed above, Petitioner offers no such evidence or reasoned analysis, and a POSITA would not be able to derive any such a "support structure requirement" without undue experimentation. (Pet., 49; EX1003, ¶113; EX2013, ¶141).

4. Conclusion

Because Devos fails to teach, render obvious, or enable element 19[e]'s requirement that the determined operational parameter include at least one of the enumerated items—specifically a "support structure requirement"—Petitioner has not met its burden to prove claim 19 unpatentable under Ground 2. (EX2013, ¶142).

IX. THE CHALLENGED CLAIMS ARE NOT UNPATENTABLE UNDER GROUND 3A

A. Overview of *Menchik* (EX1009)

Menchik describes a 3D printing system with material cartridges/supplies, sensors that monitor material status, and a controller that receives cartridge data and computes supply parameters. (EX1009, Abstract, ¶[0020], Fig. 1 (below); EX2013, ¶¶143–144).

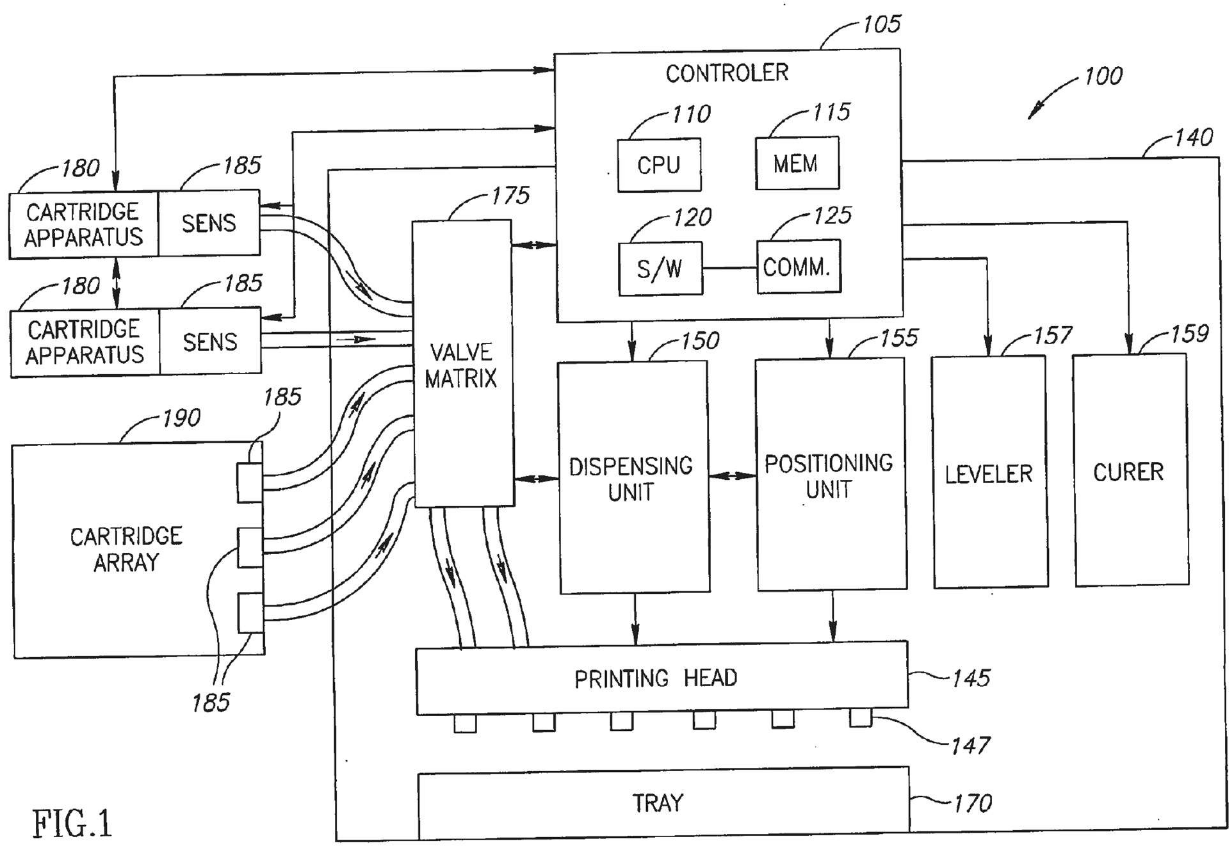


FIG.1

B. Overview of ***Dahlin*** (EX1011)

Dahlin describes a rapid-prototyping system using filament spools with an electronic circuit (EEPROM) storing filament type and remaining amount, which the processor reads/updates and can use to determine whether enough material is available for a job. (EX1011, 1:13-17, 5:1-17, 5:25-32; EX2013, ¶145).

C. Ground 3A Does Not Render Claim 1 Unpatentable

Petitioner fails to show that Menchik discloses or teaches each of the elements of claim 1 and thus the reference does not anticipate or render obvious the claim. (EX2013, ¶146).

The Board instituted review on Ground 3A, accepting Petitioner's premise that Menchik's "controller 105" can be the claimed "client," and that Menchik's "computing platform connected to [the] 3D printer system" is an embodiment of that controller such that the "printing file" is a "request" sent from the "client" to the printer. (Inst., 31–33; Pet., 57–59; EX1009, ¶¶[0024]–[0026]; EX1003, ¶¶129–130). Respectfully, that premise is inconsistent with claim 1's structure and the intrinsic evidence, and it collapses '466 Patent's distinct "controller" and "client" roles into a single component in a manner that Menchik does not teach. (EX2013, ¶147).

1. Menchik does not teach element 1[b] because claim 1's "client" is distinct from the printer's controller, and Menchik's "controller 105" is a printer-controller component—not a client device that sends a fabrication request

Claim 1 requires "receiving a request from ***a client*** over a network to fabricate an object on the three-dimensional printer," whereas claim 19 specifically recites "providing a three-dimensional printer that includes ***a controller***," confirming that the claimed "client" is not the printer's own controller. (EX1001, claims 1, 19). The specification similarly describes "client device 206" as a device "operated by users to initiate, manage, monitor, or otherwise interact with print jobs at the three-dimensional printers," reinforcing that the "client" is a user-facing device external to (and interacting with) the printer(s), not the printer's internal controller. (EX1001, 5:40–46). As Dr. Cormier testified, in networked additive-manufacturing systems the "client" is typically a separate computing device that submits a job/request over a network, whereas an internal "controller" inside the printer executes that job and directly actuates motors, heaters, dispensers, and other subsystems. (EX2013, ¶148). Further, a POSITA would understand that the machine controller, which is a functional part of the 3D printing system, is not a networked client device, as these are distinct components that serve different functions. (EX2013, ¶148). Dr. Hickner, by contrast, admitted that he "didn't analyze … whether or not controller and client can be equated" in the context of the '466 Patent. (EX2015, 16:22–18:11).

Menchik describes "controller 105" as a control component that "may receive data from one or more material supply sources, and control the supply of building material to printing apparatus 140," i.e., it is disclosed as a system controller for printer operation and material delivery. (EX1009, ¶[0027]). Menchik also expressly discloses an embodiment where controller 105 is "located inside printing apparatus 140," which is the opposite of a "client device" that is operated by users to interact with print jobs at 3D printers over a network. (EX1009, ¶[0024]; Pet., 57–58 (citing EX1009, Fig. 1, ¶[0024]); EX2013, ¶149).

The Board's institution decision reasoned that Menchik's controller could satisfy the "client" because both can be implemented on a PC-class device. (Inst., 32–33 (citing EX1001, 5:40–46; EX1009, ¶[0026])). However, the intrinsic evidence ties the "client" to the user-operated role of initiating/managing/monitoring print jobs, whereas Menchik's controller is disclosed as a printer-control component; describing a possible PC-class implementation does not disclose the printer receiving a client request from such a device as in claim 1. (EX1009, ¶[0024]; EX2013, ¶150).

Petitioner's "request" mapping likewise depends on this same improper "controller-as-client" recharacterization. (Pet., 58–59; EX1003, ¶¶129–130). Petitioner relies on Menchik's disclosure that "a printing file … may be … provided … by a computing platform connected to 3D printer system 100" and categorizes this file as "a request." (*Id.*; EX1009, ¶[0025]). However, Menchik does not say that the "computing platform" is the claimed "client," nor does Menchik disclose that the printer "receiv[es] a request from a client over a network" as opposed to simply using a "printing file" prepared by a connected computing platform. (EX1009, ¶[0025]). As Dr. Cormier explained, a file can be created and transferred without initiating fabrication until a separate start/build command is issued to the printer. (EX2013, ¶151).

Even accepting the Board's conclusion that controller 105 can be partially external (Inst., 32), Menchik's disclosure is that any such external unit "may provide some or all of the printing system control capability," which again describes the controller function—not a user-operated "client" sending a fabrication request as required. (EX1009, ¶[0024]; EX2013, ¶152).

Finally, to the extent Petitioner relied on an "at least suggests" theory that a wired/wireless connection could be implemented "over a network," that is not an anticipation disclosure and does not cure the absence of Menchik teaching claim 1's "request from a client over a network" framework in the first place. (Inst., 31; Pet., 57–59; EX2013, ¶153).

2. Menchik does not teach element 1[e] because it does not disclose "providing the data from the tag to the client over the network"

Element 1[e] requires "providing the data from the tag to the client over the network." (EX1001, claim 1). The Board accepted Petitioner's position that "transmitting data to [a] printer controller" from a memory chip storing build-material information satisfies providing tag data "to the client," given its earlier conclusion that controller 105 is the "client." (Inst., 33; Pet., 60–61). However, Menchik's cited disclosures describe transmitting information from a cartridge memory mechanism/chip to the controller so the controller can compute or use parameters for printing and material supply, not providing tag data to a client device over a network. (Pet., 60–62; EX1009, ¶¶[0027], [0047]–[0048]). Thus, Petitioner's element 1[e] mapping likewise fails due to a mistaken conflation of Menchik's printer controller with claim 1's "client." (EX2013, ¶154).

3. Menchik does not teach element 1[f] because the asserted "operational parameters" are not "receiv[ed] … from the client selected for use" as claim 1 requires

Element 1[f] requires "receiving one or more operational parameters from the client selected for use in controlling operation of the three-dimensional printer when fabricating the object with the build material having the at least one property stored in the tag." (EX1001, claim 1).

Petitioner contends this is met because "printing apparatus 140 … receives the printing file and … printing parameters, operation parameters, building parameters, material parameters, and supply parameters … from the controller 105 in the computing device (client) over a network." (Pet., 63; EX1003, ¶137). However, Menchik's cited workflow is that controller 105 uses data from sensors and cartridge memory chips to compute "material parameters" and "supply parameters," including computing quantities/availability and determining whether/when/how much material to extract according to printer requirements for a particular object. (EX1009, ¶¶[0027], [0047]–[0048]). That is the opposite of claim 1's requirement that the printer receives operational parameters "from the client selected for use," which presupposes a client-side selection (element 1[e]) and then a receipt of those selected parameters by the printer. (EX1001, 5:40–46, claim 1; EX2013, ¶¶155–156).

Moreover, while Petitioner concludes that the printer "receives the printing file and the printing parameters, operation parameters, building parameters, material parameters, and supply parameters (collectively operational parameters) from the controller 105," (Pet. 63), it fails to explain which printing file, printing parameters, operation parameters, building parameters, material parameters, and supply parameters are allegedly received. On this point, the Board relied on the specification's statement that "operational parameters" may include any "operational parameter that might usefully be determined by the controller from the data stored by the data tag 304," and reasoned that this "broad scope" does not exclude Menchik's "printing file." (Inst., 34 (quoting EX1001, 15:17–24); EX1009, ¶[0025]). However, even if "operational parameter" is broad in the abstract, element 1[f] is not satisfied unless those parameters are received from the client selected for use, and Menchik's cited disclosures are directed to controller-computed parameters and controller-provided control capability—not client-selected operational parameters transmitted back to the printer after providing tag data to a client. (EX1009, ¶¶[0024], [0027], [0047]–[0048]; EX2013, ¶157).

For instance, Menchik discloses a separate device—"a computing platform connected to 3D printer system 100"—as providing a printing file which the system then uses to determine "the order and configuration of deposition of building material." (EX1009, ¶[0025]). This separate device in Menchik is not the controller.

Thus, the printing file is not sent or received from a client identified by Petitioner, but rather a separate device that Petitioner does not identify as the client. (EX2013, ¶158).

Petitioner references printing parameters on page 61 of the Petition, but that portion of the Petition only says that "printing parameters" are "compute[d]." (Pet., 61). There is no teaching or disclosure that any "printing parameters" are received from controller 105. Indeed, Menchik does not describe that the computed printing parameters, such as "guidelines for which cartridges to use, how many to use, if and when any replacements are necessary etc.," are received from the controller 105. (EX1009, ¶[0037]; EX2013, ¶159).

Besides a conclusory assertion, Petitioner never references operation parameters or building parameters in its argument for claim element 1[f] or claim element 1[b], which is referenced in the argument for claim element 1[f]. Menchik only uses each of the terms "operation parameters" and "building parameters" once to describe the information stored on the memory chip. See (EX1009, ¶[0035] ("optimal operation parameters" and "optimum building parameters")). However, Menchik does not teach or disclose receiving any of the parameters from the controller 105. Rather, Menchik discloses the opposite—that the parameters are stored on the memory chip 260, which is read by reader 225, which sends data to the controller. (*Id.*, ¶[0037]; EX2013, ¶160).

Although Petitioner references material parameters on page 61 of the Petition and Menchik discloses "material parameters," the reference merely describes computing "material parameters" and not receiving such parameters from the controller. (EX1009, ¶[0027] ("controller 105 may use software code 120 to process data related to the status of building material in one or more supply sources to compute material parameters for building material(s)" and "For example, material parameters may indicate potential yields during printing usage etc. For example, computations of material required may indicate how much material from one or more material supply sources may be used in constructing one or more objects."); EX2013, ¶161).

Similarly, there is no teaching or disclosure of receiving the supply parameters from the controller. (Pet., 61-62). Menchik merely describes determining the supply parameters and then controlling system components or sending messages to a system operator to alert the operator to replace a cartridge. *See* (EX1009, ¶¶[0027], [0051] ("the controller may provide instructions to close a valve of an empty cartridge, or a cartridge or source"), [0053] ("controller 105 may, for example, transmit an alert message to one or more system operators"); *see also id.*, Fig. 6, ¶¶[0007] ("control the supply of the building material from two or more cartridges according to the supply parameters"), [0027], [0049]; EX2013, ¶162).

Thus, even if Petitioner were to articulate its theories, as it was required to do, identifying which pieces of information are allegedly received and why such information are operational parameters (it has failed to satisfy its burden), there is no teaching or disclosure in Menchik that such information (printing file, printing parameters, operation parameters, building parameters, material parameters, and supply parameters) are received from a client. (EX2013, ¶163)

D. Ground 3A Does Not Render Claim 19 Unpatentable

As discussed below, Petitioner fails to show that Menchik discloses or teaches each of the elements of claim 19 and thus the reference does not anticipate or render obvious the claim. (EX2013, ¶164).

1. Petitioner failed to appropriately address element 19[e]

In its institution decision, the Board recognized that Petitioner contends element 19[e] is taught "based on the analysis of 'element 1[f] and claim 10,'" and the Board reproduced a side-by-side comparison showing that element 19[e] includes requirements, including that the operational parameter is determined "based upon at least on[e] property of the build material," that are not found in element 1[f] or dependent claim 10. (Inst., 35–36; Pet., 71).

2. Petitioner still bears the burden on the merits, and its "supra element 1[f] and claim 10" cross-reference does not prove element 19[e]

Claim 19 requires "determining an operational parameter for configuring the three-dimensional printer for a fabrication process using the build material based upon at least one property of the build material in the data," and requires that the operational parameter include at least one of the enumerated items (including, e.g., "a support structure requirement"). (EX1001, claim 19). Petitioner, however, did not provide a Menchik-specific mapping for element 19[e], instead asserting only: "Supra, element 1[f] and claim 10." (Pet., 71). Petitioner's expert likewise provided no element-19[e]-specific analysis, opining only that "Menchik anticipates element 19[e] for the same or substantially the same reasons that I discussed above with respect to element 1[f] and claim 10." (EX1003, ¶154).

The Board's own comparison confirms why Petitioner's cross-reference fails: element 19[e] requires determining an operational parameter based upon at least one property of the build material in the data and requires the parameter include at least one of the specific enumerated requirements, whereas element 1[f] is directed to receiving operational parameters "from the client," and claim 10 is directed to a different subset that includes, for example, "extruder temperature" and "feed rate," which are not among claim 19[e]'s enumerated requirements. (Inst., 35–36; EX1001, claims 10, 19; EX2013, ¶¶165–167).

3. Menchik's cited disclosures do not satisfy element 19[e]'s "determining … based upon at least one property … in the data" requirement

Petitioner's Ground 3A claim 1 discussion relies on Menchik's disclosure that cartridge memory may store information such as "optimal operation parameters (e.g., recommended jetting temperature)" and "optimum building parameters (e.g., for building or support)," along with "material parameters (e.g., viscosity and surface tension at the recommended temperature)." (Pet., 59–60; EX1009, ¶[0035]). However, element 19[e] requires that the operational parameter be determined "based upon at least one property of the build material in the data," not merely that some information may be stored on a cartridge memory or otherwise exist in the system. (EX1001, claim 8; Inst., 36). Petitioner's element-19[e] showing never identifies what Menchik allegedly "determines" as the operational parameter for configuring the printer, nor does it identify what "at least one property" in the tag data is supposedly used as the basis for such determination. (Pet., 71; EX1003, ¶154; EX2013, ¶168).

4. Menchik's disclosures also do not establish that the "determined" parameter includes at least one of claim 19[e]'s enumerated requirements, including a "support structure requirement"

Claim 19[e] further requires that the determined operational parameter include at least one of: "a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement." (EX1001, claim 19). As Dr. Cormier explained, a POSITA would understand that the operational parameters listed in claim 19 specifically relate to fused filament fabrication processes, not the inkjet printing processes of Menchik. (EX1009, ¶[0004]; EX2013, ¶169). As such, a POSITA reading Menchik would not understand that reference to disclose or teach any of the claimed operational parameters of claim 19. (EX2013, ¶169).

Furthermore, to the extent Petitioner's theory gestures at "support" by pointing to Menchik's statement that the controller may compute "the amount of modeling material, support liquid, or combination of modeling and supporting materials required for printing a given three-dimensional object," that passage is about estimating material quantities for a job, not about a printer-configuration "support structure requirement" of the type enumerated in claim 19[e]. (EX1009, ¶[0048]). Even for that "support liquid/support materials required" computation, Petitioner did not explain (or cite evidence) how the computed amount constitutes a "support structure requirement" and how it is "based upon at least one property of the build material in the data," as claim 19[e] requires. (Pet., 67–71; EX1001, claim 19). Notably, the Board recently addressed a similar argument raised by Petitioner in denying institution in IPR2025-00585 (the related '464 Patent). There, the Board found that "[t]he record before us therefore lacks any teaching or suggestion that 'the amount of modeling material, support liquid, or combination of modeling and support materials required for printing a given three-dimensional object' (which Petitioner contends are operational parameters) are determined 'based upon the data [that includes at least one property of the building material].'" IPR2025-00585, Paper 11 at 29-30 (P.T.A.B. Oct. 6, 2025) (alteration in original). Claim 19 contains the same requirement here. *See* (EX1001, claim 19). In short, there is no teaching or disclosure of why the amount of support liquid or support materials required is a "support structure requirement," and there is no teaching or disclosure of the amount of support liquid and support materials required being based upon at least one property of the build material in the data. For each of these reasons, Petitioner has failed to show that Menchik anticipates or renders obvious claim 19. (EX2013, ¶¶170–171).

E. Ground 3A Does Not Render Dependent Claims 3–5, 7, 9–11, and 20 Unpatentable

Dependent claims 3-5, 7, 9-11, and 20 all depend from claim 1, and therefore Ground 3A does not render those dependent claims unpatentable for the reasons discussed above. For the additional reasons discussed below, Ground 3A further fails to teach or suggest the additional limitations of dependent claims 3-5 and 10. (EX2013, ¶172).

1. Claim 3-5

Claim 3 further requires "wherein the three-dimensional printer is coupled to a first supply of a first build material and a second supply of a second build material different from the first build material, the first supply including a first tag that stores at least one property of the first build material, and the second supply including a second tag that stores at least one property of the second build material." (EX1001, 23:53-59). Claims 4 and 5 (through claim 4) depend from claim 3.

Petitioner's treatment of claim 3 consists solely of the conclusory statement: "Supra, element 1[a]," with a single citation to Dr. Hickner. (Pet., 64; EX1003, ¶139). Dr. Hickner likewise does not analyze claim 3's additional requirements regarding two supplies of different build materials and two corresponding tags; instead, he cites only Menchik's generic disclosure that the printing apparatus "may include" "one or more three-dimensional modeling material supply sources such as cartridge apparatuses 180 or cartridge arrays 190." (EX1003, ¶139; EX1009, ¶[0020]).

Menchik's cited disclosure that the system may include "one or more" supply sources "such as" cartridges does not identify claim 3's requirement of two different build-material supplies coupled to the printer, each with its own tag storing at least one property of that supply's build material. (EX1001, claim 3; EX1009, ¶[0020]). Because Petitioner provides no element-by-element showing for claim 3, Petitioner fails to meet its burden to prove unpatentability for claim 3, and claims 4-5 which depend therefrom. (EX2013, ¶¶173–175).

2. Claim 10

Claim 10 further requires "wherein the one or more operational parameters includes at least one of an extruder temperature, a feed rate, a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement." (EX1001, 24:21-26). Claim 10 depends from claim 1 and therefore incorporates claim 1's requirements (including receiving "one or more operational parameters from the client" in element 1[f]). (EX1001, claim 1).

a) Petitioner's claim-10 theory equates Menchik's "recommended jetting temperature" with "an extruder temperature" and relies on Menchik's "optimum building parameters" and "amount of support liquid … required" as a "support structure requirement"

Petitioner asserts that "[b]ased on Menchik's disclosure as discussed above in 1[f], the recommended jetting temperature is an extruder temperature," and that "the optimum building parameters (e.g., for building or support) and the amount of support liquid and support materials required is a support structure requirement." (Pet., 67–68; EX1009, ¶[0035]). Dr. Hickner repeats this same theory. (EX1003, ¶146; EX2013, ¶¶176–177).

b) **<u>Petitioner's theory fails because Menchik's "recommended jetting temperature" is not "an extruder temperature," and Petitioner supplies no record basis for treating it as one</u>**

Claim 10 expressly recites "an extruder temperature" as one of the enumerated operational-parameter types, which is different on its face from a "jetting temperature." (EX1001, claim 10). Menchik's disclosure Petitioner relies upon is expressly a "recommended jetting temperature," not an "extruder temperature." (EX1009, ¶[0035]; Pet., 67). Petitioner's showing on this point is purely conclusory—Petitioner simply asserts that "recommended jetting temperature is an extruder temperature" without identifying any disclosure in Menchik describing an "extruder," describing an "extruder temperature," or explaining how "jetting" temperature equates to "extruder" temperature in the manner claim 10 requires. (Pet., 67–68; EX1009, ¶[0035]; EX1003, ¶146).

As Dr. Cormier explained, Menchik describes an inkjet 3D printing process in which droplets of liquid ink are jetted. (EX2013, ¶178). The "recommended jetting temperature" is specific to this inkjet process. (*Id.*). The "extrusion temperature" of claim 10 instead refers to an entirely different 3D printing process known as fused filament fabrication (FFF). (*Id.*). FFF is fundamentally different from inkjet printing, and it fabricates parts by melting/softening plastic in a nozzle and continuously extruding it from a moving nozzle to "draw" the desired shape.

(*Id.*). As such, Petitioner's statement that "recommended jetting temperature is an extruder temperature" is erroneous. (*Id.*).

c) **<u>Petitioner's claim-10 mapping also fails because claim 10 requires the printer to receive the operational parameters from the client, while Petitioner relies on parameters stored on cartridge memory and computed by the controller</u>**

Petitioner's (and Dr. Hickner's) claim-10 theory relies on information stored on cartridge memory (including "recommended jetting temperature" and "optimum building parameters") and on controller computations of material quantities (including the "amount of … support liquid … required"), which are not operational parameters received from the client as claim 1[f] requires. (Pet., 61–62 (element 1[f]), 67–68; EX1009, ¶¶[0035], [0048]; EX2013, ¶179).

d) **<u>Petitioner's reliance on "amount of support liquid … required" does not establish claim 10's recited "support structure requirement," and in any event is not shown to be a client-provided operational parameter</u>**

Petitioner attempts to satisfy the "support structure requirement" by citing Menchik's disclosure that the controller may compute "the amount of … support liquid … required," but that disclosure addresses a quantity computation, not a printer-configuration "support structure requirement" of the type recited in claim 10. (Pet., 68; EX1009, ¶[0048]; EX1001, claim 10). Petitioner does not explain—nor does it cite evidence showing—how a computed "amount of support liquid …

required" constitutes a "support structure requirement" as an operational parameter, rather than a consumption estimate or planning metric. (Pet., 67–68; EX1003, ¶146; EX1009, ¶[0048]). Even if Menchik's computed "amount of support liquid … required" could be characterized as support-related information, Petitioner still does not show it is an operational parameter received from the client as required by claim 10 through claim 1[f]. (EX1001, claims 1, 10; Pet., 61–62 (element 1[f]); Pet., 68; EX1009, ¶[0048]; EX2013, ¶180).

e) <u>Conclusion</u>

For each of the foregoing reasons, Petitioner has not met its burden to prove claim 10 unpatentable under Ground 3A. (EX2013, ¶181).

X. THE CHALLENGED CLAIMS ARE NOT UNPATENTABLE UNDER GROUND 3B

Ground 3B proposes the combination of *Menchik* and *Jazayeri*. *See* (Pet. 1). As explained above, *Jazayeri* is not a proper reference for an obviousness challenge. *Supra* § VII.B. A POSITA would likewise not be motivated to combine Jazayeri (directed to 2D printing) with Menchick (directed to 3D printing) for the reasons previously discussed for Ground 1B. *Supra* § VII.C. Further, Petitioner does not separately address claim element 1[e] and 1[f] in Ground 3B (Menchik and Jazayeri) and thus Ground 3B does not teach claim elements 1[e] and 1[f] for the same reasons as provided for Ground 3A. *Supra* §§ IX.B.2, IX.B.3; (EX2013, ¶¶182–183).

A. Ground 3B Does Not Render Independent Claim 1 Unpatentable

Claim 1 expressly requires "receiving a request from a client over a network to fabricate an object on the three-dimensional printer." (EX1001, claim 1).

Ground 3B is expressly conditional—"[t]o the extent" Menchik's "printing file" is not a "request," Petitioner imports Jazayeri's 2D-printing cloud workflow (network print request, print dialog/printer selection, print job with print data/characteristics) to satisfy element 1[b]. (Pet., 71). This conditional import underscores Ground 3B's reliance on non-analogous art and does not cure the absence of the claimed networked fabrication request, as Jazayeri's "print request" is received by a "print server," not by the three-dimensional printer. (EX1010, Abstract, ¶[0036]). Petitioner therefore satisfies element 1[b] only by an architecture-level redesign rather than any teaching that the printer receives the claimed fabrication request over the network. (EX2013, ¶¶184–185)

Accordingly, Petitioner has not met its burden to show claim 1 unpatentable under Ground 3B.

B. Ground 3B Does Not Render Dependent Claims 3–5, 7, 9–11, 20 Unpatentable

Petitioner states that, other than claim element 1[b], "the analysis of all other claim elements is identical" to Ground 3A. (Pet., 71). Accordingly, Ground 3B does not render Dependent Claims 3-5, 7, 9-11, and 20 unpatentable for the reasons discussed previously for Ground 3A. *Supra* IX; (EX2013, ¶186).

XI. DEPENDENT CLAIMS 2, 8, 12, 16 ARE NOT UNPATENTABLE UNDER GROUNDS 3C/3D

Dependent claims 2, 8, 12, and 16 all depend from claim 1, and therefore Grounds 3C/3D do not render those dependent claims unpatentable for the reasons discussed above for Grounds 3A/3B. *Supra* IX-X; (EX2013, ¶187).

XII. DEPENDENT CLAIM 17 IS NOT UNPATENTABLE UNDER GROUND 1E/1F/3E/3F

Dependent claim 17 depends from claim 1, and therefore Grounds 1E/1F/3E/3F do not render those dependent claims unpatentable for the reasons discussed above for Grounds 1A/1B/3A/3B. *Supra* VI-VII, IX-X. Grounds 1E/1F/3E/3F further fail to teach or suggest the additional limitation of claim 17. (EX2013, ¶188).

A. Claim 17

Claim 17 further requires "performing a diagnostic test to determine whether the one or more operational parameters ["receiv[ed] … from the client" and "selected for use in controlling operation of the three-dimensional printer when fabricating the object with the build material"] is suitable for the three-dimensional printer." (EX1001, claims 1, 17).

a) <u>Petitioner's claim-17 theory across Grounds 1E/1F/3E/3F hinges on recharacterizing a material-sufficiency computation as both the claimed "operational parameter" and the claimed "diagnostic test"</u>

Petitioner's Ground 1E/1F/3E/3F claim 17 theory is that Menchik's controller computes the "amount of modeling material, support liquid, or combination of modeling and support materials required for printing a given three-dimensional object," and then determines "whether the amount of modeling and/or support material in the available cartridges is sufficient to complete a three-dimensional object." (Pet., 39–40, 78-80; EX1009, ¶¶[0048]–[0049]). Petitioner then asserts that the computed "amount … required" is itself "an operational parameter," and that "calculating whether a cartridge contains enough material to complete the print job" is "a diagnostic test to determine whether the operational parameter (the amount of material required) is suitable for the printing apparatus to complete the print job." (Pet., 40–41, 78-79; EX1003, ¶174). Petitioner further contends that, "[t]o the extent that Menchik were considered to not disclose a diagnostic test that provides an error message when the amount of support material is insufficient," a POSITA would have found it "obvious and straightforward" to implement Menchik to provide such an error message. (Pet., 40, 78-79; EX1003, ¶172; EX2013, ¶¶188–191).

As purported evidence of such a "diagnostic" notification concept, Petitioner cites Dahlin's disclosure that a CPU "calculate[s] whether a spool … contains enough filament to complete the job" and then provides operator notification stating either that filament is adequate or that a spool "will need replacement and reloading during the process." (Pet., 40, 79; EX1011, 5:26–37). Petitioner also relies on Dahlin's disclosure that the CPU uses "support filament data" to provide operator information "in the same manner" as for modeling filament. (Pet., 40; EX1011, 5:55–64; EX2013, ¶192).

b) Petitioner's theory fails because "amount of material required" is not the claim-17 "operational parameters" whose "suitab[ility]" is tested

Claim 17's "diagnostic test" is expressly tied to whether "the one or more operational parameters" are "suitable for the three-dimensional printer," and claim 1 makes those "operational parameters" the parameters the client selects and sends for controlling printer operation during fabrication. (EX1001, claims 1, 17). Petitioner's identification of "the amount of material required" as the relevant "operational parameter" is thus a categorical mismatch with claim 1's client-selected "operational parameters." (*Id.*). An "amount of material required" is a consumables-quantity estimate used for supply management; it does not "control[] operation of the three-dimensional printer" during fabrication, and therefore cannot be the claim-1 "operational parameter" whose "suitab[ility]" claim 17 requires the diagnostic test to assess. (EX2013, ¶193).

The intrinsic record reinforces that mismatch by describing "operational parameters" as printer-configuration settings (e.g., "extruder temperature," "feed rate," "build platform temperature," "infill requirement," "rafting requirement," "support structure requirement," and "cooling requirement"), not a computed consumables-quantity estimate. (EX1001, 15:17–24). Menchik's cited disclosures describe a supply-management sufficiency check (required quantity vs. available quantity), not a diagnostic test of whether an operational parameter is "suitable for the three-dimensional printer" as claim 17 requires. (EX1009, ¶¶[0048]–[0049]; EX1001, claim 17; EX2013, ¶194).

Indeed, the Board recently addressed materially similar "diagnostic test" language in denying institution in IPR2025-00585 (the related '464 Patent). The Board recognized that "the plain language of [the] claim … requires two distinctive steps: determining an operational parameter … followed by performing a diagnostic test," and—under its "best understanding"—assumed the diagnostic test is distinct from the operational-parameter determination. IPR2025-00585, Paper 11 at 15–18. That reasoning is conflicts with Petitioner's attempt here to satisfy claim 17 by relabeling a material-sufficiency computation as both the claimed "operational parameter" and the claimed "diagnostic test." (EX2013, ¶195).

c) **<u>Dahlin does not cure the defect because Dahlin likewise discloses only a filament-sufficiency check and operator notification—not a diagnostic test of claim-1 "operational parameters"</u>**

Dahlin's cited disclosure is that "at the outset of a job" the CPU "will calculate whether a spool … contains enough filament to complete the job," and then notify the operator that filament is adequate or that a spool will require replacement/reloading. (EX1011, 5:26–37). That Dahlin calculation is expressly driven by "amount of filament on the spool" data and whether it is "insufficient to create a desired object," i.e., an inventory sufficiency determination rather than a test of operational-parameter suitability. (EX1011, 1:64–2:2, 5:26–37). Dahlin's "support filament" disclosure likewise concerns using support-filament data to provide operator information "in the same manner" as modeling filament, again reflecting a inventory check and notification paradigm rather than a suitability test of printer-operating parameters. (EX1011, 5:55–64; EX2013, ¶196).

Accordingly, even accepting Petitioner's premise that Menchik and/or Dahlin disclose ways to warn an operator about insufficient material, those disclosures still do not teach claim 17's requirement of performing a diagnostic test of whether the claim 1 "operational parameters" (client-selected parameters for controlling printer operation) are suitable for the three-dimensional printer. (EX2013, ¶197).

d) Conclusion

For the foregoing reasons, Petitioner fails to show that claim 17 is taught or rendered obvious under Grounds 1E/1F/3E/3F. (EX2013, ¶198).

XIII. DEPENDENT CLAIM 5 IS NOT UNPATENTABLE UNDER GROUND 1C/1D/3G/3H

Dependent claim 5 depends from claim 1, and therefore Grounds 1C/1D/3G/3H do not render those dependent claims unpatentable for the reasons discussed above for Grounds 1A/1B/3A/3B. *Supra* VI-VII, IX-X. Grounds 1C/1D/3G/3H further fail to teach or suggest the additional limitation of claim 5. (EX2013, ¶¶199–200).

A. Overview of KISSlicer (EX1018)

KISSlicer is a short "Quick-Start Guide" for creating a "first print file." (EX1018, 1; EX2013, ¶201).

B. Claim 5

Claim 5 further requires "receiving a selection of one of the first build material and the second build material from the client for use in fabricating the object using the three-dimensional printer." (EX1001, 23:64-67). Claim 5 depends from claim 4, which requires "providing data from the first tag and the second tag to the client over the network," reinforcing that the claimed selection is made in (and transmitted back within) the same networked client/printer workflow involving tag data for two different supplies. (EX1001, claims 4-5).

1. Petitioner's Ground 1C/1D theory (Loughran + Dubois + KISSlicer, and Loughran + Dubois + Jazayeri + KISSlicer) does not teach "receiving a selection … from the client"

Petitioner relies on Loughran's disclosure that an "inkjet SFF system" may use "a jet for each of a plastic build material and a wax-like support material." (Pet., 36-37; EX1004, ¶[0016]; EX1003, ¶101). Petitioner then asserts that a POSITA would have found it obvious to implement the Loughran/Dubois system (or Loughran/Dubois/Jazayeri) "to allow the user of the client system to select the plastic build material to be extruded by one jet" and "to select the support material extruded by another jet," purportedly "based on KISSlicer's suggestions." (Pet., 37–39; EX1003, ¶101; EX1018, 1–11). However, that theory does not identify any disclosure in Loughran, Dubois, Jazayeri, or KISSlicer where the three-dimensional printer actually receives from a client a selection of one of two tagged build materials for use in fabricating the object, as claim 5 requires. (EX2013, ¶¶202–203). Moreover, Petitioner erroneously conflates two different 3D printing processes. KISSlicer specifically prepares 3D printer build jobs for extrusion-based FFF printers, not inkjet 3D printing processes. As Dr. Cormier explained, the term "extrusion" would be known to a POSITA to refer to the fused filament fabrication (FFF) process, whereas the term "jet" would be known to refer to inkjet 3D printing.

Those are two very different 3D printing processes, and "material to be extruded by one jet" (Pet. at 37) represents an infeasible combination. (EX2013, ¶¶203–204).

Finally, KISSlicer's described "select"/"assign" functions are slicer settings for preparing print files (e.g., assigning extruders to part/raft/support behaviors), not a network exchange where the printer receives a client-provided selection between two tagged build materials in response to tag data provided "over the network." (EX1018, 1–3, 5, 11). As Dr. Cormier explained, slicer software can "assign" different extruders/materials within a print file, but that offline assignment does not disclose the claimed workflow. (EX2013 ¶¶204–205). In fact, Dr. Hickner admitted during his deposition that KISSlicer provides default materials and allows manual parameter updates (e.g., temperature), but it does not ingest tag data from a material supply. (EX2015, 108:11–110:18). Dr. Hickner also admitted that "in general … within [a] slicer program … there's information about the build material in that slicer program," and that "it's entirely possible to … transmit a data about a build material over a network in the absence of [a] tag." (EX2015, 25:17–26:11). Thus, KISSlicer does not provide the claimed tag-to-client-to-selection workflow. (EX2013, ¶205).

Jazayeri (added in Grounds 1D/3H) likewise concerns a print-server "print request" and "print job" framework for printing "print data" with "print characteristics," not client selection between two tagged build materials for 3D fabrication. (EX1010, ¶[0036]; EX2013, ¶206).

2. Petitioner's Ground 3G/3H theory (Menchik + KISSlicer, and Menchik + Jazayeri + KISSlicer) fails for the same reasons

For Grounds 3G/3H, Petitioner cites Menchik's statement that the supply of materials "may be … selectively controlled," and asserts a POSITA would modify Menchik (or Menchik as combined with Jazayeri) so a client can select build and support materials for different print heads, again "based on KISSlicer's suggestions" discussed for Grounds 1C/1D. (Pet., 80–82; EX1009, ¶[0018]). However, Petitioner again does not identify any disclosure where the printer ***receives*** the selection claim 5 requires, as opposed to (at most) controller-side or software-profile configuration of materials/heads. *Supra* § XIII.B.1. Accordingly, Petitioner has not met its burden to prove claim 5 unpatentable under Grounds 1C/1D/3G/3H. (EX2013, ¶207).

XIV. CONCLUSION

For the foregoing reasons, Patent Owner respectfully requests that the Board reject Petitioner's unpatentability challenges against the '466 Patent.

Respectfully submitted,

Dated: January 16, 2026 /s/Brian W. Oaks

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CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), I certify that this Response complies with the type-volume limits of 37 C.F.R. § 42.24(b)(1) because it contains 13,988 words, excluding the parts that are exempted by 37 C.F.R. § 42.24(a), according to the word processing system used in preparation of this Response.

Dated: January 16, 2026

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR § 42.6(e)(4), the undersigned certifies that on January 16, 2026, a complete copy of the foregoing Patent Owner's Response was served on Lead and Back-up Counsel for Petitioner at the service address provided in Petitioner's Mandatory Notices:

Email: IPR56224-0010IP1@fr.com

Dated: January 16, 2025 /s/ Brian W. Oaks

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