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IPR2025-00438 — U.S. Patent No. 10,569,466

Overview of Argument

I. Overview of the ‘466 Patent

II. Overview of the Prior Art

III. The Challenged Claims are Patentable Under Ground 1A

IV. Claim 19 is Patentable Under Ground 2

V. The Challenged Claims are Patentable under Ground 3A

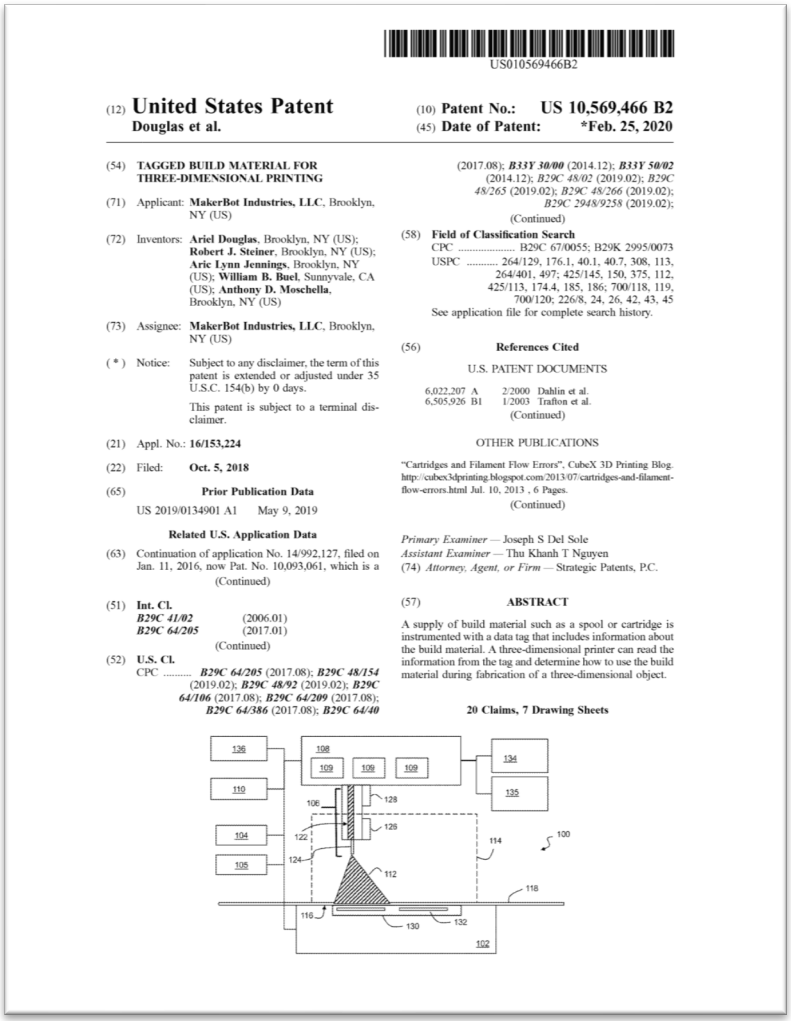
VI. The Challenged Claims are Patentable under Grounds 1B/1D/1F/3B/3D/3F/3H (adding Jazayeri)

VII. Claim 17 is Patentable Under Grounds 1E/1F/3E/3F

VIII. Claim 5 is Patentable Under Grounds 1C/1D/3G/3H

Overview of the '466 Patent

- The '466 Patent relates to a three-dimensional printer that can read information about a build material from a data tag on a supply of the material, supply that information to a client, and then receive from that client operational parameters relating to the use the build material during fabrication of a three-dimensional object.
  - EX1001 at 1:29-34; claim 1



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(12) **United States Patent**
Douglas et al.

(10) **Patent No.: US 10,569,466 B2**
(45) **Date of Patent: *Feb. 25, 2020**

(54) **TAGGED BUILD MATERIAL FOR THREE-DIMENSIONAL PRINTING**

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(72) Inventors: **Ariel Douglas**, Brooklyn, NY (US); **Robert J. Steiner**, Brooklyn, NY (US); **Aric Lynn Jennings**, Brooklyn, NY (US); **William B. Buel**, Sunnyvale, CA (US); **Anthony D. Moschella**, Brooklyn, NY (US)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **16/153,224**

(22) Filed: **Oct. 5, 2018**

(65) **Prior Publication Data**

US 2019/0134901 A1 May 9, 2019

Related U.S. Application Data

(63) Continuation of application No. 14/992,127, filed on Jan. 11, 2016, now Pat. No. 10,093,061, which is a (Continued)

(51) **Int. Cl.**
B29C 41/02 (2006.01)
B29C 64/205 (2017.01)
(Continued)

(52) **U.S. Cl.**
CPC ***B29C 64/205*** (2017.08); ***B29C 48/154*** (2019.02); ***B29C 48/92*** (2019.02); ***B29C 64/106*** (2017.08); ***B29C 64/209*** (2017.08); ***B29C 64/386*** (2017.08); ***B29C 64/40*** (2017.08); ***B33Y 30/00*** (2014.12); ***B33Y 50/02*** (2014.12); *B29C 48/02* (2019.02); *B29C 48/265* (2019.02); *B29C 48/266* (2019.02); *B29C 2948/9258* (2019.02);
(Continued)

(58) **Field of Classification Search**
CPC B29C 67/0055; B29K 2995/0073
USPC 264/129, 176.1, 40.1, 40.7, 308, 113, 264/401, 497; 425/145, 150, 375, 112, 425/113, 174.4, 185, 186; 700/118, 119, 700/120; 226/8, 24, 26, 42, 43, 45
See application file for complete search history.

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(57) **ABSTRACT**

A supply of build material such as a spool or cartridge is instrumented with a data tag that includes information about the build material. A three-dimensional printer can read the information from the tag and determine how to use the build material during fabrication of a three-dimensional object.

20 Claims, 7 Drawing Sheets

Overview of the ’466 Patent

- Petitioner challenges independent claims 1 and 19

Claim Element	Language
1[p]	A method, comprising:
1[a]	providing a three-dimensional printer that includes a tag sensor;
1[b]	receiving a request from a client over a network to fabricate an object on the three-dimensional printer,
1[c]	the three-dimensional printer coupled to a supply of a build material including a tag that stores at least one property of the build material;
1[d]	reading data from the tag with the tag sensor;
1[e]	providing the data from the tag to the client over the network, the data including at least one property of the build material;
1[f]	receiving one or more operational parameters from the client selected for use in controlling operation of the three-dimensional printer when fabricating the object with the build material having the at least one property stored in the tag; and
1[g]	fabricating the object with the build material according to the one or more operational parameters.

19[p]	A method, comprising:
19[a]	providing a three-dimensional printer that includes a controller and a tag sensor;
19[b]	coupling a container of a build material to the three-dimensional printer, the container including a tag that stores at least one property of the build material;
19[c]	reading data from the tag with the tag sensor;
19[d]	transmitting the data to the controller;
19[e]	determining an operational parameter for configuring the three-dimensional printer for a fabrication process using the build material based upon at least one property of the build material in the data, the operational parameter including at least one of a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement;
19[f]	controlling operation of the three-dimensional printer with the controller according to the operational parameter; and fabricating an object with the three-dimensional printer based upon the operational parameter.

Pet. 1-2.

Overview of the '466 Patent

- Petitioner also challenges claims 2-5, 7-13, 16-18, and 20, depending on claim 1.

2. The method of claim **1**, further comprising receiving a request from the client for the data from the tag.

3. The method of claim **1**, wherein the three-dimensional printer is coupled to a first supply of a first build material and a second supply of a second build material different from the first build material, the first supply including a first tag that stores at least one property of the first build material, and the second supply including a second tag that stores at least one property of the second build material.

4. The method of claim **3**, further comprising providing data from the first tag and the second tag to the client over the network, the data including at least one property of the first build material and the second build material.

5. The method of claim **4**, further comprising receiving a selection of one of the first build material and the second build material from the client for use in fabricating the object using the three-dimensional printer.

7. The method of claim **1**, further comprising fabricating the object with the three-dimensional printer based upon the one or more operational parameters received from the client.

8. The method of claim **1**, wherein the tag includes at least one of a radio frequency identification (RFID) tag, an optically-identifiable tag, a magnetically-identifiable tag, and a mechanical feature of the supply.

9. The method of claim **1**, wherein the data includes at least one of a material identification number, a build material type, a build material diameter, an extruder temperature requirement, a build material melting temperature, a build material color, a build material color lot number, a cost per unit of build material, a build material density, a build material tensile strength, a build material viscosity, a build material recycle code, and a build material expiration date.

10. The method of claim **1**, wherein the one or more operational parameters includes at least one of an extruder temperature, a feed rate, a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement.

11. The method of claim **1**, wherein the supply includes at least one of a cartridge, a spool, a filament, a number of pellets, and a liquid.

12. The method of claim **1**, wherein the tag includes a radio frequency identification (RFID) tag, and the RFID tag is at least one of a passive RFID tag and an active RFID tag.

13. The method of claim **1**, wherein the tag includes an optically-identifiable tag, and the optically-identifiable tag is at least one of bar code and quick read (QR) code.

16. The method of claim **1**, wherein the tag sensor includes at least one of a radio frequency identification (RFID) reader, an optical scanner, a magnetic reader, and a contact point sensor.

17. The method of claim **1**, further comprising performing a diagnostic test to determine whether the one or more operational parameters is suitable for the three-dimensional printer.

18. The method of claim **1**, wherein the one or more operational parameters are based upon a build material identification number contained in the data.

20. The method of claim **1**, wherein the client includes a computing device.

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VI. The Challenged Claims are Patentable under Grounds 1B/1D/1F/3B/3D/3F/3H (adding Jazayeri)

VII. Claim 17 is Patentable Under Grounds 1E/1F/3E/3F

VIII. Claim 5 is Patentable Under Grounds 1C/1D/3G/3H

Overview of the Prior Art

- *Loughran* (EX1004), *Dubois* (EX1005), *Devos* (EX1008), *Menchik* (EX1009), and *Jazayeri* (EX1010) are published patent applications
- *KISSlicer* (EX1018) is a software "Quick-Start Guide"
- *Dahlin* (EX1011) is a U.S. Patent

Ground	Claims	Basis for Rejection
1A	1-5, 7-13, 16, 18, 20	§103: Loughran and Dubois
1B	1-5, 7-13, 16, 18, 20	§103: Loughran, Dubois, and Jazayeri
1C	5	§103: Loughran, Dubois, and KISSlicer
1D	5	§103: Loughran, Dubois, Jazayer, and KISSlicer
1E	17	§103: Loughran, Dubois, Menchik, and Dahlin
1F	17	§103: Loughran, Dubois, Jazayer, Menchik, and Dahlin
2	19	§103: Devos
3A	1, 3-5, 7, 9-11, 19, 20	§102/103: Menchik
3B	1, 3-5, 7, 9-11, 20	§103: Menchik and Jazayeri

Ground	Claims	Basis for Rejection
3C	2, 8, 12, 16	§103: Menchik and Loughran
3D	2, 8, 12, 16	§103: Menchik, Jazayeri, and Loughran
3E	17	§103: Menchik and Dahlin
3F	17	§103: Menchik, Jazayeri, and Dahlin
3G	5	§103: Menchik and KISSlicer
3H	5	§103: Menchik, Jazayeri, and KISSlicer

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The Challenged Claims are Patentable Under Ground 1A

- Ground 1A combines *Loughran* and *Dubois* to challenge claims 1-5, 7-13, 16, 18, and 20

Ground	Claims	Basis for Rejection
1A	1-5, 7-13, 16, 18, 20	§103: Loughran and Dubois
1B	1-5, 7-13, 16, 18, 20	§103: Loughran, Dubois, and Jazayeri
1C	5	§103: Loughran, Dubois, and KISSlicer
1D	5	§103: Loughran, Dubois, Jazayer, and KISSlicer
1E	17	§103: Loughran, Dubois, Menchik, and Dahlin
1F	17	§103: Loughran, Dubois, Jazayer, Menchik, and Dahlin

The Challenged Claims are Patentable Under Ground 1A – No Motivation to Combine

- Petitioner contends:

3. Loughran-Dubois Combination

By the relatively late timeframe leading up to 2012, a POSITA would have been motivated to implement Loughran's SFF system in a manner that employs Dubois's suggestion (e.g., sending the fabrication job from the CAD client using CAD information that includes printing parameters concerning the state or characteristics of the materials) to achieve several known benefits (articulated below) and thereby enabled Loughran's system to complete each fabrication job based on CAD information with the optimal set of material parameters. EX1003, ¶45. A POSITA would have been motivated to apply Dubois's suggestions to Loughran for multiple reasons. *Id.*

Pet., 10.

The Challenged Claims are Patentable Under Ground 1A – No Motivation to Combine

- Petitioner's "send printing parameters from the client" rationale conflicts with Loughran's disclosed architecture, which relies on ***printer-side*** automatic and dynamic adjustment:

> [0024] The type and format of the information retrieved by the second SFF system **104** from the material information server **108** regarding the material **112** can vary. For instance, the information retrieved by the second SFF system **104** regarding the material **112** may include information in a machine-readable format that is not readily understood by users, and by which the second SFF system **104** is automatically and dynamically adjusted for utilization with the material **112**. Such information may include parameters of the material **112**, including, but not limited to, melting temperature, storage temperature, minimum feature size, horizontal and vertical shrinkage rates, material lifetime, inter-layer delay time, and amount of ultraviolet (UV) light required per layer, among other parameters.

POR, 12; PO Sur-Reply, 1-2.

The Challenged Claims are Patentable Under Ground 1A – No Motivation to Combine

- Similarly, *Loughran* teaches that the printer-side system "parses the retrieved information" and "dynamically adjusts its own parameters."

[0037] The second SFF system **104** parses the retrieved information regarding the material **112** to, for instance, extract parameters regarding the material **112**, and dynamically adjusts its own parameters based on parameters extracted (**326**). For example, if the information is retrieved in extensible Markup Language (XML) format, the second

POR, 12; PO Sur-Reply 1-2.

The Challenged Claims are Patentable Under Ground 1A – No Motivation to Combine

- Petitioner's combination, by contrast, depends on redesigning Loughran so the CAD client sends the printer a fabrication job "including CAD information with operational parameters as suggested by Dubois."
  - Pet., 10-11.

> ***First***, a POSITA would have been motivated to apply Dubois's suggestions
>
> to Loughran's SFF fabrication job (from Loughran's client computer 102, including CAD information with operational parameters as suggested by Dubois) so that the SFF printer 104 uses—for each individual fabrication job—the "optimum values of printing parameters as a function of the nature of the materials, the characteristics of the printer and deposition conditions." EX1005, [0148]; EX1003, ¶46. Indeed, Dubois explains that "the quality of the object to be

- This shifts parameter-setting into the ***client***-generated job.

POR, 12-13; PO Sur-Reply, 1-2.

The Challenged Claims are Patentable Under Ground 1A – No Motivation to Combine

- That proposed shift is not grounded in a technical need identified in *Loughran* to a POSITA.
  - EX2013, ¶79.

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

POR, 12-13; PO Sur-Reply, 1-2.

The Challenged Claims are Patentable Under Ground 1A – No Motivation to Combine

- Petitioner never explains how *Loughran*'s remote CAD client would possess (or be provided) the printer-characteristics and deposition-condition inputs that *Dubois* identifies as necessary to determine "optimum values."
  - Pet., 11-12; *see also* EX1005, ¶[0148]; EX1004, ¶¶[0024], [0037]; EX2013, ¶81.

printing. EX1005, [0021]-[0022]. A POSITA would have been motivated to implement Loughran's SFF fabrication job based on Dubois's suggestion of sending the fabrication job from the CAD client using CAD information that includes printing parameters concerning the state or characteristics of the materials and identifying and correcting printing errors to advantageously allow production of structures with multiple different materials, printing of structures and patterns with micrometre precision and high definition, and production of a higher quality object. EX1003, ¶46.

POR, 12-13; PO Sur-Reply, 2.

The Challenged Claims are Patentable Under Ground 1A – No Motivation to Combine

- *Dubois* does not provide the missing motivation—its "optimum values" framework is implemented through a printer-side "computation unit" and "data processing unit"
  - EX1005, ¶¶[130], [0147]-[0148]; *see also id.* at [0149]–[0156]; EX2013, ¶80.

[0130] FIG. **5** is a basic diagram of the printer according to the invention. The device according to the invention com-

[0147] The data processing unit **105** in FIG. **5** will now be described with reference to FIG. **6**.

[0148] A computation unit **198**, adapted, in particular, to cut up a 3D representation of the component to be produced into characteristic objects has as its inputs said 3D representation, the production specification of the component, parameterised in the form of digital data, and is connected to a database **199**. The database **199** contains all the results of investigations carried out prior to production of said component. These investigations relate to the choice of optimum values of printing parameters as a function of the nature of the materials, the characteristics of the printer and the deposition conditions.

POR, 12-13; PO Sur-Reply 2.

The Challenged Claims are Patentable Under Ground 1A – No Motivation to Combine

- *Dubois*'s "known technique" is printer-centric and not directed to Petitioner's proposed client-side parameter selection.
- Dr. Hickner conceded *Dubois*'s shortcomings:
  - EX2015, 61:13–22

13 Q Does Dubois describe a remote CAD
14 client selecting and sending printer control
15 parameters to a printer over a network?
16 A So Dubois, as I say in my overview
17 paragraph on -- sorry, in my declaration, in
18 paragraph 32, Dubois describes a method and a
19 device for producing three-dimensional
20 multi-material components by inkjet printing of
21 successive layers. So Dubois doesn't really talk
22 about clients and networks, and things like that,

POR, 15-16.

The Challenged Claims are Patentable Under Ground 1A – No Motivation to Combine

- Petitioner's "predictable results" theory also fails as conclusory:
  - Pet., 12

> Finally, such an implementation of Loughran's SFF jobs and SFF system based on Dubois's suggested techniques would have been merely the application of known techniques to a known system ready for improvement to yield predictable results. EX1003, ¶48; *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007). Here, the systems of Loughran and Dubois are each related to systems for fabricating three-dimensional objects in a layer-by-layer manner, which is the same as the '466 patent. EX1004, [0001], [0013]; EX1005, [0001], [0025]-[0028],

PO Sur-Reply, 2-3.

The Challenged Claims are Patentable Under Ground 1A – No Motivation to Combine

- Dr. Hickner relied on unsupported POSITA "routine" modification
  - EX2015, 70:19-71:10; *see also id.* at 68:10–79:15
- Architecture-level reallocation of where parameters are determined and applied is not shown to be a "known method" in the asserted art.

Based on my knowledge and experience in this field and my review of Loughran and Dubois, I'm confident a POSITA would have recognized that this modification would have yielded predictable results and required only routine adjustments to the software to provide the additional functionality disclosed by Dubois, and as such, a POSITA would have had a reasonable expectation of success in making such modifications.

So I didn't propose a schematic. I didn't propose an example. But my analysis of Loughran and Dubois and the combination and expectation of success is detailed in paragraph 48 of my declaration.

POR, 14-15; PO Sur-Reply 3.

The Challenged Claims are Patentable Under Ground 1A – No Motivation to Combine

- *See* Adidas AG v. Nike, Inc., 963 F.3d 1355, 1359 (Fed. Cir. 2020)

> The obviousness inquiry does not merely ask whether a skilled artisan could combine the references, but instead asks whether "they would have been motivated to do so." *InTouch Techs., Inc. v. VGO Commc'ns, Inc.*, 751 F.3d 1327, 1352 (Fed. Cir. 2014). Fundamental differences between the references are central to this motivation to combine inquiry. Thus, while the Board construed the Base Claims as encompassing pre-seamed and unseamed garments and garment sections, the Board properly considered the fundamental differences in the seaming techniques of Reed and Nishida. Rather than address these differences,

POR, 17.

The Challenged Claims are Patentable Under Ground 1A – No Motivation to Combine

- Petitioner's combination also renders *Loughran* inoperable for its intended purpose.
  - EX2013, ¶88.

running. (EX1004 ¶¶[0024]–[0026], [0037]). Petitioner's proposed redesign instead shifts parameter-setting into the client-generated fabrication job—so that the printer purportedly relies on client-supplied "operational parameters" rather than on Loughran's server-driven, printer-side parsing and dynamic adjustment—

thereby displacing the very mechanism Loughran teaches to ensure correct, material-appropriate fabrication. (Pet. at 10–12; EX1003 ¶¶45–47; EX1004 ¶¶[0024]–[0026], [0037]). Moreover, once Petitioner shifts parameter-setting into the remote CAD client, the Petition does not show that the client would have (or could keep current) the printer-specific characteristics and deposition-condition inputs that Dubois indicates are needed to generate or validate "optimum values." (EX1005 ¶¶[0016]–[0017], [0148]–[0156]). As a result, Petitioner's modified

POR, 17.

The Challenged Claims are Patentable Under Ground 1A – No Teaching of Element 1[f]

- Even if combined, *Loughran* and *Dubois* do not teach element 1[f]:

> receiving one or more operational parameters from the client selected for use in controlling operation of the three-dimensional printer when fabricating the object with the build material having the at least one property stored in the tag; and

Claim 1[f]

POR, 18-22; PO Sur-Reply, 1-3.

The Challenged Claims are Patentable Under Ground 1A – No Teaching of Element 1[f]

- *Loughran* assigns different roles to the client and the printer.
- The client uses material information to generate jobs—for example, for build-time estimation, orientation, and scaling.
  - EX1004, ¶ [0002], *see also id.* at ¶¶ [0027], [0043], [0055].

[0002] The materials from which SFF systems of SFF fabricators can fabricate physical objects can have different types of information. For example, melting temperature, storage temperature, minimum feature size, horizontal and vertical shrinkage rates, material lifetime, inter-layer delay time, and amount of ultraviolet (UV) light required per layer, among other types of information, can vary from material to material. SFF systems thus have to be updated in order to accommodate new materials. Some types of information are also needed by client devices of users, such as the computing devices like desktop computers that run CAD software which generate the SFF fabrication jobs in accordance with which physical objects are constructed by the SFF systems. For instance, build time estimation, feature orientation suggestion, and part scaling based on expected shrinkage are determinations that the CAD software makes based on information of the expected material from which a physical object is to be constructed.

POR, 18-21; PO Sur-Reply, 1-3.

The Challenged Claims are Patentable Under Ground 1A – No Teaching of Element 1[f]

- The printer, by contrast, retrieves material information and "automatically and dynamically" adjusts itself for fabrication.
- This is not the claimed receipt **at the printer** of **client-selected operational parameters**.
  - EX1004, ¶ [0024]; *see also id.* at ¶¶ [0026], [0035]-[0037], [0045], [0048].

[0024] The type and format of the information retrieved by the second SFF system **104** from the material information server **108** regarding the material **112** can vary. For instance, the information retrieved by the second SFF system **104** regarding the material **112** may include information in a machine-readable format that is not readily understood by users, and by which the second SFF system **104** is automatically and dynamically adjusted for utilization with the material **112**. Such information may include parameters of the material **112**, including, but not limited to, melting temperature, storage temperature, minimum feature size, horizontal and vertical shrinkage rates, material lifetime, inter-layer delay time, and amount of ultraviolet (UV) light required per layer, among other parameters.

POR, 18-21; PO Sur-Reply, 1-3.

The Challenged Claims are Patentable Under Ground 1A – No Teaching of Element 1[f]

- Dr. Hickner agreed that *Loughran*'s dynamic adjustment is printer side and not contained in any fabrication job sent by a client.
  - EX2015, 54:2-10.

> Q You would agree that if the adjustment is dynamic and can occur while the system is running, the information for that adjustment is not contained in the fabrication job that is sent to start the print, right?
>
> A Oh, I see what you're saying. So once the job is sent, the second SFF system just does its own thing in dynamically adjusting without any other jobs being sent or anything like that.

POR, 20; PO Sur-Reply, 1-3.

The Challenged Claims are Patentable Under Ground 1A – No Teaching of Element 1[f]

- Nor does *Loughran* ¶[0041] disclose client-side selection of printer-control parameters.
- It says only that the first SFF system may receive information about the second SFF system and its materials:

> [0041] The first SFF system **102** receives a first list of material identifiers known to the second SFF system **104** over the network **106**, as well as optionally other information (**402**). Receiving the first list may involve the first SFF system **102** receiving the list as part of an information extraction process performed by the first SFF system **102** relative to the second SFF system **104**. For instance, the first SFF system **102** may query the second SFF system **104** for information regarding the second SFF system **104**. In response, the second SFF system **104** may provide the first SFF system **102** with information about itself, including a list of material identifiers known to the second SFF system **104**. The second SFF system **104** may provide, for example, the known base URL address that has been described.

EX1004, ¶[0041]

POR, 18-21; PO Sur-Reply, 2.

The Challenged Claims are Patentable Under Ground 1A – No Teaching of Element 1[f]

- Even if combined, *Dubois* doesn't fill the gap.
- Even if data processing unit 105 may reside on a PC, it is disclosed as part of the printer (Fig. 5).
  - EX1005, ¶¶ [0130], [0147]-[0148]; *see also id. at* ¶¶ [0029], [0149]-[0169], [0170], Figs. 5-6)
- Thus, *Dubois* still discloses a printer-centric control architecture—not a remote CAD client sending printer operational parameters to a printer.

[0130] FIG. **5** is a basic diagram of the printer according to the invention. The device according to the invention com-

[0147] The data processing unit **105** in FIG. **5** will now be described with reference to FIG. **6**.

[0148] A computation unit **198**, adapted, in particular, to cut up a 3D representation of the component to be produced into characteristic objects has as its inputs said 3D representation, the production specification of the component, parameterised in the form of digital data, and is connected to a database **199**. The database **199** contains all the results of investigations carried out prior to production of said component. These investigations relate to the choice of optimum values of printing parameters as a function of the nature of the materials, the characteristics of the printer and the deposition conditions.

POR, 21-22; PO Sur-Reply, 2.

The Challenged Claims are Patentable Under Ground 1A – No Teaching of Element 1[f]

- Claim 1[f] requires a particular client-to-printer transmission of selected operational parameters.
- Generalized assertions that a POSITA could have done so are not a substitute for evidence.
- Conclusions that it would have been "straightforward," "ordinary option," and "predictable" do not supply the missing disclosure or explanation.

In re Magnum Oil Tools Int'l, Ltd., 829 F.3d 1364, 1380–81 (Fed. Cir. 2016)

[17] To satisfy its burden of proving obviousness, a petitioner cannot employ mere conclusory statements. The petitioner must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness. *Id.* In its petition, McClinton merely argued in conclusory fashion that "[t]he same analysis" for Alpha also applied to Lehr, without further explanation. JA 117-18. The Board had no basis apart from this and similar conclusory statements to find a motivation to combine Lehr with the other prior art references, Cockrell and Kristiansen. Because such conclusory statements cannot satisfy the petitioner's burden of demonstrating obviousness, the Board did not have sufficient evidence on which to base its legal conclusion of obviousness.

PO Sur-Reply, 2-3.

The Challenged Claims are Patentable Under Ground 1A – No Teaching of Claim 5

- Claim 5, which additionally depends on claims 3 and 4, is unpatentable for additional reasons.

3. The method of claim **1**, wherein the three-dimensional printer is coupled to a first supply of a first build material and a second supply of a second build material different from the first build material, the first supply including a first tag that stores at least one property of the first build material, and the second supply including a second tag that stores at least one property of the second build material.

4. The method of claim **3**, further comprising providing data from the first tag and the second tag to the client over the network, the data including at least one property of the first build material and the second build material.

5. The method of claim **4**, further comprising receiving a selection of one of the first build material and the second build material from the client for use in fabricating the object using the three-dimensional printer.

POR, 22-25; PO Sur-Reply, 3-5.

The Challenged Claims are Patentable Under Ground 1A – No Teaching of Claim 5

- Petitioner does not show receiving a client selection of one of the two tagged build materials.
- *Loughran* passage Petitioner cites does not disclose printer receiving from the client a selection of material supplies.
  - (EX1004, ¶[0052]).

[0052] The communication mechanism **604** may include network adapters and/or other types of communication technologies to communicate with the second SFF system **104** over the network **106**, and may share these technologies with the information-retrieval mechanism **608**. The communication mechanism **604** receives from the second SFF system **104** a list of unique material identifiers of materials known to the second SFF system **104**. This list is the first list described in relation to the method **400** of **FIG. 4**. The communication mechanism **604** is also the mechanism by which the CAD software **610** sends SFF fabrication jobs to the second SFF system **104**.

POR, 23; PO Sur-Reply, 3-4.

The Challenged Claims are Patentable Under Ground 1A – No Teaching of Claim 5

- Nor do *Loughran*'s client-side steps of retrieving material information and using it in job generation disclose the claimed client instruction selecting one of the first and second tagged build materials.
  - EX1004, ¶[0041]; *see also id*. at ¶¶[0042]-[0043], [0052]-[0055].

> [**0041**] The first SFF system **102** receives a first list of material identifiers known to the second SFF system **104** over the network **106**, as well as optionally other information (**402**). Receiving the first list may involve the first SFF system **102** receiving the list as part of an information extraction process performed by the first SFF system **102** relative to the second SFF system **104**. For instance, the first SFF system **102** may query the second SFF system **104** for information regarding the second SFF system **104**. In response, the second SFF system **104** may provide the first SFF system **102** with information about itself, including a list of material identifiers known to the second SFF system **104**. The second SFF system **104** may provide, for example, the known base URL address that has been described.

POR, 23; PO Sur-Reply, 4.

The Challenged Claims are Patentable Under Ground 1A – No Teaching of Claim 5

- Petitioner's "obvious to include" assertion is an expert-driven addition to Loughran's job file, not a teaching in the asserted Ground 1A references of the claimed client-to-printer selection exchange.
  - *See Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1362 (Fed. Cir. 2016).

> [7] Third, our cases repeatedly warn that references to "common sense"—whether to supply a motivation to combine or a missing limitation—cannot be used as a wholesale substitute for reasoned analysis and evidentiary support, especially when dealing with a limitation missing from the prior art references specified.

POR, 24.

The Challenged Claims are Patentable Under Ground 1A – No Teaching of Claim 5

- *Dubois* also does not disclose receiving a selection between two tagged build-material supplies.
- Petitioner's proposition that a slice "specifies a selection of build material" comes from Dr. Hickner's gloss and *Napadensky*, not *Dubois* itself.
- Petitioner cannot re-label outside reference as mere "corroboration" to supply a missing limitation.

> EX1003, ¶¶75-77. Dr. Hickner explained what Dubois's "slicing" description taught to a POSITA—that a "slice specifies a selection of build material for use in printing the layer of the multi-material component"—citing other literature as corroboration of a POSITA's knowledge of this fact. EX1003, ¶¶78-79 ("[m]ultiple references, in addition to Dubois, corroborate"); EX1006, [0039]-[0040], [0193]-[0194]; EX2015, 26:1-6.

POR, 24-25; PO Sur-Reply, 4.

Overview of Argument

I. Overview of the ‘466 Patent

II. Overview of the Prior Art

III. The Challenged Claims are Patentable Under Ground 1A

IV. Claim 19 is Patentable Under Ground 2

V. The Challenged Claims are Patentable under Ground 3A

VI. The Challenged Claims are Patentable under Grounds 1B/1D/1F/3B/3D/3F/3H (adding Jazayeri)

VII. Claim 17 is Patentable Under Grounds 1E/1F/3E/3F

VIII. Claim 5 is Patentable Under Grounds 1C/1D/3G/3H

Claim 19 is Patentable Under Ground 2

- Ground 2 (obviousness over *Devos)* does not teach claim element 19[e].

19[p]	A method, comprising:
19[a]	providing a three-dimensional printer that includes a controller and a tag sensor;
19[b]	coupling a container of a build material to the three-dimensional printer, the container including a tag that stores at least one property of the build material;
19[c]	reading data from the tag with the tag sensor;
19[d]	transmitting the data to the controller;
19[e]	determining an operational parameter for configuring the three-dimensional printer for a fabrication process using the build material based upon at least one property of the build material in the data, the operational parameter including at least one of a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement;
19[f]	controlling operation of the three-dimensional printer with the controller according to the operational parameter; and fabricating an object with the three-dimensional printer based upon the operational parameter.

POR, 35-44; PO Sur-Reply, 5-9.

Claim 19 is Patentable Under Ground 2

- Petitioner's theory fails because *Devos* does not disclose determining a "support structure requirement" or any other enumerated operational parameter.
- Instead, *Devos* discloses determining "powder settling coefficients."
  - (EX1008, ¶[0032]).

[0032] In addition, as illustrated by FIG. **5**, the supply bin **110** can include a memory mechanism **146** that can communicate information to the controller about the supply bin, such as, for example, powder volume, powder type, bin manufacturer (e.g., to help determine if the supply bin is a genuine supply bin), allowable binder types for the powder, recommended spread-roller rotation speed, supply bin z-step size, expiration date of the powder, drop volume needed for a given layer thickness, setting time, etc. The memory mechanism **146** can be, for example, an integrated circuit (IC) chip, a tag or label with a bar code, or a mechanical device that conveys information about the powder level and/or bin. The solid freeform fabrication system can include a sensor that is capable of reading the memory mechanism **146**. For example, in the case of an IC chip, the system can use information from the supply bin in tandem with the information from the inkjet supply's memory chip to ensure, for example, that the correct binder liquid and powder are mixed. The system can also use the data encoded in or on the memory mechanism **146** to determine certain operating parameters, such as for example, print speed, drop volume per voxel, color maps, dry time needed after build completion, shrink or expansion size, adjustment factors, powder settling coefficients (e.g., to determine whether powder supports need to be included, and if so, how much support), minimum allowable layer thickness, etc.

POR, 37-38; PO Sur-Reply, 6-7.

Claim 19 is Patentable Under Ground 2

- Petitioner cites *Devos*'s example of "powder settling coefficients" and asserts that a POSITA would have been motivated to determine a support structure requirement using the powder settling coefficients.
  - Pet., 49.

Devos's "system can also use the data encoded in or on the memory mechanism 146 to determine certain operating parameters, such as for example, print speed, drop volume per voxel, color maps, dry time needed after build completion, shrink or expansion size, adjustment factors, powder settling coefficients (e.g., to determine whether powder supports need to be included, and if so, how much support), minimum allowable layer thickness, etc." EX1008, [0032]. Based on Devos's disclosure of determining operating parameters including powder settling coefficients to determine whether and how much powder supports are needed, a POSITA would have been motivated to implement Devos's system to determine an operating parameter specifying whether and how much powder supports are needed (a support structure requirement) to fabricate an object with the proper support to prevent portions of the object from collapsing during fabrication. EX1003, ¶113.

POR, 37-38.

Claim 19 is Patentable Under Ground 2

- *Devos* does not determine claimed support structure requirement or print support structures.
- *Devos* instead discloses a powder-binding process.
  - EX1008, ¶ [0015]; *see also id.* at ¶¶ [0013]-[0014]; [0035].

[0015] The process is repeated with a new layer of powder being applied over the top of the previous layer in the build bin **102**. The next cross section of the desired product is then printed with adhesive or binder into the new powder layer. The adhesive also serves to bind the adjacent or successive layers of the desired product together. This process continues until the entire object is formed within the powder bed

POR, 38-39; PO Sur-Reply, 6.

Claim 19 is Patentable Under Ground 2

- POSITA would understand that the surrounding unbound powder supports part during printing—thus rigid printed support structures are unnecessary.
  - EX2013, ¶138 and EX2014, p. 327; *see also* EX2014, 325-327; EX1045, 13:3-17.

(EX2014 at p.327). A POSITA would understand that printing of rigid support structures is therefore not needed due to the fact that the loose powder surrounding the part provides the necessary support. Indeed, the same article explains th

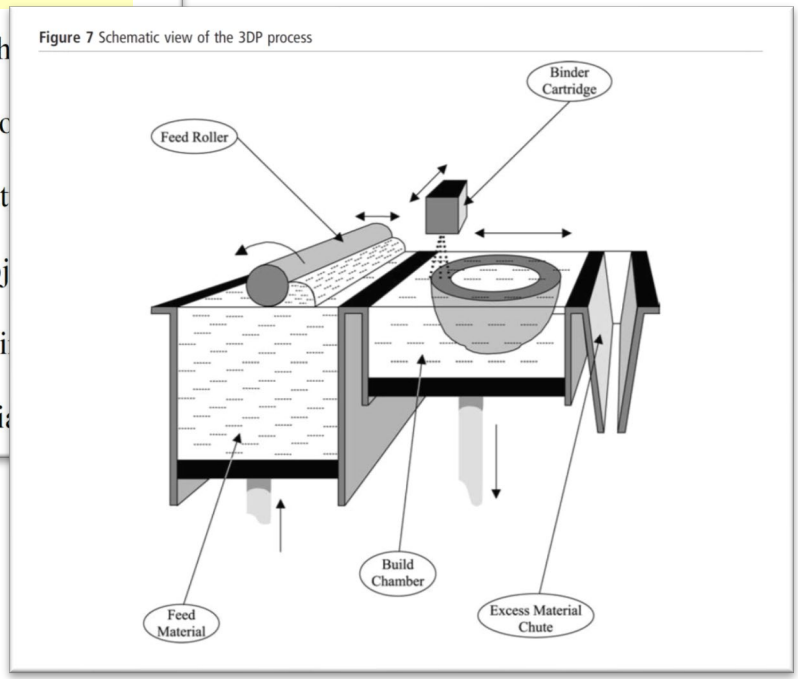
the "advantages" of Devos's type of additive manufacturing is that "[n]c

structures allow complex geometry to be created." (EX2014 at p.326). In at

to equate powder supports with the need to "prevent portions of the obj

collapsing during fabrication" (EX1003 ¶114) Hickner avoids saying "duri

dimensional printing." This is because the potential for "collapse" is associ



POR, 39-44; PO Sur-Reply, 6.

Stratasys, Ex. 2016

Claim 19 is Patentable Under Ground 2

- The powder settling coefficient by itself is not "a support structure requirement" and is insufficient to determine one.
  - EX2013, ¶133, 135.
- Any use of a powder settling coefficient with other information to compute a post-processing requirement would involve undisclosed expert level knowledge.
  - EX2013, ¶139.

when it is spread out and/or when droplets of liquid binder are jetted onto it. The powder settling coefficient by itself is insufficient to determine whether or not support structures are needed for thermal post-processing after three-dimensional printing is completed. A numerical powder settling coefficient is therefore not "a support structure requirement". Furthermore, any use of a powder settling coefficient together with other information, such as part geometry and the strength of the material, to compute a post-processing support structure requirement would

involve expert level knowledge that would be well beyond the knowledge base of a POSITA. In fact, I note that Dr. Hickner acknowledged Devos provides "no

PO Sur-Reply, 7.

Claim 19 is Patentable Under Ground 2

- *Devos* provides no algorithm, working example, or explanation of how a settling coefficient becomes a determination whether supports are needed, where they should go, or how much should be printed.
  - EX2013, ¶140 *see also id.* at ¶¶139-141; EX1008, ¶[0032].

> 140. In my opinion, nothing in Devos's cited disclosures explains (i) what a "support structure requirement" would be in Devos's system, (ii) how it would be derived from the memory-mechanism data, or (iii) how the printer would be configured or controlled to fabricate "support structures" based on that derived requirement. (Pet. at 49; EX1008 ¶[0032]; EX1003 ¶113).

PO Sur-Reply, 8.

Claim 19 is Patentable Under Ground 2

- Dr. Cormier confirmed that a powder settling coefficient would be only one input into a complex ***post-print*** sintering analysis requiring expertise beyond a POSITA to predict whether a part might sag.
  - EX1045, 80:4-81:12.

Q. How would a powder settling coefficient inform decisions about thermal postprocessing support requirements?

So as it's explained there, the powder settling coefficient determines how much powder particles will compact, if you will, during that printing process.

During the subsequent sintering process, the density of those particles can affect how strong the material is and whether or not it's therefore liable to sag or collapse.

And so you have to look at the shape of the part, and then you're looking at the powder settling coefficient and doing very complex simulations to -- simulations of how the material will behave during the sintering process after the 3D printing process to predict whether or not it will sag.

PO Sur-Reply, 9.

Claim 19 is Patentable Under Ground 2

- Petitioner's citations to outside publications about merely "***some*** powder bed processes" confirm the limitation is missing from *Devos* itself.
  - Reply, 10.

> Devos would never need 3D printed support structures. *Id.* Rather, the evidence here plainly confirms the traditional understanding that in some powder bed processes, "overhanging surfaces… are not directly possible" and "support structures are necessary to guarantee adequate process continuation." *Id.* (quoting corroborating publications at EX1043, 4 and EX1044, 1-2). Devos makes clear "***[t]he system***…determine[s]…how much support" is needed based on the settling coefficients and therefore constitutes a support structure operational parameter. *Id.*; EX1008, [0032]; EX1003, ¶¶113-115; EX2013, ¶139.

PO Sur-Reply, 7.

Claim 19 is Patentable Under Ground 2

- Petitioner's new citations to outside art cannot supply what its own expert admitted is missing from *Devos*.
  - EX2015, 121:2–121:10 *see also id.* at 121:11-122:3.

Q Can you identify, in Devos, where Devos provides technical details for how a POSITA could implement a support structure requirement based on a powder settling coefficient?

A So Devos discusses this issue of powder settling coefficient, for example, to determine whether powder supports need to be included, and if so, how much support. There's no technical detail in Devos as to how that's done. But at

PO Sur-Reply, 7.

Claim 19 is Patentable Under Ground 2

- Petitioner's enablement response (Reply at 10-11) misses the point.
- Any presumption of enablement attaches to what *Devos* ***actually discloses***, not to Petitioner's reconstruction of an undisclosed support-structure operational parameter.

> **[14, 15]** In the absence of such other supporting evidence to enable a skilled artisan to make the claimed invention, a standalone § 103 reference must enable the portions of its disclosure being relied upon. *See Ashland Oil, Inc. v. Delta Res-*

Raytheon Techs. Corp. v. Gen. Elec. Co., 993 F.3d 1374, 1381 (Fed. Cir. 2021)

PO Sur-Reply, 8.

Overview of Argument

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IV. Claim 19 is Patentable Under Ground 2

V. The Challenged Claims are Patentable under Ground 3A

VI. The Challenged Claims are Patentable under Grounds 1B/1D/1F/3B/3D/3F/3H (adding Jazayeri)

VII. Claim 17 is Patentable Under Grounds 1E/1F/3E/3F

VIII. Claim 5 is Patentable Under Grounds 1C/1D/3G/3H

The Challenged Claims are Patentable under Ground 3A

- Ground 3A relies on *Menchik* alone. Grounds 3B-3H combine *Menchik* with various references (addressed later):

Ground	Claims	Basis for Rejection
3A	1, 3-5, 7, 9-11, 19, 20	§102/103: Menchik
3B	1, 3-5, 7, 9-11, 20	§103: Menchik and Jazayeri

Ground	Claims	Basis for Rejection
3C	2, 8, 12, 16	§103: Menchik and Loughran
3D	2, 8, 12, 16	§103: Menchik, Jazayeri, and Loughran
3E	17	§103: Menchik and Dahlin
3F	17	§103: Menchik, Jazayeri, and Dahlin
3G	5	§103: Menchik and KISSlicer
3H	5	§103: Menchik, Jazayeri, and KISSlicer

The Challenged Claims are Patentable under Ground 3A – Claim 1 is Patentable

- Petitioner does not show the "client" or "request" of element 1[b].

receiving a request from a client over a network to fabricate an object on the three-dimensional printer, the three-dimensional printer coupled to a supply of a build material including a tag that stores at least one property of the build material;

Claim 1[b]

- *Menchik* expressly states that controller 105, even when partially external, provides "some or all of the printing system control capability."
  - EX1009, ¶[0024].
- That is a printer controller component, not the claimed "client."

may be partially external to 3D printer system **100**. For example, an external control or processing unit (e.g., a personal computer, workstation, computing platform, or other processing device) may provide some or all of the printing system control capability.

EX1009, ¶[0024]

POR 46-49; PO Sur-Reply, 9-11.

The Challenged Claims are Patentable under Ground 3A – Claim 1 is Patentable

- A "client" is a separate computing device that submits a job/request over a network.
- An internal "controller" executes that job and actuates motors, heaters, dispensers, and other subsystems.
  - EX2013, ¶148.

controller. (EX1001 at 5:40–46). In networked additive-manufacturing systems the "client" is typically a separate computing device that submits a job/request over a network, whereas an internal "controller" inside the 3D printer executes that job and directly actuates motors, heaters, dispensers, and other subsystems. A POSITA would understand that regardless of whether it is physically inside of or nearby the 3D printer, the machine controller is not a networked client device. Simply put, the 3D printer cannot operate without a controller. A POSITA would therefore clearly understand that the controller is functional part of the 3D printing system. If the

POR, 46-47.

The Challenged Claims are Patentable under Ground 3A – Claim 1 is Patentable

- Dr. Hickner admitted he did not analyze whether the '466 Patent's "controller" and "client" can be equated.
  - EX2015, 17:10-21.

A So the '466 patent gives various examples of controller and client throughout the text. I didn't analyze, in the -- just in the context of '466, whether or not controller and client can be equated in some way or not. Just looking at the '466, the text talks about controllers and clients. But I would have to analyze further whether those terms can be interchangeable or not, in the context of '466.

In my initial analysis, I didn't consider whether those terms can be equated or not, just looking at the '466.

PO Sur-Reply, 9-11.

The Challenged Claims are Patentable under Ground 3A – Claim 1 is Patentable

- Petitioner's theory for disclosure of a "request" fares no better, as *Menchik* provides print data, not a "request" to fabricate an object
  - EX1009, ¶[0025].

> **[0025]** In some embodiments, a printing file or other collection of print data may be prepared and/or provided and/or programmed, for example, by a computing platform connected to 3D printer system **100**. The printing file may be used to determine, for example, the order and configuration of deposition of building material via, for example, movement of and activation and/or non-activation of one or more nozzles **147** of printing head **145**, according to the 3D object to be built.

POR 48; PO Sur-Reply, 9-11.

The Challenged Claims are Patentable under Ground 3A – Claim 1 is Patentable

- Menchik also does not disclose the "client" of elements 1[e] and 1[f].
- Petitioner again relies on the same controller/client conflation.
  - Reply, 13.

C. Menchik Teaches Element 1[e]

PO admits that "Menchik's cited disclosures describe transmitting information from a cartridge memory mechanism/chip to the controller." POR, 49. As discussed above, Menchik teaches that the controller is a client that communicates with the printer over a wired or wireless network, and therefore Menchik teaches providing the information from the memory chip (data from the tag) to the client over the network. EX1009, [0027], [0047]-[0048]; EX1003, ¶¶133-134; EX1042, ¶25.

POR, 49; PO Sur-Reply, 11.

The Challenged Claims are Patentable under Ground 3A – Claim 1 is Patentable

- Petitioner also does not show other requirements of element 1[f]:

> receiving one or more operational parameters from the client selected for use in controlling operation of the three-dimensional printer when fabricating the object with the build material having the at least one property stored in the tag; and

Cl. 1[f]

- Petition relied on receiving a print file with *alleged* operational parameters:

> Based on these and other express teachings as discussed above in element 1[b], the printing apparatus 140 (three-dimensional printer) receives the printing file and the printing parameters, operation parameters, building parameters, material parameters, and supply parameters (collectively operational parameters) from the controller 105 in the computing device (client) over a network. EX1003, ¶137. Receiving a printing file (request) with operational parameters satisfies the scope of this limitation as advanced by Patent Owner in the litigation. *Id.*

POR 50-54; PO Sur-Reply, 11-12.

The Challenged Claims are Patentable under Ground 3A – Claim 1 is Patentable

- But *Menchik* discloses controller-side computation of "material parameters," not sending of operational parameters.
  - EX1009, ¶[0027].

> [0027] Controller **105** may receive data from one or more material supply sources, and control the supply of building material to printing apparatus **140**, for example, by controlling the extraction or flow of materials from the printing material sources, such as printing cartridges. For example, controller **105** may use software code **120** to process data related to the status of building material in one or more supply sources to compute material parameters for building material(s), material required to construct one or more objects, and supply parameters for materials in one or more cartridges. For example, material status data may indicate

POR 50-54; PO Sur-Reply, 11-12

The Challenged Claims are Patentable under Ground 3A – Claim 1 is Patentable

- *Menchik* likewise says the controller may ***compute*** "printing parameters," not that it sends them.
  - EX1009, ¶[0037].

> **[0037]** According to some embodiments, a memory chip reader **225** may be associated with cartridge housing **210**, to read data stored in memory chip **260**. A memory device

> reader such as memory chip reader **225** may be connected to controller **105**, and may transfer data to controller **105**, for example, using a cable connection. Controller **105** may use the data received, for example, data from memory chip reader **225**, data from load cell **230**, and other data, to compute printing parameters, including, for example, guide-lines for which cartridges to use, how many to use, if and when any replacements are necessary etc., as is described in detail below.

POR 50-54; PO Sur-Reply, 11-12.

The Challenged Claims are Patentable under Ground 3A – Claim 1 is Patentable

- Even if controller 105 is a "client" (it's not), there is no disclosure that any parameters are received from it.

> [0025] In some embodiments, a printing file or other collection of print data may be prepared and/or provided and/or programmed, for example, by a computing platform connected to 3D printer system **100**. The printing file may be used to determine, for example, the order and configuration of deposition of building material via, for example, movement of and activation and/or non-activation of one or more nozzles **147** of printing head **145**, according to the 3D object to be built.

EX1009, ¶[0025]

- There is no disclosure that printing file (alleged to contain parameters) is received from controller 105

> 158. In my opinion, for instance, Menchik discloses a separate device—"a computing platform connected to 3D printer system 100"—as providing a printing file which the system then uses to determine "the order and configuration of deposition of building material." EX1009, ¶[0025]. This separate device in Menchik is not the controller. Thus, the printing file is not sent or received from a

EX2013, ¶158

POR, 51-54; PO Sur-Reply, 11-12.

The Challenged Claims are Patentable under Ground 3A – Claim 1 is Patentable

- Reply's new assertion that a POSITA would have found it obvious that controller 105 would provide these parameters and instructions "as part of the printing file" is unsupported.
  - See *Reply*, 13-14.

- Paragraph [0025] of *Menchik* does not say the file includes chip-stored "optimal operation parameters" or controller-computed "material parameters" or "supply parameters."

[0025] In some embodiments, a printing file or other collection of print data may be prepared and/or provided and/or programmed, for example, by a computing platform connected to 3D printer system **100**. The printing file may be used to determine, for example, the order and configuration of deposition of building material via, for example, movement of and activation and/or non-activation of one or more nozzles **147** of printing head **145**, according to the 3D object to be built.

POR, 51-52; PO Sur-Reply, 11-12.

The Challenged Claims are Patentable under Ground 3A – Claim 19 is Patentable

- Petitioner does not show element 19[e] of Claim 19:

determining an operational parameter for configuring the three-dimensional printer for a fabrication process using the build material based upon at least one property of the build material in the data, the operational parameter including at least one of a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement;

Claim 19[e]

POR, 54-58; PO Sur-Reply, 13-15.

The Challenged Claims are Patentable under Ground 3A – Claim 19 is Patentable

- Petition's sole argument for element 19[e] (Pet. 71):

> **Element 19[e]**
>
> *Supra*, element 1[f] and claim 10. EX1003, ¶154.

- Institution Decision rightly found this lacking (Inst., 35–36):

> As Patent Owner points out, Petitioner's analysis of element 19e is solely based on element 1f and dependent claim 10, which collectively differ in scope and requirement from element 19e. Prelim. Resp. 48. The requirement in element 19e that the "operational parameter" is determined "based upon at least on property of the build material" is not required in element 1f or dependent claim 10.

POR, 54; PO Sur-Reply, 13-15.

The Challenged Claims are Patentable under Ground 3A – Claim 19 is Patentable

- Petitioner impermissibly expands its element-19[e] theory in reply—turning a single cross-reference into four pages of new analysis.
- The Board should not consider those untimely arguments.
  - *Wasica Fin. GmbH v. Cont'l Auto. Sys., Inc.*, 853 F.3d 1272, 1286 (Fed. Cir. 2017).

> It is of the utmost importance that petitioners in the IPR proceedings adhere to the requirement that the initial petition identify with particularity the evidence that supports the grounds for the challenge to each claim. . . . Unlike district court litigation—where parties have greater freedom to revise and develop their arguments over time and in response to newly discovered material—the expedited nature of IPRs bring with it an obligation for petitioners to make their case in their petition to institute.

PO Sur-Reply, 13-15.

The Challenged Claims are Patentable under Ground 3A – Claim 19 is Patentable

- Even if considered, a quantity of support material to be extracted is not a "support structure requirement."
  - EX2013, ¶133.

> requirement." (EX1003 ¶113). In my opinion, a POSITA would understand a "support structure requirement" as an operational parameter would specify whether/where supports should be generated and printed and with what settings,

PO Sur-Reply, 13-14.

The Challenged Claims are Patentable under Ground 3A – Claim 19 is Patentable

- Reply treats "optimum building parameters (e.g., for building or support)" as both a "property of the build material" and basis for the claimed support-structure requirement.
  - Reply, 16.

- If the "optimum building parameters" are already stored on the chip, *Menchik* is not "determining" them based on a property in the data; it is reading them.

> The Petition's analysis of claim 10 provides another example that satisfies element 19[e]. As discussed in the Petition and reiterated above, Menchik describes that each cartridge memory chip stores "information relating to the material" including "***optimum building parameters*** (e.g., for building ***or support***)." Pet., 59-60, 67-68; EX1009, [0035], [0043]. The optimum building parameters for support structures is a property of the build material stored in the memory chip and used to determine the parameters for support structures which is a support structure requirement. Pet., 67-68; EX1042, ¶31.

PO Sur-Reply, 14-15.

The Challenged Claims are Patentable under Ground 3A – Claim 19 is Patentable

- Petitioner also does not address the deficiency the Board identified in IPR2025-00585.
  - IPR2025-00585, Paper 11 at 29-30

> dimensional object." *Id.* ¶¶ 47, 48. The record before us therefore lacks any teaching or suggestion that "the amount of modeling material, support liquid, or combination of modeling and support materials required for printing a given three-dimensional object" (which Petitioner contends are

> operational parameters) are determined "based upon the data [that includes at least one property of the building material]" as claim element 1b requires.

POR 57-58; PO Sur-Reply, 14-15.

The Challenged Claims are Patentable under Ground 3A – Claim 10 is Patentable

- Menchik also does not disclose claim 10:

> **10**. The method of claim **1**, wherein the one or more operational parameters includes at least one of an extruder temperature, a feed rate, a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement.

POR, 60-63; PO Sur-Reply, 16-17.

The Challenged Claims are Patentable under Ground 3A – Claim 10 is Patentable

- *Menchik*'s "recommended jetting temperature" is not claim 10's "extruder temperature."
- The Reply's assertion that the two are "analogous terms in ***different*** printing techniques" concedes this point.
  - Reply, 19.

> [0035], [0043]. Both Menchik's "recommended jetting temperature" and the claim's "extruder temperature" are temperatures for dispensing material and are therefore analogous terms in different printing techniques. EX1042, ¶34. The optimum

POR, 61; PO Sur-Reply, 16.

The Challenged Claims are Patentable under Ground 3A – Claim 10 is Patentable

- The Reply's support-structure theory for claim 10 fails for the same reasons as claim 19.
- *Menchik*'s "optimum building parameters (e.g., for building or support)" are chip-stored information ***sent to*** controller.
- Its computed "amount of support liquid" or support materials required is a ***quantity*** computation
- Neither is shown to be claim 10's "support structure requirement."
  - EX1009, ¶¶[0035], [0048].

[0035] According to some embodiments a memory device such as a memory chip **260** or other suitable data storage device may be associated with cartridge **250**. Memory chip **260** may, for example, store and/or record information relating to the material stored within cartridge **250**, for example, the type of building material in the cartridge bag **300**, the material's color, manufacturing date, optimal operation parameters (e.g., recommended jetting temperature), optimum building parameters (e.g., for building or support), and material parameters (e.g., viscosity and surface tension at the recommended temperature etc.) etc. Other suitable data may be stored. Building material information may include, for example, material density, material mass per volume, and other suitable data from which material status may be computed.

[0048] At block **615** the printer controller may compute, for example, the amount of modeling material, support liquid, or combination of modeling and support materials required for printing a given three-dimensional object. The printer controller may also compute the expected order and quantity of uptake and deposition of each type of material into the printing apparatus, for the printing or construction of a given object.

POR, 60-63; PO Sur-Reply, 16-17.

Overview of Argument

I. Overview of the '466 Patent

II. Overview of the Prior Art

III. The Challenged Claims are Patentable Under Ground 1A

IV. Claim 19 is Patentable Under Ground 2

V. The Challenged Claims are Patentable under Ground 3A

VI. The Challenged Claims are Patentable under Grounds 1B/1D/1F/3B/3D/3F/3H (adding Jazayeri)

VII. Claim 17 is Patentable Under Grounds 1E/1F/3E/3F

VIII. Claim 5 is Patentable Under Grounds 1C/1D/3G/3H

The Challenged Claims are Patentable under Grounds 1B/1D/1F/3B/3D/3F/3H (adding Jazayeri)

- Grounds 1B/1D/1F/3B/3D/3F/3H (adding Jazayeri) do not render the challenged claims unpatentable

Ground	Claims	Basis for Rejection
1A	1-5, 7-13, 16, 18, 20	§103: Loughran and Dubois
1B	1-5, 7-13, 16, 18, 20	§103: Loughran, Dubois, and Jazayeri
1C	5	§103: Loughran, Dubois, and KISSlicer
1D	5	§103: Loughran, Dubois, Jazayer, and KISSlicer
1E	17	§103: Loughran, Dubois, Menchik, and Dahlin
1F	17	§103: Loughran, Dubois, Jazayer, Menchik, and Dahlin
2	19	§103: Devos
3A	1, 3-5, 7, 9-11, 19, 20	§102/103: Menchik
3B	1, 3-5, 7, 9-11, 20	§103: Menchik and Jazayeri

Ground	Claims	Basis for Rejection
3C	2, 8, 12, 16	§103: Menchik and Loughran
3D	2, 8, 12, 16	§103: Menchik, Jazayeri, and Loughran
3E	17	§103: Menchik and Dahlin
3F	17	§103: Menchik, Jazayeri, and Dahlin
3G	5	§103: Menchik and KISSlicer
3H	5	§103: Menchik, Jazayeri, and KISSlicer

POR, 63-65;

Stratasys, Ex. 2016

The Challenged Claims are Patentable under Grounds 1B/1D/1F/3B/3D/3F/3H (adding Jazayeri)

- *Jazayeri* is not analogous art.
- The '466 Patent concerns a networked 3D-printing environment in which a printer reads tag data from build-material supplies and uses build-material information/properties to determine fabrication parameters.
  - EX1001, 1:23-33; *see also id.* at 20:61-22:33.

There remains a need for methods and systems for the automatic detection and acquiring of three-dimensional printer build material characteristics.

SUMMARY

A supply of build material such as a spool or cartridge is instrumented with a data tag that includes information about the build material. A three-dimensional printer can read the information from the tag and determine how to use the build material during fabrication of a three-dimensional object.

The Challenged Claims are Patentable under Grounds 1B/1D/1F/3B/3D/3F/3H (adding Jazayeri)

- *Jazayeri* addresses "conventional printers and printing paradigms"
  - EX1010, ¶ [0007]; *see also id. at* ¶¶[0002]-[0006], [0018]-[0028], [0036], [0070]-[0072].

> **[0007]** In short, conventional printers and printing paradigms often provide a fragmented, expensive, resource-intensive, potentially unpredictable user experience which is suboptimal at best and unworkable at worst for many users.

The Challenged Claims are Patentable under Grounds 1B/1D/1F/3B/3D/3F/3H (adding Jazayeri)

- Defining the field as generic "networked printing" would sweep in virtually any networked printing reference, whether or not it addresses tagged build materials, three-dimensional fabrication, or material-dependent process control.
  - See EX2013, ¶110.

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

The Challenged Claims are Patentable under Grounds 3A-3D

- There is no motivation to combine *Jazayeri* with the asserted 3D-printing references.
- Petitioner already asserts that the 3D-printing references disclose direct networked job submission without *Jazayeri*'s cloud-print workflow.
  - *See, e.g.*, Reply, 1-2 (*Loughran-Dubois*), 11-12 (*Menchik*).

> system 104. EX1004, [0027], [0012], [0020], FIG. 1. Loughran is also clear that "material information server 108 sends [material] information back to the first SFF system 102" and "CAD software 610" executing on SFF system 102 "***generates a SFF fabrication job*** for fabrication from a specific material ***based on the information regarding that material*** which has been received." EX1004, [0027]-[0028], [0055], [0041]-[0042], [0050]-[0051]. The SFF system then "sends the SFF fabrication job to the…SFF system 104." *Id.*, [0055]; EX1042, ¶7.

Reply, 1

POR, 30-33, PO Sur-Reply, 17-19

Stratasys, Ex. 2016

The Challenged Claims are Patentable under Ground 3B (adding Jazayeri)

- Ground 3B does not cure Ground 3A's defects regarding element 1[b].

Claim Element	Language
1[p]	A method, comprising:
1[a]	providing a three-dimensional printer that includes a tag sensor;
1[b]	receiving a request from a client over a network to fabricate an object on the three-dimensional printer,
1[c]	the three-dimensional printer coupled to a supply of a build material including a tag that stores at least one property of the build material;
1[d]	reading data from the tag with the tag sensor;
1[e]	providing the data from the tag to the client over the network, the data including at least one property of the build material;
1[f]	receiving one or more operational parameters from the client selected for use in controlling operation of the three-dimensional printer when fabricating the object with the build material having the at least one property stored in the tag; and
1[g]	fabricating the object with the build material according to the one or more operational parameters.

POR, 64; PO Sur-Reply, 20-21.

The Challenged Claims are Patentable under Ground 3B (adding Jazayeri)

- *Jazayeri*'s "print request" is received at a print server, not by a three-dimensional printer.
  - EX1010, Abstract; *see also id.* at ¶¶[0008]-[0010], [0036], [0066]; EX2013, ¶¶184-185.

> A print server may include an application manager configured to receive a print request over a network from an application executing on a device, and configured to provide, over the network, a print dialog to a user of the application, the print dialog configured to provide for a selection of at least one printer associated with a user account of the user and thereafter receive a selected printer from the selection. A format converter may be configured to receive a print job designating the selected printer, the print job including print data and print characteristics expressed in a first format, and configured to convert the print job from the first format into a printer-specific format associated with the selected printer. A print job router may be configured to route the print job over the network from the print server to a print client associated with the selected printer, for printing by the selected printer, using the printer-specific format.

POR, 64; PO Sur-Reply 20-21.

Overview of Argument

I. Overview of the '466 Patent

II. Overview of the Prior Art

III. The Challenged Claims are Patentable Under Ground 1A

IV. Claim 19 is Patentable Under Ground 2

V. The Challenged Claims are Patentable under Ground 3A

VI. The Challenged Claims are Patentable under Grounds 1B/1D/1F/3B/3D/3F/3H (adding Jazayeri)

VII. Claim 17 is Patentable Under Grounds 1E/1F/3E/3F

VIII. Claim 5 is Patentable Under Grounds 1C/1D/3G/3H

Claim 17 is Patentable Under Grounds 1E/1F/3E/3F

- Petitioner has not shown Claim 17 to be unpatentable under Grounds 1E/1F/3E/3F:

receiving one or more operational parameters from the client selected for use in controlling operation of the three-dimensional printer when fabricating the object with the build material having the at least one property stored in the tag; and

Claim 1[f]

17. The method of claim **1**, further comprising performing a diagnostic test to determine whether the one or more operational parameters is suitable for the three-dimensional printer.

Claim 17

POR, 65-70; PO Sur-Reply, 21-25..

Claim 17 is Patentable Under Grounds 1E/1F/3E/3F

- Petitioner's theory:

> PO's expert acknowledges that "a POSITA would understand a 'support structure requirement' as an operational parameter would specify whether/where supports should be generated and printed and with what settings." EX2013, ¶133. In each of the proposed combinations, the material type information is read from a tag affixed to the material supply. EX1042, ¶42. The amount of material required (such as the amount of material ejected per layer) is "a function of the characteristics of the materials" used. EX1005, [0081]-[0090], [0069]-[0072]. In Menchik, the amount of support material required (indicating how much material to extract) is an operational parameter that controls printer operation during fabrication because Menchik chooses whether and when to use a cartridge based on the amount required. EX1009, [0007], [0027].

Reply, 25.

Claim 17 is Patentable Under Grounds 1E/1F/3E/3F

- As discussed for Claim 19, an "amount of material required" does not "control[] operation of the three-dimensional printer" during fabrication, and therefore cannot an "operational parameter" whose "suitab[ility]" claim 17 requires the diagnostic test to assess:

> Petitioner's identification of "the amount of material required" as the relevant "operational parameter" is thus a categorical mismatch with claim 1's client-selected, printer-operation-controlling "operational parameters." (*Id.*). An "amount of material required" is a consumables-quantity estimate used for supply management; it does not "control[] operation of the three-dimensional printer" during fabrication, and therefore cannot be the claim-1 "operational parameter" whose "suitab[ility]" claim 17 requires the diagnostic test to assess.

EX2013, ¶ 193

POR, 67.

Claim 17 is Patentable Under Grounds 1E/1F/3E/3F

- The board's reasoning in IPR2025-00585 applies.
  - IPR2025-00585, Paper 11 at 15; *see also id.* at 16-18.
- The same structural problem remains because Petitioner still tries to satisfy both steps with the same supply-sufficiency computation.

> Contrary to the interpretation that the operational parameter determination in claim element 1b encompasses the diagnostic testing in claim element 1c, the plain language of claim 1 requires two distinctive steps: determining an operational parameter in 1b; followed by performing a diagnostic test in 1c. Consistent with the specification, the plain language of the claim also requires the operational parameter to be determined based on "at least one property of the build material." *See id.* at 15:12–17 (describing a controller that receives build material property data "to determine at least one operational parameter for the three-dimensional printer 306 based on at least one characteristic of the build material 312 for the fabrication of an object"). The '464 patent provides an embodiment that a controller "may

POR, 68; PO Sur-Reply, 24-25.

Overview of Argument

I. Overview of the ‘466 Patent

II. Overview of the Prior Art

III. The Challenged Claims are Patentable Under Ground 1A

IV. Claim 19 is Patentable Under Ground 2

V. The Challenged Claims are Patentable under Ground 3A

VI. The Challenged Claims are Patentable under Grounds 1B/1D/1F/3B/3D/3F/3H (adding Jazayeri)

VII. Claim 17 is Patentable Under Grounds 1E/1F/3E/3F

VIII. Claim 5 is Patentable Under Grounds 1C/1D/3G/3H

Claim 5 is Patentable Under Grounds 1C/1D/3G/3H

- Grounds 1C/1D/3G/3H fail to render dependent claim 5 unpatentable.

1C	5	§103: Loughran, Dubois, and KISSlicer
1D	5	§103: Loughran, Dubois, Jazayer, and KISSlicer

3G	5	§103: Menchik and KISSlicer
3H	5	§103: Menchik, Jazayeri, and KISSlicer

POR, 70-73; PO Sur-Reply, 25-27..

Claim 5 is Patentable Under Grounds 1C/1D/3G/3H

- The claim-5 selection occurs in a two-tag, networked client/printer workflow due to its dependence on claims 3 and 4.
  - EX2013, ¶¶202-205.

3. The method of claim **1**, wherein the three-dimensional printer is coupled to a first supply of a first build material and a second supply of a second build material different from the first build material, the first supply including a first tag that stores at least one property of the first build material, and the second supply including a second tag that stores at least one property of the second build material.

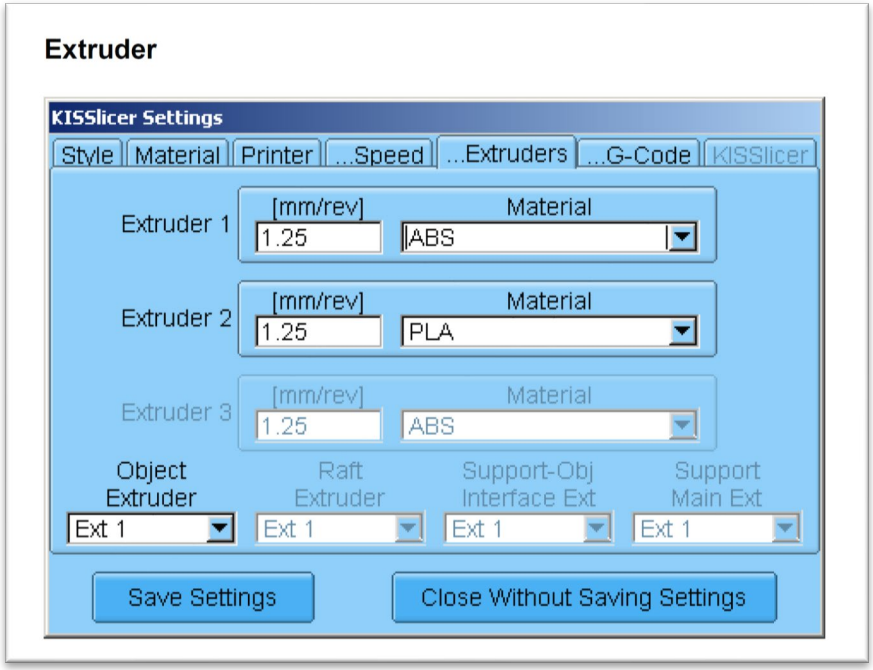
4. The method of claim **3**, further comprising providing data from the first tag and the second tag to the client over the network, the data including at least one property of the first build material and the second build material.

5. The method of claim **4**, further comprising receiving a selection of one of the first build material and the second build material from the client for use in fabricating the object using the three-dimensional printer.

POR, 70-71, PO Sur-Reply, 25.

Claim 5 is Patentable Under Grounds 1C/1D/3G/3H

- *KISSlicer*'s local slicer assignments are not the claimed "receiving a selection from the client."
- *KISSlicer* instead describes local slicer settings used when generating a print file.
  - EX1018, 5; *see also id.* at 3-4, 9-10; Pet. at 81.



POR, 72; PO Sur-Reply, 25-26.

Claim 5 is Patentable Under Grounds 1C/1D/3G/3H

- Dr. Hickner admits *KISSlicer* does not receive tag data or discuss tags at all.
- EX2015, 109:7-19.

Q And KISSlicer doesn't say anything about being able to automatically receive information from a data tag about a material and have that update in the software, right?

A So KISSlicer talks about these default materials, and it also says, at the bottom of page 3, "In case you already have a working temperature profile for your material, update it accordingly."

That update, where you can adjust the parameters, it doesn't say whether that update is automatic. As we said, it doesn't talk about the tag. But it does talk about the ability to update

POR, 72, PO Sur-Reply, 26.

Claim 5 is Patentable Under Grounds 1C/1D/3G/3H

- General statements that 3D models may be sliced, or that slicer software may generate path instructions from STL files, do not teach the missing step of the printer receiving from the client a selection between two tagged build-material supplies.
  - EX2013, ¶ 205, *see also id.* at ¶¶ 203-204, 207.

a selection between tagged supplies is returned to the printer over a network. In fact, Dr. Hickner admitted during his deposition that KISSlicer provides default materials and allows manual parameter updates (e.g., temperature), but it does not ingest tag data from a material supply. (EX2015, 108:11–22; 108:12 – 110:18). Dr. Hickner further admitted, when speaking about his own experiences, that "in general . . . within [a] slicer program . . . there's information about the build material in that slicer program. And that's transmitted over the network to the printer," and that "it's entirely possible to transmit material – or, sorry, transmit a data about a build material over a network in the absence of that tag." (EX2015, 25:17–26:11). Thus, even if KISSlicer were considered, it would not provide the claimed tag to client to selection workflow.

POR, 72; PO Sur-Reply, 26-27.

Claim 5 is Patentable Under Grounds 1C/1D/3G/3H

- Considering the combinations "as a whole" does not cure the missing step.
- As discussed:
  - *Loughran* and *Menchik* still do not disclose the printer receiving from the client a selection of one of two tagged build-material supplies.
  - *KISSlicer* adds only local slicer-side extruder/material assignments when preparing a print file.
  - *Jazayeri* only adds a print-server framework.
- The printer still does not receive from the client a selection between two tagged build-material supplies.

POR, 24-25; PO Sur-Reply, 27.