

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: Douglas et al.
U.S. Patent No.: 10,569,466 Attorney Docket No.: 56224-0010IP1
Issue Date: February 25, 2020
App. Serial No.: 16/153,224
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Title: TAGGED BUILD MATERIAL FOR THREE-
DIMENSIONAL PRINTING

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**PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT
NO. 10,569,466 PURSUANT TO 35 U.S.C. §§ 311-319, 37 C.F.R. § 42**

TABLE OF CONTENTS

I.	REQUIREMENTS FOR IPR.....	1
A.	Standing.....	1
B.	Challenge and Relief Requested	1
II.	THE '466 PATENT	3
A.	Brief Description.....	3
B.	Summary of the Prosecution History	5
C.	Level of Ordinary Skill	6
D.	Claim Construction	6
III.	THE CHALLENGED CLAIMS ARE UNPATENTABLE	7
A.	GROUND 1A—Claims 1-5, 7-13, 16, 18, and 20 are obvious over Loughran and Dubois	7
1.	Loughran	7
2.	Dubois	9
3.	Loughran-Dubois Combination	10
4.	Claim Element Analysis	13
B.	GROUND 1B—Claims 1-5, 7-13, 16, 18, and 20 are obvious over Loughran, Dubois, and Jazayeri.....	33
C.	FOUNDATIONS 1C/1D—Claim 5 is obvious over Loughran, Dubois, and KISSlicer (1C) and Loughran, Dubois, Jazayeri, and KISSlicer (1D)	36
D.	FOUNDATIONS 1E/1F—Claim 17 is obvious over Loughran, Dubois, Menchik, and Dahlin (1E), and Loughran, Dubois, Jazayeri, Menchik, and Dahlin (1F)	39
E.	GROUND 2—Claim 19 is obvious over Devos.....	42
F.	GROUND 3A—Claims 1, 3-5, 7, 9-11, 19, and 20 are anticipated or rendered obvious by Menchik.....	52
1.	Claim Element Analysis	52
G.	GROUND 3B—Claims 1, 3-5, 7, 9-11, and 20 are obvious over Menchik and Jazayeri	71
H.	FOUNDATIONS 3C/3D—Claims 2, 8, 12, and 16 are obvious over Menchik and Loughran (3C) and Menchik, Jazayeri, and Loughran (3D).....	74

1. Claim Element Analysis	74
I. GROUNDS 3E/3F—Claim 17 is obvious over Menchik and Dahlin (3E) and Menchik, Jazayeri, and Dahlin (3F)	78
J. GROUNDS 3G/3H—Claim 5 is obvious Menchik and KISSlicer (3G) and Menchik, Jazayeri, and KISSlicer (3H)	80
IV. DISCRETIONARY DENIAL IS NOT JUSTIFIED	82
A. The Petition’s New Prior Art and Errors Made During Prosecution Warrant Institution—35 U.S.C. § 325(d)	82
B. The <i>Fintiv</i> Factors Weigh in Favor of Institution—35 U.S.C. § 314(a).....	83
V. PAYMENT OF FEES – 37 C.F.R. §42.103	85
VI. MANDATORY NOTICES UNDER 37 C.F.R § 42.8(a)(1)	85
A. Real Party-In-Interest Under 37 C.F.R. § 42.8(b)(1).....	85
B. Related Matters Under 37 C.F.R. § 42.8(b)(2)	85
C. Lead And Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3)	86
D. Service Information.....	86

EXHIBITS

EX1001	U.S. Patent No. 10,569,466 to Douglas et al. (“the ’466 patent”)
EX1002	Excerpts from the Prosecution History of the ’466 patent
EX1003	Declaration of Dr. Michael A. Hickner
EX1004	U.S. Patent Application Publication No. 2006/0091199 to Loughran (“Loughran”)
EX1005	U.S. Patent Application Publication No. 2008/0192074 to Dubois et al. (“Dubois”)
EX1006	U.S. Patent Application Publication No. 2010/0191360 to Napadensky et al. (“Napadensky”)
EX1007	Kaur et al., RFID Technology Principles, Advantages, Limitations & Its Applications, International Journal of Computer and Electrical Engineering, Vol. 3, No. 1, February 2011 (“Kaur”)
EX1008	U.S. Patent Application Publication No. 2007/0026102 to Devos et al. (“Devos”)
EX1009	U.S. Patent Application Publication No. 2006/0127153 to Menchik et al.
EX1010	U.S. Patent Application Publication No. 2011/0299110 to Jazayeri et al (“Jazayeri”)
EX1011	U.S. Patent No. 6,022,207 to Dahlin et al. (“Dahlin”)
EX1012	U.S. Patent Application Publication No. 2007/0077323 to Stonesmith et al.
EX1013	U.S. Patent Application Publication No. 2013/0075954 to Gregory, II et al.

EX1014	U.S. Patent Application Publication No. 2011/0223349 to Scott
EX1015	U.S. Patent Application Publication No. 2002/0171703 to Phillips et al.
EX1016	U.S. Patent Application Publication No. 2010/0192806 to Heugel et al.
EX1017	Declaration of Jonathan Dummer
EX1018	KISSlicer Quick-Start Guide (2012), <i>available at</i> https://web.archive.org/web/20121224171520/http://kisslicer.com/files/KISSlicerQuickStart.pdf#expand (“KISSlicer”)
EX1019	Stipulation sent by Petitioner’s counsel to Patent Owner’s counsel
EX1020	Docket Control Order (Document 34), <i>Stratasys, Inc. v. Shenzhen Tuozhu Technology Co. Ltd. et al.</i> , 2-24-cv-00644 (EDTX)
EX1021	Defendant’s Motion to Dismiss for Failure to Join Indispensable Party (Document 38), <i>Stratasys, Inc. v. Shenzhen Tuozhu Technology Co., Ltd. et al.</i> , 2:24-cv-00644-JRG (EDTX)
EX1022-1024	Reserved
EX1025	U.S. District Court, Eastern District of Texas [Live] Calendar Events Set for 6/1/2026-7/1/2026

LISTING OF CHALLENGED CLAIMS

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.
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.

Claim Element	Language
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.

Claim Element	Language
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.
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.

Claim Element	Language
20	The method of claim 1, wherein the client includes a computing device.

Petitioner Shenzhen Tuozhu Technology Co., Ltd. petitions for *Inter Partes* Review (“IPR”) of claims 1-5, 7-13, 16-20 (“the Challenged Claims”) of U.S. Patent No. 10,569,466 (“the ’466 patent”).

I. REQUIREMENTS FOR IPR

A. Standing

Petitioner certifies that the ’466 patent is available for IPR, and Petitioner is not barred or estopped from requesting IPR.

B. Challenge and Relief Requested

Petitioner requests IPR of the Challenged Claims on the grounds below. Dr. Hickner provides supporting explanations in an expert declaration cited throughout this Petition. EX1003, ¶¶28-179.

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

Even if the '466 patent was entitled to its earliest alleged priority date (October 29, 2012; “Critical Date”), which it is not, each of the references in Grounds 1A-3H was published long before the Critical Date:

Reference	Date	Prior Art At Least Under
Loughran (EX1004)	5/4/2006 (published)	§102(b)
Dubois (EX1005)	8/14/2008 (published)	§102(b)
Devos (EX1008)	2/1/2007 (published)	§102(b)
Menchik (EX1009)	6/15/2006 (published)	§102(b)
Jazayeri (EX1010)	12/8/2011 (published)	§102(a)
Dahlin (EX1011)	2/8/2000 (issued)	§102(b)
KISSlicer (EX1018)	2/15/2012 (published)	§102(a)

This Petition is accompanied by testimony evidence confirming that the KISSlicer Quick-Start Guide (“KISSlicer”) was published and made publicly accessible to interested persons in this field in February 2012—prior to the filing date of the '466 patent. EX1017, 1-2.

II. THE '466 PATENT

A. Brief Description

The '466 patent describes “methods and systems for the automatic detection and acquiring of three-dimensional printer build material characteristics.”

EX1001, 1:23-25; EX1003, ¶¶26-27. A “supply of build material such as a spool or cartridge is instrumented with a data tag that includes information about the build material,” and 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.” EX1001, 1:29-33.

FIG. 3 depicts a three-dimensional printer system 300 that includes a three-dimensional printer 306 and a supply 302 of build material 312:

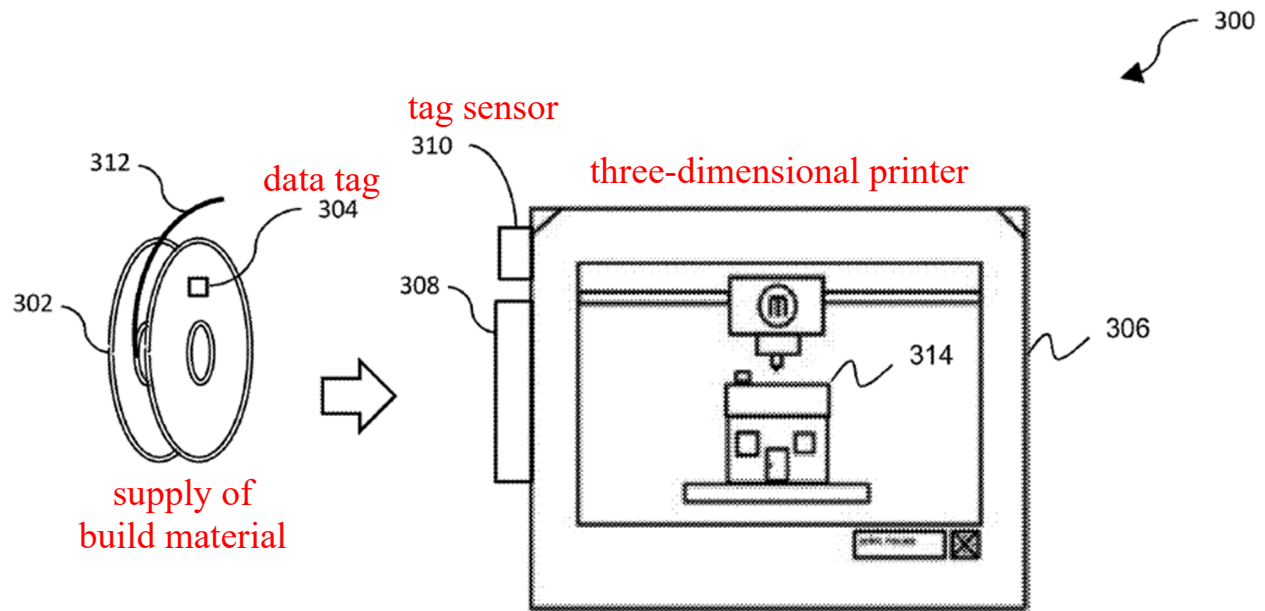


Fig. 3

EX1001, FIG. 3¹, 13:65-67. “The supply 302 may include a data tag 304 that stores data providing information on characteristics of the build material 312,” and this tag 304 “may be automatically read by a tag sensor 310 on the three-dimensional printer 306.” EX1001, 14:30-15:10. “Once the supply 302 has been coupled to the coupling 308 and the tag sensor 310 has read the data tag 304 data, the data may be transmitted to the controller... to determine at least one operational parameter for the three-dimensional printer 306 based on at least one

¹ Annotations and color added to figures unless otherwise noted.

characteristic of the build material 312 for the fabrication of an object 314.”

EX1001, 15:11-17.

B. Summary of the Prosecution History

The examination of the '466 patent was short—including only a single office action that raised a §103 rejection based on US8,286,236 (Jung) in view of US7,520,740 (Wahlstrom). EX1002, 116-124. In a response, the applicant amended independent claim 18 (now issued claim 1) to further clarify “the one or more operational parameters” for use in controlling operation of the printer was different from Wahlstrom’s teaching for sounding an alarm. EX1002, 153-161. EX1002, 153-161. The applicant also amended independent claim 37 (now issued claim 19) to include “controlling operation of the three-dimensional printer with the controller according to the operational parameter” and argued that “[i]ndependent claim 37 is believed to be patentable over the cited art for similar reasons.” *Id.*

A few months later, the examiner allowed the claims and provided reasons for allowance that merely copied the language of now-issued claim 1 without any comment or citation to a specific publication. EX1002, 171-177, 200-203. Also, the language of issued claim 19 (which is different than that of claim 1) was never mentioned in the reasons of allowance. *Id.*

As demonstrated below, the examination focused on Jung and Wahlstrom,

but far more pertinent publications were never cited and certainly never mentioned in any office action or remarks. Under these circumstances, review of the '466 patent is proper and just.

C. Level of Ordinary Skill

A person of ordinary skill in the art at the time of the '466 patent ("POSITA") would have had (1) at least a bachelor's degree in Mechanical Engineering, Computer Engineering, Chemical Engineering, Materials Science, or a related field, and (2) at least two years of research or industry experience in 3D printing or materials used for 3D printing. EX1003, ¶20. Additional experience could substitute for a formal degree or formal training (and vice versa). *Id.*

D. Claim Construction

All claim terms should be construed according to the *Phillips* standard. *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005); 37 C.F.R. § 42.100. Given the noticeable overlap between the preferred embodiment of the '466 patent and the prior art/predictable combinations articulated in Grounds 1A-3H, Petitioner submits that no claim terms require a formal construction for purposes of evaluating the prior art and resolving issues this proceeding. *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011); *Google Inc. v. Intellectual Ventures II LLC*, 701 Fed. Appx. 946, 956 (Fed. Cir. 2017).

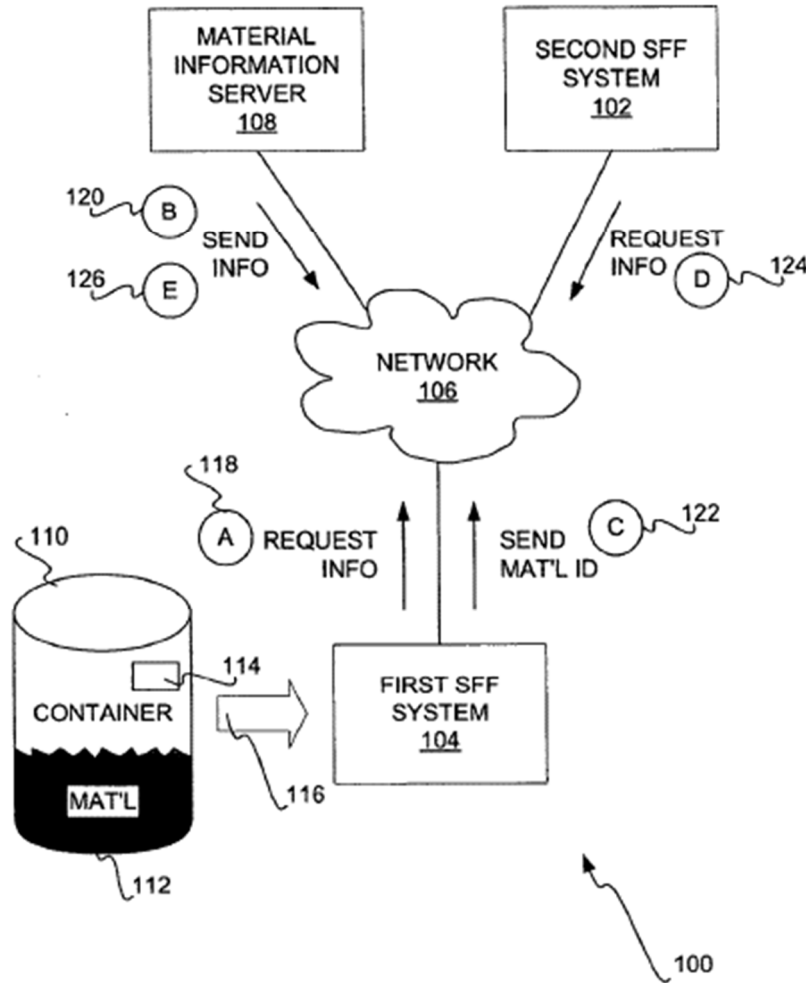
III. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. GROUND 1A—Claims 1-5, 7-13, 16, 18, and 20 are obvious over Loughran and Dubois

1. Loughran

Loughran describes “a solid freeform fabrication (SFF) system.” EX1004, Abstract, [0001]; EX1003, ¶¶29-31. Loughran’s FIG. 1 shows a diagram of a system 100 including a SFF system 104 that fabricates SFF jobs received from client system 102:

FIG 1



EX1004, FIG. 1, [0005], [0012]-[0013], [0044], [0049]-[0050]

“SFF system 104 receives the material identifier from the tag 114 of the material container 110.” EX1004, [0033], Abstract, [0047]. After the SFF system 104 reads the material identifier from the tag (EX1004, [0021], [0033]), the SFF system 104 sends “the material identifier for the material 112 to the [client] system 102, as indicated by the letter C 122” shown in FIG. 1, and the client system 102

“may receive the unique material identifier of the material 112 from the second SFF system 104.” EX1004, [0028], [0038]. Loughran’s client system 102 “parses the information regarding the materials for using it in SFF fabrication job generation.” EX1004, [0043].

Client system 102 executes “CAD software 610” to “generate[] a SFF fabrication job for fabrication from a specific material based on the information regarding that material which has been received. The CAD software 610 then sends the SFF fabrication job to the second SFF system 104 over the network 106 via the communication mechanism 604 of the [client] system 102.” EX1004, [0055], [0052], [0049]. The SFF system 104 employs “the information regarding the material 112 when fabricating physical objects from the material 112 in accordance with SFF fabrication jobs received from the [client] system 102.” EX1004, [0023].

2. Dubois

Dubois describes a method for printing “three-dimensional multi-material components” in successive layers to form a 3D-printed object. EX1005, [0001], [0021], [0055]-[0059]; EX1003, ¶¶32-34. The design process includes “establishing a set of printing parameters as a function of the nature of the materials deposited and the deposition conditions thereof for each print layer and for each discrete spatial trajectory.” EX1005, [0027], [0057]-[0059], [0107]-

[0108], [0148], [0150], [0154], [0196], cl. 79. The printing parameters include parameters concerning the state or characteristics of the materials and are used to control the dynamic production process. EX1005, [0056], [0072], [0128]. Dubois suggests the conventional practice in which these printing parameters (including the state or characteristics of the material) should be communicated to the 3D printer as part of the CAD information/print job from the CAD client device. EX1005, [0155]; [0170]. In doing so, Dubois teaches that, during each fabrication job at the 3D printer, the printer can monitor/control those parameters “so that said given values of printing parameters are satisfied.” EX1005, [0128].

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.*

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 produced... depends on all the related parameters which are representative of the nature of the [materials] used, the properties of the printer and the computer-aided design,” and Dubois further cautions that “[c]omputer-aided design which does not allow for the properties of the device and the properties of the materials does not allow optimum definition of the patterns to be printed.” EX1005, [0016]-[0017], [0005]-[0009]. Dubois thus suggests an improved technique that can provide “micrometre precision in production” and “high-definition structures” during 3D 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.

Second, a POSITA would have been motivated to apply Dubois's suggestions to Loughran's SFF fabrication job so that various functions of the SFF printer 104 are optimally utilized for each individual fabrication job. EX1003, ¶47. Indeed, Dubois notes that "it is important to control the nature of the materials in the printer to provide materials having the properties required for printing and to use the various functions of the printer optimally." EX1005, [0011]. 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 optimal use of the various functions of the printer based on the nature of the materials in the printer. EX1003, ¶47.

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],

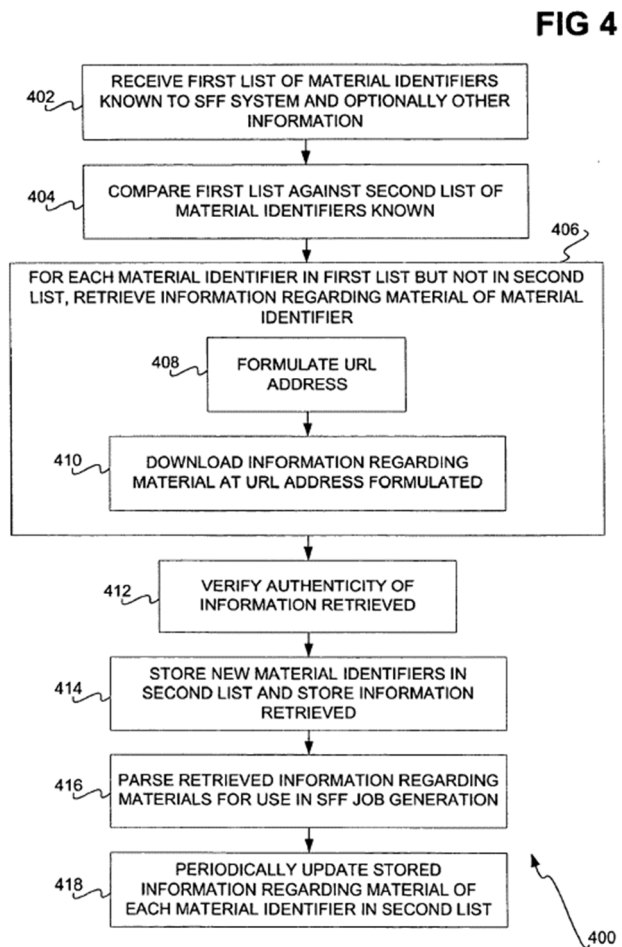
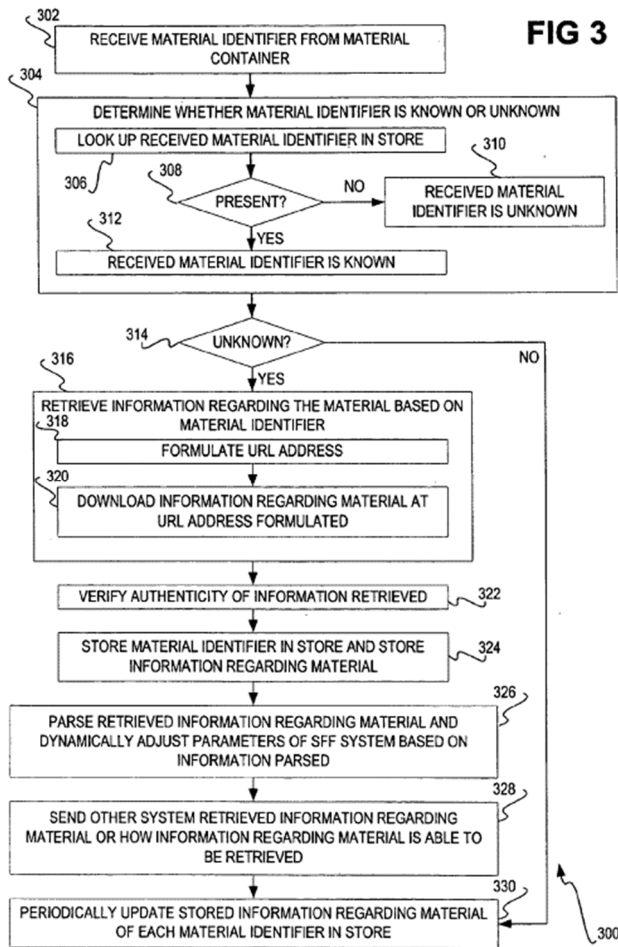
[0059]; EX1001, 1:66-2:3, 3:20-25. In this context, a POSITA was not an automaton and instead would have possessed ample skill to successfully implement the combination as described above and thus would have reasonably expected success achieving the combination. EX1003, ¶48.

4. Claim Element Analysis

(a) Claim 1

Element 1[p]

Loughran's FIGS. 3 and 4 each show "a method performable by an SFF system":

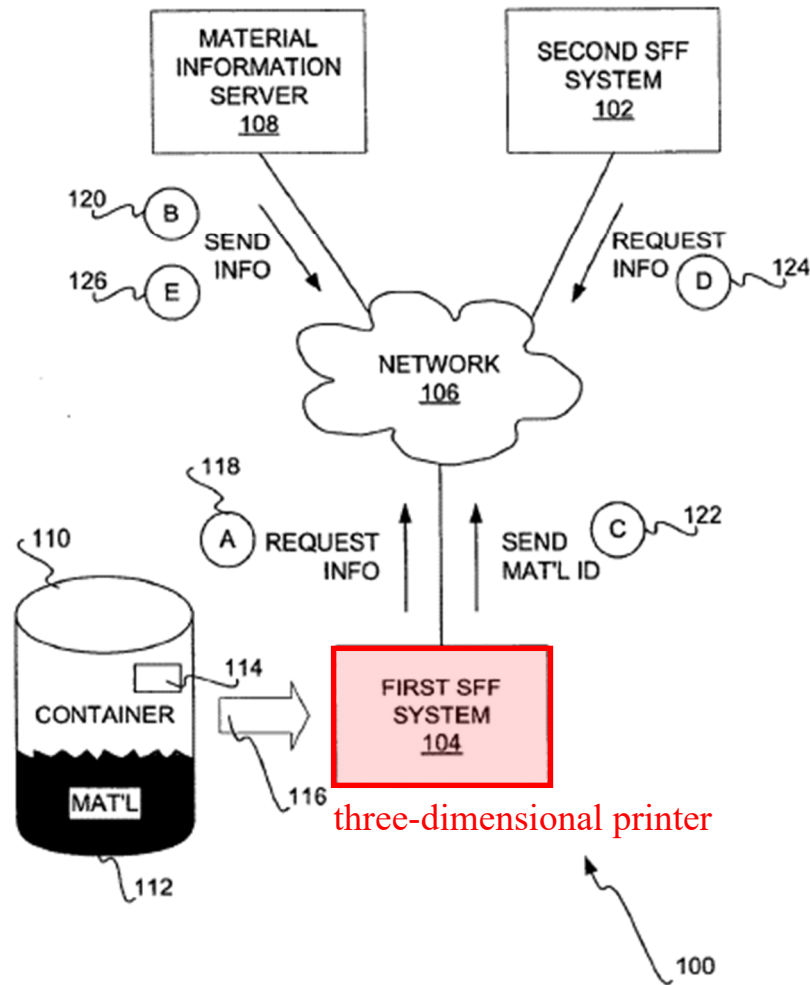


EX1004, FIGS. 3 and 4, [0007], [0032], [0040]; EX1003, ¶49.

Element 1[a]

Loughran's FIG. 1 shows a system 100 including a SFF system 104 that fabricates SFF jobs received from client system 102:

FIG 1

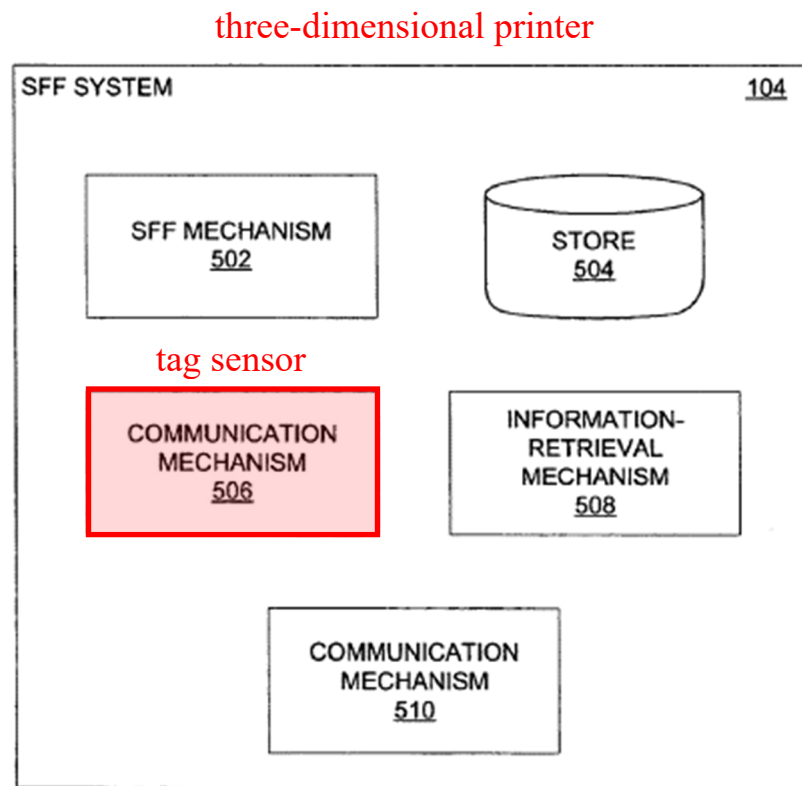


EX1004, FIG. 1, [0001], [0005], [0012]; EX1003, ¶¶50. Loughran's "SFF system 104 fabricates physical objects from SFF fabrication jobs in a layer-by-layer manner." EX1004, [0013]-[0019], [0045]. The SFF system 104 is a three-dimensional printer. EX1003, ¶¶50.

The SFF system 104 includes a tag sensor in the form of "communication mechanism 506" that "receives the unique material identifier from the material

container 110 containing the material 112 and that is presented to the second SFF system 104. The mechanism 506 may include an RF reader to detect signals returned by the tag 114 of the container 110, where the tag 114 is an RFID tag. The mechanism 506 may further include a bar code reader to scan a bar code of the tag 114, where the tag 114 is a bar code tag”:

FIG 5



EX1004, FIG. 5, [0047]; EX1003, ¶51.

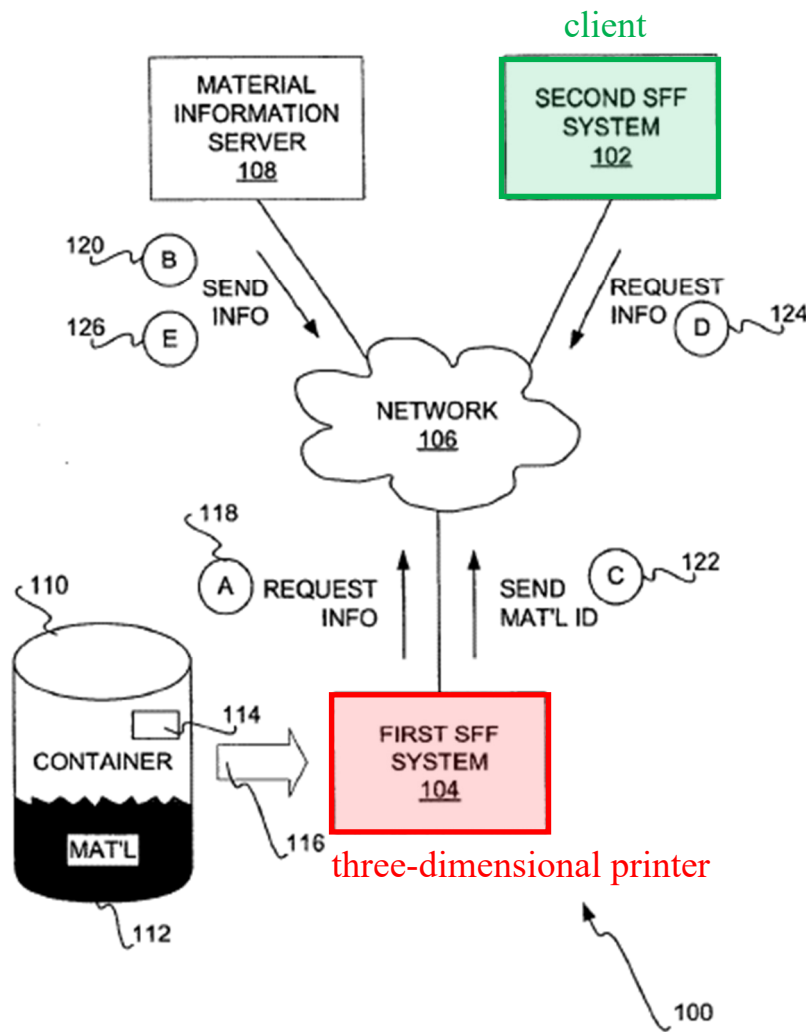
Element 1[b]

The system 100 includes a client system 102 that “may be or include a general-purpose computing device, like a desktop, portable, or server computer

running computer-aided drafting (CAD) software.” EX1004, [0012]; EX1003,

¶52. Client system 102 and SFF system 104 “are communicatively coupled to one another via a network 106”:

FIG 1



EX1004, FIG. 1, [0012], [0048]-[0049].

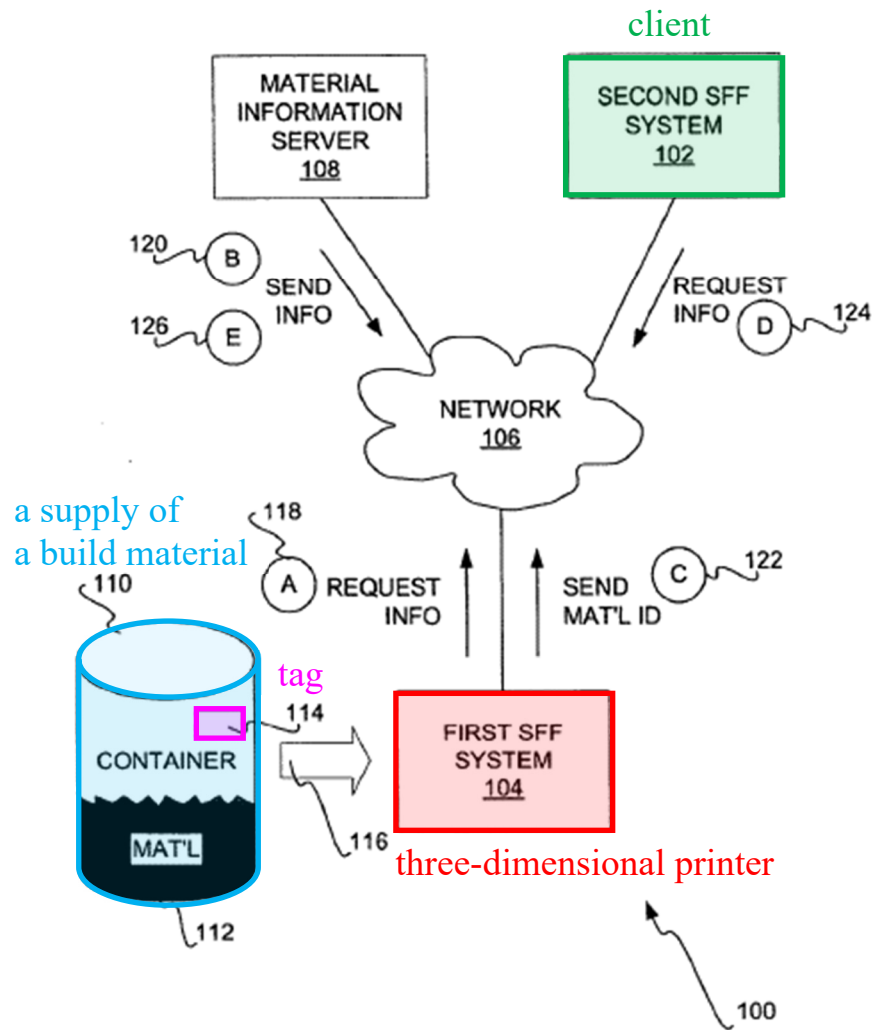
Loughran’s SFF system 104 (three-dimensional printer) “receives SFF fabrication jobs from clients, such as [client] system 102.” EX1004, [0005],

[0012], [0044], [0050]. The SFF system 104 includes “communication mechanism 510” and “SFF mechanism 502.” EX1004, [0049]. The communication mechanism 510 “receives from the [client] system 102 SFF fabrication jobs over the network,” which “are provided to the SFF mechanism 502 for the fabrication of physical objects in accordance therewith.” EX1004, [0049]. In accordance with the scope of this limitation advanced by Patent Owner in the litigation, Loughran’s SFF fabrication job corresponds to a request to fabricate an object on the three-dimensional printer. EX1003, ¶53.

Element 1[c]

Loughran’s FIG. 1 shows “a material container 110 containing a material 112 from which physical objects can be fabricated at the second SFF system 104 in accordance with SFF fabrication jobs generated at the [client] system 102 is introduced into the second SFF system 104, as indicated by the arrow 116”:

FIG 1



EX1004, FIG. 1, [0020]. The material container 110 containing material 112 is a supply of build material and is coupled to the SFF system 104 (three-dimensional printer) through introduction of the material container 110 into the SFF system 104. EX1003, ¶54.

The “material container 110 contains a tag 114 that includes a material identifier.” EX1004, [0020]. The material identifier is a property of the build

material. EX1003, ¶55. Indeed, the '466 patent discloses that the tag stores data that “may include at least one of a material identification number....” EX1001, 14:56-15:3.

“[T]he tag 114 may be a radio-frequency identifier (RFID) tag that returns a signal encoding the unique material identifier of the material 112 when sent a transmitting signal” or “a bar code tag having a bar code encoding the unique material identifier of the material 112.” EX1004, [0021]; EX1003, ¶56.

Element 1[d]

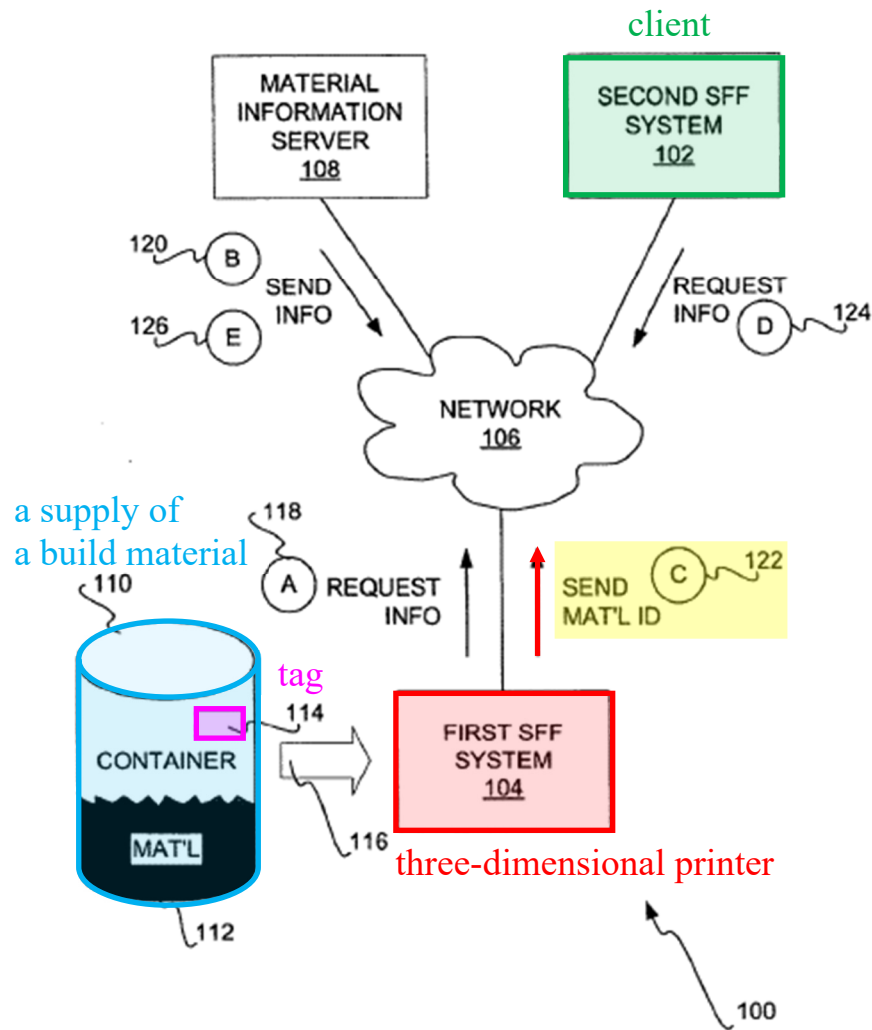
Loughran discloses that “in one embodiment, the tag 114 may be a radio-frequency identifier (RFID) tag that returns a signal encoding the unique material identifier of the material 112 when sent a transmitting signal. The second SFF system 104 in such an embodiment detects the signal, and decodes the unique material identifier from the signal. In another embodiment, the tag 114 may be a bar code tag having a bar code encoding the unique material identifier of the material 112. The second SFF system 104 in this embodiment scans the bar code, and decodes the unique material identifier from the bar code. In a different embodiment, the tag 114 may have the unique material identifier of the material 112 printed thereon. The second SFF system 104 may therefore have optical character recognition (OCR) capabilities to recognize the unique material identifier.” EX1004, [0021], [0033]; EX1003, ¶¶57-58. Loughran’s SFF system

104 includes a “communication mechanism 506” that “receives the unique material identifier from the material container 110 containing the material 112 and that is presented to the second SFF system 104. The mechanism 506 may include an RF reader to detect signals returned by the tag 114 of the container 110, where the tag 114 is an RFID tag. The mechanism 506 may further include a bar code reader to scan a bar code of the tag 114, where the tag 114 is a bar code tag.” EX1004, [0047]; EX1003, ¶59.

Element 1[e]

In Loughran, after the SFF system 104 reads the material identifier (data including at least one property of the build material) from the tag (EX1004, [0021], [0033]), the SFF system 104 sends “the material identifier for the material 112 to the [client] system 102, as indicated by the letter C 122” shown in FIG. 1, and the client system 102 “may receive the unique material identifier of the material 112 from the second SFF system 104”:

FIG 1



EX1004, FIG. 1, [0028], [0038]; EX1003, ¶60.

Loughran's SSF system 104 includes a "communication mechanism 510" that includes "network adapters and/or other types of communication technologies to communicate with the [client] system 102 over the network 106." EX1004, [0049]. "The mechanism 510 provides the [client] system 102 with the actual information regarding the material 112." *Id.*; EX1003, ¶61.

Loughran's client system 102 includes "communication mechanism 604" that "may include network adapters and/or other types of communication technologies to communicate with the second SFF system 104 over the network 106." EX1004, [0052]. "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." *Id.*; EX1003, ¶62.

Element 1[f]

In Loughran, "[s]ome 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." EX1004, [0002]; EX1003, ¶63. Loughran's client system 102 "receive[s] the information regarding the material 112. For instance, the [client] system 102 may have CAD software running thereon to generate SFF fabrication jobs outlining the fabrication of physical objects by the second SFF system 104 from materials, like the material 112. The [client] system 102, such as its CAD software, may have to have the information regarding the material 112 so that *the SFF fabrication jobs can be accurately generate[d] for ultimate fabrication of physical objects from the material 112*. For instance, build time estimation, *feature orientation suggestion, and part scaling based on expected shrinkage are determinations that the CAD*

software may make based on the information regarding the material 112 from which a physical object is to be constructed.” EX1004, [0027], [0002], [0051].

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.” EX1004, [0002]. Loughran’s client system 102 “parses the information regarding the materials for using it in SFF fabrication job generation (416).” EX1004, [0043].

Loughran’s client system 102 includes “CAD software 610” that “may be any type of computer-aided drafting software that is capable of generating SFF fabrication jobs... for fabrication from a specific material based on the information regarding that material which has been received. The CAD software 610 then sends the SFF fabrication job to the second SFF system 104 over the network 106 via the communication mechanism 604 of the [client] system 102.” EX1004, [0055], [0052], [0049]; EX1003, ¶64.

Dubois explains “[c]onventionally, the production of a component is preceded by a stage of computer-aided design which involves producing a three-dimensional (hereinafter ‘3D’) representation of this object on the basis of a

specification assembling all the requirements and properties to be fulfilled thereby” and on “the basis of this 3D representation and the specification,” Dubois “determines a set of printing characteristics.” EX1005, [0057]-[0059], [0016], [0024]-[0025], [0075]-[0106], [0170]. This design process includes “establishing a set of printing parameters as a function of the nature of the materials deposited and the deposition conditions thereof for each print layer and for each discrete spatial trajectory.” EX1005, [0027], [0059], [0107]-[0108], [0148], [0150], [0154], [0196], claim 79. The printing parameters are used to control the dynamic production process. EX1005, [0056], [0072], [0128]. Dubois describes printing parameters as including “for each of the materials, a temperature, a pressure and a state of dispersion in the storage means as a function of its nature” (EX1005, [0109], [0166]-[0167], claims 53, 55), “the temperature of the environment in which the material is deposited” to “control evaporation of the solvent in a favourable manner” (EX1005, [0111]-[0112], [0145], [0168], claim 56), “a radiation wavelength and a radiation power for each material” or “a predetermined temporal evolution of the temperature of the environment in which the component is produced” to achieve a “change of state of the material” (EX1005, [0113]-[0114], [0146], claim 57), “the ejection height of the droplets of material, the volume thereof and the ejection increment” (EX1005, [0107], [0115], [0069]-[0071], [0081], [0094], [0152], [0158], claims 51-52), “a speed of travel of the

ejection means... in order to take into account the drying time required between two successive ejections of droplets” (EX1005, [0119]), and “a drying time required between the printing of two print layers” (EX1005, [0120]). EX1003, ¶¶65-66. Printing parameters concerning the state or characteristics of the material are operational parameters selected by the CAD software on the client for use in controlling operation of the three-dimensional printer when fabricating the object with the material having the state or characteristics (at least one property). *Id.*

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 (*supra*, Section III.A.3) and thereby enabled Loughran’s system to complete each fabrication job based on CAD information with the optimal set of material parameters. EX1003, ¶67. Receiving a SFF fabrication job (request) with printing (operational) parameters satisfies the scope of this limitation as advanced by Patent Owner in the litigation. *Id.*

Element 1[g]

Loughran’s SFF system 104 (three-dimensional printer) receives SFF fabrication jobs from clients, such as [client] system 102” and fabricates SFF jobs received from client system 102. EX1004, [0005], [0012], [0023], [0037], [0044];

EX1003, ¶68. Loughran's "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." EX1004, [0024]-[0025]. Loughran's SFF system 104 includes "SFF mechanism 502" that "fabricates a physical object directly from the CAD information of a SFF fabrication job received from the [client] system 102, in a layer-by-layer manner.... The SFF mechanism 502 can fabricate the physical object from the material 112, since the parameters of the second SFF system 104 are dynamically adjustable based on the information regarding the material 112." EX1004, [0045], [0048]; EX1003, ¶69.

As discussed above in Section III.A.3, 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 and thereby enabled Loughran's system to complete each fabrication job based on CAD information with the optimal set of material parameters. EX1003, ¶70. In the resulting combination, the SFF system 104 (three-dimensional printer) would

fabricate the object with the material according to the CAD information of a SFF fabrication job which includes the printing (operational) parameters. *Id.*

(b) Claim 2

Loughran's client 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 [client] system 102 with information about itself, including a list of material identifiers known to the second SFF system 104." EX1004, [0041]; EX1003, ¶71.

(c) Claim 3

Loughran's SFF system 104 can include "a wide-area thermal inkjet or a single jet inkjet SFF system" where "a jet for each of a plastic build material and a wax-like support material is used." EX1004, [0016]. The build material is a first build material, and the support material is a second build material. EX1003, ¶72. Based on Loughran's disclosures here and discussed above in Section III.A.3, elements 1[c], 1[f], and 1[g], and claim 2, a POSITA would have found it obvious for Loughran's SFF system 104 to be coupled to multiple supplies of different materials, each supply including a tag that stores a property of the material. *Id.*

Additionally, Dubois describes a printer that includes a "plurality of material storage tanks 106a, 106b, with one tank per material used during the production of the multi-material component." EX1005, [0133]. In the resulting combination, the

SFF system 104 (three-dimensional printer) would fabricate the object with the materials according to the CAD information of a SFF fabrication job which includes the printing (operational) parameters concerning the state or characteristics (at least one property stored on the tag) of the materials. EX1003, ¶73.

(d) Claim 4

Supra, element 1[e] and claim 3. EX1003, ¶74.

(e) Claim 5

Loughran's "SFF mechanism 502 is the mechanism that actually fabricates a physical object directly from the CAD information of a SFF fabrication job received from the first SFF system 102, in a layer-by-layer manner." EX1004, [0045], [0001], [0013]. Similarly, Dubois provides a method "for production by ink-jet-type printing which allow production of three-dimensional structures consisting of a plurality of different materials." EX1005, [0021]. Dubois explains that "[c]omputer-aided design conventionally consists in cutting up a representation of the object to be produced in successive print layers and defining for each layer patterns which are to be printed by the printer" and is "implemented by means of software on a personal computer." EX1005, [0016], [0024]-[0025], [0059], [0061]-[0062], [0067], [0075]-[0106], [0170]. Dubois slices "the 3D representation of the component into print layers," which "involves slicing the 3D

representation of the component to be produced into print layers which are to be printed in succession” and “is carried out as a function of the characteristic objects.” EX1005, [0075]. A slice specifies a selection of build material for use in printing the layer of the multi-material component. EX1003, ¶¶77-79; EX1006, [0039]-[0040], [0193]-[0194].

A POSITA would have found it obvious to include, in Loughran’s SFF fabrication job received from the client, a selection of the build material for use in fabricating the object using the three-dimensional printer. EX1003, ¶79. In the resulting combination of Loughran and Dubois, Loughran’s SFF fabrication job would include slices that each specifies a selection of build material for use in printing a layer of the object using the three-dimensional printer. *Id.*

(f) Claim 7

Supra, elements 1[f]-1[g]. EX1003, ¶80.

(g) Claim 8

Supra, element 1[c]. EX1003, ¶81.

(h) Claim 9

Supra, elements 1[c]-1[d]. A POSITA would have recognized that a “material identifier” provides, or at least renders obvious a material identification number. EX1004, [0028]; EX1003, ¶82. Loughran also expressly discloses using a material identification number (“101785”). EX1004, [0031]; EX1003, ¶82.

(i) Claim 10

Based on Dubois's disclosure as discussed above in element 1[f], a temperature of dispersion is an extruder temperature, a speed of travel of the ejection means is a feed rate, the temperature of the environment in which the material is deposited is a build volume temperature, and a predetermined temporal evolution of the temperature of the environment in which the component is produced is a cooling requirement. EX1003, ¶83. In accordance with the scope of this limitation advanced by Patent Owner in the litigation, Dubois's disclosure of printing (operational) parameters including a temperature of dispersion, a speed of travel of the ejection means, a temperature of the environment in which the material is deposited, and a predetermined temporal evolution of the temperature of the environment in which the component is reproduced satisfies this claim. *Id.*

(j) Claim 11

Loughran's SFF system 104 can include "a stereo lithography SFF system" where "plastic objects are built a layer at a time by tracing a laser beam on the surface of a vat of liquid photopolymer." EX1004, [0015]. Loughran's SFF system 104 can also include "a wide-area thermal inkjet or a single jet inkjet SFF system" where "a jet for each of a plastic build material and a wax-like support material is used." EX1004, [0016]. "The materials are held in a melted liquid state in reservoirs. The liquids are fed to individual jetting heads that squirt tiny

droplets of the materials in the required pattern as they are moved to form a layer of the object.” *Id.* Thus, Loughran discloses that the supply includes a liquid.

EX1003, ¶84.

Loughran’s SFF system 104 can also include “a fused deposition modeling SFF system” where “a plastic filament is unwound from a coil and supplies material to an extrusion nozzle.” EX1004, [0017]. Thus, Loughran also discloses that the supply includes a filament. EX1003, ¶85.

(k) Claim 12

As discussed above in 1[c], Loughran discloses a RFID tag. EX1004, [0021], [0033], [0047]. Loughran’s RFID tag is either passive or active because RFID tags are of one of two types: passive or active. EX1007, 1; EX1003, ¶86.

(l) Claim 13

Supra, element 1[c]. EX1003, ¶87.

(m) Claim 16

Supra, element 1[a]. EX1003, ¶88.

(n) Claim 18

Supra, elements 1[e] and 1[f]. Loughran also expressly discloses using a material identification number (“101785”) to retrieve operational parameters. EX1004, [0031]; EX1003, ¶91.

(o) Claim 20

Supra, element 1[b]. EX1003, ¶92.

B. GROUND 1B—Claims 1-5, 7-13, 16, 18, and 20 are obvious over Loughran, Dubois, and Jazayeri

Ground 1B is substantively identical to, and incorporates the analysis of, Ground 1A in all but one respect. Where Ground 1A relies on Loughran’s disclosure to satisfy 1[b], Ground 1B relies on the additional disclosure of Jazayeri. The predictable implementation of Jazayeri’s suggestion here does not disturb the aspects of Loughran and Dubois mapped to other claim elements. EX1003, ¶93. To avoid repetition, and because the analysis of all other claim elements is identical, only 1[b] is addressed below.

Element 1[b]

To the extent that Loughran’s SFF fabrication job (*supra*, Ground 1A, element 1[b]) is not considered a request, a POSITA would have found it obvious for the SFF system 104 to receive a request prior to receiving the SFF fabrication job. EX1003, ¶¶94-95. Jazayeri describes a print server including an application manager that receives “a print request over a network from an application executing on a device.” EX1010, Abstract, [0008]-[0010], [0019]-[0021], [0036]. In response to receiving the print request, the application manager provides the device with “a print dialog or other user interface with which the user may select an available/associated registered printer.” *Id.* The application manager then

receives, “via the print dialog, a selected printer from the selection,” and receives “a print job designating the selected printer” and “including print data and print characteristics.” *Id.*; EX1003, ¶¶35-36.

A POSITA would have been motivated to implement Loughran’s system in a manner that employs Jazayeri’s suggestion (e.g., providing the functionality of the print server including an application manager for receiving a print request over the network from a client device, providing the client with a print dialog or other user interface for the user to select an available printer, and then receiving a print job designating the selected printer from the client device) to achieve several known benefits (articulated below) and thereby enable Loughran’s SFF system 104 to receive a print request over the network from a client device and respond by providing the client with a dialog to select an available printer. EX1003, ¶96. A POSITA would have been motivated to combine Loughran’s and Jazayeri’s teachings to provide this functionality for multiple reasons. *Id.*

First, such an implementation would have allowed Loughran’s SFF system 104 to include multiple SFF systems and the client to select one of the multiple SFF systems for fabricating the object. EX1003, ¶97. Loughran discloses that the SFF system 104 “may be or include in particular one or more of: a selective laser sintering SFF system, a stereo lithography SFF system, a wide-area thermal inkjet SFF system, a fused deposition modeling SFF system, a single jet inkjet SFF

system, a three-dimensional printing SFF system, and a laminated object manufacturing SFF system, among other types of SFF systems.” EX1004, [0013]-[0019], [0045]. Applying Jazayeri suggestion to Loughran would provide “an ability for virtually any application running on any device within the network 106 (e.g., the applications 112, 116 and devices 108, 120) to communicate with the cloud print service 102 to thereby print to any printer which is also in (direct or indirect) communication with the cloud print service 102. Consequently, users may benefit from increased printing options and abilities.” EX1010, [0028].

Second, the predictable combination would have provided a user with a printing experience that is “platform-independent.” EX1010, [0018]. Jazayeri discloses that the application manager “enables the application 112 to print directly to the cloud-aware printer” “without e.g., requiring a local driver within the operating system 110. As a result, virtually any application 112 that may be configured to communicate with the cloud print service 118 may make use of the cloud-aware printer 118.” EX1010, [0025]. In this way, a user can use software that is not printer specific for generating the SFF fabrication job. EX1003, ¶98.

Third, a POSITA would have been motivated to implement Loughran’s SFF system 104 to include Jazayeri’s suggested functionality to beneficially provide printer manufacturers with “a decreased or eliminated need to provide users with the (updated) driver(s) and other prerequisites for users to fully experience the

benefits of their products. This may result in, for example, higher customer satisfaction, and a decreased cost of producing and maintaining printers.”

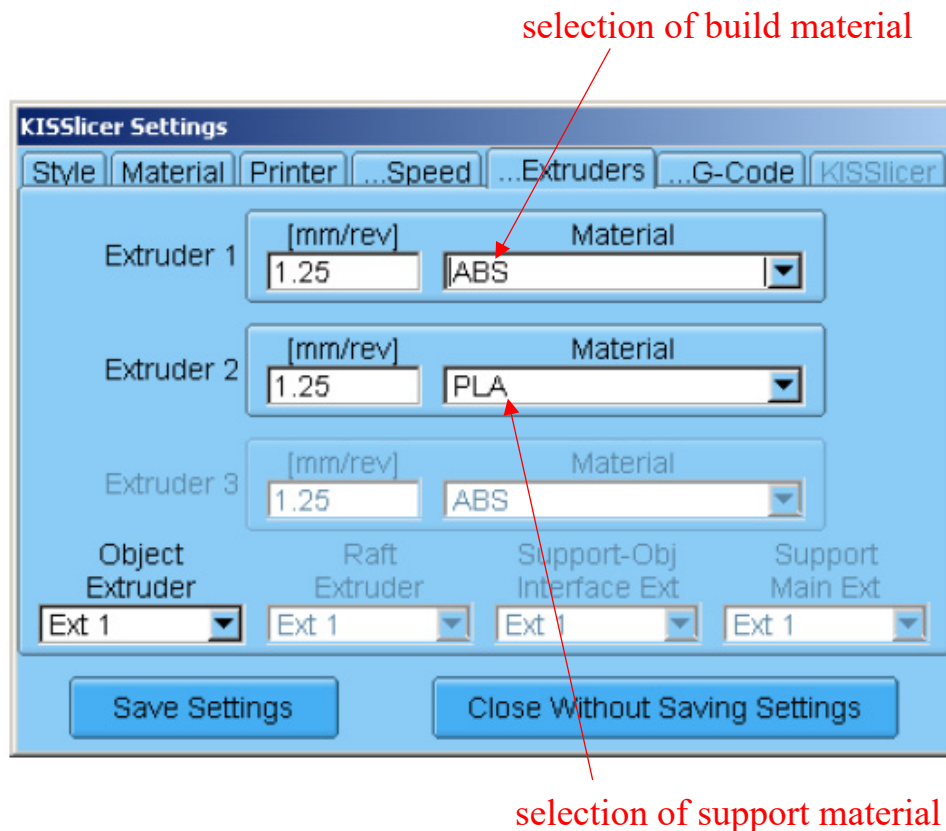
EX1010, [0028]. In this way, a user can use software that is not printer specific for generating the SFF fabrication job. EX1003, ¶99.

Finally, such an implementation of Loughran’s SFF system 104 based on Jazayeri’s suggested techniques would have been merely the application of known techniques to a known system ready for improvement to yield predictable results. EX1003, ¶100; EX1010, [0018]-[0028], FIG. 1; KSR, 550 U.S. at 417. Here, the systems of Loughran and Jazayeri are each related to networked printing environments, which is the same as the ’466 patent. EX1004, [0012], FIG. 1; EX1010, [0018]-[0028], FIG. 1; EX1001, 4:57-13:64, FIG. 2. While Jazayeri describes a networked printing environment with respect to 2D printers, a POSITA was not an automaton and instead would have possessed ample skill to successfully incorporate Jazayeri’s suggested teachings into Loughran’s networked environment of 3D printers and thus would have reasonably expected success achieving the combination. EX1003, ¶100.

C. GROUNDS 1C/1D—Claim 5 is obvious over Loughran, Dubois, and KISSlicer (1C) and Loughran, Dubois, Jazayeri, and KISSlicer (1D)

Loughran’s system can include an “inkjet SFF system” where “a jet for each of a plastic build material and a wax-like support material is used.” EX1004,

[0016]. A POSITA would have found it obvious to implement Loughran's inkjet SFF system to allow the user of the client system to select the plastic build material to be extruded by one jet for printing the three-dimensional object and to select the support material extruded by another jet for printing the support structure, as was known in the art at the time of the '466 patent. EX1003, ¶101. For example, KISSlicer describes software for controlling a multi-extruder system (e.g., like the inkjet SFF system described in Loughran) to print a three-dimensional object and support structure. EX1018, 1-11; EX1003, ¶37. Specifically, KISSlicer's software allows a user to select one material (e.g., a build material) for deposition by "Extruder 1" and another material (e.g., a support material) for deposition by "Extruder 2":



EX1018, 5 (annotated).

Multiple reasons would have prompted a POSITA to implement Loughran's system to allow user selection of materials for building a three-dimensional object. EX1003, ¶102. For instance, a POSITA would have recognized that the Loughran-Dubois-KISSlicer and Loughran-Dubois-Jazayeri-KISSlicer combinations would have achieved a more flexible user customization of materials used to build and support the three-dimensional object depending upon the desired build quality and strength of a particular object. *Id.*

Furthermore, a POSITA would have implemented Loughran's system based

on KISSlicer's suggestions because doing so would be the application of known techniques to a known system to achieve predictable results. *KSR*, 550 U.S. at 417. For the reasons detailed above, and based upon the predictable mechanical components and software involved in the combination and the state of the art at the time for 3D printer systems like Loughran and KISSlicer, a POSITA would have reasonably expected success achieving the combination before the '466 patent. EX1003, ¶103.

D. GROUNDS 1E/1F—Claim 17 is obvious over Loughran, Dubois, Menchik, and Dahlin (1E), and Loughran, Dubois, Jazayeri, Menchik, and Dahlin (1F)

Menchik's memory chip 260 stores information about "the type of building material in the cartridge bag 300" and "optimum building parameters (e.g., for building or support)," and the controller 105 uses the data to determine printing parameters, operation parameters, building parameters, material parameters, and supply parameters (collectively operational parameters) including "the amount of material of each type and/or color presently available in each cartridge" and "the amount of modeling material, support liquid, or combination of modeling and support materials required for printing a given three-dimensional object."

EX1009, [0007], [0027], [0035], [0037], [0047]-[0048]. Menchik's controller also determines "whether the amount of modeling and/or support material in the available cartridges is sufficient to complete a three-dimensional object to be built

or printed,” and the “relevant information may be displayed on, for example, a computer screen.” EX1009, [0049]. To the extent that Menchik were considered to not disclose a diagnostic test that provides an error message when the amount of support material is insufficient, a POSITA would have found it obvious and straightforward to implement Menchik’s system to provide such an error message as was well-known at the time of the ’466 patent. EX1003, ¶172.

For example, Dahlin discloses that based on the “data regarding the... amount of filament on the spool,” Dahlin’s system “notifies the operator... if the amount of filament on the spool is insufficient to create a desired object.” EX1011, 1:64-2:2. Specifically, “CPU 92 receives the modeling filament data from IO card 94. At the outset of a job, the CPU 92 will calculate whether a spool 42 or 56 contains enough filament to complete the job. Operator notification is then provided via touch screen display 21, stating either that the filament is adequate to complete the job, or that the filament spool will need replacement and reloading during the process.” EX1011, 5:26-37. Additionally, “CPU 92 receives the support filament data from support processor board 132, and uses it to provide operator information in the same manner as described above with respect to the modeling filament.” EX1011, 5:55-64; EX1003, ¶¶44, 173.

The “amount of modeling material, support liquid, or combination of modeling and support materials required for printing a given three-dimensional

object” (EX1009, [0048]) is an operational parameter used in controlling operation of the three-dimensional printer when fabricating the object with the material.

EX1003, ¶174. Calculating whether a cartridge contains enough material to complete the print job specified in the printing file is a diagnostic test to determine whether the operational parameter (the amount of material required) is suitable for the printing apparatus to complete the print job. *Id.*

A POSITA would have been motivated to implement Loughran’s system in a manner that employs Menchik’s and Dahlin’s suggestions to beneficially provide the user with a notification either that the amount of material is adequate to complete the job or that the container will need replacement and reloading during the process. EX1011, 5:26-37; EX1003, ¶175. Notifying the user advantageously provides the user the opportunity to make modifications to the fabrication job or to replace the container before printing begins when the container does not contain enough material to complete the print job. *Id.*

Such an implementation of Loughran’s system based on Menchik’s and Dahlin’s suggested techniques would have been merely the application of known techniques to a known system ready for improvement to yield predictable results. EX1003, ¶176; *KSR*, 550 U.S. at 417. Here, the systems of Loughran, Menchik, and Dahlin are each related to storing and using build material data for fabricating three-dimensional objects, which is the same as the ’466 patent. EX1004, [0020]-

[0021], [0033], [0047]; EX1009, [0007], [0027], [0035], [0037], [0047]-[0048]; EX1011, 1:13-17, 1:51-64, 5:3-14, 5:55-64; EX1001, 1:23-25, 1:29-33, 14:30-32, 14:32-15:10, 15:11-17. In this context, a POSITA was not an automaton and instead would have possessed ample skill to successfully implement the combination as described above and thus would have reasonably expected success achieving the combination. EX1003, ¶176.

E. GROUND 2—Claim 19 is obvious over Devos

Element 19[p]

Devos discloses “methods of solid freeform fabrication” as shown in FIG. 6 below. EX1008, Abstract, [0010], [0035], FIG. 6; EX1003, ¶¶38-40, 104.

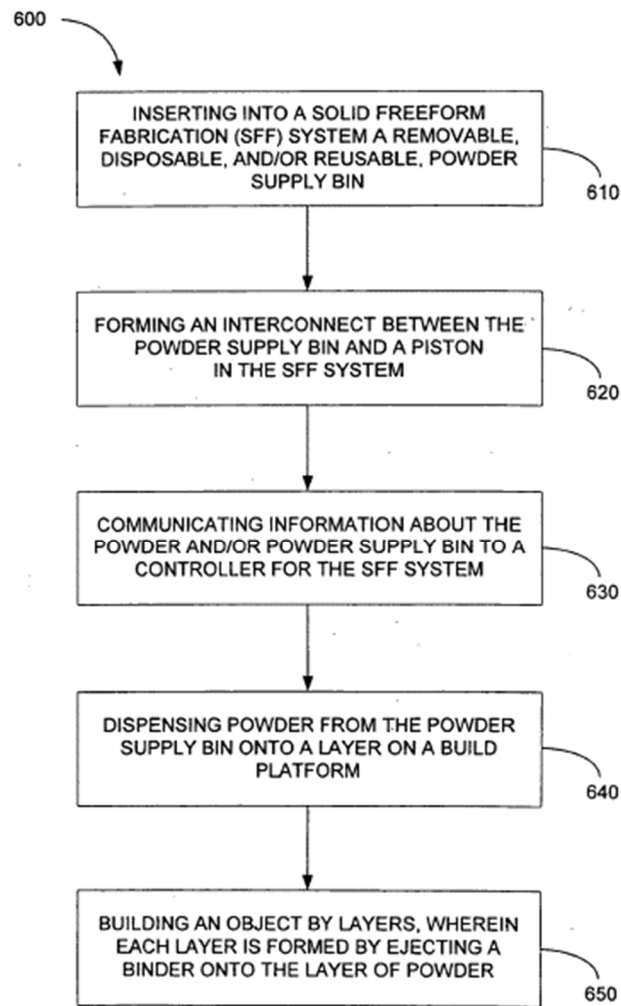


FIG. 6

EX1008, FIG. 6.

Element 19[a]

Devos's FIG. 1 "illustrates a solid freeform fabrication system" that "uses 3D printing technology":

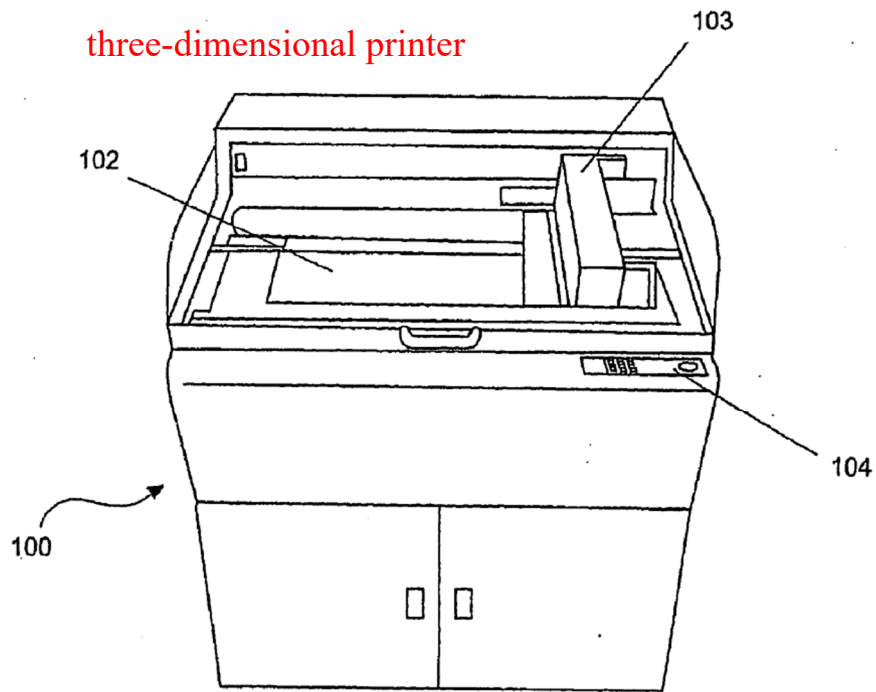


FIG. 1

EX1008, FIG. 1, [0005], [0012]. Devos's solid freeform fabrication system 100 is a three-dimensional printer. EX1003, ¶105.

The system includes a controller and a supply bin. EX1008, [0011], [0016], [0019]; EX1003, ¶106. “FIG. 2 illustrates a partial top view of the solid freeform fabrication system [100] of FIG. 1, showing an exemplary supply bin 110”:

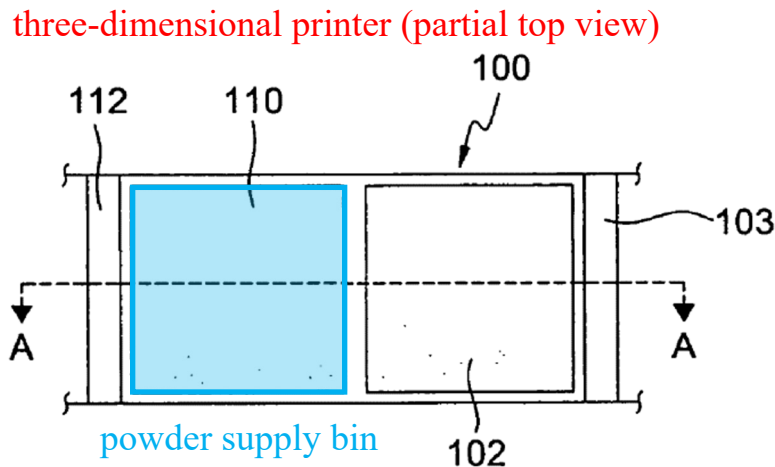


FIG. 2

EX1008, FIG. 2, [0019].

As shown in FIG. 5, “the supply bin 110 can include a memory mechanism 146 that can communicate information to the controller about the supply bin”:

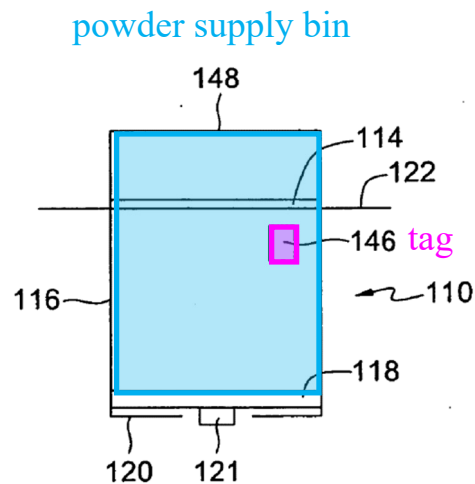


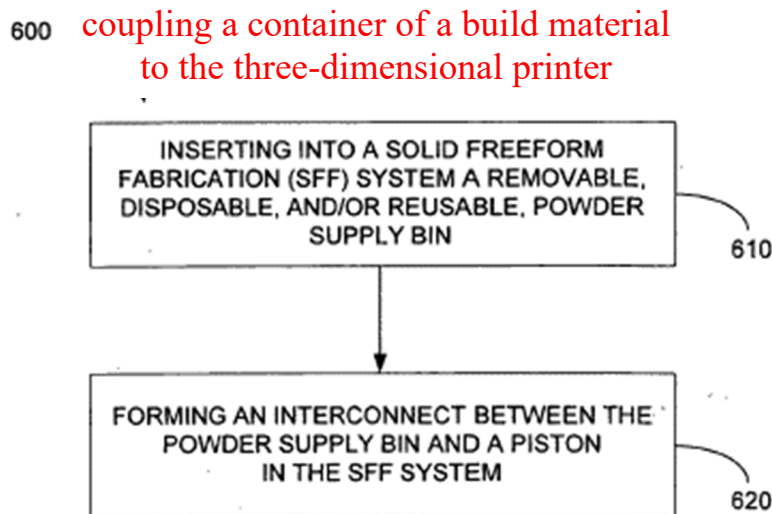
FIG. 5

EX1008, FIG. 5, [0032]. “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.” *Id.* “The solid

freeform fabrication system can include a sensor that is capable of reading the memory mechanism.” EX1008, [0032]. The memory mechanism 146 is a tag, and the sensor capable of reading the memory mechanism is a tag sensor. EX1003, ¶107.

Element 19[b]

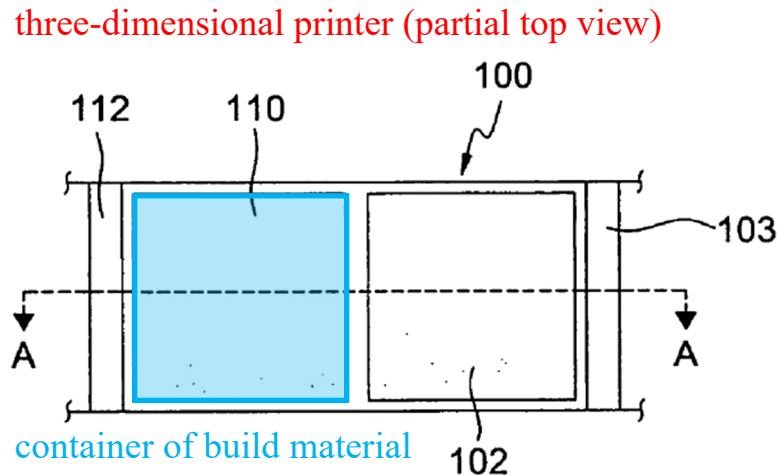
Devos’s “solid freeform fabrication systems have incorporated therein a convenient supply powder packaging.” EX1008, [0011], [0019]. As shown in FIG. 6, in “block 610, a removable, disposable, and/or reusable powder supply bin is inserted into a solid freeform fabrication system. In block 620, an interconnect is formed between the powder supply bin and a piston cylinder in the solid freeform fabrication system”:



EX1008, FIG. 6 (partial), [0035]; EX1003, ¶108.

“FIG. 2 illustrates a partial top view of the solid freeform fabrication system

[100] of FIG. 1, showing an exemplary supply bin 110”:



EX1008, FIG. 2, [0019]. The powder supply bin 110 supplying powder is a container of a build material and the container is coupled to the freeform fabrication system 100 (three-dimensional printer). EX1003, ¶109.

As shown in 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.” EX1008, FIG. 5, [0032]. “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”:

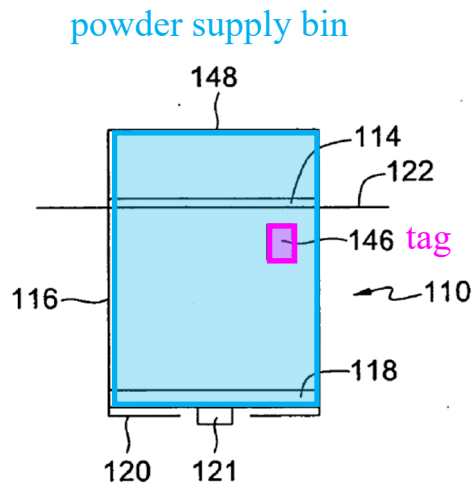


FIG. 5

EX1008, FIG. 5, [0032]. The memory mechanism 146 is a tag. EX1003, ¶110.

Element 19[c]

Devos's sensor "is capable of reading the memory mechanism 146" which can be "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."

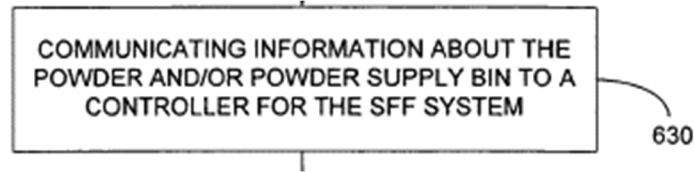
EX1008, [0032]. "Communication with the IC can be via contact pads or wireless via radio frequency signals." EX1008, [0033]; EX1003, ¶111.

Element 19[d]

Devos's "the supply bin 110 can include a memory mechanism 146 that can communicate information to the controller about the supply bin." EX1008, [0032].

As shown in FIG. 6, "in block 630, information can optionally be communicated from the powder supply bin to a controller for the solid freeform fabrication system":

transmitting the data to the controller



EX1008, FIG. 6 (partial), [0035]; EX1003, ¶112.

Element 19[e]

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.

Element 19[f]

Devos discloses that “[p]owder is then dispensed from the powder bin onto a

build platform, as shown in block 640. Block 650 shows how an object is built, by ejecting a binder from, for example, an inkjet print head, onto the layer of powder on the build platform, thereby forming layers of the object”:

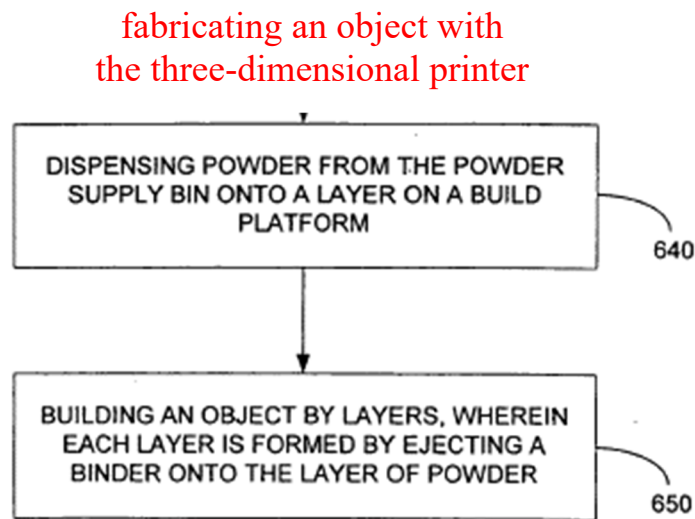


FIG. 6

EX1008, FIG. 6 (partial), [0035], [0013]-[0016], [0018]-[0019], [0024], [0029];
EX1003, ¶114.

Based on Devos’s disclosure that 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,” (EX1008, [0032]) as discussed above in element 19[e], a POSITA would have

found it obvious that Devos controls operation of the three-dimensional printer with the controller according to the operating parameters and fabricates an object with the three-dimensional printer based upon the operating parameters. EX1003, ¶115. A POSITA would have been motivated to implement Devos's system in this predictable manner for multiple reasons. *Id.*

First, a POSITA would have been motivated to implement the controller to control the roller so that it “distributes and compresses the powder at the top of a fabrication chamber or build bin to a desired thickness” (EX1008, [0013], [0019]) according to the “minimum allowable layer thickness” operating parameter determined from the data encoded in the memory mechanism (EX1008, [0032]) to fabricate each layer of the object using the appropriate thickness. EX1003, ¶116.

Second, a POSITA would have been motivated to implement the controller to control the print head so that it “deposits an adhesive or binder onto the powder” and ejects “colored binder, toner, and/or color activator into the layer of powder to provide a desired color or color pattern for this particular cross section of the desired product” (EX1008, [0013], [0018]) according to the “print speed, drop volume per voxel, color maps” operating parameters determined from the data encoded in the memory mechanism (EX1008, [0032]). EX1003, ¶117.

Third, a POSITA would have been motivated to implement the controller to control the system according to the operating parameter including 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, ¶118.

Finally, such an implementation of Devos's system would have been merely the application of known techniques to a known system ready for improvement to yield predictable results. EX1003, ¶119; *KSR*, 550 U.S. at 417. A POSITA was not an automaton and instead would have possessed ample skill to successfully implement this system according to Devos's straightforward suggestions with a reasonable expectation of success. EX1003, ¶119.

F. GROUND 3A—Claims 1, 3-5, 7, 9-11, 19, and 20 are anticipated or rendered obvious by Menchik

1. Claim Element Analysis

(a) Claim 1

Element 1[p]

Menchik discloses “methods useful in three-dimensional object printing” as shown in FIG. 6 (below). EX1009, [0001], [0006], [0018]; EX1003, ¶¶41-43, 120.

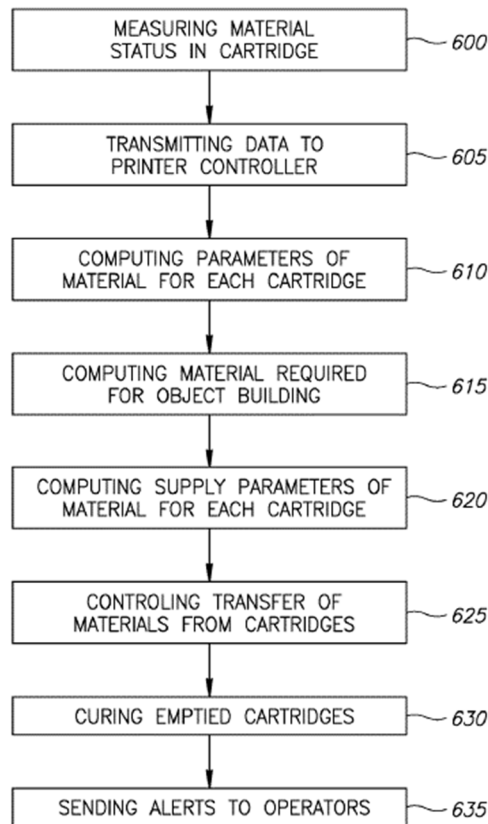


FIG.6

EX1009, FIG. 6, [0047], [0014].

Element 1[a]

Menchik's "FIG. 1 is a block diagram of a 3D printer system 100" that "may include, for example, a controller 105, printing apparatus 140, and one or more three dimensional modeling material supply sources such as cartridge apparatuses 180 or cartridge arrays 190":

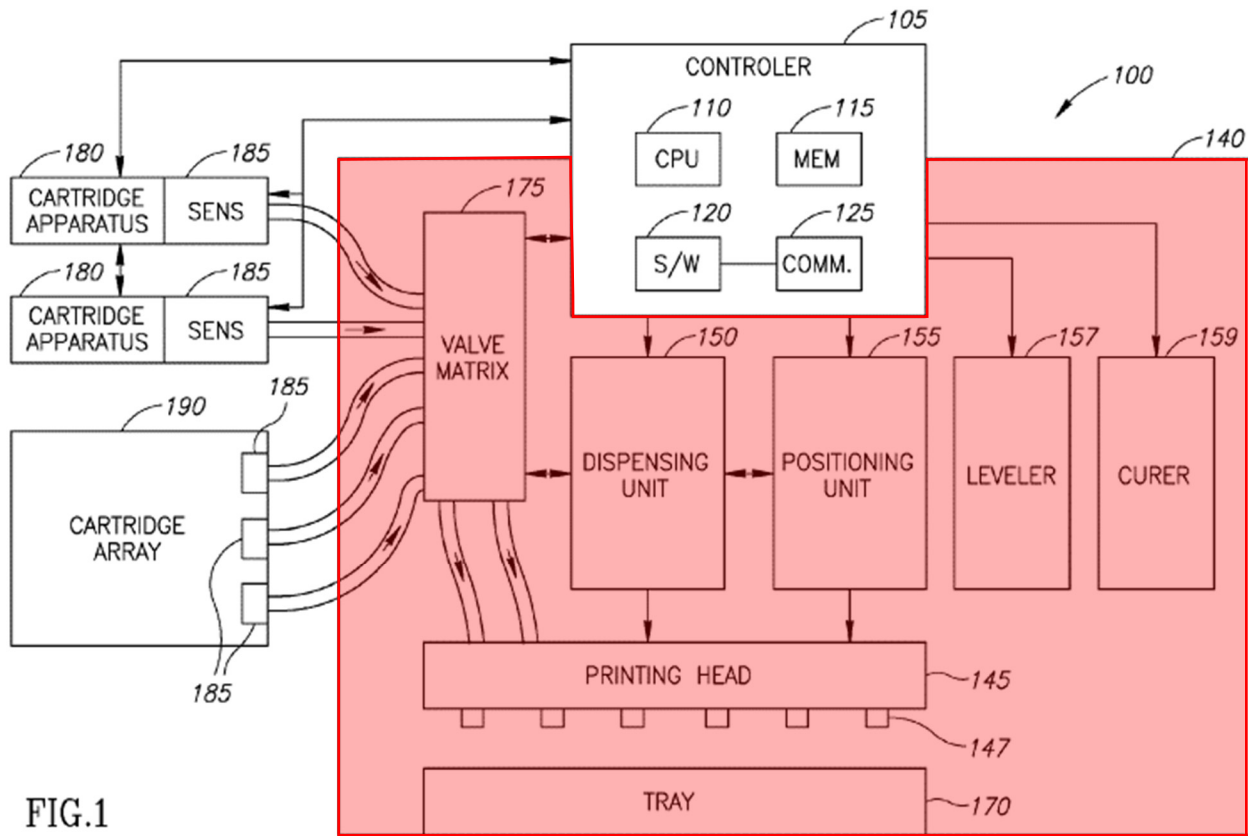
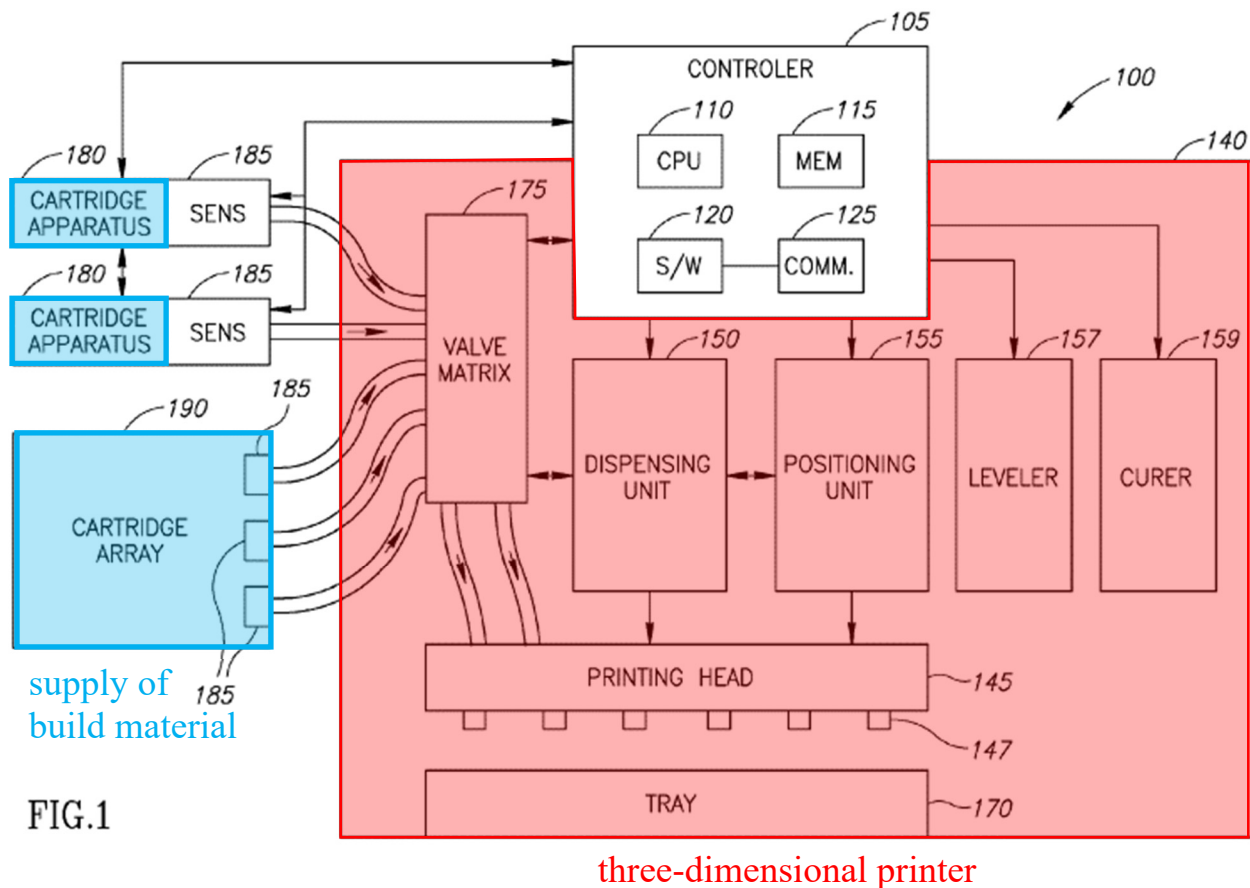


FIG.1

three-dimensional printer

EX1009, FIG. 1, [0020], [0009], [0002]-[0003], [0006], [0022]. The printing apparatus 140 operates as a 3D printer in which the nozzles 147 of the printing head 145” are used to fabricate “the 3D object to be built.” EX1009, [0025], [0006], [0024]; EX1003, ¶¶121-123.

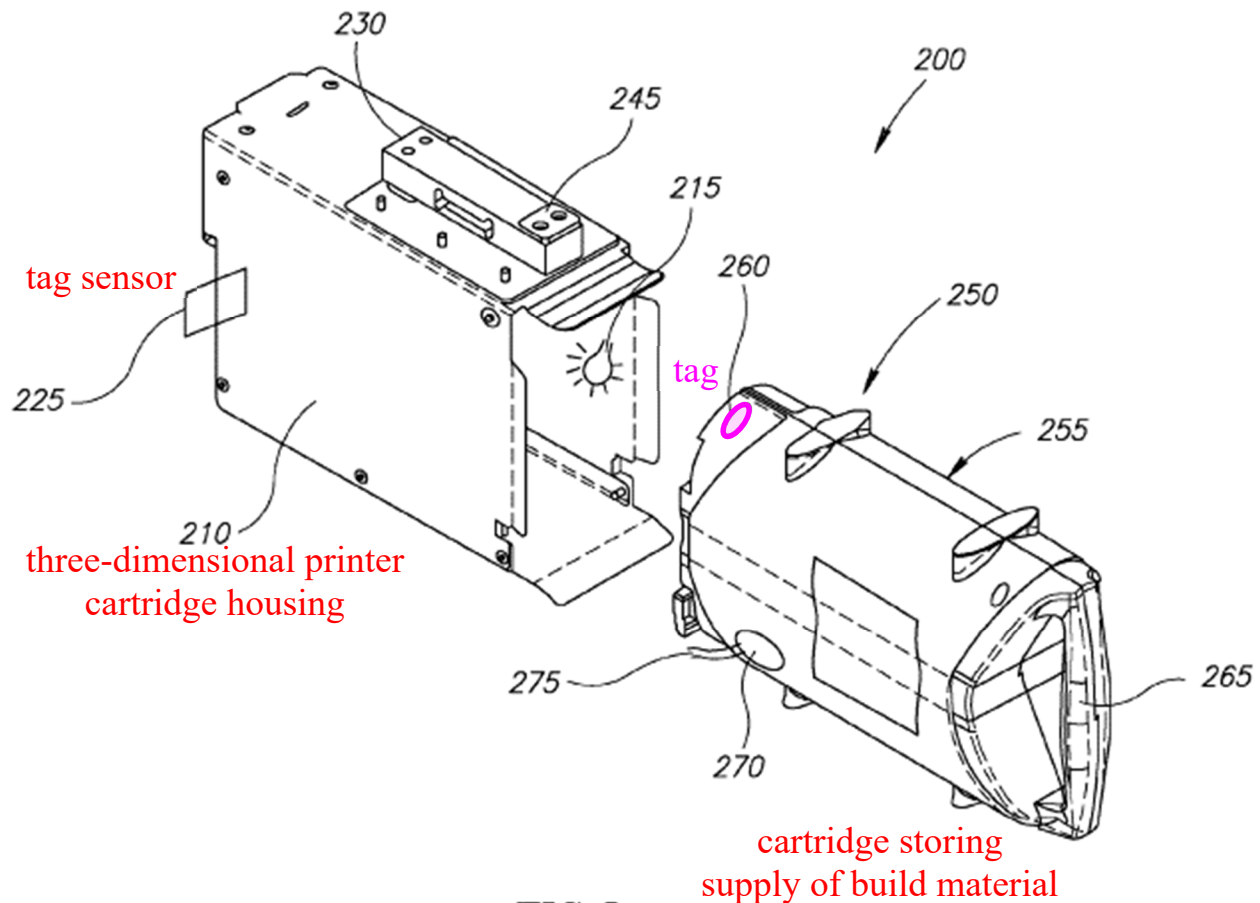
Menchik discloses that “[m]aterial supply sources, such as cartridge apparatus 180, may be situated within printing apparatus 140.” EX1009, [0023]. Menchik’s system 100 can also include “[o]ne or more cartridge arrays 190”:



EX1009, FIG. 1, [0023].; EX1003, ¶124.

Menchik's FIG. 2 "is a schematic illustration of an exemplary material supply source, such as, for example, cartridge apparatus 200.... Cartridge apparatus 200, which may be integrated into printing system 100, may include a cartridge housing or holder 210, to house a typically disposable cartridge 250, which may store building material required by printing apparatus 140." EX1009, [0028]; EX1003, ¶125. Menchik's "[c]artridge housing 210 may include an interface unit or memory device reader, such as a memory chip reader 225 that may be connected to printing controller 105, to read data from one or more

memory devices such as memory chips or other data storage units associated with cartridge 250, and transfer data to controller 105”:



EX1009, FIG. 2, [0030], [0037].

Menchik also describes “an array 400 of cartridges 410, each of which may contain building material” and “may be located within printing apparatus 140.”

EX1009, [0042]. “Each cartridge 410 may be associated with a memory or storage device such as a memory chip 260 and reader or data transfer device such as a memory chip reader 225.” EX1009, [0043]. Menchik’s printing apparatus 140

(three-dimensional printer) includes the memory chip reader 225 (tag sensor) because the cartridge housing with the memory chip reader 225 (tag sensor) is situated within printing apparatus 140 (three-dimensional printer). EX1003, ¶127.

Element 1[b]

In Menchik, “a separate unit, such as a personal computer or workstation... may provide some control or data storage capability.” EX1009, [0021]. Specifically, “[c]ontroller 105 may be located... outside of printing apparatus 100” and “may communicate with printing system 100, for example, over a wire and/or using wireless communications.” EX1009, [0024] (“...controller 105 may be partially external to 3D printer system 100.”). Controller 105 (client) can be “a computing device such as a personal computer, a desktop computer, a mobile computer, a laptop computer, a server computer, or workstation (and thus part or all of the functionality of controller 105 may be external to 3D printer system 100).” EX1009, [0026]. Alternatively, to the extent this element is interpreted such that the disclosed communication over a wired or wireless connection does not satisfy the claimed communication “over a network,” based on this disclosure of an external computer (client) communicating with the printer over a wired/wireless connection, it would have been obvious to implement the system such that the communication is over a network, to beneficially allow for remote control of the printer, or to allow for control of the printer by multiple computers

within an office or work space. EX1003, ¶128.

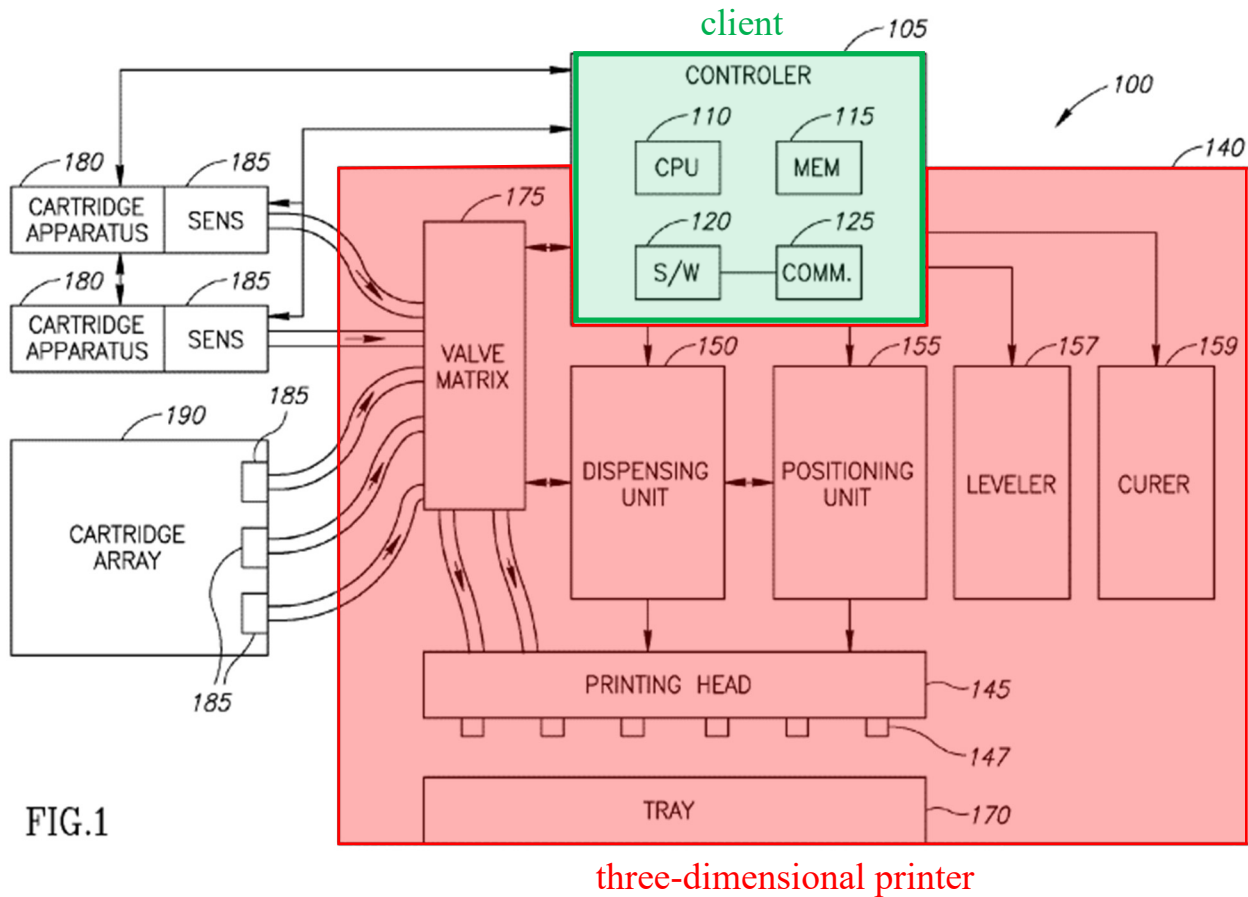


FIG.1

EX1009, FIG. 1.

“Controller 105 may utilize Computer Object Data (COD) representing an object or a model, such as CAD data in Stereo Lithography (STL) format....

Controller 105 may convert such data *to instructions* for the various units within 3D printer system 100 to print a 3D object.” EX1009, [0024]-[0026] (“CAD

system”). Menchik discloses that “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]. The “computing platform” providing the printing file is an example of the controller 105 external to the printing apparatus 140. EX1003, ¶¶129-130. In accordance with the scope of this limitation advanced by Patent Owner in the litigation, the printing file provided by the controller of the computing device (client) to the printing apparatus (three-dimensional printer) is a request to fabricate an object on the printing apparatus (three-dimensional printer). *Id.*

Element 1[c]

As discussed above in element 1[a], Menchik’s 3D printer system 100 includes material supply sources such as cartridge apparatuses 180 and cartridge arrays 190 that house cartridges 250 and 410, respectively. EX1009, FIG. 1, [0020], [0009], [0002]-[0003], [0006], [0022]. In one example, Menchik describes that each cartridge 250 (or 410) includes “a memory device such as a memory chip 260” which stores “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.” EX1009, [0035], [0043]. Printing apparatus 140 (three-dimensional printer) is coupled to the cartridge 250/410 (a supply of build material) and the memory chip 260 is a tag that stores at least one property of the building material. EX1003, ¶131.

Element 1[d]

Menchik’s “memory chip reader 225 may be associated with cartridge housing 210, to read data stored in memory chip 260.” EX1009, [0037], [0030], [0043]; EX1003, ¶132.

Element 1[e]

Menchik’s “[c]artridge housing 210 may include an interface unit or memory device reader, such as a memory chip reader 225 that may be connected to printing controller 105, to read data from one or more memory devices such as memory chips or other data storage units associated with cartridge 250, and transfer data to controller 105.” EX1009, [0030], [0037], Abstract. Menchik’s FIG. 6 shows that at “block 605 this data, as well as other data, for example, from a memory chip associated with a cartridge, may be transmitted to a printer controller”:



EX1009, FIG. 6 (partial), [0047]. Menchik discloses that the controller 105 is in a computing device (client) that communicates with the printing apparatus 140 (three-dimensional printer) over a network. EX1003, ¶133; *supra* 1[b]. The data transferred to the controller includes at least one property of the build material. EX1009, [0035]; EX1003, ¶134; *supra* 1[c], 1[e].

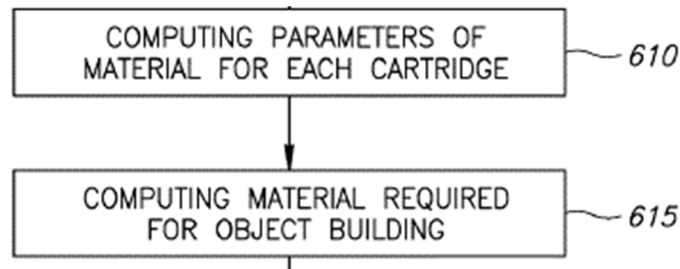
Element 1[f]

Menchik’s “[c]ontroller 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, guidelines for which cartridges to use, how many to use, if and when any replacements are necessary etc.” EX1009, [0037]. Menchik’s “[c]ontroller 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

parameters may indicate potential yields during printing usage.... For example, supply parameters may indicate or help determine, by controller 105 and/or one or more operators, whether or not to use building material from at least one selected cartridge or other source (e.g., to prevent the need for a source switch during an object build), when to extract building material from one or more cartridges, and how much building material to extract from one or more cartridges at any given time, according to the requirements of printing apparatus 140 for a particular object being printed.” EX1009, [0027], [0007]. Menchik’s client controller 105 external to the printing apparatus 140 (per 1[b]) “control[s] the supply of building material to printing apparatus 140” based on the data by sending operational parameters to the printing apparatus 140. EX1003, ¶135.

Menchik’s FIG. 6 shows that at “block 610 various parameters of the materials within the various cartridges may be computed by the controller, for example, the amount of material of each type and/or color presently available in each cartridge, by, for example, utilizing the data provided by the respective sensors and respective memory chips attached to the respective cartridges.” EX1009, [0047]. Additionally, 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”:



EX1009, FIG. 6 (partial), [0048]; EX1003, ¶136.

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.*

Element 1[g]

Menchik’s printing apparatus 140 prints 3D objects and “may include for example a printing head 145, a material dispenser 150, a positioner 155, a printing tray 170, a set of valves (wherein set may include one item) such as a valve matrix 175, a leveler 157, and curer 159 and any other suitable components.” EX1009, [0022]-[0023]. Menchik’s “[c]ontroller 105 may receive data from one or more

material supply sources, and control the supply of building material to printing apparatus 140.” EX1009, [0027], [0007]. Based on Menchik’s disclosure discussed above in 1[f], the printing apparatus 140 (three-dimensional printer) fabricates the object with the building material according to the printing parameters, operation parameters, building parameters, material parameters, and supply parameters (collectively operational parameters) received from the controller 105 in the computing device (client). EX1003, ¶138.

(b) Claim 3

Supra, element 1[a]. EX1003, ¶139.

(c) Claim 4

Supra, element 1[e]. EX1003, ¶140.

(d) Claim 5

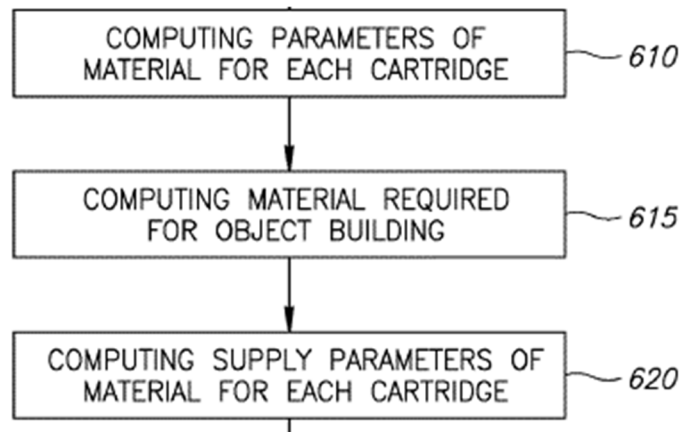
Menchik’s “[c]ontroller 105 may use the data received, for example, data from memory chip reader 225, data from load cell 230, and other data, to compute printing parameters, including, for example, guidelines for which cartridges to use, how many to use, if and when any replacements are necessary etc.” EX1009, [0037]. Menchik’s “[c]ontroller 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, ***supply parameters may indicate or help determine, by controller 105 and/or one or more operators, whether or not to use building material from at least one selected cartridge or other source*** (e.g., to prevent the need for a source switch during an object build), when to extract building material from one or more cartridges, and how much building material to extract from one or more cartridges at any given time, according to the requirements of printing apparatus 140 for a particular object being printed.” EX1009, [0027], [0007]; EX1003, ¶141.

Menchik discloses that “[c]ontroller 105 may select which cartridges 410 to use for object printing based on, for example, data received from sensor(s) 430, memory chip reader(s) 225, cartridge sensor 550, and any other suitable sensor elements. For example, cartridge 250 availability, weight, material types, material color, or any other parameters may be factored into such a selection.” EX1009, [0043]; EX1003, ¶142.

Menchik’s FIG. 6 shows that at “block 610 various parameters of the materials within the various cartridges may be computed by the controller, for example, the amount of material of each type and/or color presently available in

each cartridge, by, for example, utilizing the data provided by the respective sensors and respective memory chips attached to the respective cartridges. For example, the memory devices or chips may store data relating to the material type, properties, etc.” EX1009, [0047]. Additionally, 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.” EX1009, [0048]. Further, at “block 620 the printer controller may compute, based on the materials required for printing a given object, supply parameters for the material in each cartridge. For example, the controller may determine whether the amount of modeling and/or support material in the available cartridges is sufficient to complete a three-dimensional object to be built or printed, and the order of usage of the available cartridges to meet these needs”:



EX1009, FIG. 6 (partial), [0049]. The client controller 105 external to the printing apparatus 140 (per 1[b]) provides the selection of the cartridges with different material types (e.g., modeling material and support material) as operational parameters (per 1[f]) to the printing apparatus 140 for a particular object being printed. EX1003, ¶143.

(e) Claim 7

Supra, elements 1[f]-1[g]. EX1003, ¶144.

(f) Claim 9

Supra, elements 1[c]-1[d]. EX1003, ¶145.

(g) Claim 10

Based on Menchik's disclosure as discussed above in 1[f], the recommended jetting temperature is an extruder temperature, and the optimum building

parameters (e.g., for building or support)² and the amount of support liquid and support materials required is a support structure requirement. EX1003, ¶146.

(h) Claim 11

Supra, element 1[a]. EX1003, ¶147.

(i) Claim 20

Supra, element 1[b]. EX1003, ¶148.

(j) Claim 19

Element 19[p]

Supra, element 1[p]. EX1003, ¶149.

Element 19[a]

Menchik's printing apparatus 140 (three-dimensional printer) includes one or more cartridge apparatuses 180 and/or cartridge arrays 190, each including a housing for a container of build material and a memory chip reader 225 (tag sensor), as shown in FIGS. 1 and 2 below. EX1009, [0020], [0009], [0006], [0030],

² This implementation of Menchik aligns with the '466 patent's example where "the controller may make the determination of operational parameters using only the data from the data tag 304. For example, the data tag 304 may explicitly specify an extruder temperature and the controller may use the extruder temperature as an operational parameter." EX1001, 15:26-31.

[0037], [0043]; EX1003, ¶150; *supra* 1[c]. Menchik discloses an option in which controller 105 is “located inside printing apparatus 140”:

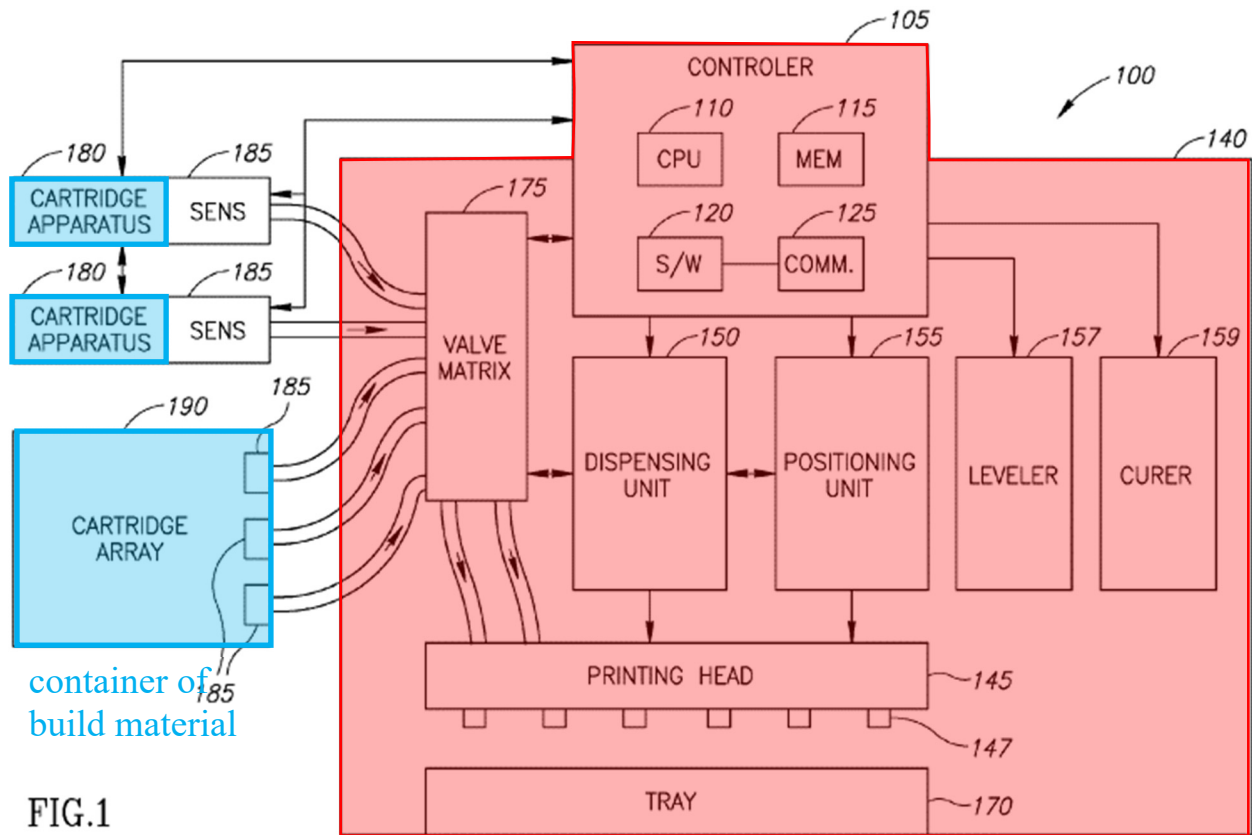


FIG.1

three-dimensional printer

EX1009, FIG. 1, [0024].

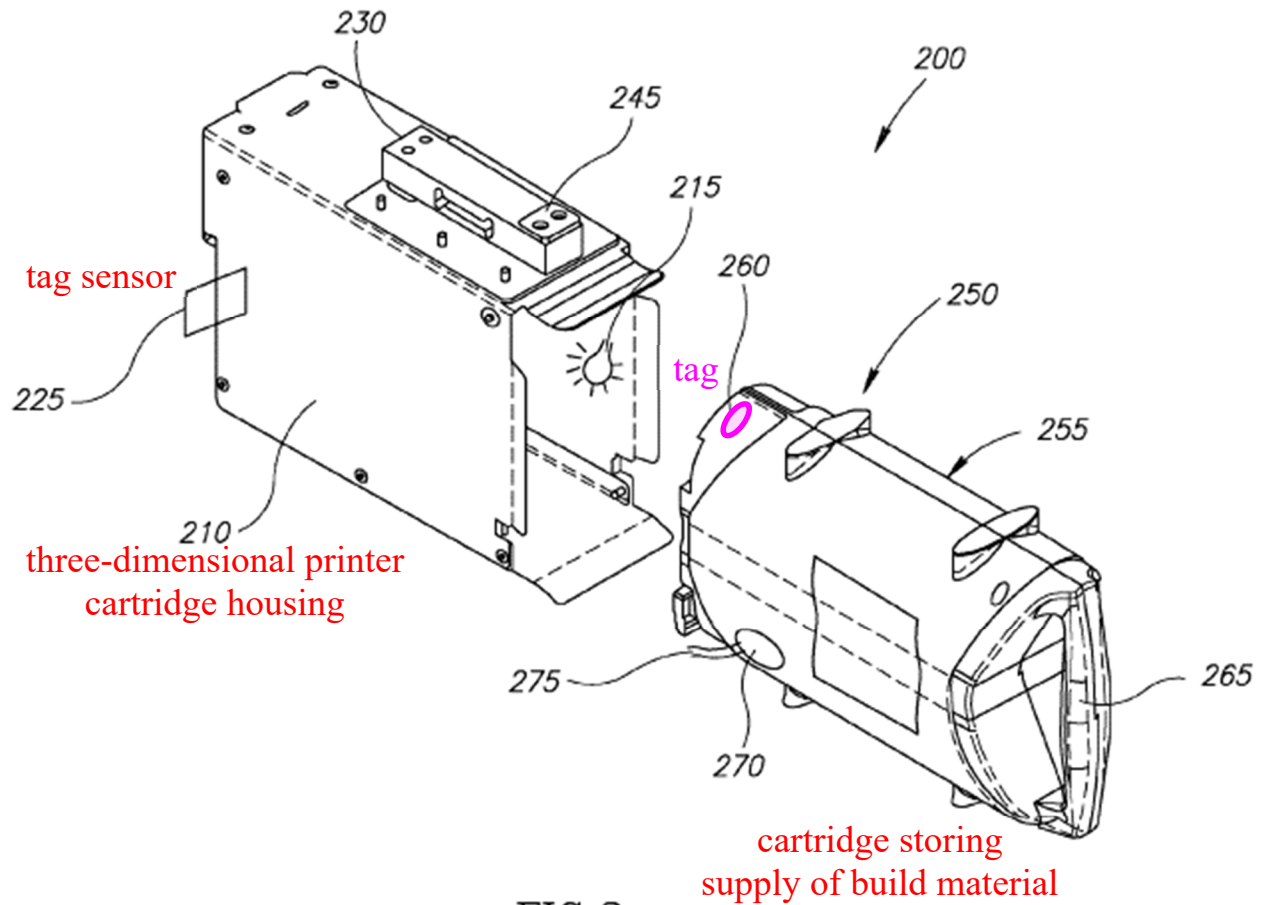


FIG.2

EX1009, FIG. 2

Element 19[b]

Supra, element 1[a]. EX1003, ¶151.

Element 19[c]

Supra, element 1[d]. EX1003, ¶152.

Element 19[d]

In the embodiment where the controller 105 is “located inside printing apparatus 140” (EX1009, [0024]), the data read from the tag would be transmitted to the controller in a similar manner as described above in 1[e]. EX1003, ¶153.

Element 19[e]

Supra, element 1[f] and claim 10. EX1003, ¶154.

Element 19[f]

Supra, element 1[g]. EX1003, ¶155.

G. GROUND 3B—Claims 1, 3-5, 7, 9-11, and 20 are obvious over Menchik and Jazayeri

Ground 3B is substantively identical to, and incorporates the analysis of, Ground 3A in all but one respect. Where Ground 3A relies on Menchik's disclosure to satisfy 1[b], Ground 3B relies on the additional disclosure of Jazayeri. The predictable implementation of Jazayeri's suggestion here does not disturb the aspects of Menchik mapped to other claim elements. EX1003, ¶156. To avoid repetition, and because the analysis of all other claim elements is identical, only 1[b] is addressed below.

Element 1[b]

To the extent that Menchik's printing file (*supra*, Ground 3A, element 1[b]) is not considered a request, a POSITA would have found it obvious for Menchik's system to include a print server for receiving a print request over the network from a client device, providing the client with a print dialog or other user interface for the user to select an available printer, and then receiving a print job designating the selected printer from the client device, based on Jazayeri's suggestion described above in Section III.B. EX1003, ¶¶35-36, 157; EX1010, Abstract, [0008]-[0010],

[0019]-[0021], [0036]. A POSITA would have been motivated to implement Menchik's system in a manner that employs Jazayeri's suggestion to achieve several known benefits (articulated below) and thereby enable Menchik's system to accommodate multiple client devices and multiple printers. EX1003, ¶158. A POSITA would have been motivated to combine Menchik's and Jazayeri's teachings to provide this functionality for multiple reasons. *Id.*

First, A POSITA would have been motivated to apply Jazayeri's suggestions to Menchik to beneficially provide a networked printing environment that supports multiple clients and multiple printers. EX1003, ¶159. As Jazayeri explains, "the system 100 provides an ability for virtually any application running on any device within the network 106 (e.g., the applications 112, 116 and devices 108, 120) to communicate with the cloud print service 102 to thereby print to any printer which is also in (direct or indirect) communication with the cloud print service 102. Consequently, users may benefit from increased printing options and abilities." EX1010, [0028].

Second, a POSITA would have been motivated to apply Jazayeri's suggestions to Menchik to beneficially provide "a user with a uniform printing experience which is platform-independent and which unburdens the user of the need to configure, update, or otherwise maintain or oversee printer operations." EX1010, [0018]; EX1003, ¶160. Jazayeri discloses that the application manager

“enables the application 112 to print directly to the cloud-aware printer” “without e.g., requiring a local driver within the operating system 110. As a result, virtually any application 112 that may be configured to communicate with the cloud print service 118 may make use of the cloud-aware printer 118.” EX1010, [0025].

Third, a POSITA would have been motivated to implement Menchik’s system to include Jazayeri’s suggested functionality to beneficially provide printer manufacturers with “a decreased or eliminated need to provide users with the (updated) driver(s) and other prerequisites for users to fully experience the benefits of their products. This may result in, for example, higher customer satisfaction, and a decreased cost of producing and maintaining printers.” EX1010, [0028]; EX1003, ¶161.

Finally, such an implementation of Menchik’s system to include Jazayeri’s suggested techniques would have been merely the application of known techniques to a known system ready for improvement to yield predictable results. EX1003, ¶162; EX1010, [0018]-[0028], FIG. 1; *KSR*, 550 U.S. at 417. Here, the systems of Menchik and Jazayeri are each related to networked printing environments, which is the same as the ’466 patent. EX1009, [0021], [0024], [0026]; EX1010, [0018]-[0028], FIG. 1; EX1001, 4:57-13:64, FIG. 2. While Jazayeri describes a networked printing environment with respect to 2D printers, a POSITA was not an automaton and instead would have possessed ample skill to successfully

incorporate Jazayeri's suggested teachings into Menchik's networked environment of 3D printers and thus would have reasonably expected success achieving the combination. EX1003, ¶162.

H. GROUND 3C/3D—Claims 2, 8, 12, and 16 are obvious over Menchik and Loughran (3C) and Menchik, Jazayeri, and Loughran (3D)

1. Claim Element Analysis

(a) Claim 2

Menchik's "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, guidelines for which cartridges to use, how many to use, if and when any replacements are necessary etc." EX1009, [0037], [0027], [0030], [0043], [0047]. A POSITA would have found it obvious and straightforward to implement Menchik's system such that printing apparatus 140 receives a request from the client controller 105 for the data from the tag, and in response, the memory chip reader 225 transfers the data to the controller 105, based on Loughran's suggestion as discussed above in Section III.A.4(b). EX1003, ¶163; EX1004, [0033], [0041],

[0047].

A POSITA would have been motivated to apply Loughran's suggestions to Menchik to beneficially enable the client controller 105 to request updated information regarding the materials used by the printing apparatus 140 when preparing the printing file for fabricating the object. EX1003, ¶164; EX1009, [0024]-[0025]. Loughran explains that "materials from which SFF systems of SFF fabricators can fabricate physical objects can have different types of information" and "can vary from material to material," and "[s]ome 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." EX1004, [0002]. It would be desirable for the client controller to use the most up-to-date information to prepare the printing file to avoid errors in fabricating the object. EX1003, ¶164.

Such an implementation of Menchik's system based on Loughran's suggested techniques would have been merely the application of known techniques to a known system ready for improvement to yield predictable results. EX1003, ¶165; *KSR*, 550 U.S. at 417. Here, the systems of Menchik and Loughran are each related to a networked printing environment including a three-dimensional printer, which is the same as the '466 patent. EX1004, [0001], [0012]-[0013], FIG. 1;

EX1009, [0002]-[0003], [0021], [0024], [0026]; EX1001, 1:66-2:3, 3:20-25, 4:57-13:64, FIG. 2. In this context, a POSITA was not an automaton and instead would have possessed ample skill to successfully implement the combination as described above and thus would have reasonably expected success achieving the combination. EX1003, ¶165.

(b) Claim 8

Menchik's tag includes "a memory device such as a memory chip 260 or other suitable data storage device" (EX1009, [0035]) and "an interface unit or memory device reader, such as a memory chip reader 225... to read data from one or more memory devices such as memory chips or other data storage units" (EX1009, [0030]). EX1003, ¶166; *supra* 1[a]. Menchik further discloses that "information relating to the material stored within cartridge 250 may be preprogrammed onto a memory chip, e.g., chip 260" and "may be continuously updated." EX1009, [0036]. A POSITA would have found it obvious and straightforward to implement Menchik's memory chip reader as a RF reader and to include Menchik's memory chip in a RFID tag, based on Loughran's suggestion. EX1003, ¶166. As one example, Loughran discloses a build material container containing a RFID tag, and a RF reader to detect signals returned by the RFID tag. EX1004, [0020]-[0021], [0047]. An RFID tag includes a memory chip. EX1003, ¶166; EX1007, 3.

A POSITA would have been motivated to Loughran's suggestion to Menchik to provide this functionality for multiple reasons. *Id.* For example, a POSITA would have been motivated to use RFID technology in Menchik's system because a number of advantages suggest applying RFID for added value of identification. EX1003, ¶¶166-167. Compared to conventional semiconductor memory which requires the printer to have electrical contact with the memory to transfer data to the printer (EX1015, [0026]), RFID requires no contact, so tag placement is less constrained. EX1007, 3. Additionally, tags are less sensitive to adverse conditions such as dust, chemicals, physical damage, etc. *Id.*

The use of RFID technology for Menchik's memory chip and memory chip reader would have been an obvious design choice. EX1003, ¶168; *KSR*, 550 U.S. at 421 ("a person of ordinary skill has good reason to pursue the known options within his or her technical grasp."). A number of publications establish that use of RFID tags to store data regarding printing materials was well-known at the time of the '466 patent. EX1007; EX1004, [0020]-[0021], [0047]; EX1012, [0017], [0024]; EX1013, [0008], [0063]; EX1014, [0040]; EX1015, [0020], [0022]-[0026]; EX1016, [0049], [0054], [0068]-[0069].

Such an implementation of Menchik's system based on Loughran's suggested techniques would have been merely the application of known techniques to a known system ready for improvement to yield predictable results. EX1003,

¶169; *KSR*, 550 U.S. at 417. Here, the systems of Menchik and Loughran are each related to storing and using build material data for fabricating three-dimensional objects, which is the same as the '466 patent. EX1004, [0020]-[0021], [0033], [0047]; EX1009, [0030], [0037], [0043]; EX1001, 1:23-25, 1:29-33, 14:30-32, 14:32-15:10, 15:11-17. In this context, a POSITA was not an automaton and instead would have possessed ample skill to successfully implement the combination as described above and thus would have reasonably expected success achieving the combination. EX1003, ¶169.

(c) Claim 12

As discussed above in claim 8, POSITA would have found it obvious to include Menchik's memory chip in an RFID tag that is read by an RFID reader. EX1003, ¶170. A RFID tag is either passive or active because RFID tags are of one of two types: passive or active. *Id.*; EX1007, 1.

(d) Claim 16

Supra, claim 8. EX1003, ¶171.

I. GROUNDS 3E/3F—Claim 17 is obvious over Menchik and Dahlin (3E) and Menchik, Jazayeri, and Dahlin (3F)

To the extent that Menchik's disclosures discussed above in Section III.D (citing EX1009, [0007], [0027], [0035], [0037], [0047]-[0049]; *supra* 1[f]) were considered to not disclose a diagnostic test that provides an error message when the amount of support material is insufficient, a POSITA would have found it obvious

and straightforward to implement Menchik's system to provide such an error message as was well-known at the time of the '466 patent based on Dahlin's suggestions as described above in Section III.D (citing EX1011, 1:64-2:2, 5:26-37, 5:55-64). EX1003, ¶¶172-173, 44. The "amount of modeling material, support liquid, or combination of modeling and support materials required for printing a given three-dimensional object" (EX1009, [0048]) is an operational parameter used in controlling operation of the three-dimensional printer when fabricating the object with the material. EX1003, ¶174. Calculating whether a cartridge contains enough material to complete the print job specified in the printing file is a diagnostic test to determine whether the operational parameter (the amount of material required) is suitable for the printing apparatus to complete the print job. *Id.*

A POSITA would have been motivated to implement Menchik's system in a manner that employs Dahlin's suggestions regarding performing a diagnostic test to beneficially provide the user with a notification either that the amount of material is adequate to complete the job or that the cartridge will need replacement and reloading during the process. EX1011, 5:26-37; EX1003, ¶175. Notifying the user advantageously provides the user the opportunity to make modifications to the printing file or to replace the cartridge before printing begins when the cartridge does not contain enough material to complete the print job. *Id.*

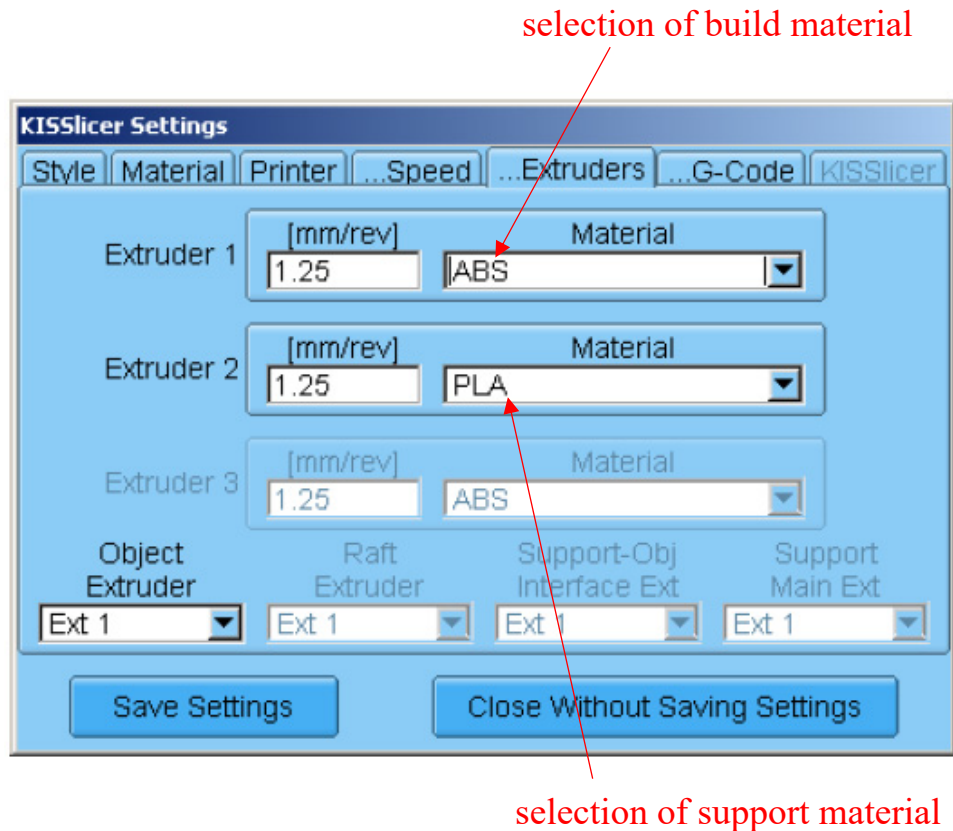
Such an implementation of Menchik's system based on Dahlin's suggested techniques would have been merely the application of known techniques to a known system ready for improvement to yield predictable results. EX1003, ¶176; *KSR*, 550 U.S. at 417. Here, the systems of Menchik and Dahlin are each related to storing and using build material data for fabricating three-dimensional objects, which is the same as the '466 patent. EX1009, [0007], [0027], [0035], [0037], [0047]-[0048]; EX1011, 1:13-17, 1:51-64, 5:3-14, 5:55-64; EX1001, 1:23-25, 1:29-33, 14:30-32, 14:32-15:10, 15:11-17. In this context, a POSITA was not an automaton and instead would have possessed ample skill to successfully implement the combination as described above and thus would have reasonably expected success achieving the combination. EX1003, ¶176.

**J. GROUNDS 3G/3H—Claim 5 is obvious Menchik and
 KISSlicer (3G) and Menchik, Jazayeri, and KISSlicer (3H)**

Menchik's system provides that "the supply of building materials of multiple colors or types required for the printing of a given object may be... selectively controlled." EX1009, [0018]. A POSITA would have found it obvious to implement Menchik's system to allow the user of the client system to select the plastic build material to be extruded by one printing head for printing the three-dimensional object and to select the support material extruded by another printing head for printing the support structure, as was known in the art at the time of the

'466 patent based on KISSlicer's suggestions as described above in Section III.C.

EX1003, ¶¶177, 37; EX1018, 1-11.



EX1018, 5 (annotated).

Multiple reasons would have prompted a POSITA to implement Menchik's system to allow user selection of materials for building a three-dimensional object. EX1003, ¶178. For instance, a POSITA would have recognized that the Menchik-KISSlicer and Menchik-Jazayeri-KISSlicer combinations would have achieved a more flexible user customization of materials used to build and support the three-dimensional object depending upon the desired build quality and strength of a

particular object. *Id.*

Furthermore, a POSITA would have implemented Menchik's system based on KISSlicer's suggestions because doing so would be the application of known techniques to a known system to achieve predictable results. *KSR*, 550 U.S. at 417 ("simply arranges old elements with each performing the same function it had been known to perform"). For the reasons detailed above, and based upon the predictable mechanical components and software involved in the combination and the state of the art at the time for 3D printer systems like Menchik and KISSlicer, a POSITA would have reasonably expected success achieving the combination before the '466 patent. EX1003, ¶179.

IV. DISCRETIONARY DENIAL IS NOT JUSTIFIED

A. The Petition's New Prior Art and Errors Made During Prosecution Warrant Institution—35 U.S.C. § 325(d)

This Petition does not present a situation where the same or substantially the same prior art or arguments were previously presented during prosecution.

Regarding Part 1 of the *Advanced Bionics* framework, Grounds 1A-D rely upon Loughran and Dubois, Ground 2 relies upon Devos, and Grounds 3A-H rely on Menchik (or the Menchik-Jazayeri combination), yet none of these publications were actually addressed in any Office Action or remarks during prosecution.

Amazon.com, Inc. v. M2M Sols. LLC, IPR2019-01205, Paper 14, 15 (PTAB Jan.

27, 2020) (“a reference that ‘was neither applied against the claims nor discussed by the Examiner’ does not weigh in favor of exercising the Board’s discretion under § 325(d) to deny a petition”). And even if Part 2 of the *Advanced Bionics* framework is addressed, it is clear that there was a material error during examination because the Loughran-Dubois combination, Devos, and Menchik all provided Elements 1[f]/19[f], which the examiner mistakenly believed to be missing from the prior art. *Supra*, Section II.B; *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6, at 8 n.9 (PTAB “precedential” February 13, 2020) (“misapprehending or overlooking specific teachings of the relevant prior art where those teachings impact patentability of the challenged claims”).

B. The *Fintiv* Factors Weigh in Favor of Institution—35 U.S.C. § 314(a)

The *Fintiv* precedent should not be followed here because it exceeds the Director’s authority, is arbitrary and capricious, and was adopted without notice-and-comment rulemaking. Even if considered, the factors favor institution.

Factor 1 is neutral since there is no evidence that, if the action is maintained and a stay is requested, the court will deny a stay.

Factor 2 is neutral because the theoretical start of jury selection in June 2026 in EDTX (EX1020) is merely one of six different litigations scheduled to

start jury selection in the same court on the same date, and none of those parties—not even PO here—has certainty on which five litigations will be delayed/rescheduled. EX1025. Further, specific to this case, the theoretical start of jury selection in EDTX is not set in stone because there is a pending motion to dismiss the EDTX litigation in favor of litigation in another district (WDTX; a declaratory judgment action involving the same patent) where the jury trial is unscheduled but is statistically estimated to occur in mid-2027. EX1021. In reality, the jury trial in EDTX (if any) would not conclude until “at or around the projected deadline for the Final Written Decision.” *Canadian Solar Inc. v. Maxeon Solar Pte. Ltd.*, IPR2024-01194, Paper 12, 29-30 (PTAB January 24, 2025). Finally, Petitioner’s diligence in preparing this petition in less than six months from service of the EDTX complaint also weighs against discretionary denial, especially in light of the stipulation (see Factor 4) that avoids overlap with obviousness grounds (if any) at the theoretical EDTX trial. *Canadian Solar*, 32 (“does mitigate, at least to some extent, concerns”).

Factor 3 favors institution because there has been little investment by the court and the Markman hearing is scheduled for December 3, 2025, well after institution. See EX1020.

Factor 4 favors institution as Petitioner has made a stipulation not to pursue the IPR grounds in District Court. See EX1019.

Factor 5 is neutral. Although the parties in the parallel litigation are the same, there is no indication that the parallel litigation will reach a jury trial before the conclusion of this IPR.

And finally, Petitioner's Motion to Dismiss further favors institution under **Factor 6** because, if granted, there will be no potential overlap of issues between the IPR and parallel District Court action.

V. PAYMENT OF FEES – 37 C.F.R. §42.103

Petitioner authorizes the Patent and Trademark Office to charge Deposit Account No. 06-1050.

VI. MANDATORY NOTICES UNDER 37 C.F.R § 42.8(a)(1)

A. Real Party-In-Interest Under 37 C.F.R. § 42.8(b)(1)

In addition to Petitioner, Bambulab Limited, Shanghai Lunkuo Technology Co. Ltd., Tuozhu Technology Limited, and Bambulab USA Inc. are listed as potential real parties-in-interest.

B. Related Matters Under 37 C.F.R. § 42.8(b)(2)

Petitioner is not aware of any disclaimers, reexamination certificates, or other petitions for IPR of the '466 patent. The '466 patent was asserted in *Stratasys, Inc. v. Shenzhen Tuozhu Technology Co. Ltd. et al.*, EDTX-2-24-cv-00645 (complaint service date: September 11, 2024). That case has been consolidated with EDTX-2:24-CV-644, which involves the same plaintiff and

defendants. Additionally, the '466 patent is the subject of a declaratory judgement action (for non-infringement) in *BambuLab USA, Inc. et al. v. Stratasys, Inc.*, WDTX-1-24-cv-01511 (filed on December 9, 2024). The parties are also involved in concurrent IPR case nos. IPR2025-00257, IPR2025-00311, IPR2025-00321, IPR2025-00354, IPR2025-00531, and IPR2025-00532.

C. Lead And Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3)

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D. Service Information

Please address all correspondence and service to the address listed above.

Petitioner consents to electronic service by email at IPR56224-0010IP1@fr.com (referencing No. 56224-0010IP1).

Respectfully submitted,

Dated: February 6, 2025

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CERTIFICATION UNDER 37 CFR § 42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter Partes* Review totals 13,915 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated: February 6, 2025

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on February 6, 2025, a complete and entire copy of this Petition for *Inter Partes* Review and all supporting exhibits were provided via Express Mail, to the Patent Owner by serving the correspondence address of record as follows:

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