

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SHENZHEN TUOZHU TECHNOLOGY CO., LTD.,
Petitioner,

v.

STRATASYS, INC.,
Patent Owner.

IPR2025-00611
Patent 11,886,774 B2

Before HYUN J. JUNG, CHRISTOPHER L. OGDEN, and
BRIAN D. RANGE, *Administrative Patent Judges*.

OGDEN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

Petitioner Shenzhen Tuozhu Technology Co., Ltd. (“Petitioner”) filed a Petition (Paper 2, “Pet.”) under 35 U.S.C. §§ 311–319 requesting *inter partes* review (“IPR”) of claims 1–10, 12, 13, 19, and 20 of U.S. Patent No. 11,886,774 B2 (Ex. 1001, “the ’774 patent”). Patent Owner Stratasy, Inc. (“Patent Owner”) filed a Preliminary Response. Paper 8 (“Prelim. Resp.”). After considering the arguments presented in the Preliminary Response, we determined that the information presented in the Petition established that there was a reasonable likelihood that Petitioner would prevail with respect to at least one of the challenged claims of the ’774 patent. We instituted this IPR under 35 U.S.C. § 314 on October 6, 2025, as to all claims and grounds raised in the Petition. Paper 11 (“Inst. Dec.”).

Patent Owner filed a Response to the Petition (Paper 22, “PO Resp.”), Petitioner filed a Reply (Paper 27, “Pet. Reply”), and Patent Owner filed a Sur-reply (Paper 29, “PO Sur-reply”). We held an oral hearing on July 13, 2026, and the transcript is entered into the record. Paper 38 (“Tr.”).

This is a final written decision under 35 U.S.C. § 318(a) as to whether the claims challenged in the IPR are unpatentable. For the reasons below, we conclude that all the challenged claims are unpatentable.

II. BACKGROUND

A. THE ’774 PATENT (EX. 1001)

The ’774 patent describes a method of querying a target 3D printer for configuration information and receiving a dictionary of such information, which is used to create a fabrication profile for generating a 3D object.

Ex. 1001, code (57), 21:19–24:22. Then the system generates a machine-ready representation of the 3D model. *Id.* at 24:23–25:12.

The target 3D printer’s “configuration information” (also called “properties”) includes “information, capabilities, features, functions, configurations, data, and the like relevant to fabrication of an object.” Ex. 1001, 19:15–17. For example, it may include “a hardware configuration of the target printer, a software configuration, a user setting or preference, or a firmware configuration of the target printer.” *Id.* at 19:22–25; *see also id.* at 1:28–30; *id.* at 19:26–21:18 (describing various other examples of configuration information).

The “dictionary of configuration information” received from the target 3D printer “may be a list or collection of the properties, or may be otherwise configured to organize the properties of the printer, e.g., for readability and use by a print server, slicing engine, user, other resource, or the like.” Ex. 1001, 21:24–28.

The “fabrication profile” can include “information for generating machine-ready representations for the target printer,” and may “include[] the dictionary” or “may also or instead be a profile used to determine which machine-ready representation is available or suitable for a target printer.” *Id.* at 23:40–52.

The “machine-ready representation” can be a “model of the three[-]dimensional model of the object that is executable by a target printer to fabricate the object.” *Id.* at 24:27–29.

B. CHALLENGED CLAIMS AND GROUNDS

Independent claim 1 is as follows:

- [1.pre] 1. A method comprising:
 - [1.1] receiving a request to fabricate an object from a three-dimensional model;
 - [1.2] determining a target printer to fabricate the object;
 - [1.3] querying the target printer for configuration information of the target printer relevant to creation of a printable model for fabrication of the object on the target printer;
 - [1.4] receiving, from the target printer, a dictionary of configuration information containing one or more properties from the target printer that affect fabrication capabilities of the target printer;
 - [1.5] creating a fabrication profile based on the one or more properties; and
 - [1.6] generating a machine-ready representation of the three-dimensional model executable by the target printer to fabricate the object.

Ex. 1001, 35:18–32 (Petitioner’s reference numbers and formatting added);
accord Pet. v.

Petitioner argues nine grounds for *inter partes* review, as summarized in the following table (*see* Pet. 1–2):

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–5, 9, 10, 12, 13, 20	103	Douglas, ¹ Mark ²
6, 7, 9, 10	103	Douglas, Mark, Dahlin ³
8	103	Douglas, Mark, Batchelder ⁴
19	103	Douglas, Mark, Pax ⁵
1–5, 9, 10, 12, 13	103	Hamilton, ⁶ Evans, ⁷ KISSlicer ⁸
6, 7, 19	103	Hamilton, Evans, Pax, KISSlicer
19	103	Hamilton, Evans, Pax, Pettis, ⁹ KISSlicer
8	103	Hamilton, Evans, Batchelder, KISSlicer
20	103	Hamilton, Evans, Wang, ¹⁰ KISSlicer

C. DECLARATORY TESTIMONY

Petitioner submits a declaration by Dr. Michael Hickner. Ex. 1003; *see also* Ex. 1004 (Dr. Hickner’s curriculum vitae). Petitioner also submits a

¹ Douglas et al., US 2014/0117585 A1, published May 1, 2014 (Ex. 1005).

² Mark et al., US 9,694,544 B2, published July 4, 2017 (Ex. 1006).

³ Dahlin et al., EP 1 087 862 B1, published July 29, 1999 (Ex. 1008).

⁴ Batchelder et al., US 2014/0127524 A1, published May 8, 2014 (Ex. 1007).

⁵ Pax, WO 2014/039825 A2, published Mar. 13, 2014 (Ex. 1013).

⁶ Hamilton et al., US 2014/0236773 A1, published Aug. 21, 2014 (Ex. 1010).

⁷ Brian Evans, *Practical 3D Printers: The Science and Art of 3D Printing* (2012) (Ex. 1011).

⁸ KISSlicer Quick-Start Guide (2012), available at <http://archive.org> as an archive of <http://www.kisslicer.com/download.html> (accessed Feb. 15, 2012) (Ex. 1012).

⁹ Pettis et al., US 2013/0329258 A1, published Dec. 12, 2013 (Ex. 1009).

¹⁰ Wang et al., US 9,862,149 B2, issued Jan. 9, 2018 (Ex. 1014).

declaration by Jonathan Drummer to support its argument that KISSlicer is a prior-art printed publication (Ex. 1015), and a similar declaration by June Munford relating to Evans (Ex. 1016).

Patent Owner submits a corrected declaration by Dr. Denis Cormier. Ex. 2014.

D. RELATED PROCEEDINGS

As related matters, the parties identify *Stratasys, Inc. v. Shenzhen Tuozhu Technology Co. Ltd.*, No. 2:24-cv-00644, -00645 (E.D. Tex. filed Aug. 8, 2024; consolidated); *BambuLab USA, Inc. et al. v. Stratasys, Inc.*, 1:24-cv-01511 (W.D. Tex. filed Dec. 9, 2024; terminated May 5, 2025). Pet. 90; Paper 3, 2.

III. ANALYSIS

A. LEVEL OF ORDINARY SKILL IN THE ART

The level of ordinary skill in the pertinent art at the time of the invention is a factor in how we construe patent claims. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc). It is also one of the factors we consider when determining whether a patent claim is obvious over the prior art. *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

To assess the level of ordinary skill, we construct a hypothetical “person of ordinary skill in the art,” from whose vantage point we assess obviousness and claim interpretation. *See In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998). This legal construct “presumes that all prior art references in the field of the invention are available to this hypothetical skilled artisan.” *Id.* (citing *In re Carlson*, 983 F.2d 1032, 1038 (Fed. Cir. 1993)).

Petitioner argues that a person of ordinary skill in the art would have had “a bachelor’s degree in Mechanical Engineering, Computer Engineering, Electrical Engineering, or a comparable field and at least two years of experience related to 3D printers and software including remote control of rapid fabrication systems.” Pet. 3 (citing Ex. 1003 ¶¶ 19–21).

Patent Owner argues that a person of ordinary skill in the art 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.” PO Resp. 9–10 (citing Ex. 2014 ¶ 21–25).

The parties agree that experience could substitute for a degree, and vice versa. Pet. 3; PO Resp. 10.

The parties’ proposed levels of ordinary skill are substantially similar. For this decision, as in the Institution Decision, we adopt Petitioner’s proposed level, which is supported by credible testimonial evidence and is consistent with the problems addressed in the ’774 patent. *See* Ex. 1001, 1:16–52. Our decision would be the same, however, if we were to adopt Patent Owner’s proposal.

B. CLAIM CONSTRUCTION

In an IPR, we construe a patent claim “using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b).” 37 C.F.R. § 42.100(b). This generally includes “construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” *Id.* The ordinary

and customary meaning of a claim term “is its meaning to the ordinary artisan after reading the entire patent” and “as of the effective filing date of the patent application.” *Phillips*, 415 F.3d at 1313, 1321.

Neither Petitioner nor Patent Owner argues that we need to construe any claim terms explicitly. *See* Pet. 2–3; PO Resp. 10. However, the parties contest two material claim-construction issues which we address below. To the extent that the parties’ positions depend on interpreting other claim language in a particular way, we discuss the relevant claim language below in the context of the parties’ arguments regarding the prior art.

1. *Whether limitation 1.2 must precede limitations 1.3 and 1.4.*

The parties contest whether claim 1 should be construed such that limitation 1.2 must precede limitations 1.3 and 1.4.¹¹ Limitation 1.2 recites “determining a target printer to fabricate the object.” Ex. 1001, 35:21. Limitation 1.3 recites “querying the target printer for configuration information of the target printer relevant to creation of a printable model for fabrication of the object on the target printer.” *Id.* at 35:22–24. Limitation 1.4 recites “receiving, from the target printer, a dictionary of configuration

¹¹ Patent Owner contends that limitations 1.1–1.6 must all be performed in the recited order. *See* PO Resp. 14–15. However, only the timing of limitations 1.2–1.4 are material to the contested issues in this proceeding. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

information containing one or more properties from the target printer that affect fabrication capabilities of the target printer.” *Id.* at 35:25–28.

Patent Owner argues that limitations 1.3 and 1.4 must follow limitation 1.2 because limitation 1.3 recites “querying the target printer for configuration information” and limitation 1.4 recites receiving the configuration information “from the target printer,” both of which refer to the result of “determining a target printer” recited in limitation 1.2. PO Resp. 14–15, 19, 47.¹²

Patent Owner acknowledges that the ’774 patent recites two embodiments in which “queries may be used to select a target printer,” PO Resp. 14 (citing Ex. 1001, 19:8–14). But according to Patent Owner, one of these embodiments is in the context of querying multiple printers. *Id.* (citing Ex. 1001, 19:8–10). In the other embodiment, the query is “sent to a printer that is not necessarily the target printer as described herein.” *Id.* (quoting Ex. 1001, 19:11–14). Because these embodiments query printers other than the target printer, Patent Owner argues that they are unclaimed embodiments outside the scope of claim 1. *Id.*

In its Reply, Petitioner disagrees that the embodiments in the ’774 patent in which the “determining” (1.2) step follows the “querying” (1.3) step are unclaimed. Pet. Reply 1. Petitioner argues that courts do not normally interpret claims to exclude embodiments, and there is no probative evidence here to overcome that presumption. *Id.* at 1–2.

¹² Because it is not material to the parties’ controversy, we do not determine whether limitation 1.4 must follow limitation 1.3. *Realtime Data*, 912 F.3d at 1375.

Petitioner also argues that claim 1 is a “comprising” claim that does not prevent sending queries to printers other than the target printer, so there is no logical reason to exclude the ’774 patent’s two reverse-order embodiments from the scope of claim 1. Pet. Reply 2. Petitioner contends that limitation 1.2 only *selects*, not *creates*, a target printer, so other steps relating to what ultimately is determined to be the target printer may occur before that determination is made. *Id.* at 2–3.

In its Sur-reply, Patent Owner counters that the plain language of claim 1 clearly requires performing limitations 1.2 and 1.3 in the recited order. PO Sur-reply 4. Patent Owner argues that interpreting the claim such that the target printer could be determined after querying that printer would render the word “target” meaningless. According to Patent Owner, the “target printer” is the printer that is “to fabricate the object . . . from a three-dimensional model.” *Id.* at 5 (citing limitations 1.1 and 1.2). Thus, one would need to have already determined what printer will fabricate the object before querying that printer. *Id.*

We disagree with Patent Owner that a person of ordinary skill in the art would have understood that limitation 1.2 must be performed before limitations 1.3 or 1.4. *See* Ex. 1001, 35:21–24. *See Interactive Gift Exp., Inc. v. Compuserve Inc.*, 256 F.3d 1323, 1342 (Fed. Cir. 2001) (“Unless the steps of a method actually recite an order, the steps are not ordinarily construed to require one.” (citing *Loral Fairchild Corp. v. Sony Corp.*, 181 F.3d 1313, 1322 (Fed. Cir. 1999))). The evidence suggests that a “target printer” is any printer that is ultimately selected for fabricating the object, and such a printer could send its configuration information either before or after that determination is made in limitation 1.2.

This interpretation does not render the word “target” meaningless. At some point, a printer must be determined to be the target printer, which is the one intended to ultimately fabricate the three-dimensional object. But the target printer still exists, and is capable of being queried, before that determination is made.

We find the examples in the ’774 patent pertinent to this question. The ’774 patent states that “the target printer may include more than one printer.” Ex. 1001, 18:66–67. In discussing the step of “query target printer for properties 306” (Fig. 3A), the ’774 patent states that “[i]n one aspect, numerous queries are sent to numerous printers, e.g., for use in selecting one or more of the printers as the target printer.” *Id.* at 19:8–10. Alternatively, “the query is sent to a printer that is not necessarily the target printer as described herein, e.g., when the query or information received from a response to the query is used for the selection of the target printer.” *Id.* at 19:11–14. Importantly, the second embodiment states that the queried printer “is not *necessarily* the target printer,” suggesting that the queried printer could *be* the target printer even before it is *determined* to be such. *Id.* at 19:11–12 (emphasis added).

Based on the evidence of record, a person of ordinary skill in the art would have understood that the “target printer” can be determined after the query recited in limitation 1.3 or the reception of configuration information recited in limitation 1.4. Thus, the evidence does not impose an ordering between limitations 1.2 and 1.3 or between limitations 1.2 and 1.4. The evidence also does not support Patent Owner’s argument that the two reverse-order examples in the ’774 patent are unclaimed embodiments.

2. “*Dictionary*”

Limitation 1.4 recites “receiving, from the target printer, a dictionary of configuration information containing one or more properties from the target printer that affect fabrication capabilities of the target printer.”

Ex. 1001, 35:25–28.

Petitioner argues that, according to the ’774 patent, the recited dictionary of configuration information “may be a list or collection of the properties, or may be otherwise configured to organize the properties of the printer.” Pet. 14 (citing Ex. 1001, 21:24–26).

In its Response, Patent Owner does not offer its own construction of the term “dictionary,” but proceeds based on the assumption that it is a “collection of configuration information” as Petitioner argues. *See* PO Resp. 17 (“Petitioner fails to explain why the data sent from the target printer [in Douglas] is a collection of configuration information”); *id.* at 19 (“[E]ven if a ‘dictionary’ is simply a collection of properties, ...”); *id.* at 45 (“Petitioner fails to explain why the accuracy and material capabilities in Hamilton that are sent from the printer is a collection of properties”); *see also* Tr. 48:23–49:3. Patent Owner also asserts that a “collection” must have some additional organization beyond mere presence in a set of transmitted properties. *See id.* at 18–19; *see also* Tr. 47:6–8 (“[I]f you don’t need any organization, how can it be a collection? Because to me, a collection is an organization—some organization of data.”).

In its Reply, Petitioner argues that “[t]he ’744 patent defines ‘dictionary’ broadly to be ‘a list or collection of the properties, or may be otherwise configured to organize the properties of the printer.’” Pet. Reply 6

(quoting Ex. 1001, 21:24–26). Petitioner points to disclosures in the ’774 patent that the dictionary

“may be provided in *any suitable format*” and that “[o]ne skilled in the art will recognize that the dictionary may include properties of a printer, and information pertaining to the properties of the printer, *at any desired level of granularity*, according to, e.g., the data storage and processing capabilities of the components being used in a system implementing the method.”

Id. at 7 (alteration in original) (quoting Ex. 1001, 22:37–48).

Petitioner also argues that during prosecution of a related application, “the Applicant’s only restriction of ‘dictionary’ was to specify that the dictionary is received ‘from the target printer,’ and that it contains configuration information that ‘affect[s] fabrication capabilities of the printer.’” Pet. Reply 6–7 (alteration in original) (quoting Ex. 1022, 36–41, 80–88).

In its Sur-reply, Patent Owner argues that, “[w]hile a specific organization is not required, the claims require a dictionary and not just configuration information or properties.” PO Sur-reply 8. According to Patent Owner, “the dictionary of configuration information [must have] some organization” other than the information itself. *Id.* at 8, 18 (arguing that one of the references “merely sends its accuracy and material capabilities It does not teach whether those capabilities are sent and received as a collection of information, as Petitioner asserts.”).

We disagree with Patent Owner’s interpretation. As Petitioner correctly notes, the ’774 patent describes a “dictionary” in broad terms. It may be “a list or collection of the properties” or it “may be otherwise configured to organize the properties . . . for readability and use by a print server, slicing engine, user, or resource, or the like.” Ex. 1001, 21:24–28; *see*

also id. at 22:37–38 (“In general, the dictionary may be provided in any suitable format.”); *id.* at 22:43–46 (“[T]he dictionary may include properties of a printer, and information pertaining to the properties of the printer, at any desired level of granularity”). In other words, the dictionary could simply be a “collection of the properties” in “any suitable format.” *Id.* at 21:25, 22:37–38.

The ’774 patent does not support Patent Owner’s contention that a “dictionary” is something more than a collection in the ordinary sense of that term. The ’774 patent conveys that a dictionary need only list or collect properties without regard for any particular format, and the fact that the properties have been aggregated for transmission is, itself, a kind of organization: “The dictionary may be a list or collection of the properties, or may be *otherwise* configured to organize the properties” Ex. 1001, 21:24–26 (emphasis added).

Therefore, based on the evidence of record, we determine that a person of ordinary skill in the art would have understood that a “dictionary,” as recited in limitation 1.4, need not include organization beyond simply being a collection of properties in any form suitable for transmission.

C. OBVIOUSNESS GROUNDS BASED ON DOUGLAS AND MARK

In four separate grounds, Petitioner argues that claims 1–10, 12, 13, 19, and 20 are unpatentable as obvious over combinations including Douglas and Mark. Pet. 1, 4–42. Petitioner also cites Dahlin for claims 6, 7, 9, and 10, Batchelder for claim 8, and Pax for claim 19. Pet. 1, 29–42.

A claim is unpatentable as obvious under § 103 if the differences between the claimed subject matter and the prior art are “such that the

subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). When a ground in a petition is based on a combination of references, we consider “whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *Id.* at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

We base our obviousness inquiry on factors including (1) the scope and content of the prior art, (2) any differences between the claimed subject matter and the prior art, (3) the level of skill in the art, and (4) any objective indicia of obviousness or non-obviousness that may be in evidence.¹³ *See Graham*, 383 U.S. at 17–18.

For the reasons below, Petitioner has shown that claims 1–10, 12, 13, 19, and 20 would have been obvious over the combination of Douglas and Mark.

1. Douglas

Douglas describes a system in which a 3D printer reads a data tag on a spool or cartridge containing a build material, the tag containing information about the build material. Ex. 1005, code (57). Using that information, the printer will “determine how to use the build material during fabrication of a three-dimensional object.” *Id.*

¹³ The parties do not argue that there are objective indicia of obviousness or non-obviousness. *See* Pet.; PO Resp. 72.

Douglas's system is part of a networked environment as depicted in Figure 2, reproduced below:

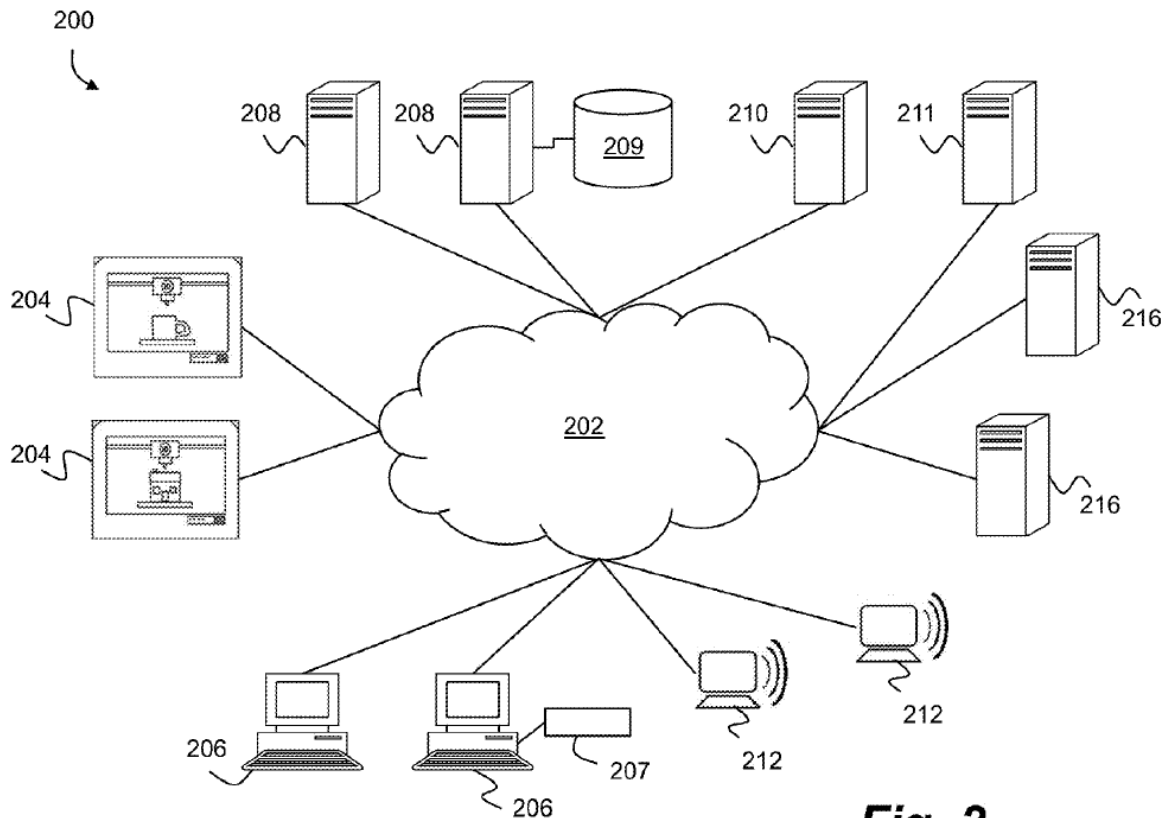


Fig. 2

Figure 2 shows “networked three-dimensional printing environment” 200, which includes data network 202 interconnecting various devices including client devices 206, print server 208 and 3D printers 204. Ex. 1005 ¶ 26. Client devices 206 “initiate, manage, monitor, [and] otherwise interact with print jobs at the three-dimensional printers 204.” *Id.* ¶ 30.

Print servers 208 include processing circuitry to “perform a variety of processing tasks related to management of networked printing.” *Id.* ¶ 32. For example, print server 208 may “communicate periodically with three-dimensional printers 204 in order to obtain status information concerning, e.g., availability of printers and/or the status of particular print jobs.” *Id.*

Print servers 208 may select a particular 3D printer 204 automatically or in response to a user request. *Id.*

Spools of build material may include a data tag that “characterize[s] at least one property of the build material,” including any “characteristic information appropriate for a three-dimensional printer.” Ex. 1005 ¶ 64; *see also id.* ¶ 94 (the tag may include information about mechanical, structural, or thermal properties of the build material). A 3D printer “may transmit the data tag . . . data to one of the remote sources configured for determination of . . . operational parameters and the appropriate remote source may transmit the determined operational parameters back to the three-dimensional printer . . . for fabrication of the object.” *Id.* ¶ 72. Such a remote source may include print server 208. *Id.* ¶ 74. The “operational parameters” can include information such as “an extruder temperature, a feed rate, a build platform temperature,” or any other “parameter that can be controlled by the three-dimensional printer.” *Id.* ¶¶ 65, 97.

2. *Mark*

Mark describes a method of slicing the 3D geometry of an object to be printed in a 3D printer, so that a fill tool can follow a toolpath to build the object layer by layer. Ex. 1006, code (57). The “toolpaths are used to create an instruction file for actuation, conventionally called a ‘G-code’^[14] file,” which is sent to the 3D printer. *Id.* at 12:15–17. This “G-code” file includes “all starting and finishing times, control or command variables (e.g., speed

¹⁴ According to the ’774 patent, G-code was known in the prior art as a “machine-ready representation” of a 3D model. *See* Ex. 1001, 25:33–34.

for a motor, current for a heater), and the like, to arrange the actuator instructions sufficient for a job to complete.” *Id.* at 12:20–23.

The process of creating toolpaths may include using a set of rules and parameters, stored in a database or a configuration file, “that control path planning for each layer.” Ex. 1006, 17:24–58, Figs. 20, 21.

3. *Claim 1*

a. Preamble (1.pre)

The preamble of claim 1 recites “[a] method.” Ex. 1001, 35:18.

Petitioner argues, and Patent Owner does not contest, that Douglas discloses a method. Pet. 10–11 (citing Ex. 1005 ¶¶ 11–15, Figs. 1, 6, claims 18–21; Ex. 1003 ¶ 47); *see* PO Resp.

Without determining whether the preamble is limiting, we find Petitioner’s argument persuasive for the reasons set forth in the Petition.

b. Limitation 1.1

Limitation 1.1 recites “receiving a request to fabricate an object from a three-dimensional model.” Ex. 1001, 35:19–20.

Petitioner argues that Douglas’s print servers 208 receives print jobs from client devices 206, which are requests to fabricate objects from 3D models. Pet. 11–12 (citing Ex. 1005 ¶¶ 30–46, 52, Fig. 2; Ex. 1001, 18:10–41; Ex. 1003 ¶ 48).

Patent Owner does not specifically contest this argument. *See* PO Resp. We find Petitioner’s argument for limitation 1.1 persuasive for the reasons set forth in the Petition.

c. Limitations 1.2 and 1.3

Limitations 1.2 and 1.3 recite “determining a target printer to fabricate the object; [and] querying the target printer for configuration information of the target printer relevant to creation of a printable model for fabrication of the object on the target printer.” Ex. 1001, 35:21–24.

Petitioner argues that within Douglas’s networked environment 200, print server 208 can automatically select one of 3D printers 204 as a target printer. Pet. 12–13 (citing Ex. 1005 ¶¶ 32, 38–43, 73, Fig. 2; Ex. 1003 ¶ 49). Petitioner also argues that print server 208 requests the target 3D printer to transmit tag data relating to properties such as build material type, which is relevant to creating a printable model for fabricating the object. Pet. 13–14 (citing Ex. 1005 ¶¶ 2, 32, 64, 72–73, 94, Figs. 2, 6; Ex. 1001, 22:56–23:5; Ex. 1003 ¶¶ 50–51).

(1) *Whether Douglas Teaches Both Limitations 1.2 and 1.3 in Any Order*

In its Response, Patent Owner argues that Petitioner has not shown that Douglas determines a target printer (limitation 1.2) before querying the target printer for configuration information (limitation 1.3). PO Resp. 13, 15–17 (citing Ex. 2014 ¶ 79). According to Patent Owner, Douglas’s print server “may request information from a printer to be used ‘as an input to a process on the print server for allocating print requests to various three-dimensional printers.’” *Id.* at 15–16 (quoting Ex. 1005 ¶ 74); Tr. 44:19–20 (paragraph 74 describes build material information from the printer as “an input to the process to decide which printer you’re going to allocate for

printing”).¹⁵ In other words, Patent Owner contends that print server 208 “determines the target printer . . . *after* requesting information.” *Id.* at 16 (citing Ex. 2014 ¶ 80).

In its Reply, Petitioner argues that paragraph 74 is just one non-limiting embodiment and in no way a teaching that target printer selection must occur after requesting the data tag. Pet. Reply 5–6.

As we discuss in more detail below, we find Petitioner’s argument persuasive that Douglas discloses both limitations 1.2 and 1.3 in various embodiments, including paragraph 74. Patent Owner does not substantially challenge Petitioner’s arguments that Douglas discloses both limitations, only that it does not teach them in the recited order. But as explained above, claim 1 imposes no ordering between limitations 1.2 and 1.3. *See supra* Section III.B.

(2) *Whether Douglas Teaches that Limitation 1.2 Precedes Limitation 1.3.*

Alternatively, we determine that Douglas teaches or suggests performing limitations 1.2 followed by limitation 1.3.

For limitation 1.2, Petitioner relies primarily on Douglas’s automatic printer selection mechanism in which print server 208 selects the printer from a list of available printers. *See* Pet. 12–13 (citing Ex. 1005 ¶ 32). For limitation 1.3, Petitioner relies primarily on Douglas’s teaching that print server 208 may, after selecting the target printer, request tag data from the

¹⁵ Petitioner did not specifically rely on Douglas’s paragraph 74 embodiment in its Petition. *See* Pet. 4–5, 12–14.

printer, which includes configuration information. Pet. 13–14 (citing Ex. 1005 ¶¶ 72–73).

As the noted in the Institution Decision, the example given in Douglas’s paragraph 73 teaches that remote client device 206 receives a request to print an object on a particular 3D printer within the network (“printer 306” as depicted in Figure 3 of Douglas), and then client device 206 requests printer 306 to transmit its tag data so that client device 206 can determine what operational parameters to send back to printer 306. Inst. Dec. 13–14 (citing Ex. 1005 ¶¶ 60, 73). We suggested that in this embodiment, the step of selecting printer 306 as the target printer (limitation 1.2) occurs before querying printer 306 for configuration information (limitation 1.3). *Id.* at 14.

However, in its Response, Patent Owner argues that “[i]f a received [print] request already identifies the printer, there is no need for ‘determining a target printer.’” PO Resp. 16. In other words, Patent Owner argues that a person of ordinary skill in the art would have had no reason to perform limitation 1.2 if the target printer was already identified in the print request.

Patent Owner also argues that in Petitioner’s ground, the entity performing the steps of claim 1 is print server 208, but in the paragraph 73 example, remote client device 206 originates the print request and the tag-data request, and the paragraph does not say which entity *receives* the print request, so this embodiment is inconsistent with the rationale in the Petition. *See* PO Resp. 16 (citing Ex. 1005 ¶ 73; Ex. 2014 ¶ 81).

In its Reply, Petitioner argues that Douglas’s print server 208 selects the target printer based on “any number of criteria” such as “geographical proximity, printing capabilities, current print queue, [and] fees” which may

be known in advance without reference to the printer's tag data. Pet. Reply 3–4 (alteration in original) (quoting Ex. 1005 ¶ 32). Petitioner also argues that Douglas's print server 208 “‘communicate[s] periodically with three-dimensional printers,’ indicating that the print server need not wait for the receipt of a data tag to allocate a print job to a printer.” *Id.* at 4 (alteration in original) (quoting Ex. 1005 ¶ 32).

Petitioner also argues that although paragraph 73 describes an embodiment in which the request to the printer is from remote client device 206, this is part of Douglas's virtual workspace embodiment in which the user creates a virtual workspace via client device 206 and then print server 208 determines the target printer based on the virtual workspace. Pet. Reply 4–5 (citing Ex. 1005 ¶ 73; Ex. 1003 ¶ 49). Petitioner contends that a person of ordinary skill in the art would have understood that Douglas's teachings as to remote client device 206 are also applicable to print server 208. *Id.* at 5 (citing Ex. 1005 ¶¶ 30, 32, 72).

In its Sur-reply, Patent Owner argues that Petitioner has not explained how the other criteria for printer selection do not still rely on the printer's tag data because “[t]he printer's location (for geographical proximity), capabilities, print queue, and fees all describe information from a printer.” PO Sur-reply 6 (citing Ex. 1005 ¶ 32). And although print server 208 communicates periodically with the printer, this “indicates that the target printer is queried before (and not after) the determining step.” *Id.*

Patent Owner also argues that Petitioner's arguments about remote client device 206 are untimely because the Petition focused on the actions of print server 208, and this amounts to introducing a new theory in the Reply. PO Sur-reply 6–7. Moreover, Patent Owner argues, “There is no teaching in

Douglas of the print server (or the print server's virtual workspace user) determining a target printer before querying the target printer.” *Id.* at 7. And according to Patent Owner, Douglas's “virtual workspace” is not a client device but a virtual service provided by the print server. *Id.* at 7–8 (citing Ex. 1005 ¶¶ 30, 43, Fig. 2).

We find Petitioner's arguments persuasive. Because claim 1 is a “comprising” claim, it encompasses multiple queries to the target printer, only one of which need correspond to limitation 1.3. Douglas's print server 208 periodically queries potential target printers and then, after a particular fabrication request, determines which of those is a target printer based on prior queries. Ex. 1005 ¶ 32. Then print server 208 requests and receives tag data from the selected target printer. Ex. 1005 ¶ 72. Thus, Petitioner has shown that Douglas teaches that limitation 1.3 follows limitation 1.2 in this embodiment, even if there have been other printer queries before performing limitation 1.2.

We find Petitioner's argument persuasive that a person of ordinary skill in the art would have regarded paragraph 73's teachings involving remote client device 206 to be applicable to the actions of printer server 208 as taught in other embodiments. Pet. Reply 5. Paragraph 73 is a “non-limiting example” of the embodiment described in preceding paragraph 72, which teaches that “the determination of operational parameters may be performed by the client device 206 or one of the other remote sources such as a printer server 208.” Ex. 1005 ¶ 72. Thus, paragraphs 72 and 73, together, teach an example consistent with the Petition's focus on print server 208 as the entity sending the printer query.

We also determine that Petitioner’s arguments about the paragraph 73 example in its Reply are not untimely. Petitioner cited the example in paragraph 73 several times in its Petition. Pet. 4–5, 12–14. In its Reply, Petitioner responded to issues raised in Patent Owner’s Response, such as the fact that paragraph 73 only specifically mentions remote client device 206 as being involved in the printer-querying step. PO Resp. 16; Pet. Reply 4–6.

For the above reasons, we determine that Petitioner has shown that Douglas not only discloses limitations 1.2 and 1.3, but also teaches that the two limitations are performed in the recited order.

d. Limitation 1.4

Limitation 1.4 recites “receiving, from the target printer, a dictionary of configuration information containing one or more properties from the target printer that affect fabrication capabilities of the target printer.” Ex. 1001, 35:25–28.

Petitioner argues that after receiving an inquiry from print server 208 as per limitation 1.3, Douglas’s 3D printer transmits back to print server 208 “data tag 304 data.” Pet. 14–15. According to Petitioner, this data is a “dictionary” of configuration information as recited in limitation 1.4 because it is a collection of properties that includes information about build material characteristics. *Id.* (citing Ex. 1005 ¶¶ 19, 32, 62–64, 72–73, 97, Figs. 2, 6; Ex. 1003 ¶¶ 52–53).

In response, Patent Owner argues that Petitioner improperly relies on expert testimony to fill in missing details as to how Douglas’s tag data constitutes a dictionary of configuration information. PO Resp. 17–18 (citing *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1361 (Fed. Cir. 2016); 35

U.S.C. § 311(b)). Patent Owner contends that Douglas only discloses that “‘data concerning a type of build material’ can be provided to a controller without explaining how the data is provided.” *Id.* at 18 (quoting Ex. 1005 ¶ 63) (citing Ex. 1005 ¶ 64). Thus, according to Patent Owner, Douglas “does not teach how its data is provided from the printer and received by the print server and thus does not teach receiving a dictionary of configuration information containing one or more properties from the target printer that affect fabrication capabilities of the target printer.” *Id.* at 18–19 (citing Ex. 2014 ¶ 84; Ex. 2015, 21:9–12 (Dr. Hickner: “So Douglas is broad in that it doesn’t talk about any specific file format or any—well, way to—method to transmit that information.”))).

Patent Owner also argues that Douglas “does not disclose *any* organization or collection of properties used to transmit said properties.” PO Resp. 19. And according to Patent Owner, data tag 304 cannot itself be the recited dictionary because Douglas does not actually transmit the tag. *Id.* (citing Ex. 2014 ¶ 84). Finally, Patent Owner argues that any information received from the printer would not be “from the target printer” because at that stage, limitation 1.2 has not been performed so there is no target printer. *Id.* (citing Ex. 2014 ¶ 85).

In its Reply, Petitioner argues that “[n]owhere does the ’774 patent describe that the dictionary must be transmitted in a particular fashion or format, and the transmission method of the dictionary is completely irrelevant to the content of the dictionary itself.” Pet. Reply 7 (citing Ex. 1001, 21:19–23:31). Petitioner also argues that Douglas clearly discloses transmitting a collection of properties in the form of the tag 304 data, which is sufficient to meet limitation 1.4. *Id.* at 8–9 (citing Ex. 1005 ¶¶ 64, 85–87).

In its Sur-reply, Patent Owner contends that Petitioner's argument that tag 304 is "read and transmitted as a collection" is an untimely new theory because it cites paragraphs 85–87 of Douglas, which were not cited in the Petition for this purpose. PO Sur-reply 9.

We find Petitioner's arguments persuasive. As we discuss above, we disagree with Patent Owner that a dictionary must have more organization than a simple collection or aggregation of properties. *See supra* Section III.B.2.

Petitioner has shown that Douglas discloses that a target printer sends a collection of properties relevant to creating a printable model for fabricating the object on the target printer. The data tag "characterize[s] at least one property of the build material," including any "characteristic information appropriate for a three-dimensional printer." Ex. 1005 ¶ 64. For example, this may include information about mechanical, structural, or thermal properties of the build material. *Id.* ¶ 94. Petitioner's argument in the Reply (Pet. Reply 9, including citations to Douglas ¶¶ 85–87) that Douglas teaches reading and transmitting data tag 304 as a collection is also consistent with the arguments in the Petition, and is thus timely. *See* Pet. 14 (arguing that data tag 304 is "received from the printer" and "includes a collection").

We disagree with Patent Owner's argument that the Petition improperly relies on expert testimony to fill in gaps in the Douglas disclosure. Petitioner has shown, from the Douglas disclosure, that the printer transmits a collection of properties as recited in limitation 1.4, and credibly cites Dr. Hickner to support that understanding of Douglas's teachings. *See* Pet. 14–15; Pet. Reply 6–7.

As to Patent Owner’s argument that Douglas does not disclose receiving a dictionary “from the target printer” because the target printer has not yet been determined according to limitation 1.2 (PO Resp. 19), we disagree that limitation 1.2 must necessarily precede limitation 1.4. *See supra* Section III.B.1. Alternatively, we find Petitioner’s argument persuasive that Douglas discloses performing limitation 1.4 after limitation 1.3, which is itself performed after limitation 1.2 in at least some embodiments. Pet. 14–15; *see supra* Section III.C.3.c(2).

Thus, we determine that Petitioner has shown that Douglas discloses limitation 1.4.

e. Limitation 1.5

Limitation 1.5 recites “creating a fabrication profile based on the one or more properties [received from the target printer].” Ex. 1001, 35:29–30.

Petitioner identifies the recited “fabrication profile” with the “operational parameters” disclosed in Douglas. *See* Pet. 15–17. Petitioner argues that Douglas’s “operational parameters” are based on the received tag data (i.e., the recited “dictionary of configuration information”) and are used as a profile for fabrication the object. Pet. 16–17 (citing Ex. 1005 ¶¶ 64–69, 73, 77, 97, 99; Ex. 1001, 23:34–41, 23:50–52; Ex. 1003 ¶¶ 55–56).

According to Petitioner, a person of ordinary skill in the art “would have recognized . . . that determining operational parameters for fabrication of the object would have been ‘creating a fabrication profile’ as these operational parameters are used ‘for a fabrication process using the build material . . .’ and ‘for the fabrication of the object’” Pet. 15–16 (citing Ex. 1005 ¶¶ 64, 74; Ex. 1003 ¶ 54).

In addition, Petitioner argues that Mark's G-code file is a fabrication profile created from the operational parameters in Mark's configuration file. Pet. 17–19 (citing Ex. 1005 ¶¶ 65–66; Ex. 1006, 17:34–44, 11:33–65, 13:4–19, 17:53–58, Figs. 5–7, 20, 21; Ex. 1001, 23:58–67; Ex. 1003 ¶ 57). According to Petitioner, a person of ordinary skill in the art would have had reason “to organize Douglas’ operational parameters into a ‘profile,’” such as Mark teaches, “at least because organizing these parameters in such a data structure facilitates the use of these parameters for the generation of toolpaths/G-code, and provide better storage and computational efficiency, and allow easier rendering of such operational parameters for user view in a user interface.” Pet. 19 (citing Ex. 1005 ¶¶ 65–66, Figs. 10, 20, 21; Ex. 1006, 11:33–65, 13:4–19, 17:34–44, 17:53–58, Figs. 5–7, 9, 10, 21, 22; Ex. 1003 ¶¶ 58–59).

Petitioner further argues that a person of ordinary skill in the art would have combined Douglas's system with Mark's slicer and tool-path generator because (1) the skilled artisan “would have been motivated to look to references disclosing implementation details for generating print data (e.g., tool instructions) for printing from 3D printers”; (2) 3D printing was known to “use[] code/instructions executable on the 3D printer to control the 3D printer, and such code/instructions are typically generated by a slicer and/or toolpath generator”; (3) Mark's techniques would have facilitated “data transmission and printing efficiency by collecting Douglas'[s] operational parameters in a file/set/database, ensuring models submitted in Douglas'[s] print jobs are suitable for the selected printer to execute”; and (4) the combination “would have merely involved combining prior art

elements . . . according to known methods to yield predictable results.” Pet. 8–10 (citing Ex. 1003 ¶¶ 40–46).

We address Patent Owner’s responsive arguments below.

(1) *Alleged Improper Hindsight*

Patent Owner characterizes Petitioner’s argument as improper hindsight because “[t]here is no evidence cited or explanation provided that using operational parameters in a fabrication process creates a fabrication profile,” or that the alleged benefits identified by Petitioner would have materialized. PO Resp. 21.

Specifically, Patent Owner takes issue with Petitioner’s efficiency rationales, for which Patent Owner argues there is no evidence of record. PO Resp. 21–22 (citing Ex. 2015, 27:5–8 (Dr. Hickner: “So I didn’t analyze paragraph 73 in that context of ‘better’ data transmission. I guess—I didn’t perform that analysis of better or more efficient data transmission.”)); Ex. 2014 ¶ 89); *id.* at 23 (citing Ex. 1005 ¶¶ 65–66; Ex. 1006, 11:33–65, 13:4–19, 17:34–44, 53–58, Figs. 5–7, 9, 10, 21, 22; Ex. 2014 ¶ 91); *see also* PO Sur-reply 9–10 (arguing that Petitioner’s arguments in its Reply are likewise based on improper hindsight).

We disagree that Petitioner’s arguments are based on impermissible hindsight, because they are based on the disclosures in Douglas and Mark, and Petitioner has articulated a persuasive reason to combine those references without referring to the ’774 patent itself, as we discuss below. *See In re McLaughlin*, 443 F.2d 1392, 1395 (CCPA 1971) (an obvious rationale is not improper hindsight if it “takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention

was made and does not include knowledge gleaned only from applicant's disclosure").

(2) *Whether Douglas's Operational Parameters Are a "Fabrication Profile"*

Next, Patent Owner argues that in Douglas, "the operational parameters are sent to the printer rather than being used to generate toolpaths," and Petitioner has not explained why a person of ordinary skill in the art would have further modified Douglas to organize the operational parameters into a fabrication profile. PO Resp. 22–23 (citing Ex. 1005 ¶ 73; Ex. 2014 ¶ 90). According to Patent Owner, "[t]here is no explanation of why a profile would be created using the parameters if the parameters are sent to the printer." *Id.* (citing Ex. 2014 ¶ 90). While acknowledging that Douglas's operational parameters "may be combined into a single set of operational parameters by either the three-dimensional printer 306 or the remote source" (Ex. 1005 ¶ 75), Patent Owner contends that Petitioner did not point to this as part of its rationale in the Petition. *Id.* at 23 (citing Ex. 2014 ¶ 90).

In its Reply, Petitioner argues that "[t]he '774 patent describes the 'fabrication profile' broadly, stating that it can simply 'include the dictionary,' or be 'used to determine which machine-ready representation is available or suitable for a target printer.'" Pet. Reply 9 (quoting Ex. 1001, 23:32–24:22).

We find Petitioner's arguments persuasive. Patent Owner implies that a "fabrication profile" must be analogous to a toolpath description, but nothing in the plain language of claim 1 supports that narrow interpretation. As Petitioner correctly argues, the '774 patent describes a "fabrication

profile” broadly and states that the profile can simply “include the dictionary [of configuration information],” or be “used to determine which machine-ready representation is available or suitable for a target printer.” Ex. 1001, 23:49–52. Based on the evidence of record, a person of ordinary skill in the art would have regarded Douglas’s “operational parameters” to be a “fabrication profile” because they are “the basis for generation of a machine-ready representation of the three-dimensional model that is executable on the target printer.” *Id.* at 23:37–39; *see infra* Section III.C.3.f.

(3) *Whether the Douglas–Mark Combination Teaches Away from Limitation 1.5*

Patent Owner argues that the combination of Douglas and Mark does not teach limitation 1.5 and teaches away from that combination. *See* PO Resp. 24–25; PO Sur-reply 10. According to Patent Owner, Mark only teaches that the printer receives G-code, not that the printer is involved in generating G-code. *Id.* at 24 (citing Ex. 1006, Fig. 5). Thus, “any parameters viewed according to Mark are not and do not correspond to one or more properties that are from the target printer and that affect fabrication capabilities of the target printer, and any parameters according to Douglas are not viewed but rather are sent to the printer.” PO Resp. 24–25 (citing Ex. 1006, Figs. 5, 20; Ex. 2014 ¶ 92).

In its Reply, Petitioner argues that “the sending of operational parameters to the printer is irrelevant to their organization into a fabrication profile” as recited in limitation 1.5. Pet. Reply 11. Petitioner states that it relies on Mark “for providing a particular example of a fabrication profile, not to replace Douglas’s overall system in which the 3D printer can receive ‘operational parameters’ rather than just G-code.” *Id.* (quoting Inst. Dec. 19–

20). According to Petitioner, nothing in Douglas or Mark teaches away from organizing Douglas’s operational parameters based on Mark’s teachings, and Douglas itself teaches that operational parameters from different sources can be combined with each other and with print job information. *Id.* (citing Ex. 1005 ¶¶ 74–75).

Petitioner also argues that it was well known in the art to organize operational parameters in the form of a slicer or toolpath generator. Pet. Reply 11–12 (citing Ex. 1043, 36:23–37:20, 43:3–20, 58:18–62:10, 64:2–19; Ex. 1003 ¶ 42).

In its Sur-reply, Patent Owner argues that “[t]he fact that Douglas’s parameters can [be] combined with ‘print job information’ . . . only confirms that Douglas teaches that *the printer* decodes how to fabricate an object according to its parameters, which stands in contrast to Mark’s solution, which *tells* the printer what instructions to perform.” PO Sur-reply 10–11 (citing Ex. 1005 ¶¶ 73–74; Ex. 2014 ¶ 90). Thus, according to Patent Owner, “the very function of Douglas teaches away from organizing Douglas’ operational parameters as Petitioner asserts based on Mark.” *Id.* at 11.

We find Petitioner’s arguments persuasive and disagree with Patent Owner that the prior art teaches away from the Douglas–Mark combination. As we discuss above, Petitioner already shows that Douglas discloses creating a fabrication profile. *See supra* Section III.C.3.e(2). Petitioner relies on Mark for providing a particular known example of a fabrication profile, not to replace Douglas’s overall system in which the 3D printer can receive “operational parameters” rather than just G-code. *See* Pet. 8–10, 17–23; *see also* Ex. 1005 ¶ 41 (the print queue, which stores tool instructions, may be maintained locally on printers 204 or on print servers 208); *see In re*

Mouttet, 686 F.3d 1322, 1332 (Fed. Cir. 2012) (“[A] determination of obviousness based on teachings from multiple references does not require an actual, physical substitution of elements.” (citing *In re Etter*, 756 F.2d 852, 859 (Fed. Cir. 1985) (en banc))).

Patent Owner has not pointed to anything in the prior art to “‘criticize, discredit, or otherwise discourage’ investigation into” how Petitioner proposes combining Douglas and Mark. *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1327 (Fed. Cir. 2009). Nor has Patent Owner pointed to evidence that Petitioner’s combination would have been inoperable for its intended purpose.

Thus, we determine that Petitioner has shown that the combination of Douglas and Mark teaches limitation 1.5.

f. Limitation 1.6

Limitation 1.6 recites “generating a machine-ready representation of the three-dimensional model executable by the target printer to fabricate the object.” Ex. 1001, 35:30–32.

Petitioner argues that Douglas discloses a print queue that contains “tool instructions to fabricate an object,” and a person of ordinary skill in the art would have understood these instructions to be a machine-ready representation of the three-dimensional model that the printer can use to fabricate the object. Pet. 19–21 (citing Ex. 1005 ¶¶ 40–41, 99, Fig. 6; Ex. 1001, 24:25–29; Ex. 1003 ¶¶ 60–62). Petitioner also contends that Mark discloses generating a “G-code” file, which is also a machine-ready representation, and a person of ordinary skill in the art would have had reason to use G-code tool instructions in Douglas’s system. Pet. 21–23 (citing Ex. 1006, 3:65–4:6, 11:33–65, 12:15–25, 12:49–61, 13:4–19,

17:53–58, Fig. 6; Ex. 1001, 25:33–34; Ex. 1005 ¶¶ 40–41, 65–66, 99, Figs. 2, 6; Ex. 1003 ¶¶ 63–64); *see also* Pet. 8–10 (discussion motivations to combine Douglas and Mark).

Patent Owner does not specifically address these arguments. *See* PO Resp. We find Petitioner’s argument for limitation 1.6 persuasive for the reasons set forth in the Petition.

g. Conclusion as to claim 1

For the above reasons, we determine that Petitioner has shown, by a preponderance of the evidence, that the combination of Douglas and Mark teaches all the limitations of claim 1, and that a person of ordinary skill in the art would have had reason to combine Douglas and Mark to implement the method of claim 1.

We therefore determine that Petitioner has shown that claim 1 is unpatentable under § 103 based on Douglas and Mark.

4. *Claims 2–5, 12, 13, and 20*

Claims 2–10, 12, 13, 19, and 20, depend from claim 1 and thus include the limitations discussed above. Petitioner presents arguments that each of these claims is unpatentable as obvious over the combination of Douglas and Mark. Pet. 23–29.

Patent Owner does not specifically contest Petitioner’s arguments for these claims apart from the arguments addressed above in the context of claim 1. *See* PO Resp. 25–26. We find Petitioner’s arguments persuasive for the reasons provided in the Petition. *See* Pet. 23–29.

5. *Claims 9 and 10*

Claims 9 depends from claim 1 and further recites “wherein the one or more properties include one or more user settings on the target printer.” Ex. 1001, 36:4–6.

Petitioner argues that in Douglas’s disclosure, a user can “order replacement material” with properties such as “a part number, build material type,” for “a suitable replacement.” Pet. 26 (quoting Ex. 1005 ¶¶ 77, 99). According to Petitioner, a person of ordinary skill in the art

would have recognized . . . that the data tag data related to material properties (e.g., ‘a build material type’) would have been ‘*one or more user settings on the target printer*’ because the material is chosen and installed into the printer by the user and the printer is set to reflect the material (e.g., by the data tag).

Id. (citing Ex. 1003 ¶ 71); *see also* Pet. 34 (citing Ex. 1003 ¶ 87).

Claim 10 depends from claim 9 and further recites “wherein the one or more user settings include user setting from a previous fabrication process.” Ex. 1001, 36:7–9.

Petitioner argues that Douglas discloses detecting “a depletion of build material” and that “a user can order replacement material.” Pet. 26 (quoting Ex. 1005 ¶ 77). According to Petitioner, a person of ordinary skill in the art “would have recognized . . . that the data tag data (e.g., ‘a build material type’) reused for subsequent multiple builds would have been ‘*user setting from a previous fabrication process*’ when the material selected/loaded by the user has not been depleted.” Pet. 26–27 (quoting Ex. 1005 ¶ 77) (citing Ex. 1003 ¶ 72).

In its Response, Patent Owner argues that Petitioner’s argument for claim 9 fails to disclose a user setting because “the setting is changed ‘by the data tag,’ rather than the user.” PO Resp. 26 (citing Ex. 2014 ¶ 96).

In its Reply, Petitioner argues that “[t]he data tag itself does not (and cannot) load any printer material—it only reflects the loaded material type.” Pet. Reply 12. Petitioner contends that the ’774 patent describes “user settings” that include those “detected through the use of a labeled material source.” *Id.* at 13 (quoting Ex. 1001, 21:11–12).

We find Petitioner’s argument persuasive. The ’774 patent explicitly includes automatically derived build-material settings as among the potential “user settings.” Ex. 1001, 21:10–13. The fact that Douglas may derive the setting from the tag data, rather than be physically input by a user, is consistent with this.

Likewise, for claim 10, after a fabrication process, any build-material setting used in the previous fabrication would be a “user setting from a previous fabrication process” until the material is depleted and it is time for reordering.

Thus, we determine that claims 9 and 10 would have been obvious over Douglas and Mark. On that basis, Petitioner has shown, by a preponderance of the evidence, that the claims are unpatentable under § 103.

D. OBVIOUSNESS GROUND BASED ON DOUGLAS, MARK, AND DAHLIN (CLAIMS 6, 7, 9, AND 10)

1. *Dahlin*

Dahlin describes a filament spool for a 3D printer that has a circuit for recording “the type and amount of filament on the spool” and potentially

notify an operator if that does not match the requirements of a fabrication job or if the amount of filament is inadequate to complete a print job.

Ex. 1008 ¶¶ 7, 8, 22–23.

2. *Claim 6*

Claim 6 depends from claim 4 and further recites “wherein the hardware configuration [property of the target printer] includes an automatically detected hardware reconfiguration [of the target printer].”

Ex. 1001, 35:47–49.

Petitioner argues that Dahlin’s detection of whether the filament material on the spool matches the specified material is automatic, and Dahlin teaches transmitting the filament type to the control system so that “the CPU keeps track of how much material was commanded to be extruded.” Pet. 32–33 (quoting Ex. 1008 ¶ 22) (citing Ex. 1008 ¶¶ 22–23; Ex. 1003 ¶ 85).

Petitioner also argues that Douglas discloses detecting when materials are inadequate. Pet. 32 (citing Ex. 1005 ¶¶ 63, 77). According to Petitioner, a person of ordinary skill in the art would have had reason to incorporate Dahlin’s teaching into Douglas because Douglas explicitly includes build material as an example of the target printer’s hardware configuration. Pet. 33 (citing Ex. 1005 ¶¶ 64, 74; Ex. 1008 ¶¶ 22–23; Ex. 1003 ¶ 85); *supra* Section III.D.1. In addition, Petitioner argues that Dahlin’s teachings (1) “provide[d] the assurance that the selected printer has enough material to complete the print job”; (2) improved print quality by preventing defects caused by such mismatches; and (3) “merely involved combining prior art elements according to known methods to yield predictable results.” Pet. 30–32 (citing Ex. 1003 ¶¶ 78–83).

In its Response, Patent Owner argues that Dahlin “does not disclose creating or modifying any fabrication profile in response to a detected change, nor does it disclose regenerating print instructions after a spool is replaced.” PO Resp. 27. Rather, according to Patent Owner, Dahlin only pauses the process and allows the user to intervene. *Id.* (citing Ex. 1008 ¶¶ 22–23).

Patent Owner also argues that Dahlin is incompatible with the requirements of limitations 1.5 and 1.6 because those limitations require generating a fabrication profile based on an automatically detected hardware reconfiguration, but the proposed Douglas–Mark–Dahlin combination does not do this. PO Resp. 27–28; PO Sur-reply 13.

In its Reply, Petitioner argues that Patent Owner incorrectly assumes that Dahlin must be bodily incorporated into the Douglas–Mark combination. Pet. Reply 14–16. Petitioner states that it relies on Dalin for its teaching of automatically querying the material type at the outset of a print job, whereas Douglas already discloses the automatic handling of build-material data, including build-material type and depletion data. *Id.*

Petitioner also argues that claim 6, including limitations 1.5 and 1.6, does not require generating a fabrication profile upon every detection of a hardware reconfiguration; rather, only the affected hardware configuration property need be changed. Pet. Reply 15.

In its Sur-reply, Patent Owner argues that “Douglas and Douglas–Mark do not cure the deficiencies in Dahlin.” PO Sur-reply 12. Patent Owner also argues that the “fabrication profile” in limitations 1.5 and 1.6 must be based on “every one of the ‘properties’ of the dictionary,” not just “one or more” of the properties. *Id.* at 12–13.

We find Petitioner’s argument persuasive. The question is not whether Douglas or Mark “cure the deficiencies in Dahlin.” Rather, Petitioner starts with the Douglas–Mark combination and cites Dahlin for supplemental teachings to be added to the combination.

We also disagree with Patent Owner that claims 1, 4, and 6 require generating a fabrication profile based on an automatically detected hardware reconfiguration. PO Resp. 27–28; PO Sur-reply 13. The claims only recite that the fabrication profile includes, among its “one or more properties,” a hardware configuration property that includes an “automatically detected hardware reconfiguration.” When that reconfiguration occurs, the claims do not require the hardware reconfiguration to *cause* the creation of a fabrication profile.

Thus, we determine that claim 6 would have been obvious over the combination of Douglas, Mark, and Dahlin. We determine that Petitioner has shown, by a preponderance of the evidence, that claim 6 is unpatentable under § 103 on that basis.

3. *Claim 7*

Analogously to claim 6, claim 7 depends from claim 4 and further recites “wherein the hardware configuration includes a manually specified hardware reconfiguration.” Ex. 1001, 35:50–52.

Referring to its arguments for claim 6, Petitioner argues that when Dahlin’s system notifies a user to replace materials chosen and loaded by the user, this is a “manually specified hardware reconfiguration,” and that a person of ordinary skill in the art would have looked to Dahlin’s teachings in this regard for the same reasons as for claim 6. Pet. 33–34 (citing Ex. 1008 ¶¶ 22–23; Ex. 1003 ¶ 86).

In its Response, Patent Owner argues that there is no evidence suggesting that Dahlin’s filament materials were chosen and loaded by the user. PO Resp. 29 (citing Ex. 1008 ¶¶ 22–23). According to Patent Owner, Dahlin only discloses notifying a user to replace materials. *Id.* (citing Ex. 1008 ¶¶ 22–23; Ex. 2014 ¶ 104).

Patent Owner also argues that “the language of claim 7 requires that the hardware reconfiguration be ‘manually *specified*,’ not just manually performed,” but in Dehlin the system specifies the reconfiguration automatically. PO Resp. 29 (citing Ex. 1008 ¶ 23; Ex. 2014 ¶ 103).

In its Reply, Petitioner argues that Patent Owner has not addressed the proposed combination, and points to disclosures in Dahlin allegedly conveying that a user would manually replace a filament. Pet. Reply 16 (citing Ex. 1008 ¶ 22). Petitioner also argues that “[a] property can be both ‘automatically detected’ and ‘manually specified’ (e.g., a manually loaded material can be automatically detected, as argued in the Petition).” Pet. Reply 16–17.

In its Sur-reply, Patent Owner counters that “a property can be automatically detected and used to manually perform a task and yet be automatically specified.” PO Sur-reply 13.

We find Petitioner’s argument unpersuasive. In claim 7, the hardware configuration includes “a manually *specified* hardware reconfiguration.” This is not about whether the hardware reconfiguration was manually *performed*, only whether the reconfiguration was manually *specified*. Petitioner has not shown by a preponderance of the evidence that Dehlin, or either of the other two references, teaches the latter.

Thus, we determine that Petitioner has *not* shown that claim 7 is unpatentable under § 103 over Douglas, Mark, and Dehlin.

4. *Claims 9 and 10*

We discuss claims 9 and 10 above in the context of Petitioner’s ground based on Douglas and Mark (without Dahlin). *See supra* Section III.C.5. In addition to the arguments for that ground, Petitioner argues that Dehlin’s recording of material type, described above in the context of claims 6 and 7, would constitute the recited “one or more user settings.” Pet. 34 (citing Ex. 1008 ¶¶ 22–23; Ex. 1003 ¶ 87); *supra* Sections III.D.2, 3.

Like for claim 10, Petitioner argues that Dahlin’s calculation of remaining filament on the spool “suggest[s] that filament loaded by a user can be used across multiple print jobs,” and a person of ordinary skill in the art would have recognized that “in at least some occasions, the same user selected material would have been maintained across print jobs.” Pet. 34 (citing Ex. 1008 ¶¶ 22–23; Ex. 1003 ¶ 88; Ex. 1011, 26–27, 62–70).

In its Response, Patent Owner cites to its arguments for claim 6 and argues that “Petitioner presents no argument regarding why this would be ‘one or more user settings on the target printer,’ and argues that “[l]oading the material is not inputting a setting.” PO Resp. 30–31 (citing Ex. 2014 ¶ 107).

Because Petitioner has shown that claims 9 and 10 would have been obvious over Douglas and Mark alone, it follows that it would have been obvious over the additional teachings of Dahlin, as the evidence does not suggest that Dahlin teaches away from the combination. Moreover, Dahlin’s build-material settings are analogous to the user settings described in

Douglas, which already detects build-material type and depletion. *See* Ex. 1005 ¶¶ 77, 99.

Thus, we determine that claims 9 and 10 would have been obvious over Douglas, Mark, and Dahlin. On that basis, Petitioner has shown, by a preponderance of the evidence, that the claims are unpatentable under § 103.

E. OBVIOUSNESS GROUND BASED ON DOUGLAS, MARK, AND
BATCHELDER (CLAIM 8)

Claim 8 depends from claim 1 and further recites “wherein the one or more properties include a firmware configuration of the target printer.” Ex. 1001, 36:1–3.

Petitioner relies on teachings from Batchelder, which describes a filament for use in a 3D printing system which includes encoded markings that may be read by a sensor and transmitted to a control system. Ex. 1007, code (57), ¶¶ 8–10, 49–55. According to Petitioner, Batchelder discloses “firmware updates for the system” as an example of a property that would assist in building a 3D model. Pet. 37 (citing Ex. 1007 ¶¶ 52–54, Fig. 2; Ex. 1003 ¶ 96).

According to Petitioner, it would have been obvious to incorporate this teaching into the Douglas–Mark combination “to facilitate the printing job because the important role that the firmware configuration in affecting fabrication capabilities of the target printer.” Pet. 37 (citing Ex. 1003 ¶ 96); *see also id.* at 35–37 (citing Ex. 1003 ¶¶ 89–95) (providing detailed reasons for the combination).

In its Response, Patent Owner argues that “providing a firmware update does not provide a firmware configuration” because it only conveys a *change* in the configuration. PO Resp. 31–32 (citing Ex. 2015, 66:14–15).

Patent Owner also argues that Petitioner’s expert Dr. Hickner stated on cross-examination that Batchelder’s encoded markings “*might* give an indication of what software and firmware are most suitable for printing that specific material,” and used the words “might” and “could” in describing the understanding of a person of ordinary skill in the art. *Id.* at 32 (citing Ex. 2015, 68:19–69:1, 69:5–11; Ex. 2014 ¶ 111).

In its Reply, Petitioner argues that the Petition relies on the firmware configuration information conveyed by the update, not the update itself, and provides reasons why it would have been obvious to incorporate that information into the Douglas–Mark combination, none of which Patent Owner addressed in its Response. Pet. Reply 17.

In its Sur-reply, Patent Owner argues that it has no burden to address Petitioner’s proposed motivations to combine, and Dr. Hickner’s statements on cross-examination are relevant to those proposed rationales. PO Sur-reply 14–15.

Having considered Petitioner’s arguments as to the reasons for combining Batchelder with Douglas and Mark, we find them persuasive. Petitioner first argues that firmware was known to be a vital component to a 3D printer so a person of ordinary skill in the art would have had reason to include that information in information transmitted by the printer. Pet. 35–36 (citing Ex. 1005 ¶¶ 28–32, 72–75, 94–97; Ex. 1007 ¶¶ 43, 54; Ex. 1011, 35, 41, 76–80; Ex. 1003 ¶ 90).

Second, Petitioner argues that incorporating the firmware configuration information into the Douglas–Mark transmission would have improved print quality because it would allow G-code to be more compatible with the system. Pet. 36 (citing Ex. 1003 ¶ 91).

Third, Petitioner argues that the combination “would have improved user experience, e.g., by avoiding re-submitting of a failed or less satisfied print result result[ing] from incompatible firmware.” Pet. 36 (citing Ex. 1005 ¶¶ 64, 74; Ex. 1007 ¶¶ 52–54, Fig. 2; Ex. 1003 ¶ 92).

Finally, Petitioner argues that “Douglas already discloses a printer sending various printer configuration information to the printer server, and including critical firmware information for generating the machine-ready models would have been well within a [person of ordinary skill in the art’s] capability.” Pet. 37 (Ex. 1005 ¶¶ 23–24, 62–64, 78–83, 91–97, Fig. 6; Ex. 1007 ¶¶ 52–58; Ex. 1003 ¶¶ 93–95).

We find these rationales persuasive and the supporting expert testimony credible. For example, Batchelder specifically discloses that information about firmware updates may be included as part of the encoded markings on the filament which are transmitted to the control system. Ex. 1007 ¶ 54. Thus, a person of ordinary skill in the art would have understood that Batchelder’s firmware information can be one of the relevant properties of a target printer within a system such as Douglas’s. Ex. 1007 ¶ 54. Dr. Hickner’s statements during cross-examination do not diminish the credibility of his testimony in his declaration because the declaration testimony is supported by the evidence of record.

Thus, we determine that claim 8 would have been obvious over Douglas, Mark, and Batchelder. On that basis, Petitioner has shown, by a preponderance of the evidence, that claim 8 is unpatentable under § 103.

F. OBVIOUSNESS GROUND BASED ON DOUGLAS, MARK, AND PAX
(CLAIM 19)

Claim 19 depends from claim 1 and further recites “generating descriptive metadata to accompany the machine-ready representation, the descriptive metadata specifying one or more properties for comparison to properties of printers selected for fabricating the model.” Ex. 1001, 36:44–48.

Petitioner relies on the teachings of Pax, which describes a 3D printer that can mix different build materials to achieve various colors. Ex. 1003 ¶¶ 64–67, Fig. 3A. It encodes color and material requirements for fabricating an object as metadata in the object model, and performs a pre-fabrication check as to that data. *Id.* ¶¶ 95–101, Fig. 11.

Petitioner argues that Pax’s system teaches the step recited in claim 19, and a person of ordinary skill in the art would have had reason to incorporate Pax’s use of metadata and the performance of a pre-fabrication check to ensure that the machine-ready model is compatible with the materials in the printer. Pet. 40–41 (citing Ex. 1013 ¶¶ 96–99, Fig. 11; Ex. 1005 ¶¶ 40–41; Ex. 1009 ¶¶ 8, 62–63, Fig. 3; Ex. 1003 ¶¶ 102–105); *see also id.* at 39–40 (detailed reasons for combining Pax with Douglas–Mark).

In its Response, Patent Owner argues that Pax fails to teach *generating* metadata and instead merely *identifies* requirements, “which therefore must already exist (as must the metadata they are contained in).” PO Resp. 33 (citing Ex. 1013 ¶ 97; Ex. 2014 ¶ 114). Patent Owner also argues that Douglas fails to disclose generating metadata. *Id.* (citing Ex. 1004 ¶¶ 40–41).

In its Reply, Pax argues that Patent Owner only attacks Pax in isolation without considering the combined teachings of the references. According to Petitioner, the proposed combination incorporates Pax’s pre-fabrication check within Douglas’s print queue, which already includes metadata, and this “print queue itself comprises generated data.” Pet. Reply 18 (citing Ex. 1041¹⁶).

We find Petitioner’s argument persuasive. As Petitioner correctly notes, Douglas already discloses the use of a print queue that includes metadata about print jobs, which is generated rather than merely identified. Ex. 1005 ¶ 41. Petitioner persuasively argues that Pax teaches an example of the type of metadata that may be used in similar printers, which may include color and material information, and that the metadata may be used for a pre-fabrication check to ensure the metadata matches the capabilities of the printer. Pet. 39 (citing Ex. 1013 ¶¶ 96–99, Fig. 11; Ex. 1003 ¶ 98). We find it persuasive, for the reasons given in the Petition, that a person of ordinary skill in the art would have used Pax’s metadata and Pax’s pre-fabrication check in the Douglas–Mark combination. Pet. 39–40; Ex. 1003 ¶¶ 97–101.

Thus, we determine that claim 19 would have been obvious over Douglas, Mark, and Pax. On that basis, Petitioner has shown, by a preponderance of the evidence, that claim 19 is unpatentable under § 103.

¹⁶ In its Sur-reply, Patent Owner points out that Petitioner’s citation to Exhibit 1041 was an error and suggests that Petitioner may have intended to cite paragraph 41 of Douglas (Ex. 1005). PO Sur-reply 15.

G. OBVIOUSNESS GROUND BASED ON HAMILTON, EVANS, AND
OPTIONALLY KISSLICER

1. *Hamilton*

Hamilton discloses a “product delivery system” where a product is “manufactured locally using a 3D printer.” Ex. 1010, code (57). Part of the system involves “query[ing] the user’s 3D printer for its accuracy and material abilities.” Ex. 1010 ¶ 21. This includes “an indication of a material stock available to the 3D printer.” *Id.* ¶ 17.

2. *Evans and KISSlicer*

Evans is a book about 3D printing describing a “slicer” that takes a 3D model of an object and slices it into layers suitable for printing based on various parameters. Ex. 1011, 34.¹⁷ Petitioner asserts in its Petition that Evans was published in 2012. Pet. 2. Petitioner also submits declaratory evidence that Evans was published in 2012 but did not cite or discuss this evidence in the Petition. *See* Ex. 1016.

KISSlicer is a manual describing a slicer application, which “slices” a 3D model and creates a G-code file used by the printer to fabricate a 3D object. Ex. 1012. In its Petition, Petitioner asserts that KISSlicer was published in January 2012. Pet. 2. Petitioner also submits declaratory evidence that KISSlicer was published in January 2012 but did not cite or discuss this evidence in the Petition. *See* Ex. 1015.

¹⁷ We use the added pagination provided with Exhibit 1011 rather than Evans’ original pagination.

Patent Owner argues that neither Evans nor KISSlicer is prior art. PO Resp. 35–39. According to Patent Owner, Petitioner has not provided any evidence in its Petition that either reference is prior art and has failed to explain why either of them are prior art. *Id.* Patent Owner also argues that Petitioner did not cite its supporting declarations (Exs. 1015, 1016) in the Petition, so the declarations should be disregarded as being improperly incorporated by reference. *Id.* at 36 n.1, 38 (citing 37 C.F.R. § 42.6(a)(3)).

In its Reply, Petitioner argues that it has met its burden of production to show that Evans and KISSlicer are prior art by “identifying the dates of publication[] and providing evidence [of] publication and accessibility.” Pet. Reply 22–23, 25. Petitioner also contends that evidence of their publication “was plainly evident from the references themselves.” *Id.* at 23. For example, Petitioner argues that Evans is a book and includes a copyright date, ISBN, and Springer publication information. *Id.* at 23–24 (citing Ex. 1011). According to Petitioner, KISSlicer has an archive.org date and indicates that it is a guide for freely downloadable software. *Id.* (citing Ex. 1012). According to Petitioner, the burden has shifted to Patent Owner to submit rebuttal evidence, which it has not done. *Id.* at 26.

Petitioner also argues that Patent Owner has suffered no prejudice for the lack of citation in the Petition because it “has long been on notice of this evidence and its purpose, even before the Board considered the same” in the Institution Decision. Pet. Reply 23.

Petitioner also submits further evidence of public accessibility with its Reply. For Evans, Petitioner submits the book’s US Copyright Office registration, indicating a publication date of “2012-08-28,” which, according

to Petitioner, is evidence of public availability. Pet. Reply 25–26 (citing Ex. 1042; *VidStream LLC v. Twitter, Inc.*, 981 F.3d 1060 (Fed. Cir. 2020)).

For KISSlicer, Petitioner submits forum posts discussing KISSlicer dated to January 2012. Pet. Reply 26 (citing Exs. 1044–1046). And Petitioner argues that Patent Owner’s expert declarant stated that he was familiar with KISSlicer. *Id.* (citing Ex. 1043, 72:4–12).

In its Sur-reply, Patent Owner disagrees that Petitioner met its initial burden as to whether Evans and KISSlicer are prior-art printed publications because Petitioner provided no explanation in the Petition itself other than stating the alleged publication dates for the references. PO Sur-reply 1–2. Thus, Patent Owner contends that Petitioner’s arguments in the Reply are untimely, and Petitioner has not explained the reason for the delay. *Id.* at 2–3. According to Patent Owner, Petitioner could easily have discussed Exhibits 1015 and 1016 in its Petition and remained under the allowed word count. *Id.* at 2–3 & n.1.

We find that Petitioner has met both its initial burden of production and its ultimate burden of persuasion to show that Evans and KISSlicer are prior-art printed publications.

Petitioner stated alleged publication dates in its Petition and submitted, along with its Petition, supporting testimonial evidence. Under the circumstances, this was sufficient to meet Petitioner’s initial burden of going forward. Although Petitioner failed to cite its testimonial evidence in the Petition, this was not prejudicial to Patent Owner, who was aware of the submissions when it submitted its Preliminary Response. *See* Prelim. Resp. 21–25. Patent Owner was also on notice, based on the Institution Decision, of the Board’s preliminary view that the available evidence showed that both

Evans and KISSlicer were prior-art printed publications. Inst. Dec. 22–23. And the evidence does not suggest that Petitioner omitted references to Exhibits 1015 and 1016 from its Petition to obtain an unfair advantage, such as to circumvent Petitioner’s word-count restrictions. *See* PO Sur-reply 2–3 & n.1.

Because Petitioner met its initial burden in the Petition, we disagree that its arguments and additional evidence submitted in the Reply are untimely. These arguments and evidence are responsive to Patent Owner’s challenge to whether Evans and KISSlicer were publicly available in 2012.

Further, the evidence of record, which is substantially un rebutted, satisfies Petitioner’s burden of persuasion as to both Evans and KISSlicer.

For Evans, Petitioner submitted a testimony persuasively showing that Evans was published on October 4, 2012, based on a declaration by June Ann Munford, a librarian whose testimony is based on electronic library records. Ex. 1016. Evans also includes ISBN-13 numbers for a physical book and an e-book, and a copyright date of 2012. *See* Ex. 1011, 308. The title page states that the book was “[d]istributed to the book trade worldwide by Springer Science+Business Media New York.” *Id.*

Based on this evidence, we find that Evans was a printed publication that was available as of 2012 to interested persons of ordinary skill in the art. Petitioner’s later-submitted evidence listed on Evans’s copyright registration (Ex. 1042) corroborates that Evans was published in 2012, but we would reach the same determination with or without it.

Petitioner also persuasively shows that KISSlicer was published in 2012. Although the copy of KISSlicer included as Exhibit 1012 does not have a copyright date, Petitioner’s supporting declaration by Jonathan

Drummer testifies that he is the creator of KISSlicer and that Exhibit 1012 has been available on a public website since January 2012, as evidenced by a copy that archive.org captured on February 15, 2012. Ex. 1015.

Based on this evidence, we find that KISSlicer was available as of 2012 to interested persons of ordinary skill in the art. Petitioner's later-submitted evidence, comprising discussions of KISSlicer in forum posts dated to 2012 (Exs. 1044–1046) corroborates that KISSlicer was publicly available in 2012, but we would reach the same determination with or without this later-submitted evidence.

3. *Motivations to Combine*

Petitioner argues that a person of ordinary skill in the art would have combined Hamilton's method with Evans's teachings for slicing a 3D model into layers and generating toolpath instructions for the following reasons: (1) Hamilton does not "detail[] how the 3D printer fabricates the design," so Evans would "provide[] implementation details for Hamilton's system"; (2) Evans teaches that certain slicers advantageously "simplify the generation of machine-ready code by automatically calculating printer settings/configurations for generating toolpaths"; (3) Evans discloses selectable or alterable print settings that would have "improve[d] the capability and quality of the fabrication in Hamilton's system"; (4) "Evans provides implementation details on selecting, loading, changing, and replacing material in a 3D printer"; and (5) the combination "would have merely involved combining prior art elements according to known methods to yield predictable results." Pet. 44–48 (citing Ex. 1003 ¶¶ 106–113).

Petitioner also argues that a person of ordinary skill in the art would have had reason to "simply implement the settings/configurations of Evans

as a ‘profile’ as disclosed by KISSlicer for a better user experience.” Pet. 50 (citing Ex. 1012, 3–4, 8; Ex. 1003 ¶ 114).

We find Petitioner’s motivations to combine Hamilton, Evans, and KISSlicer persuasive. As we discuss in more detail below, Petitioner has shown by a preponderance of the evidence that this combination teaches or suggests the method of claim 1 and that there would have been a reasonable expectation of success in making this combination.

4. *Claim 1*

a. Preamble (1.pre)

The preamble of claim 1 recites “[a] method.” Ex. 1001, 35:18.

Petitioner argues, and Patent Owner does not contest, that Hamilton discloses a method. Pet. 51 (citing Ex. 1010, code (57), ¶¶ 21–22, Figs. 3, 4; Ex. 1003 ¶ 115); *see* PO Resp.

Without determining whether the preamble is limiting, we find Petitioner’s argument persuasive for the reasons set forth in the Petition.

b. Limitation 1.1

Limitation 1.1 recites “receiving a request to fabricate an object from a three-dimensional model.” Ex. 1001, 35:19–20.

Petitioner argues that Hamilton discloses requests to fabricate an object from a “three-dimensional model,” citing passages that refer to “a design.” Pet. 51–53 (citing Ex. 1010 ¶¶ 15–22, Figs. 3–4; Ex. 1003 ¶ 116). Petitioner argues that a person of ordinary skill in the art would have understood that this “design” is a three-dimensional model, and that the ’774 patent states that a “three-dimensional model may include a three-

dimensional *design* created by a user.” Pet. 53 (quoting Ex. 1001, 18:21–23) (citing Ex. 1010 ¶¶ 4–5, 19; Ex. 1003 ¶ 117).

Patent Owner argues that Hamilton “does not mention the term ‘model’” and describes “designs” as only including “the necessary printer requirements for the design, information on the materials required, instructions for the 3D printer, separately numbered individual parts, and instructions for assembly of the product for the user.” PO Resp. 40 (quoting Ex. 1010 ¶ 19). According to Patent Owner, Petitioner’s expert testified on cross-examination that it was “not clear, everything that’s included in instructions for the 3D printer in Hamilton,” and that Hamilton does not disclose slicing or generating G-code. *Id.* (quoting Ex. 2015, 51:6–8) (citing Ex. 2015, 50:15–16, 53:17). Patent Owner contends that “the reason to include a model in the process would have been to slice the model and use the resulting instructions to fabricate an object,” so without G-code or slicing, there would have been no motivation to perform a 3D printing method that uses a model. *Id.* (citing Ex. 2014 ¶ 121).

In its Reply, Petitioner argues that Patent Owner’s expert Dr. Cormier “corroborates that before [the date of the claimed invention] the printing process typically began with a model,” and does not provide an opinion to the contrary. Pet. Reply 18–19 (citing Ex. 1043, 33:18–34:19, 43:3–13, 58:8–59:13, 63:24–64:19; Ex. 2014 ¶¶ 120–121). Petitioner also argues that Patent Owner ignores Petitioner’s rationales for combining the references, including that because slicers had known advantages and a person of ordinary skill in the art would have turned to Evans for implementation details. *Id.* at 19.

In its Sur-reply, Patent Owner argues that “Hamilton’s designs already include instructions for the 3D printer and assembly of the product,” so there would have been no reason to look to a slicer. PO Sur-reply 16 (citing Ex. 1010 ¶ 19). Patent Owner also argues that Dr. Cormier’s cross-examination testimony was not “about Hamilton’s design specifically.” *Id.*

We find Petitioner’s arguments persuasive. We find credible Dr. Hickner’s testimony that a person of ordinary skill in the art would have understood that Hamilton’s “design” includes a 3D model as the term “model” is used in the ’774 patent, since the design is used to construct a real-world product using a 3D printer. Ex. 1003 ¶ 117 (citing Ex. 1001, 18:21–23). The ’774 patent uses the term “three-dimensional model” broadly, and interchangeably with “three-dimensional design.” Ex. 1001, 18:21–23 (“The three-dimensional model may include a three-dimensional design created by a user, e.g., using local or online tools for three-dimensional design and modeling.”); *see also id.* at 18:11–12 (“The three-dimensional model may include a . . . computerized representation of the object . . .”), 18:31–32 (“In general, the three-dimensional model may be any suitable digital representation of a three-dimensional shape . . .”).

Patent Owner’s other main argument is effectively that Evans, and other slicer or G-code-related art, teach away from using a “three-dimensional model” in Hamilton. We disagree. It appears to be correct that Hamilton includes a solution for converting a three-dimensional model to machine-ready code without reference to a slicer or G-code. But Petitioner persuasively shows that a person of ordinary skill in the art using Hamilton’s method would have had reason to use a slicer or G-code because they were known in the art for the same purpose and had known advantages. *See*

Ex. 1003 ¶¶ 106–113, 117). Thus, we disagree that there would have been no motivation to use a three-dimensional model in a 3D-printing method such as that of Hamilton.

For the above reasons, Petitioner has shown that Hamilton discloses and teaches limitation 1.1.

c. Limitations 1.2 and 1.3

Limitations 1.2 and 1.3 recite “determining a target printer to fabricate the object; [and] querying the target printer for configuration information of the target printer relevant to creation of a printable model for fabrication of the object on the target printer.” Ex. 1001, 35:21–24.

Petitioner argues that Hamilton discloses querying “the user’s 3D printer for its accuracy and material capabilities,” and only using that 3D printer “[i]f the printer capabilities are compatible with the requested 3D model.” Pet. 54–55 (citing Ex. 1010 ¶¶ 19–21, Fig. 3; Ex. 1003 ¶ 119). The query includes “capability information” about the printer including “an indication of a material stock available to the 3D printer, and an indication of the 3D printer type.” Pet. 55 (quoting Ex. 1010¹⁸ ¶ 17) (citing Ex. 1003 ¶ 119). Petitioner argues that a person of ordinary skill in the art would have understood that the queried printer would be the “target printer.” Pet. 54 (citing Ex. 1010 ¶¶ 19–21; Ex. 1003 ¶ 118).

Alternatively, Petitioner argues that the target printer would be selected before the query “because the user first requests a product . . . and

¹⁸ Petitioner’s mistakenly cites Exhibit 1017.

the system waits for a response from the user to ensure that the printer is attached and ready.” Pet. 54 (citing Ex. 1010 ¶ 20).

In its Response, Patent Owner argues that Hamilton teaches to “query the printer for information and then use that information to determine if the printer is appropriate for the design (i.e., determine a target printer to fabricate the object corresponding to the design).” PO Resp. 41–42 (citing Ex. 1010, Fig. 3). Thus, according to Patent Owner, “a target printer to fabricate the object corresponding to the design is not determined until the supplier determines if the printer and material are okay.” *Id.* at 42 (citing Ex. 2014 ¶ 123).

Patent Owner disagrees that the process of confirming that the printer is attached and ready is sufficient to determine a target printer because at that point, before the query, “the user in Hamilton does not know the requirements of the object to be fabricated.” PO Resp. 43–45 (citing Ex. 1010 ¶ 20, Fig. 2; Ex. 2014 ¶¶ 124–125).

In its Reply, Petitioner argues that Patent Owner’s argument hinges on whether limitations 1.2 and 1.3 must be performed in order. Pet. Reply 19. Petitioner also argues that the ’774 patent states that “[d]etermining the target printer may include identifying a selected printer in the request,” which does not necessarily involve knowledge of the requirements of the object to be fabricated. *Id.* at 19–20.

In its Sur-reply, Patent Owner argues that the initial query to determine if the printer is attached and ready cannot constitute “determining a target printer to fabricate the object” because at that point, “[t]he user does not know the design, design requirements such as materials needed,

accuracy of printer needed for the design, or parts to fabricate.” PO Sur-reply 17 (citing Ex. 1010 ¶¶ 20, 23, Figs. 2, 5).

As we discuss above, we determine that Claim 1 does not require that limitation 1.3 follows limitation 1.2. *See supra* Section B.1. Thus, Petitioner has persuasively shown that Hamilton discloses both limitation 1.3 (querying the target printer for its for its accuracy and material capabilities) and limitation 1.2 determining that the queried printer is the target printer if the printer capabilities are compatible with the requested 3D model).

Alternatively, we determine that the earlier query as to whether the printer is attached and available would also satisfy limitation 1.2, and in that case limitation 1.2 would precede limitation 1.3. When this earlier request happens, the user has selected a particular object (product 210) to be printed, so determining whether the printer is attached and available would constitute “determining a target printer” for fabricating a particular object and a particular three-dimensional model. Ex. 1010 ¶ 20, Fig. 2. Unlike limitation 1.3, which requests configuration information relevant to the model and the object to be printed, we find no evidence to suggest that limitation 1.2 requires knowledge of the details of the model or any property of the object to be fabricated.

d. Limitation 1.4

Limitation 1.4 recites “receiving, from the target printer, a dictionary of configuration information containing one or more properties from the target printer that affect fabrication capabilities of the target printer.” Ex. 1001, 35:25–28.

Referring to its argument for limitation 1.3, Petitioner argues that after Hamilton’s request to the printer for accuracy and material capabilities, the

printer's response includes the requested configuration properties, which is a dictionary of configuration information as recited in limitation 1.4. Pet. 56 (citing Ex. 1010 ¶¶ 15–21, Fig. 3, claims 1–5; Ex. 1001, 21:24–26, 21:32–34; Ex. 1003 ¶¶ 120–121).

Petitioner argues that Evans also discloses that the target printer sends “information about your printer and filament,” such as “filament diameter,” “extruder nozzle size,” and “layer height,” which are “needed in order for the slicer to generate sliced layers for 3D printing.” Pet. 56–57 (quoting Ex. 1011, 43–46, 312). According to Petitioner, a person of ordinary skill in the art “would have recognized . . . that Hamilton's target printer's ‘accuracy and material capabilities’ would include additional information as disclosed by Evans because such information is needed and beneficial for the slicer application to generate codes that control the 3D printer to print the design.” Pet. 57 (citing Ex. 1011, 43–46, 62; Ex. 1003 ¶ 122).

In its Response, Patent Owner argues, analogously to its argument for the ground based on Douglas and Mark (*supra* Section III.C.3.d), that “Petitioner fails to explain why the accuracy and material capabilities in Hamilton that are sent from the printer is a collection of properties (which is what Petitioner asserts as disclosing a dictionary of configuration information).” PO Resp. 45 (citing Ex. 2014 ¶ 126). According to Patent Owner, Hamilton only “discloses that the printer sends its accuracy and material capabilities” without teaching “whether those capabilities are sent and received as a collection of information.” *Id.* at 46 (Ex. 1010 ¶ 21; Ex. 2015, 55:10–18 (Dr. Hickner: “[Hamilton] just says the user's 3D printer will, then, respond with its accuracy and material capabilities. I think a POSITA would understand that that can happen in any sort of reasonable

data transmission format. . . . [T]hat information is all sent in some sort of unspecified manner.”); Ex. 2014 ¶ 127); *see also* PO Sur-reply 18 (reiterating its arguments).

Patent Owner also argues that Petitioner improperly relies on expert testimony to fill in details as to how Hamilton’s data constitutes a dictionary of configuration information, and that the requested information is not “from the target printer” because at this point the “target printer” has not been determined according to limitation 1.2, which must precede limitation 1.4. PO Resp. 45–47 (citing Ex. 2014 ¶¶ 126, 129).

Finally, Patent Owner argues that Evans “does not teach receiving its ‘additional information’ from the target printer. Rather, a user manually measures and enters those measurements into the software.” PO Resp. 46–47 (citing Ex. 1011, 66–68; Ex. 2014 ¶ 128); *see also* PO Sur-reply 18 (reiterating the argument).

In its Reply, Petitioner argues that Patent Owner relies on an incorrect construction of “dictionary” and attacks Evans in isolation even though Petitioner relies on Evans to provide additional examples of information that would be included in Hamilton’s “accuracy and materials capabilities.” Pet. Reply 20.

We find Petitioner’s arguments persuasive. As we discuss above, we disagree with Patent Owner that a dictionary must have more organization than a simple collection or aggregation of properties. *See supra* Section III.B.2. Petitioner has shown that Hamilton’s printer sends information about accuracy and material capabilities, which under the proper construction is a dictionary of configuration information as recited in limitation 1.4. Ex. 1003 ¶¶ 120–121. Petitioner’s arguments rely on Hamilton’s disclosure without

improperly using Dr. Hickner’s testimony to fill gaps in the Hamilton disclosure.

Petitioner also shows that Evans teaches additional examples of such information and provides persuasive reasons to combine such information as part of the same dictionary of configuration information. Ex. 1003 ¶¶ 106–113, 122. We agree with Petitioner that Patent Owner’s argument regarding Evans seeks to require bodily incorporation of extraneous teachings (such as Evans’s manual entry of properties by a user) into Hamilton. Pet. Reply 20.

Finally, as to Patent Owner’s argument that Hamilton does not disclose receiving a dictionary “from the target printer” because the target printer has not yet been determined according to limitation 1.2 (PO Resp. 45–47), we disagree that limitation 1.2 must necessarily precede limitation 1.4. *See supra* Section III.B.1.

Alternatively, we find Petitioner’s argument persuasive that Hamilton discloses performing limitation 1.4 after limitation 1.3, which is itself performed after limitation 1.2 in at least one embodiment. Pet. 56 (“Per [limitation 1.3], once Hamilton’s system queries the user’s printer for its capabilities, the printer ‘will then respond with its accuracy and material capabilities’” (citation omitted)); *see supra* Section III.G.4.c.

Thus, we determine that Petitioner has shown that Hamilton discloses limitation 1.4 and that Evans provides teachings further motivating limitation 1.4.

e. Limitation 1.5

Limitation 1.5 recites “creating a fabrication profile based on the one or more properties [received from the target printer].” Ex. 1001, 35:29–30.

Petitioner argues that Evans discloses that 3D fabrication systems use slicer applications (such as “Slic3r”) to generate machine-ready code such as G-code. Pet. 57 (citing Ex. 1011, 43–46, 62; Ex. 1003 ¶ 123). According to Petitioner, a person of ordinary skill in the art would have based Evans’s Slic3r configuration profile on Hamilton’s “accuracy and material capabilities” and Evans’s “information about your printer and filament,” to create a collection of properties such as Evans’s “Print Settings” and “Printer and Filament” properties. Pet. 57–58 (citing Ex. 1010 ¶¶ 15–21, Fig. 3; Ex. 1011, Fig. 2–11; Ex. 1003 ¶ 123).

Alternatively to using Slic3r, Petitioner argues that a person of ordinary skill in the art would have organized Hamilton’s and Evans’s dictionary of configuration information into a fabrication profile using the KISSlicer application, which creates profiles for each printer based on its capabilities. Pet. 59 (citing Ex. 1012, 3–11; Ex. 1003 ¶¶ 124–125).

In its Response, Patent Owner argues that “Hamilton teaches that there is no need for a slicer application at all because his designs already include ‘instructions for the 3D printer,’” thus there would have been no motivation to combine Hamilton with Evans or KISSlicer. PO Resp. 48 (citing Ex. 1010 ¶¶ 19, 21–22, Fig. 4; Ex. 2014 ¶ 132); *see also* PO Sur-reply 19 (same citations).

As with its argument for limitation 1.4, Patent Owner contends that in Evans and KISSlicer, the properties are entered into the software manually rather than being sent “from the target printer.” PO Resp. 48–49 (citing Ex. 1011, 66–68; Ex. 1012, 3; Ex. 2014 ¶ 133).

In its Reply, Petitioner argues that Patent Owner’s argument as to the motivation to combine fails to address the combination with Evans and

KISSlicer that Petitioner proposes. Pet. Reply 20. According to Petitioner, the combinations rely on Hamilton’s accuracy and material capabilities which are received from the printer, and Petitioner relies on an embodiment in Evans for which the Slic3r profile properties are determined automatically, not manually. *Id.* at 20–21 (citing Ex. 1010 ¶¶ 15–17; Ex. 1011, 46). Petitioner also argues that KISSlicer teaches “that it was well-known for slicers to generate settings/configurations based on printer capabilities, shown in KISSlicer including ‘default profiles’ for Acrylonitrile Butadiene Styrene (‘ABS’).” *Id.* at 21 (citing Ex. 1012, 3).

In its Sur-reply, Patent Owner argues that Petitioner identified user-entered parameters in Evans and KISSlicer in the Petition. PO Sur-reply 19–20 (citing Ex. 1011, 46, 66–68; Ex. 1012, 3; Ex. 2014 ¶ 133). Patent Owner contends that “[t]he Petition does not discuss automatically determining print settings,” or “present any rationale or evidence for obviating the need for the user to input measured printer characteristics,” and its arguments in the Reply are merely attorney argument. *Id.* at 20–21 (citing Ex. 2014 ¶¶ 128, 132).

We find Petitioner’s arguments persuasive. Petitioner relies primarily on Hamilton for the teaching that the configuration properties are received from the printer, as we discuss above in the context of limitation 1.4. *See supra* Section III.G.4.d. Petitioner persuasively shows that fabrication profiles were known in the art, as exemplified in Evans and KISSlicer, and that a person of ordinary skill in the art would have had reason to use the properties received from the target printer in limitation 1.4 to create such a fabrication profile. *See* Ex. 1003 ¶¶ 106–114.

Thus, we determine that Petitioner has shown that the combination of Hamilton and either Evans or KISSlicer, or both, teaches limitation 1.5.

f. Limitation 1.6

Limitation 1.6 recites “generating a machine-ready representation of the three-dimensional model executable by the target printer to fabricate the object.” Ex. 1001, 35:30–32.

Petitioner argues that Evans discloses slicing a three-dimensional model into a set of commands (e.g., G-code) for the 3D printer to follow, which meets limitation 1.6. Pet. 60–61 (citing Ex. 1011, 34–35, 43, 62, 70–71, Figs. 2-1, 2-8, 2-9; Ex. 1003 ¶ 126).

In its Response, Patent Owner argues, as it did for limitations 1.1 and 1.5, that Hamilton already includes a solution for providing printer instructions that would not meet limitation 1.6, so a person of ordinary skill in the art would not have been motivated to look to Evans. PO Resp. 49. Patent Owner also contends that Petitioner’s expert admits “Hamilton has *no* discussion of G-code or of slicing.” *Id.* (citing Ex. 2015, 50:15, 53:17). Finally, Patent Owner argues, as it did for limitation 1.1, that “the Hamilton–Evans combination fails to teach the existence of a model, as would be necessary to ‘generate a machine-ready representation’ of said model.” *Id.* at 49–50 (citing Ex. 2014 ¶ 135); *see also* PO Sur-reply 21–22.

As we discuss above, we find Petitioner’s arguments for 1.1 and 1.5 persuasive, including that a person of ordinary skill in the art would have had reason to incorporate a slicer into Hamilton’s system, and that Hamilton discloses the use of a three-dimensional model. *See supra* Sections III.G.4.b, e.

Thus, we determine that Petitioner has shown that the combination of Hamilton and Evans teaches limitation 1.6.

g. Conclusion as to Claim 1

For the above reasons, we determine that Petitioner has shown, by a preponderance of the evidence, that the combination of Hamilton and Evans, or the combination of Hamilton, Evans, and KISSlicer, teaches all the limitations of claim 1, and that a person of ordinary skill in the art would have had reason to combine these references to implement the method of claim 1 with a reasonable expectation of success.

We therefore determine that Petitioner has shown that claim 1 is unpatentable under § 103 based on Hamilton and Evans or Hamilton, Evans, and KISSlicer.

5. *Claims 2–5, 9, 10, 12, and 13*

Claims 2–5, 9, 10, 12, and 13 depend from claim 1 and thus include the limitations discussed above. Petitioner presents arguments that each of these claims is unpatentable as obvious over the combination of Hamilton, Evans, and optionally KISSlicer. Pet. 62–69.

Patent Owner does not specifically contest Petitioner’s arguments for these claims apart from the arguments addressed above in the context of claim 1. *See* PO Resp. 50. We find Petitioner’s arguments persuasive for the reasons provided in the Petition. *See* Pet. 62–69.

6. *Claims 6, 7, and 19 (Ground Based on Hamilton, Evans, Pax, and Optionally KISSlicer)*

Claims 6, 7, and 19 depend from claim 1 and thus include the limitations discussed above. Petitioner presents arguments for each of these

claims, and Patent Owner does not specifically contest them. *See* Pet. 69–76; PO Resp. 50. We find Petitioner’s arguments persuasive for the reasons provided in the Petition.

7. *Claim 19 (Ground Based on Hamilton, Evans, Pax, Pettis, and Optionally KISSlicer)*

Claim 19 depends from claim 1 and thus includes the limitations discussed above. Petitioner presents arguments for claim 19, and Patent Owner does not specifically contest them. *See* Pet. 76–80; PO Resp. 50. We find Petitioner’s arguments persuasive for the reasons provided in the Petition.

8. *Claim 8 (Ground Based on Hamilton, Evans, Batchelder, and Optionally KISSlicer)*

Claim 8 depends from claim 1 and further recites “wherein the one or more properties include a firmware configuration of the target printer.” Ex. 1001, 36:1–3.

Petitioner argues that “a 3D printer’s firmware was typically detected when setting up or sending jobs to a 3D printer” because the firmware “had a significant effect on the capabilities of the printer and its compatibility to the user’s printer[] control applications.” Pet. 82 (citing Ex. 1003 ¶¶ 170–171). According to Petitioner, “Evans corroborates the importance of printer firmware” and teaches that the firmware must be compatible with the printer control application. Pet. 82–83 (citing Ex. 1011, 35, 41–43, 76–80). Thus, Petitioner contends that a person of ordinary skill in the art would have understood “that a printer’s firmware configuration (e.g., any current version or update) would have been queried or at least received from the printer” as

one of the recited properties of the target printer. Pet. 83 (citing Ex. 1003 ¶ 171).

In addition, Petitioner argues that Evans teaches that “[h]ow well firmware [interprets G-code] will determine how well your 3D printer will print objects.” Pet. 81 (alterations in original). According to Petitioner, a person of ordinary skill in the art “would have been motivated to include the firmware configuration into the information transmitted by the printer (e.g., Hamilton’s the printer ‘accuracy and material capabilities.’” *Id.* (citing Ex. 1010 ¶¶ 15–21, Fig. 3; Ex. 1003 ¶ 164).

Petitioner also relies on Batchelder, which we describe briefly above. *See supra* Section E. According to Petitioner, Batchelder discloses firmware updates as an example of printer properties that assist in building a 3D model. Pet. 83–84 (citing Ex. 1007 ¶¶ 52–54, Fig. 2; Ex. 1003 ¶ 172). Thus, Petitioner argues that a person of ordinary skill in the art would have had reason to include firmware configuration as one of the properties of the target printer in the Hamilton–Evans combination. Pet. 84 (citing Ex. 1003 ¶ 172).

According to Petitioner, incorporating the firmware configuration into Hamilton–Evans “would have improved the quality of resulting prints because, with the knowledge of the firmware configuration, a more compatible G-code can be generated based on the user’s printers control applications.” Pet. 81 (citing Ex. 1003 ¶ 165). In addition, Petitioner argues that the combination “would have improved user experience.” *Id.* (citing Ex. 1007 ¶¶ 52–54, Fig. 2; Ex. 1010 ¶¶ 19–21; Ex. 1003 ¶ 166).

Finally, Petitioner argues that “Evans explains firmware is a part of the 3D printing toolchain” and provides a specific firmware example that

was owned by Batchelder’s assignee before the date of the claimed invention, and according to Petitioner, a person of ordinary skill in the art would have been able to include firmware as another property in Hamilton’s accuracy and material capability information. Pet. 82 (citing Ex. 1007 ¶¶ 52–58; Ex. 1010 ¶¶ 19–21; Ex. 1011, 33–43; Ex. 1017; Ex. 1003 ¶¶ 167–169).

In its Response, Patent Owner argues that Petitioner has not cited a reference showing that a 3D printer’s firmware was typically detected when setting up print jobs to a 3D printer, as Evans does not teach querying or receiving a printer’s firmware configuration. PO Resp. 51 (citing Ex. 1011, 35, 41–43, 76–80). Patent Owner also refers to its arguments regarding Batchelder made in the context of the Douglas–Mark–Batchelder ground. *See supra* Section E (citing Ex. 2014 ¶ 140).

We find Petitioner’s arguments persuasive that a person of ordinary skill in the art would have had reason to include a firmware configuration as part of the recited “one or more properties” within the Hamilton–Evans combination, given Evans’s teachings that the firmware is an important factor relating to the capabilities of a 3D printer, and Batchelder’s teaching that information about firmware updates may be included as a property encoded on a 3D printer filament reflecting properties of interest to the user of a 3D printer. Ex. 1011, 35, 41–43, 76–80; Ex. 1007 ¶ 54.

Evans and Batchelder need not specifically teach querying and receiving a printer’s firmware configuration because Petitioner persuasively relies on Hamilton for the query. Petitioner relies on Evans and Batchelder to show that firmware configuration was another property that a person of ordinary skill in the art would have included within the method taught by the Hamilton–Evans combination.

Thus, we determine that claim 8 would have been obvious over the combination of Hamilton, Evans, and Batchelder. On that basis, we determine that Petitioner has shown, by a preponderance of the evidence, that claim 8 is unpatentable under § 103.

9. *Claim 20 (Ground Based on Hamilton, Evans, Wang, and Optionally KISSlicer)*

Claim 20 depends from claim 1 and thus includes the limitations discussed above. Petitioner presents arguments for claim 20, and Patent Owner does not specifically contest them. *See* Pet. 84–87; PO Resp. 52. We find Petitioner’s arguments persuasive for the reasons provided in the Petition.

IV. CONCLUSION¹⁹

For the reasons above, Petitioner has shown by a preponderance of the evidence that claims 1–10, 12, 13, 19, and 20 of the ’774 patent are unpatentable under § 103.

¹⁹ Should Patent Owner wish to pursue amendment of claims in a reissue or reexamination proceeding after this decision, we draw attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

In summary:

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claim(s) Shown Unpatentable	Claim(s) Not Shown Unpatentable
1–5, 9, 10, 12, 13, 20	103	Douglas, Mark	1–5, 9, 10, 12, 13, 20	
6, 7, 9, 10	103	Douglas, Mark, Dahlin	6, 9, 10	7
8	103	Douglas, Mark, Batchelder	8	
19	103	Douglas, Mark, Pax	19	
1–5, 9, 10, 12, 13	103	Hamilton, Evans, KISSlicer	1–5, 9, 10, 12, 13	
6, 7, 19	103	Hamilton, Evans, Pax, KISSlicer	6, 7, 19	
19	103	Hamilton, Evans, Pax, Pettis, KISSlicer	19	
8	103	Hamilton, Evans, Batchelder, KISSlicer	8	
20	103	Hamilton, Evans, Wang, KISSlicer	20	
Overall Outcome			1–10, 12, 13, 19, 20	

V. ORDER

It is

ORDERED that claims 1–10, 12, 13, 19, and 20 of the '774 patent are unpatentable; and

FURTHER ORDERED that, because this is a final written decision, parties to this proceeding seeking judicial review of our decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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Patent 11,886,774 B2

FOR PETITIONER:

Joshua Griswold
Michael Hawkins
Baile Xie
Patrick Bisenius
Christopher A. von Gunten
Michael Vincent
FISH & RICHARDSON P.C.
griswold@fr.com
hawkins@fr.com
xie@fr.com
IPR56224-0013IP1@fr.com

FOR PATENT OWNER:

Brian Oaks
Aashish Kapadia
Kevin Meek
Syed Fareed
Dexter Hamilton (admitted *pro hac vice*)
MCDERMOTT WILL & EMERY LLP
boaks@mwe.com
akapadia@mwe.com
kmeek@mwe.com
sfareed@mwe.com
dkhamilton@mwe.com