

Petitioner's Demonstratives

Shenzhen Tuozhu Technology Co. Ltd. (Petitioner)
v.
Stratasys, Inc. (Patent Owner)

Case No. IPR2025-00438

Patent No. 10,569,466

FISH.

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

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Case Overview



US010569466B2

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

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

(54) **TAGGED BUILD MATERIAL FOR THREE-DIMENSIONAL PRINTING**
(2017.08); *B29C 30/00* (2014.12); *B33Y 50/02* (2014.12); *B29C 48/02* (2019.02); *B29C 48/265* (2019.02); *B29C 48/266* (2019.02); *B29C 2948/9258* (2019.02); (Continued)

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

(73) Assignee: **MakerBot Industries, LLC**, Brooklyn, NY (US)

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

(56) **References Cited**
U.S. PATENT DOCUMENTS
6,022,207 A 2/2000 Dahlin et al.
6,505,926 B1 1/2003 Trahan et al. (Continued)

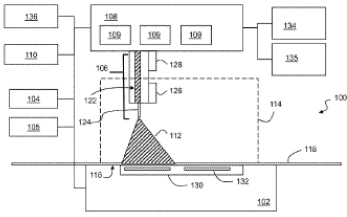
(21) Appl. No.: **16/153,224**
(22) Filed: **Oct. 5, 2018**
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US 2019/0134901 A1 May 9, 2019
Related U.S. Application Data
(63) Continuation of application No. 14/992,127, filed on Jan. 11, 2016, now Pat. No. 10,093,061, which is a (Continued)

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B29C 41/02 (2006.01)
B29C 64/205 (2017.01)
(Continued)

(52) **U.S. Cl.**
CPC *B29C 64/205* (2017.08); *B29C 48/154* (2019.02); *B29C 48/92* (2019.02); *B29C 64/106* (2017.08); *B29C 64/209* (2017.08); *B29C 64/386* (2017.08); *B29C 64/40*

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

20 Claims, 7 Drawing Sheets



- Challenged claims 1-5, 7-13, 16-20
- Claims 1, 3-5, 10, 17, and 19 are disputed

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

The '466 Patent

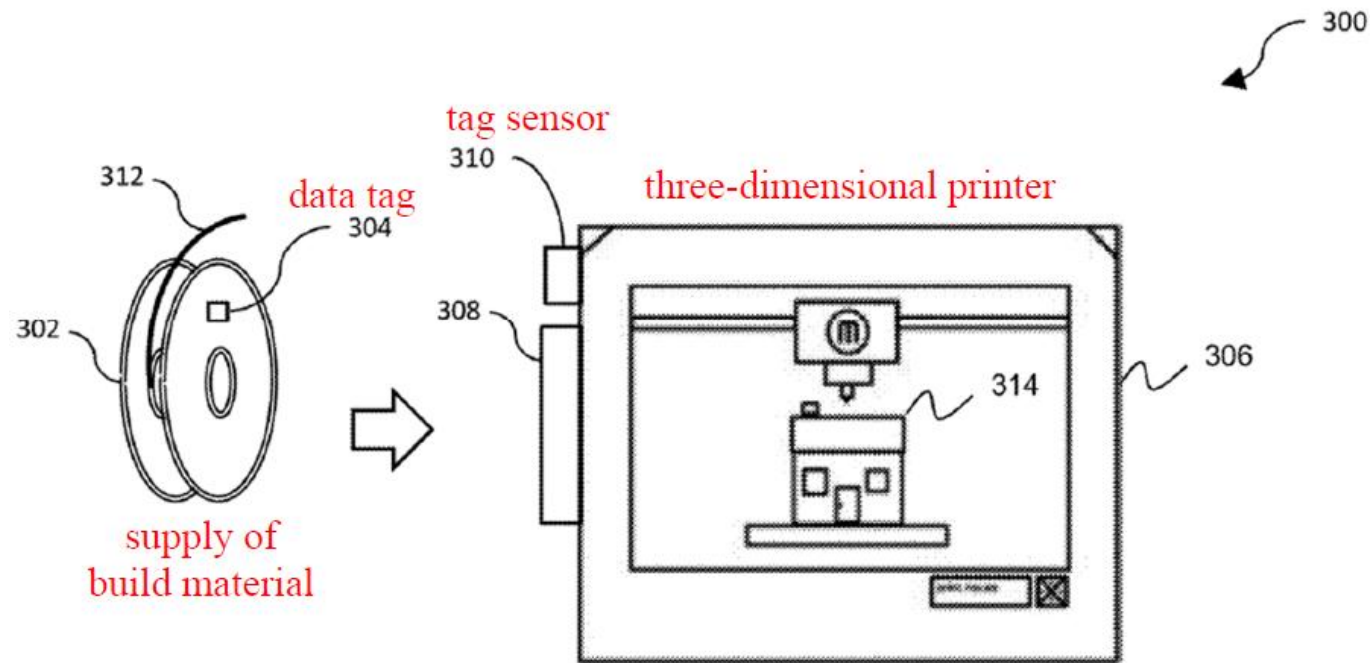


Fig. 3

The '466 Patent

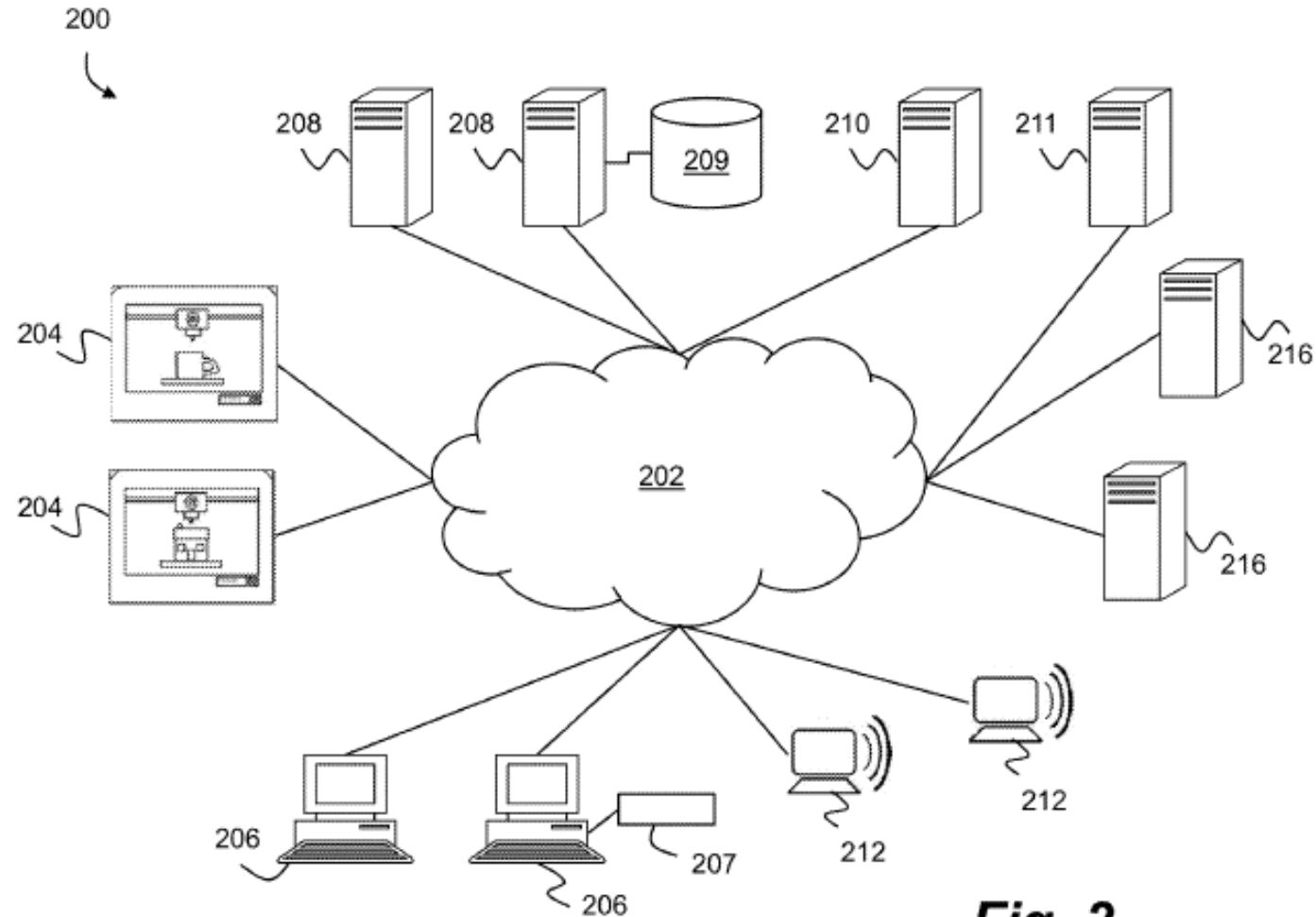


Fig. 2

The '466 Patent: Independent Claims

1. A method, comprising:
providing a three-dimensional printer that includes a tag sensor;
receiving a request from a client over a network to fabricate an object on the three-dimensional printer, the three-dimensional printer coupled to a supply of a build material including a tag that stores at least one property of the build material;
reading data from the tag with the tag sensor;
providing the data from the tag to the client over the network, the data including at least one property of the build material;
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
fabricating the object with the build material according to the one or more operational parameters.

19. A method, comprising:
providing a three-dimensional printer that includes a controller and a tag sensor;
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;
reading data from the tag with the tag sensor;
transmitting the data to the controller;
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;
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.

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DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Grounds 1A-1B: Claim 1, Element 1[f]

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Grounds 1A-1B: Claim 1, Element 1[f]

1. A method, comprising:
providing a three-dimensional printer that includes a tag sensor;
receiving a request from a client over a network to fabricate an object on the three-dimensional printer, the three-dimensional printer coupled to a supply of a build material including a tag that stores at least one property of the build material;
reading data from the tag with the tag sensor;
providing the data from the tag to the client over the network, the data including at least one property of the build material;
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
fabricating the object with the build material according to the one or more operational parameters.

Grounds 1A-1B: Claim 1, Element 1[f]

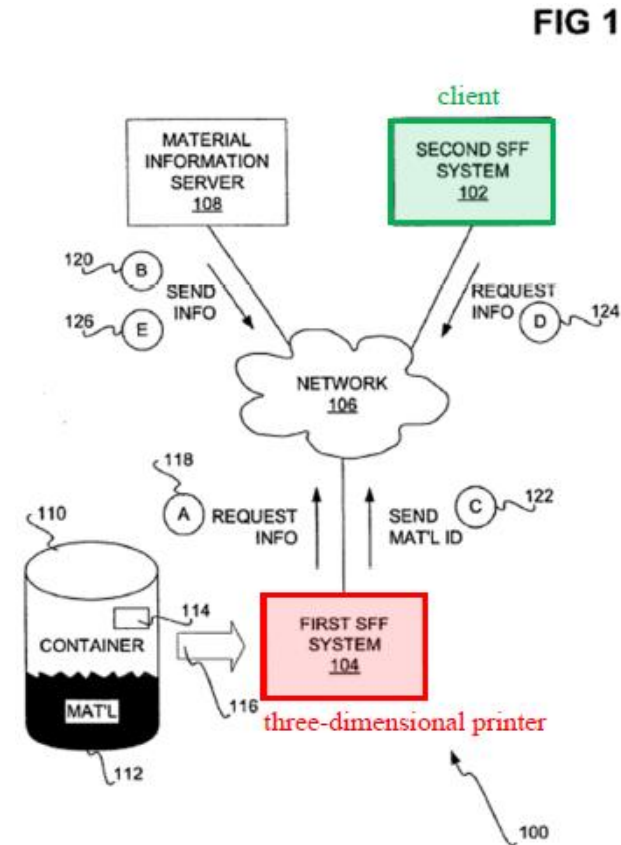
Loughran discloses receiving a fabrication job from the CAD client generated for use in controlling operation of the 3D printer when fabricating the object

[0020] Still referring to FIG. 1, 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 first SFF system 102 is introduced into the second SFF system 104, as

EX1004, [0020]; Pet., 19; Pet. Reply, 1

capable of generating SFF fabrication jobs. The CAD software 610 generates 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 first SFF system 102.

EX1004, [0055]; Pet., 24; Pet. Reply, 1-2

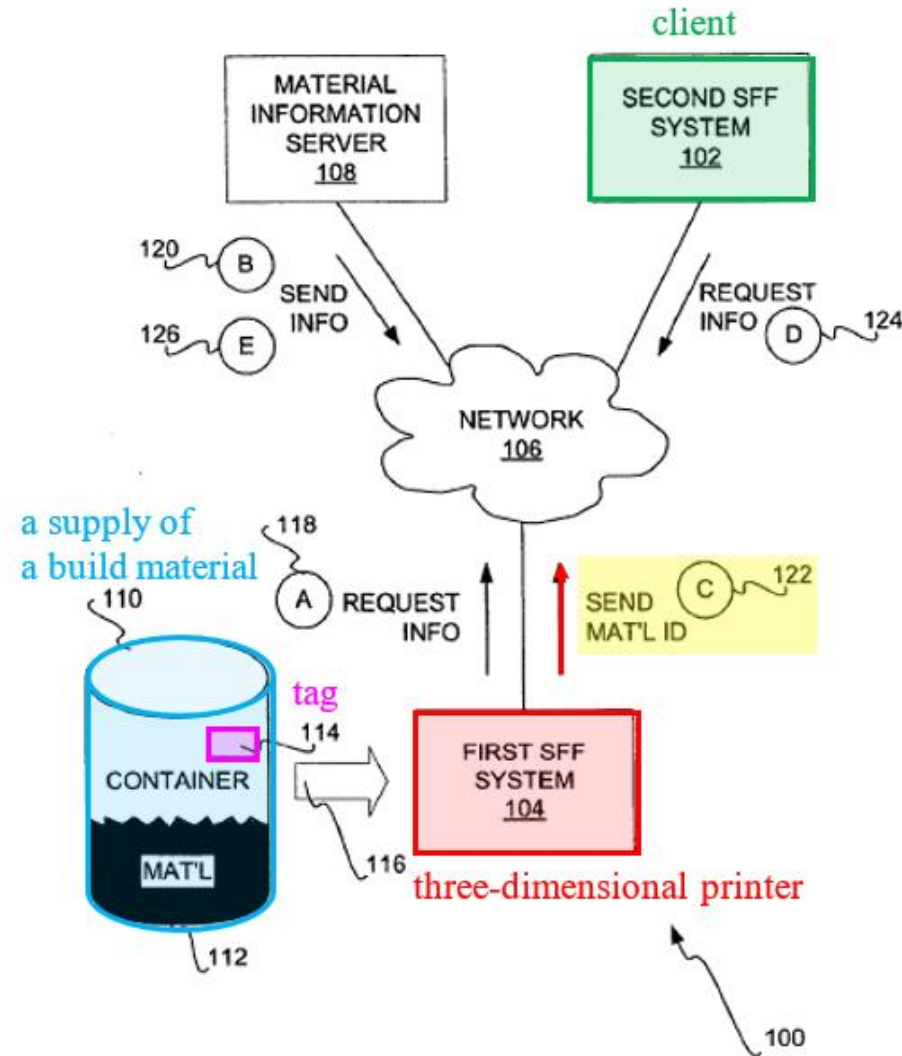


EX1004, FIG. 1; Pet., 17

Grounds 1A-1B: Claim 1, Element 1[f]

FIG 1

Loughran:



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DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Grounds 1A-1B: Claim 1, Element 1[f]

Loughran:

purpose computing device. In some embodiments of the invention, the first SFF system 102 may be considered a client to the second SFF system 104, in that the first SFF system 102 provides SFF jobs to the second SFF system 104, and the second SFF system 104 fabricates these jobs. Only one such client is depicted in FIG. 1 for illustrative convenience, and in other embodiments there may be more than one such client. Furthermore, the network 106 may be

EX1004, [0012]; Pet., 8, 15; Pet. Reply, 1

[0038] The first SFF system 102 may further be sent the retrieved information regarding the material 112, or alternatively information as to how the information regarding the material 112 can be downloaded by the first SFF system 102 itself (328). In the latter instance, for example, the second SFF system 104 may provide the first SFF system 102 with the known base URL and/or the material identifier associated with the material 112. Therefore, the first SFF system 102 has sufficient information to download the information regarding the material 112 from the material information server 108 itself.

EX1004, [0038]; Pet., 21-22; Pet. Rep. 4

[0028] In one embodiment, therefore, the first SFF system 102 requests the information regarding the material 112 from the material information server 108 over the network 106 based on the unique material identifier of the material 112, as indicated by the letter D 124. The second SFF system 104 may have already sent the material identifier for the material 112 to the first SFF system 102, as indicated by the letter C 122, such that the first SFF system 102 requests this information only if it does not already have it. The material information server 108 sends the information back to the first SFF system 102 over the network 106, as indicated by the letter E 126. The first SFF system 102 may receive the

EX1004, [0028]; Pet., 21-22; Pet. Reply, 1, 4

Grounds 1A-1B: Claim 1, Element 1[f]

Loughran:

system 104. The first SFF system 102 is depicted in FIG. 6 as including a store 602, a communication mechanism 604, a comparison mechanism 606, an information retrieval mechanism 608, and CAD software 610. The first SFF

EX1004, [0050]; Pet., 8, 17-18; Pet. Reply, 1

storage device. The store 602 stores the unique material identifiers of materials known to the first SFF system 102 for which the CAD software 610 has information by which to generate SFF fabrication jobs for transmission to the second SFF system 104 over the network 106. The information may

EX1004, [0051]; Pet., 24; Pet. Reply, 1

retrieved (414). The first SFF system 102 then parses the information regarding the materials for using it in SFF fabrication job generation (416). Periodically, the first SFF

EX1004, [0043]; Pet., 24

the CAD software 610 may be any type of software that is capable of generating SFF fabrication jobs. The CAD software 610 generates 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 first SFF system 102.

EX1004, [0055]; Pet., 9, 24; Pet. Reply, 1-2, 5

from materials, like the material 112. The first SFF 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 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]; Pet., 23-24; Pet. Reply, 1

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Grounds 1A-1B: Claim 1, Element 1[f]

Dubois discloses selecting printing parameters by a CAD computer

[0057] Conventionally, 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.

[0058] On the basis of this 3D representation and the specification, the method according to the invention determines a set of printing characteristics.

[0059] FIG. 1 is a block diagram of early stages of the method according to the invention employed when determining all the characteristics of the component production cycle. A first stage 1 of the method allows the 3D representation to be cut up into a set of characteristic objects. This set of characteristic objects is used, in a slicing stage 2 of the method, to slice the 3D representation of the component to be produced in order to obtain a set of print layers to be printed in succession. In a stage 3, the method allows a set of discrete spatial trajectories to be computed for each print layer. Stage 4 involves determining a set of printing parameters for each print layer and each spatial and temporal trajectory. The following stage 5 of the method consists in establishing a law of spatial and temporal sequencing of print path of the print layers and the discrete spatial trajectories thus determined.

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

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

[0150] The computation unit 198 is also adapted to slice the 3D representation of the component and to determine, as a function of the input data and the information stored in the database 119 about the component to be produced, the print layers to be printed successively and all of the printing parameters by employing, for example by means of software, the stage of slicing the 3D representation of the component to be produced of the method according to the invention as described hereinbefore with reference to FIG. 1.

EX1005, [0057]-[0059], [0147]-[0150]; EX1003, ¶¶65-66; Pet., 24-26

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Grounds 1A-1B: Claim 1, Element 1[f]

Dubois's printing parameters are based on the material

[0016] Problems associated with computer-aided design of the object to be produced also occur. Computer-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. Computer-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]; Pet., 11, 25

[0027] 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]; Pet., 25; Pet. Rep., 2

[0109] Firstly, the method involves determining, for each of the materials, a temperature, a pressure and a state of dispersion in the storage means as a function of its nature and its deposition conditions, in particular the arrangement of the ejection means. The object of this is, in particular, to preserve

EX1005, [0109]; Pet., 25; Pet. Rep., 2

to evolve freely or this evolution can be controlled. By controlling, in particular, the temperature of the environment in which the material is deposited, for example the air surrounding the deposited material if production takes place in the open air, and therefore the temperature of the deposited material, it is possible to control evaporation of the solvent in a favourable manner, for example by controlling uniform and/or faster or slower evaporation. It is also possible to control other properties of the surrounding environment such as the pressure, the nature of the gas in which the materials are deposited or other properties with the aim of optimising evolution of the deposited material.

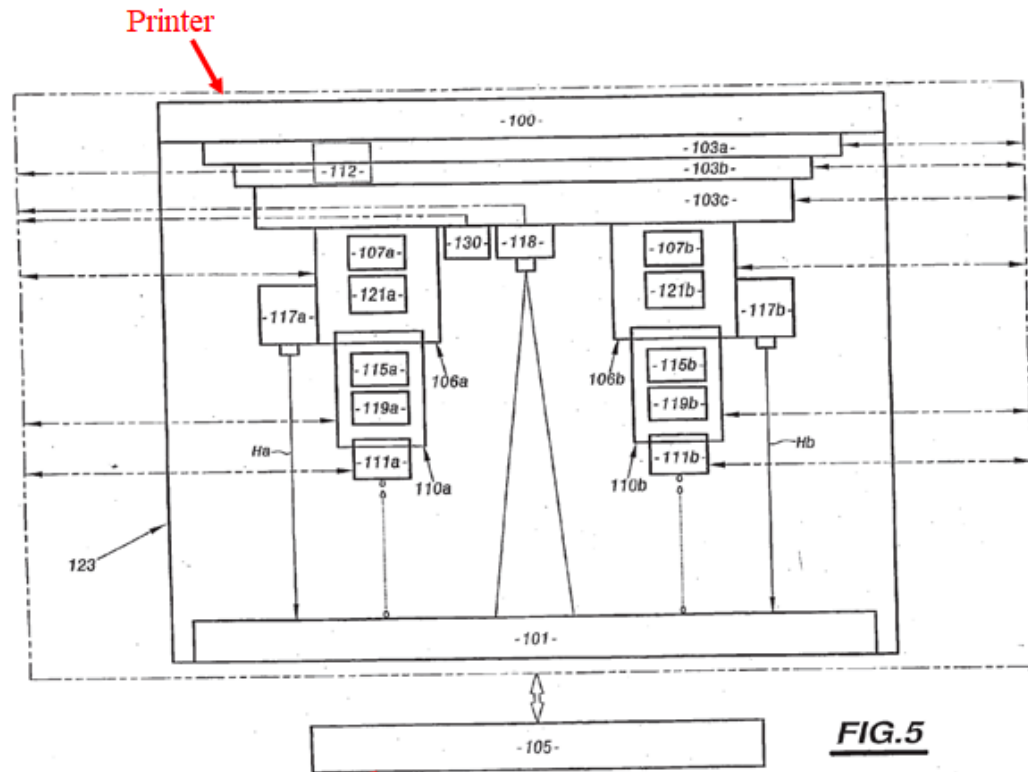
EX1005, [0111]; Pet., 25; Pet. Rep., 2

[0112] The method according to the invention thus allows the characteristics of the environment in which the component is produced to be determined, in particular by determining a temperature of the environment for each print layer.

EX1005, [0112]; Pet., 25; Pet. Rep., 2

Grounds 1A-1B: Claim 1, Element 1[f]

Dubois discloses the CAD computer being separate from the printer



Processing unit 105
(includes computation unit 198)

EX1005, [0170], FIG. 5; Pet., 25; Pet. Reply, 3

[0170] The description of the data processing unit 105 is a functional description thereof. The means which make it up can be implemented, by means of software or hardware and may be distributed in various components of the device. The computation units 198, 201, 202, 203, the analysis unit 205, the unit 206 for determining the degree of obstruction of the ejection means and the database 199 can thus be implemented by means of software on a personal computer and the various control units 207 to 211 as well as the chamber temperature control unit can be integrated in the form of a printed circuit board in the means which they are responsible for controlling. These control units can also be implemented in the form of software in a PC which can be the PC described hereinbefore.

SECOND DECLARATION OF DR. MICHAEL HICKNER

[0170]. A personal computer is a distinct device from the printer itself. During deposition, Patent Owner's expert Dr. Cormier agreed that "the computation unit 198... performs the slicing function" and "the slicer software is executing on a personal computer." EX1045, 73:15-76:13. Therefore, Dubois discloses that the computation units that determine print layers, trajectories, and printing parameters as a function of input data and information (including the state of materials, printer characteristics, and deposition conditions) are implemented on a personal computer.

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Grounds 1A-1B: Claim 1, Element 1[f]

The Loughran-Dubois combination teaches receiving printing parameters from the CAD client generated for use in controlling operation of the 3D printer when fabricating the object

DECLARATION OF DR. MICHAEL HICKNER

for each fabrication job. As I discussed above, Loughran's client computer 102 sends fabrication jobs through the network to the SFF printer 104. These fabrication jobs include CAD information and a POSITA would have beneficially applied Dubois's suggestions to the system of Loughran such that the CAD information additionally includes operational parameters, as suggested by Dubois. As such, in

Dubois's suggestions to Loughran's SFF fabrication system to include the additional parameter information disclosed by Dubois as part of the information included with each fabrication job transmitted from Loughran's client computer 102 (e.g., the CAD information discussed by Loughran in combination with operational parameters as

EX1003, ¶¶46-47; Pet., 11-12

SECOND DECLARATION OF DR. MICHAEL HICKNER

operational parameters for fabrication jobs. *Id.*; EX1003, ¶¶61-62. Therefore, the proposed modification of Loughran based on Dubois does not involve "redesigning Loughran" to "shift[] parameter-setting into the client-generated job" as Patent Owner asserts. POR, 12-13. Rather, as I explained in my first declaration, it merely implements Dubois's suggestion to provide additional details on material-based operational parameters that would beneficially be determined during fabrication job generation to complement Loughran's express disclosure of "generat[ing] a SFF fabrication job for fabrication from a specific material based on the information

EX1042, ¶8; Pet. Reply, 2

Grounds 1A-1B: Claim 1, Element 1[f]

SECOND DECLARATION OF DR. MICHAEL HICKNER

9. Loughran's disclosure of generating print jobs at the remote client computer "based on the information regarding that material" is complemented by Dubois, which suggests the conventional option of determining material-specific operational parameters at a computer separate from the printer at the time of generating print jobs (prior to printing). EX1004, [0055]; EX1005, [0069]-[0073], [0081]-[0092], [0128], [0170]. For example, Dubois suggests associating the material-specific "printing parameters" with the print job "during the stage of cutting up the 3D representation of the component," which can be performed during a slicing stage by "computation unit 198" implemented as *"software on a personal computer,"* not the printer. EX1005, [0081]-[0092] ("during or prior to the slicing stage"), [0148]-[0150] ("optimum values of *printing parameters* as a function of *the nature of the materials*" determined by "computation unit 198"), [0170]. Patent

Grounds 1A-1B: Claim 1, Element 1[f]

Patent Owner's arguments based on Loughran alone are improper

PATENT OWNER'S SUR-REPLY

does not solve the problems identified in the Response. (Reply, 1-3). Loughran assigns different roles to the client and the printer. The client uses material information to generate jobs—for example, for build-time estimation, orientation, and scaling. (EX1004, ¶¶[0002], [0027], [0043], [0055]). The printer, by contrast, retrieves machine-readable material information, extracts parameters, and “automatically and dynamically” adjusts itself for fabrication. (*Id.*, ¶¶[0024]-[0026], [0035]-[0037], [0045], [0048]). Petitioner's cited passages show client-side CAD generation plus printer-side dynamic adjustment—not the claimed receipt at the printer of client-selected operational parameters. (*Id.*, ¶¶[0002], [0024]-[0028],

[0068]-[0073], [0148]-[0150]). Nor does Loughran ¶[0041] disclose client-side selection of printer-control parameters; it says only that the first SFF system may receive information about the second SFF system, including a list of known material identifiers and perhaps a base URL. (EX1004, ¶[0041]). That does not disclose client selection of the printer-control operational parameters recited in claim 1[f].

DECISION

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

element 1b. Prelim. Resp. 27. Because Petitioner's asserted unpatentability is based on the combined teachings of Loughran and Dubois, Patent Owner's argument based on Loughran alone is unpersuasive. Patent

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PO Sur-reply, 1-2

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Grounds 1A-1B: Claim 1, Element 1[f]

The Loughran-Dubois Combination provides all necessary information to determine optimum values

Loughran

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

EX1004, [0041]; Pet. Reply, 5

[0073] All of the properties, parameters, characteristics, factors relating to the materials, to the printer and to the environment, which influence the above-described factors but which cannot be controlled, in turn constitute the deposition conditions. This applies in particular to the size and arrange-

EX1005, [0073]; Pet. Reply, 2

PATENT OWNER'S SUR-REPLY

The Reply's assertion that both systems can access the same material-information server does not close the gap. (Reply, 4-5). Loughran's server provides material information; it does not provide the printer-characteristics and deposition-condition inputs Dubois uses to determine "optimum values of printing parameters."

PO Sur-reply, 1-2

SECOND DECLARATION OF DR. MICHAEL HICKNER

1 (C 122), FIG. 4 (402). As Loughran discloses, the printer in the combination would provide the remote CAD client with "other information" and "information about itself," including the printer-characteristics and deposition-condition inputs that Dubois identifies as necessary to determine optimum values, "over the network" as part of the "information extraction process." EX1004, [0041]. As I explained in my

EX1042, ¶15; Pet. Reply, 5

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Grounds 1A-1B: Claim 1, Element 1[f]

Motivations to Combine Loughran and Dubois:

- “...‘optimum values of printing parameters as a function of the nature of the materials, the characteristics of the printer and deposition conditions.’ EX1005, [0148].”
- “...advantageously allow optimal use of the various functions of the printer based on the nature of the materials in the printer.”
- “...the application of known techniques to a known system ready for improvement to yield predictable results.”

Grounds 1A-1B: Claim 5

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Grounds 1A-1B: Claim 5

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

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

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

Grounds 1A-1B: Claim 5

The Loughran-Dubois combination teaches the printer is coupled to a first tagged build material and a second tagged build material

Loughran

[0016] In a wide-area thermal inkjet or a single jet inkjet SFF system, a jet for each of a plastic build material and a wax-like support material is used. The materials are held in a melted liquid state in reservoirs. The liquids are fed to

EX1004, [0016]; Pet., 28

and thus unknown, or already known material. The material container 110 contains a tag 114 that includes a material identifier that is unique among material identifiers of different containers containing other materials. Based on the material identifier of the tag 114, the second SFF system 104 is able to recognize the material 112 being introduced thereinto, and determine whether the material 112 is an already known material, or a new and unknown material.

EX1004, [0020]; Pet., 19

Dubois

[0021] The object of the present invention is to solve the aforementioned problems by proposing a method and a device for production by ink-jet-type printing which allow production of three-dimensional structures consisting of a plurality of different materials.

[0133] A plurality of material storage tanks 106a, 106b, with one tank per material used during the production of the multi-material component, is fixed on the displacement system. Each tank 106a, 106b comprises means 107a, 107b for

EX1005, [0021], [0133]; Pet., 28-29

Grounds 1A-1B: Claim 5

The Loughran-Dubois combination teaches the printer receives CAD information from the client for fabricating objects in a layer-by-layer manner

Loughran

[0045] The 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. The SFF

EX1004, [0045]; Pet., 29

Dubois

the object to be produced also occur. Computer-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.

EX1005, [0016]; Pet., 29

Grounds 1A-1B: Claim 5

A POSITA would have understood that the CAD information includes slices that each specifies a selection of one of the first build material and the second build material

Dubois

[0061] The first stage 1 of the method according to the invention is therefore the stage of cutting up the 3D representation of the component to be produced which involves **cutting up the 3D representation of the component** to be produced by ink-jet printing **into characteristic objects**. A characteristic object is defined by a set of geometric properties and physico-chemical properties taken in combination.

[0062] A geometric object is a region of the component which is spatially continuous, in other words in one piece. A physico-chemical object is a region of the component having a constant arrangement of particles exhibiting a particular microstructure and consisting of a single material. A characteristic object is both a geometric object and a physico-chemical object. Each of the characteristic objects of a component and the properties defining it are determined when defining the production specification **for the multi-material component to be produced.**

[0075] The following stage 2 of the method is the stage of slicing the 3D representation of the component into print layers and involves **slicing the 3D representation of the component to be produced into print layers** which are to be printed in succession. This slicing is carried out **as a function of the characteristic objects** and their desired static properties and as a function of the dynamic characteristics of the printing process which, once stabilised, ensures the required static properties of the component. This stage involves maximising the

EX1005, [0061]-[0062], [0075]; Pet., 29

Grounds 1A-1B: Claim 5

A POSITA would have understood that the CAD information includes slices that each specifies a selection of one of the first build material and the second build material

DECLARATION OF DR. MICHAEL HICKNER

78. Based on my knowledge and experience in the field and my review of Dubois, a POSITA would have understood that a slice specifies a selection of build material for use in printing the layer of the multi-material component. Multiple references, in addition to Dubois, corroborate a POSITA's understanding. For

EX1003, ¶78; Pet., 30

NAPADENSKY

[0039] Before fabrication, the virtual object is preferably 'sliced' by the system into thin slices, which may be described as bitmaps, and transferred to the fabrication engine for transforming into layers forming the three-dimensional object.

EX1006, [0039]-[0040]; Pet., 30

[0040] In a preferred embodiment of the present invention, the specific modeling materials to be used, and their combination and/or spatial deposition within the object layer are defined in the system's software for each region, according to the pre-defined properties desired for each part of the final object. For example, in a preferred embodiment, an STL is divided by an SFF system into a number of new STL-s, each defining a sub region in the object. The new STLs are then assembled to form a group of STLs, which describe the same original object. Then, a modeling material or modeling material combination to be used in the fabrication of each new STL is assigned to each STL. The system then slices the group of STLs. The resulting slices are in-turn divided into respective slices for each of the different dispensing heads. Finally the system sends the slices to the fabrication apparatus or printer to build layers of material. In another embodiment, a set of communication files, for example, a set of STL files, each defining a region in the object and referring to a common coordinate system and origin, is prepared by the object design software, i.e. CAD software.

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Grounds 1A-1B: Claim 5

Claim 5 does not require “tag-driven selection”

EX1042, ¶18; Pet. Reply, 8

PATENT OWNER’S SUR-REPLY

tag-to-client-to-printer workflow. (EX2015, 25:17-26:11). Petitioner, not Patent Owner, departs from the claim language by treating slice-level material assignment—which Petitioner asserts applies to “every 3D model”—as the specific client-based, **tag-driven selection required by claim 5**. That reading would render

PO Sur-reply, 4-5

PETITIONER’S REPLY TO PATENT OWNER’S RESPONSE

PO does not dispute that this fact that such slices would specify a selection of build material. POR, 23-25.¹ Instead, PO argues that “‘slice-level material assignment’ is not the claimed step of receiving from the client a selection of one of the two tagged supplies” **without any evidence/analysis for this implicit claim construction**. POR, 23-25. Worse yet, PO’s argument ignores that, in the Loughran-

Pet. Reply, 8

’466 Patent Claims

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

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

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

**NOT
DISPUTED**

FISH.

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Ground 2: Claim 19, Element 19[e]

FISH.

Ground 2: Claim 19, Element 19[e]

19. A method, comprising:
providing a three-dimensional printer that includes a controller and a tag sensor;
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;
reading data from the tag with the tag sensor;
transmitting the data to the controller;
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;
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.

Ground 2: Claim 19, Element 19[e]

Devos teaches determining an operational parameter that is support structure requirement

Devos

powder are mixed. The system can also use the data encoded in or on the memory mechanism 146 to determine certain operating parameters, such as for example, print speed, drop volume per voxel, color maps, dry time needed after build completion, shrink or expansion size, adjustment factors, powder settling coefficients (e.g., to determine whether powder supports need to be included, and if so, how much support), minimum allowable layer thickness, etc.

EX1008, [0032]; Pet., 49

DECLARATION OF DR. DENIS R. CORMIER

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

EX2013, ¶133; POR, 38

DECLARATION OF DR. MICHAEL HICKNER

supports are needed, a POSITA would have found it obvious and straightforward to implement Devos’s system to determine an operating parameter specifying whether and how much powder supports are needed. Indeed, based on the express disclosure of Devos that a powder settling coefficient is used to “determine whether powder supports need to be included, and if so, how much support” would have indicated to a POSITA that the system would need to generate a parameter indicating “how much support” material to use in fabricating the object. A POSITA also would have recognized that this parameter provides the claimed support structure requirement. A POSITA would have been motivated to so implement Devos’s system in this manner in order to fabricate an object with the proper support to prevent portions of the object from collapsing during fabrication.

EX1003, ¶113; Pet., 49

Ground 2: Claim 19, Element 19[e]

A POSITA would have understood that in some powder bed processes, support structures are necessary during fabrication

BENCHMARKING OF DIFFERENT SLS/SLM PROCESSES AS RAPID MANUFACTURING TECHNIQUES

J.-P. Kruth, B. Vandenbroucke, J. Van Vaerenbergh, P. Merckelis
Division PMA, Department of Mechanical Engineering, Katholieke Universiteit Leuven, Belgium

occur at the real edge of the feature. Near-horizontal overhanging surfaces (figure 2d) are not directly possible for processes with metal melting as binding mechanism. Since the laser beam penetrates deeply into the powder bed, bottom surfaces are not finished well and support structures are necessary to guarantee adequate process continuation.

EX1043, 4; Pet. Reply, 10

OPTIMIZATION OF SUPPORTS IN METAL-BASED ADDITIVE MANUFACTURING BY MEANS OF FINITE ELEMENT MODELS

T. A. Krol^a, M. F. Zaeh^b and C. Seidel^a

Metal-based additive manufacturing processes require a supporting of overhanging part areas during the powder solidification e. g. for improving the heat dissipation to the substrate. Technology users nowadays strive to

Fig. 1 shows that support structures for product manufacturing by means of metal- and powder-based additive processes are used (cf. VAN ELSSEN 2007, KROL ET AL. 2011B). These structures are exhibiting firstly the function for heat dissipation from overhanging part areas to the substrate (building plate) and are secondly protecting these part sections from displacing during manufacturing. After the process is finished, these additional support structures are separated from the part and are then disposed. Hence, these constructions are not creating value.

EX1044, 1-2; Pet. Reply, 10

Ground 2: Claim 19, Element 19[e]

Devos teaches determining an operational parameter that is support structure requirement as claimed

PATENT OWNER'S SUR-REPLY

an implementation issue as Petitioner proposes, Devos provides no algorithm, working example, or explanation of how a settling coefficient becomes a determination whether supports are needed, where they should go, or how much should be printed. (EX1008, ¶¶0032]; EX2013, ¶¶139-141). Under *Wands*, the

PO Sur-reply, 8

DECISION

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

The evidence in the record before us supports Petitioner's argument that Devos teaches or suggests element 1e. The plain language of element 1e merely requires "determining an operational parameter . . . including . . . a support structure requirement" without necessarily requiring the physical presence of a support structure. Patent Owner does not clearly explain why

NO SUCH
REQUIREMENTS

'466 Patent Claim 19

19. A method, comprising:
providing a three-dimensional printer that includes a controller and a tag sensor;
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;
reading data from the tag with the tag sensor;
transmitting the data to the controller;
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;
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.

FISH.

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Grounds 3A-3D: Claim 1

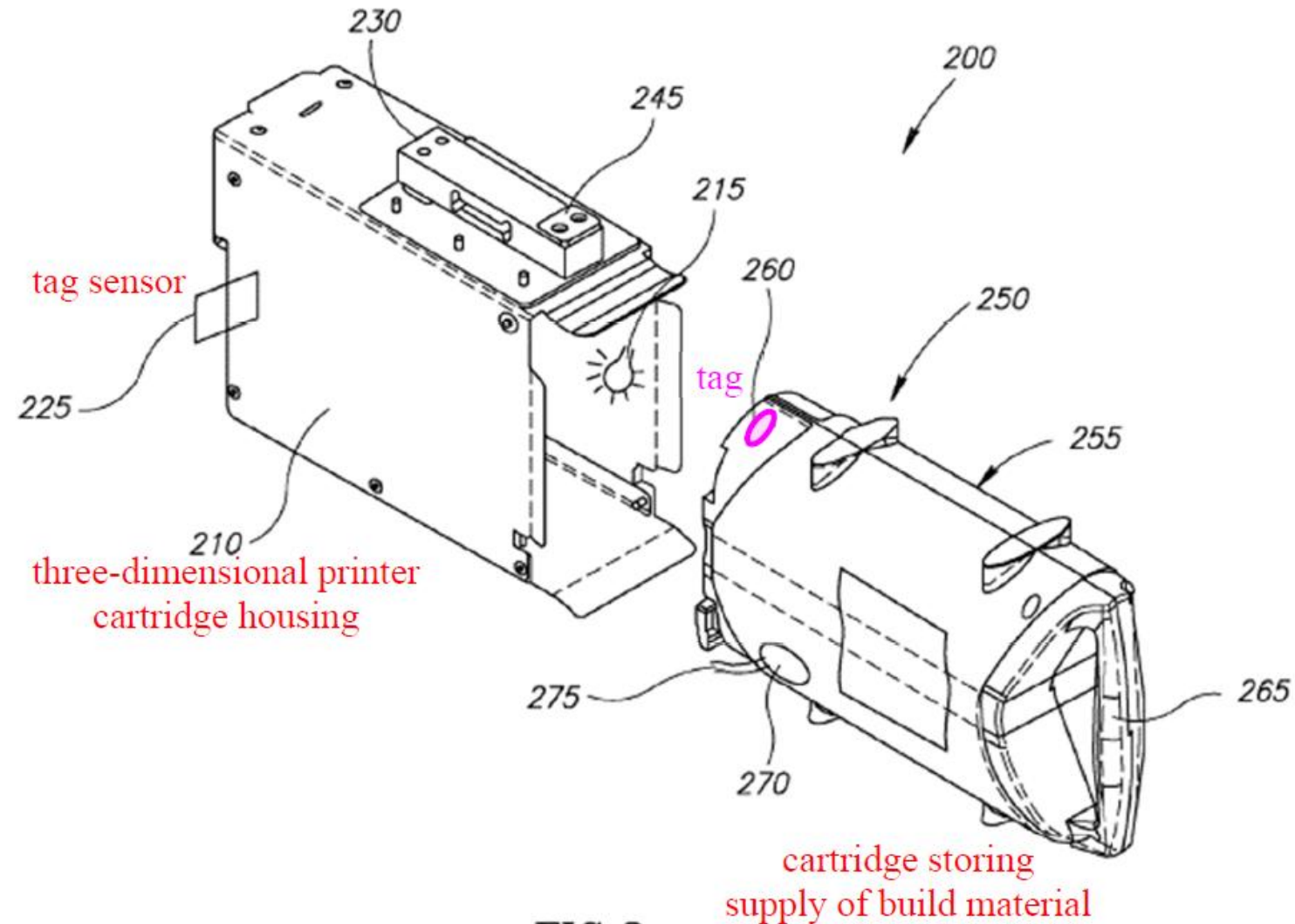
FISH.

Menchik:



Grounds 3A-3D: Claim 1, Elements 1[b], 1[e], 1[f]

Menchik:



FISH.

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Grounds 3A-3D: Claim 1, Elements 1[b], 1[e], 1[f]

1. A method, comprising:
providing a three-dimensional printer that includes a tag sensor;
receiving a request from a client over a network to fabricate an object on the three-dimensional printer, the three-dimensional printer coupled to a supply of a build material including a tag that stores at least one property of the build material;
reading data from the tag with the tag sensor;
providing the data from the tag to the client over the network, the data including at least one property of the build material;
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
fabricating the object with the build material according to the one or more operational parameters.

Grounds 3A-3D: Claim 1, Elements 1[b], 1[e], 1[f]

Menchik teaches a client that is a user-operated computing device and is distinct from the printer

[0021] Controller 105 may include, for example, a processor 110, a memory unit 115, software code 120, and a communications unit 125. Other configurations may be used for a controller or control unit. Control functionality may be spread across units, and not all control functionality may be within system 100. For example, a separate unit, such as a personal computer or workstation, or a processing unit within a supply source such as a cartridge may provide some control or data storage capability. Communications unit 125 may, for example, enable transfer of data and instructions between controller 105 and printing apparatus 140, and/or between controller 105 and one or more cartridge apparatuses 180 or cartridge arrays 190.

EX1009, [0021]; Pet., 57; Pet. Rep., 11

tus 100. Controller 105 may be located outside of printing system 100 and may communicate with printing system 100, for example, over a wire and/or using wireless communications. In some embodiments, controller 105 may include a CAD system. In alternate embodiments, controller 105

EX1009, [0024]; Pet., 57

storage, such as a CD-ROM or a hard disk. Controller 105 may be included within, or may include, 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). Controller

EX1009, [0026]; Pet., 57

external interface. For example, controller may be connectable to a computer and/or communications network, and

EX1009, [0053]; Pet. Rep., 11

Grounds 3A-3D: Claim 1 vs. Claim 19

1. A method, comprising:

providing a three-dimensional printer that includes a tag sensor;

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

reading data from the tag with the tag sensor;

providing the data from the tag to the client over the network, the data including at least one property of the build material;

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

fabricating the object with the build material according to the one or more operational parameters.

19. A method, comprising:

providing a three-dimensional printer that includes a controller and a tag sensor;

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;

reading data from the tag with the tag sensor;

transmitting the data to the controller;

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;

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.

FISH.

Grounds 3A-3D: Claim 1, Element 1[b]

Menchik teaches receiving from the client a request that includes instructions for the printer to fabricate an object

[0024] Controller 105 may utilize Computer Object Data (COD) representing an object or a model, such as CAD data in Stereo Lithography (STL) format. Other data types or formats may be used. Controller 105 may convert such data to instructions for the various units within 3D printer system 100 to print a 3D object. Controller 105 may be located inside printing apparatus 140 or outside of printing apparatus 100. Controller 105 may be located outside of printing system 100 and may communicate with printing system 100, for example, over a wire and/or using wireless communications. In some embodiments, controller 105 may include a CAD system. In alternate embodiments, controller 105 may be partially external to 3D printer system 100. For example, an external control or processing unit (e.g., a personal computer, workstation, computing platform, or other processing device) may provide some or all of the printing system control capability.

EX1009, [0024]; Pet., 58

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

EX1009, [0025]; Pet., 58

storage, such as a CD-ROM or a hard disk. Controller 105 may be included within, or may include, 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). Controller

EX1009, [0026]; Pet., 58

Grounds 3A-3D: Claim 1, Element 1[e]

Menchik teaches providing the data from the tag to the client over the network, the data including at least one property of the build material

tus 100. Controller 105 may be located outside of printing system 100 and may communicate with printing system 100, for example, over a wire and/or using wireless communications. In some embodiments, controller 105 may include a CAD system. In alternate embodiments, controller 105

EX1009, [0024]; Pet., 57

Cartridge 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. Other suitable data interface

EX1009, [0030]; Pet., 60



EX1009, FIG. 6 (partial), Pet., 61

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

EX1009, [0035]; Pet., 61, Pet. Rep., 14

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Grounds 3A-3D: Claim 1, Element 1[f]

Menchik teaches receiving an operational parameter from the client

Menchik's Example 1: Printing File

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

EX1009, [0025]; Pet., 58

DECISION

Granting Institution of *Inter Partes* Review

35 U.S.C. § 314

The broad scope of the term “operational parameter” therefore does not explicitly exclude parameters such as Menchik’s “printing file” which “may be used to determine . . . the order and configuration of disposition 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.” Ex. 1009 ¶ 25. Menchik’s teaching that controller 105 communicates with printing apparatus 104 to provide “printing system control capability” teaches or suggests that printing apparatus 104 receives information such as the printing file to control the printing operation. *See id.* ¶ 24. The record before us supports Petitioner’s contention that Menchik teaches or suggests element 1f, for purposes of institution.

Inst. Dec., 34

Grounds 3A-3D: Claim 1, Element 1[f]

Menchik teaches receiving an operational parameter from the client

Menchik's Example 2: Computed Parameters

[0007] According to some embodiments of the present invention, management and control of materials may be achieved by measuring data on the status of building material in at least one printing cartridge or supply system, and processing the building material status data to determine parameters of the building material. The printing controller may further determine supply parameters of the building material, and control the supply of the building material from two or more cartridges according to the supply parameters. In some embodiments, the printing controller may send messages to an operator.

EX1009, [0007]; Pet., 62

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., as is described in

EX1009, [0037]; Pet., 61

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

EX1009, [0027]; Pet., 62

[0049] 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. The controller may also

EX1009, [0049]; EX1003, ¶136; Pet., 63

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Grounds 3A-3D: Claim 1, Element 1[f]

Menchik teaches receiving an operational parameter from the client

Menchik's Example 2: Computed Parameters

DECLARATION OF DR. MICHAEL HICKNER

137. A POSITA would have recognized that these parameters are received at the three-dimensional printer because the three-dimensional printer would need to receive the parameters in order for the parameters to be implemented as part of the fabrication process. Alternatively, it would have been obvious to implement Menchik's device in such a manner to allow the three-dimensional printer to fabricate the object based on the parameters that are determined specific to the build material being used. Based on these and other express teachings that I discussed above with respect to element 1[b], a POSITA would have understood that 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. Receiving a printing file (request)

EX1003, ¶137; Pet., 63

Ground 3A: Claim 19, Element 19[e]

FISH.

Ground 3A: Claim 19, Element 19[e]

19. A method, comprising:
providing a three-dimensional printer that includes a controller and a tag sensor;
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;
reading data from the tag with the tag sensor;
transmitting the data to the controller;
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;
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.

Grounds 3A: Claim 19, Element 19[e]

Menchik teaches a support structure requirement based upon a property of the build material in the data

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

EX1009, [0035]; Pet., 60

controller **105**. 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**, as described in detail herein. **Controller 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. For example,

EX1009, [0043]; Pet., 60

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., as is described in**

EX1009, [0037]; Pet., 61

Grounds 3A: Claim 19, Element 19[e]

Menchik teaches a support structure requirement based upon a property of the build material in the data

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

EX1009, [0027]; Pet., 62

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

EX1009, [0048]; Pet., 63

[0049] 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. The controller may also

EX1009, [0049]; EX1003, ¶136; Pet., 63

Grounds 3A: Claim 19, Element 19[e]

Menchik teaches a support structure requirement based upon a property of the build material in the data

PATENT OWNER'S RESPONSE

Menchik's cited disclosures describe transmitting information from a cartridge memory mechanism/chip to the controller so the controller can compute or use parameters for printing and material supply, not providing tag data to a client device over a network. (Pet., 60–62; EX1009, ¶¶[0027], [0047]–[0048]). Thus, Petitioner's

POR, 49

However, Menchik's cited workflow is that controller 105 uses data from sensors and cartridge memory chips to compute "material parameters" and "supply parameters," including computing quantities/availability and determining whether/when/how much material to extract according to printer requirements for a particular object. (EX1009, ¶¶[0027], [0047]–[0048]). That is the opposite of claim

POR, 50

Grounds 3A: Claim 19, Element 19[e]

Menchik teaches operational parameters including an extruder temperature

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

EX1009, [0035]; Pet., 60-61, Pet. Rep., 18

[0027] Controller **105** may **receive data** from one or more material supply sources, and **control the supply of building material to printing apparatus 140**, for example, by **controlling the extraction or flow of materials** from the printing material sources, such as printing cartridges. For example,

object being printed. Controller **105** may be suitably coupled and/or connected to various components of printing apparatus **140**, to one or more cartridge apparatuses **180**, and to one or more cartridge arrays **190**. For example, **controller 105 may control** valves, pumps, switches, compression or inflation devices, positioning units, **dispensing units**, leveling devices, curing devices, or any other system components.

EX1009, [0027]; Pet., 62

Grounds 3A-3D: Claim 3

FISH.

Grounds 3A-3D: Claim 3

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.

Grounds 3A-3D: Claim 3

Menchik teaches first and second supplies of different build materials, each supply having a memory chip storing a property of the build material

[0023] Material supply sources, such as cartridge apparatus 180, may be situated within printing apparatus 140 or external to printing apparatus 140, and may be situated in a separate unit connected to printing apparatus 140. One or more cartridge arrays 190 may be situated in one or more independent units, connectable to printing apparatus 140. One or more cartridge apparatuses 180 and/or cartridge arrays 190 may be connected to valve matrix 175 or other set of valves via, for example, tubes carrying building material. Cartridge apparatuses 180 and/or cartridge arrays 190 may include one or more sensors 185 for each cartridge, to determine the status of the modeling material in one or more cartridges. Cartridge apparatus 180 may provide, for example, model material and/or support material for use by printing apparatus 140, to print 3D objects. Suitable material

EX1009, [0023]; Pet., 55

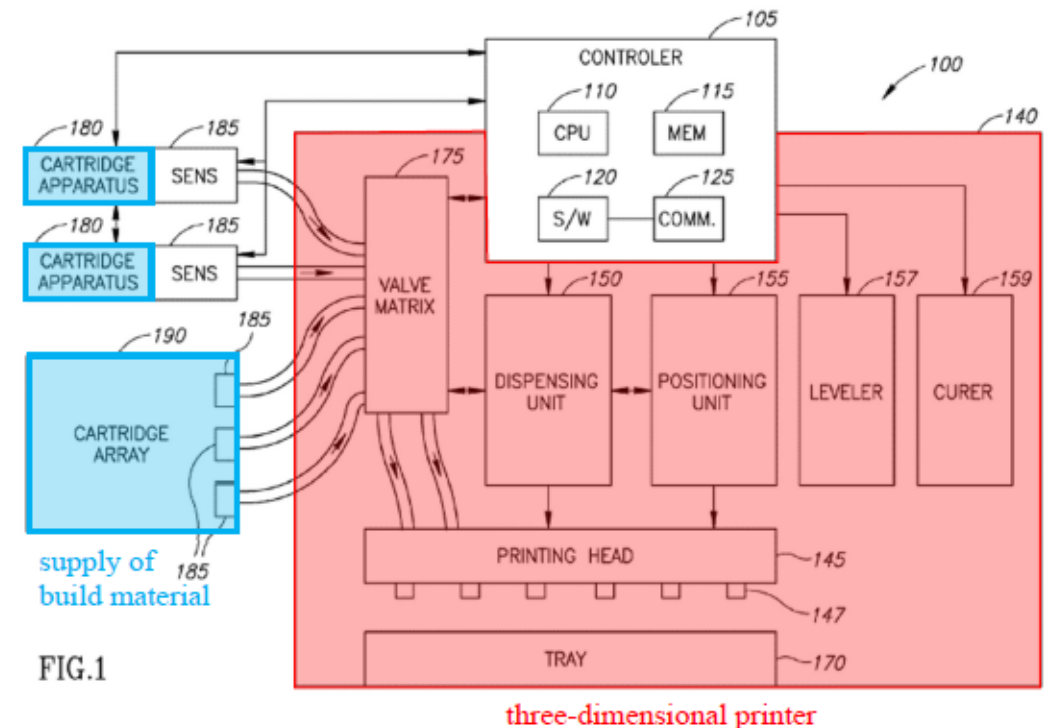


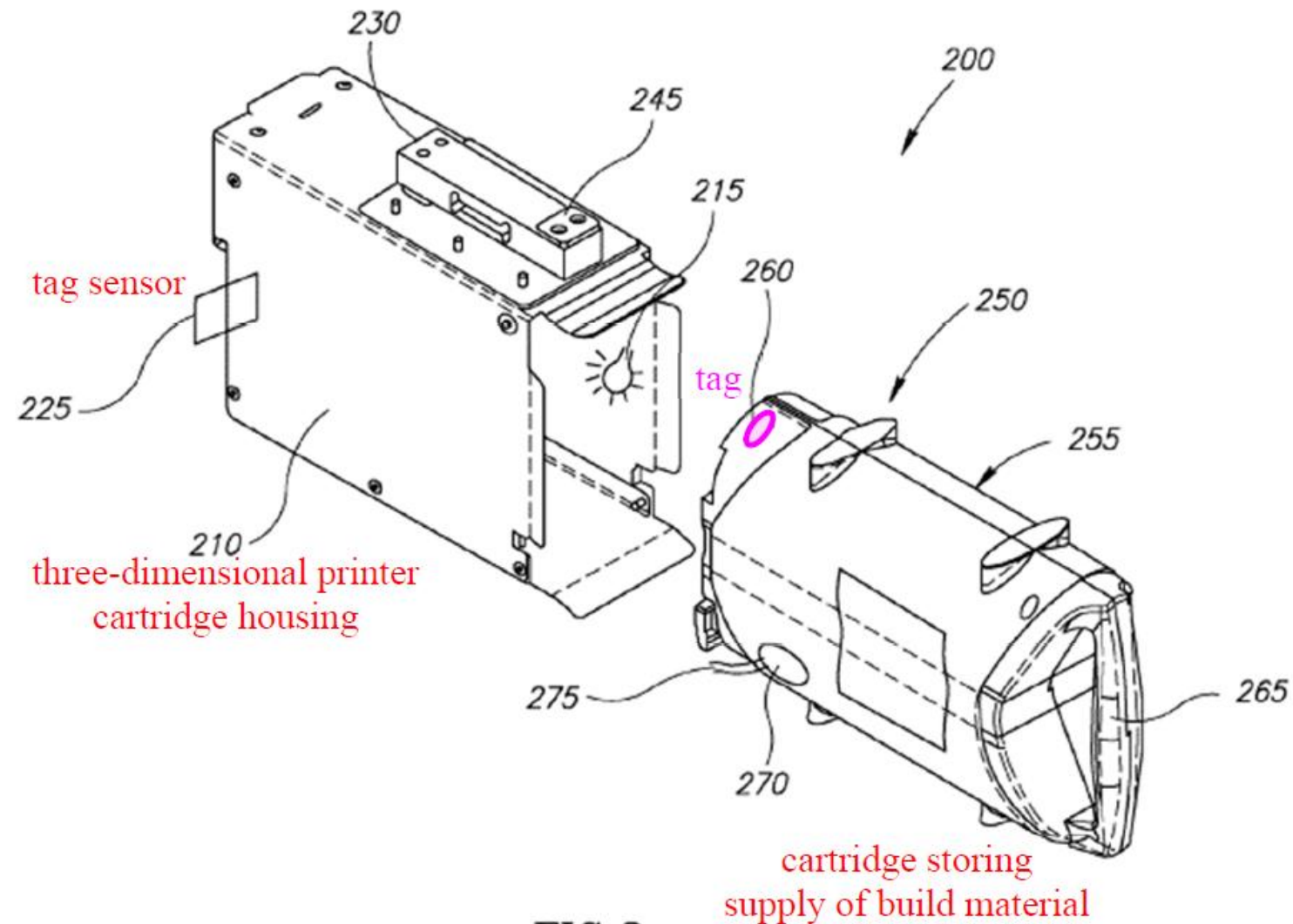
FIG.1

three-dimensional printer

EX1009, FIG. 1; Pet., 55

Grounds 3A-3D: Claim 3

Menchik:



FISH.

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Grounds 3A-3D: Claim 3

Menchik teaches first and second supplies of different build materials, each supply having a memory chip storing a property of the build material

[0042] Reference is now made to **FIG. 4**, which is a schematic illustration of an array **400** of cartridges **410**, each of which may contain building material, according to an exemplary embodiment of the present invention. A plurality of cartridges **410** may be located within array **400**. Array **400** may be located within printing apparatus **140**, or externally to printing apparatus **140**, for example in a separate unit. Cartridges **410** may be any suitable material supply or storage system, and may include a cartridge bag **415**, which may contain, for example, building material **420** and/or support material **425**. Other types of materials may be contained, and other numbers of materials (e.g., one). Building material may be stored in, for example, a liquid form, and may have different forms, colors, compositions etc.

EX1009, [0042]; Pet., 56

controller **105**. 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**, as described in detail herein. Controller **105** may select

EX1009, [0043]; Pet., 56

Grounds 3A-3D: Claim 10

FISH.

Grounds 3A-3D: Claim 10

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

In one embodiment, 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, or the data tag 304 may identify a type of build material

EX1001, 15:26-31; Pet., 68

Grounds 3A-3D: Claim 10

Menchik teaches operational parameters including an extruder temperature

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

EX1009, [0035]; Pet., 60-61, Pet. Rep., 18

[0027] Controller **105** may **receive data** from one or more material supply sources, and **control the supply of building material to printing apparatus 140**, for example, by **controlling the extraction or flow of materials** from the printing material sources, such as printing cartridges. For example,

object being printed. Controller **105** may be suitably coupled and/or connected to various components of printing apparatus **140**, to one or more cartridge apparatuses **180**, and to one or more cartridge arrays **190**. For example, **controller 105 may control** valves, pumps, switches, compression or inflation devices, positioning units, **dispensing units**, leveling devices, curing devices, or any other system components.

EX1009, [0027]; Pet., 62

Grounds 3A-3D: Claim 10

Menchik teaches operational parameters including a support structure requirement

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

EX1009, [0048]; Pet., 62-63

controller 105. 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, as described in detail herein. Controller 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. For example,

EX1009, [0043]; Pet., 60

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., as is described in

EX1009, [0037]; Pet., 61

Grounds 3A-3D: Claim 10

Menchik teaches operational parameters including a support structure requirement

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

EX1009, [0035]; Pet., 60

controller **105**. 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**, as described in detail herein. **Controller 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. For example,

EX1009, [0043]; Pet., 60

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., as is described in**

EX1009, [0037]; Pet., 61

**Grounds 1B, 1D, 1F, 3B, 3D, 3F,
3H: Claim 1, Element 1[b]**

FISH.

Grounds 1B, 1D, 1F, 3B, 3D, 3F, 3H: Claim 1, Element 1[b]

1. A method, comprising:
providing a three-dimensional printer that includes a tag sensor;
receiving a request from a client over a network to fabricate an object on the three-dimensional printer, the three-dimensional printer coupled to a supply of a build material including a tag that stores at least one property of the build material;
reading data from the tag with the tag sensor;
providing the data from the tag to the client over the network, the data including at least one property of the build material;
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
fabricating the object with the build material according to the one or more operational parameters.

Grounds 1B, 1D, 1F, 3B, 3D, 3F, 3H: Claim 1, Element 1[b]

Jazayeri teaches receiving a print request from a client over a network

[0008] According to one general aspect, a print server may include instructions stored on a computer-readable medium, and the print server may include an application manager configured to receive a print request over a network from an application executing on a device, and configured to provide, over the network, a print dialog to a user of the application, the print dialog configured to provide for a selection of at least one printer associated with a user account of the user and thereafter receive a selected printer from the selection. The

[0036] Specific examples of operations of the application manager 136 are provided below, e.g., with respect to FIGS. 3B and 4. In general, though, the application manager 136 may include the functions of receiving a print request, and then receiving an actual print job, from, e.g., the application 112. In general, the first function of receiving a print request may include providing the user of the application 112 (directly or indirectly) with a print dialog or other user interface with which the user may select an available/associated registered printer. Receiving the print job may include receiving print data to be printed, along with print characteristics characterizing preferences and other aspects of how the print data is desired to be printed (e.g., color vs. black-and-white, paper size, orientation, number of copies, or any other relevant or desired print characteristic). The application manager 136

[0019] In FIG. 1, a device 108 is illustrated as an example of virtually any computing device from which a user may wish to execute a print job. By way of non-limiting example, then, the device 108 may include a laptop or desktop computer, a netbook, a tablet computer, a smartphone, a camera, or any device which may store or have access to data which the user may desire to print.

[0021] Consequently, the application 112 may include virtually any application which may run on any underlying operating system or platform. Examples of such applications are well-known and too numerous to mention in any detail, but generally include document processing applications, email applications, image editing or presentation software, a web browser, or virtually any application which provides the user with a rendering of data which the user may wish to print.

EX1010, [0008], [0019], [0021], [0036]; Pet., 33

FISH.

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Grounds 1B, 1D, 1F, 3B, 3D, 3F, 3H: Claim 1, Element 1[b]

Jazayeri in combination with Loughran-Dubois or Menchik teaches receiving a request from a client over a network to fabricate an object on the 3D printer

DECLARATION OF DR. MICHAEL HICKNER

96. Multiple reasons would have prompted a POSITA to apply the teachings of Jazayeri to the system of Loughran (as modified by Dubois) such that the resulting system includes the functionality of Jazayeri print server as part of Loughran's SFF system. This would have included implementing Loughran's system to include the functionality of 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). The resulting system would have enabled 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; Pet., 34

SECOND DECLARATION OF DR. MICHAEL HICKNER

Pet., 33-36; EX1003, ¶¶93-100. In the Loughran-Dubois-Jazayeri combination, the selected printer would send the material information to the client, receive a fabrication job from the client, and complete the fabrication job based on CAD information with the optimal set of material parameters in the same manner as discussed in my first declaration and reiterated above in §IV.A. A POSITA would have recognized that Jazayeri's suggestion would have improved Loughran-Dubois's system by allowing multiple clients and multiple printers on a network and a client to select one of multiple printers for fabricating an object without requiring that a local printer driver be installed on the client device, as well as other improvements and benefits discussed in my first declaration. Pet., 33-36; EX1003, ¶¶93-100.

EX1042, ¶39; Pet. Reply, 23

FISH.

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DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Grounds 1B, 1D, 1F, 3B, 3D, 3F, 3H: Claim 1, Element 1[b]

Jazayeri in combination with Loughran-Dubois or Menchik teaches receiving a request from a client over a network to fabricate an object on the 3D printer

PATENT OWNER'S SUR-REPLY

Contrary to Petitioner's suggestion, Patent Owner did dispute that the Jazayeri-based combinations teach element 1[b]: Jazayeri's "print request" is received at a print server, not by the three-dimensional printer. (EX1010, Abstract, ¶¶[0008]-[0010], [0036], [0066]; EX2013, ¶¶184-185). PO Sur-reply, 20-21

'466 Patent Claim 1

1. A method, comprising:
providing a three-dimensional printer that includes a tag sensor;
receiving a request from a client over a network to fabricate an object on the three-dimensional printer, the three-dimensional printer coupled to a supply of a build material including a tag that stores at least one property of the build material;
reading data from the tag with the tag sensor;

SECOND DECLARATION OF DR. MICHAEL HICKNER

38. Element 1[b] does not preclude a server receiving a print request from a client. The '466 patent describes that "a print server 208 may maintain print queues for participating three-dimensional printers 204" that "include print data (e.g., the three-dimensional model or tool instructions to fabricate an object) for a number of print job" and the print server "allocate[s] print requests to various three-dimensional printers." EX1001, 8:27-28, 8:53-58, 17:2-12. Similarly, Jazayeri describes a print server receiving a print request over a network. EX1010, [0008]-[0010], [0036], [0066].

EX1042, ¶38; Pet. Reply, 22

Grounds 1B, 1D, 1F, 3B, 3D, 3F, 3H: Claim 1, Element 1[b]

Jazayeri in combination with Loughran-Dubois or Menchik teaches receiving a request from a client over a network to fabricate an object on the 3D printer

PATENT OWNER'S SUR-REPLY

Petitioner next argues that Patent Owner never explained how adding Jazayeri's print server would affect Loughran's material-parameter control and that the Petition did not propose modifying the underlying 3D-printing workflows. (Reply, 23-24). But Jazayeri is not merely "a print server." It discloses a cloud-print workflow: a print request is received at a server, a print dialog is presented to allow user selection of an available registered printer, a print job designating the selected printer is then received at the server, the job is converted into a printer-specific format, and the job is routed to a print client associated with the selected printer. (EX1010, ¶¶[0008]-[0010], [0036], [0066]-[0073], [0092]-[0100]). Importing that workflow into Loughran or Menchik inserts user-account, registered-printer, server-routing, and UI-selection layers foreign to the disclosed 3D-printing workflows. (EX2013, ¶¶114-119, 184-185).

PO Sur-reply, 19

FISH.

DECISION

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

The record before us supports Petitioner's contention that the proposed combination of Loughran, Dubois, and Jazayeri is no more than a "combination of familiar elements according to known methods . . . [which] does no more than yield predictable results." *Compare* Pet. 36, with Prelim. Resp. 31-33 (disputing some of Petitioner's reasons to combine without addressing Petitioner's reasoning based on *KSR*); *see KSR*, 550 U.S. at 416. All of the components of Jazayeri need not be bodily incorporated into Loughran or Dubois. *See Lear Siegler, Inc. v. Aeroquip Corp.*, 733 F.2d 881, 889 (Fed. Cir. 1984). The record before us sufficiently supports Petitioner's contention that implementing Loughran's system with a network server to receive a certain request is within the ordinary skill with a reasonable expectation of success.

Inst. Dec. 24

Grounds 1B, 1D, 1F, 3B, 3D, 3F, 3H: Claim 1, Element 1[b]

Jazayeri is analogous art

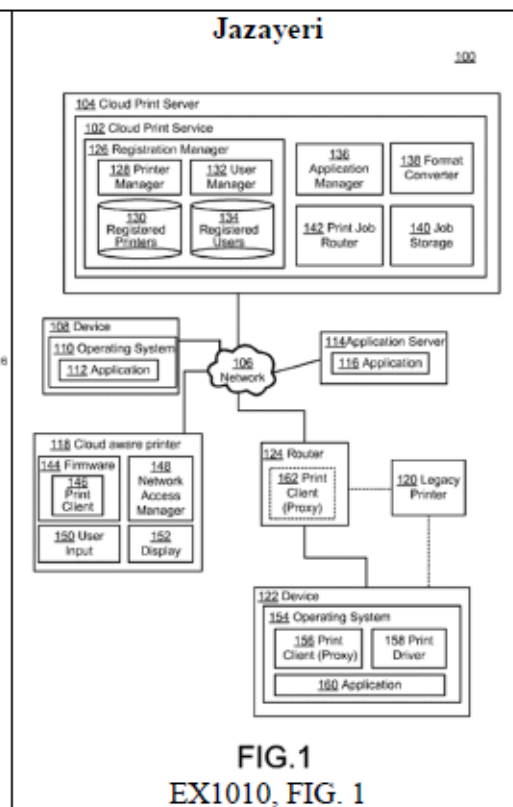
'466 patent

FIG. 2 depicts a networked three-dimensional printing environment.

FIG. 2

FIG. 2 depicts a networked three-dimensional printing environment. In general, the environment 200 may include a data network 202 interconnecting a plurality of participating devices in a communicating relationship. The partici-

EX1001, FIG. 2



[0001] This description relates to printing.

[0018] FIG. 1 is a block diagram of a system 100 for implementing a cloud print service 102. As shown in the example of FIG. 1, the cloud print service 102 may be executed on a cloud print server 104 which provides printing capabilities over a network 106. As described in detail below, the cloud print

[0076] In FIG. 1, a single cloud print service 102 is illustrated. However, it may be appreciated that the network 106 may be used by multiple providers to provide multiple cloud print services. For example, a printer manufacturer may provide a cloud print service for its printers, while a 3rd party provider for more general cloud computing may provide the cloud print service 102 as an auxiliary feature for its existing cloud-based computing platform, and therefore as a general service which is not specific to any particular type of printer.

EX1001, 1:41-42, 4:57-65; EX1010, [0001], [0018], [0076]; Pet. Reply, 20-22

Grounds 1B, 1D, 1F, 3B, 3D, 3F, 3H: Claim 1, Element 1[b]

Patent Owner's analogous art arguments rest on "too narrow a view" of the '466 patent

In re Paulson, 30 F.3d 1475, 1481 (Fed. Cir. 1994)

AST argues that claims 2, 6, and 28-34, which add particular features to the hinge and latch means of the display housing,^[10] were erroneously rejected over non-analogous references directed to hinges and latches as used in a desktop telephone directory, a piano lid, a kitchen cabinet, a washing machine cabinet, a wooden furniture cabinet, or a two-part housing for storing audio cassettes. AST maintains that because the references pertain to fields of endeavor entirely unrelated to computers and are not pertinent to the problems faced by the present inventors, they do not render the claims obvious. It argues that the cited references, dealing with such articles as cabinets and washing machines, do not deal with the particular environment presented in portable computers. This argument rests on too narrow a view of what prior art is pertinent to the invention here.

Whether a prior art reference is "analogous" is a fact question that we review under the "clearly erroneous" standard. *In re Clay*, 966 F.2d 656, 658, 23 USPQ2d 1058, 1060 (Fed. Cir. 1992). Although there is little dispute that the prior art references cited here (other than Yokoyama) are not within the same field of endeavor as computers, such references may still be analogous if they are "reasonably pertinent to the particular problem with which the inventor is involved." *Id.*; see also *Heidelberger Druckmaschinen AG v. Hantscho Commercial Prods., Inc.*, 21 F.3d 1068, 1072, 30 USPQ2d 1377, 1379 (Fed. Cir. 1994). The problems encountered by the inventors of the '466 patent were problems that were not unique to portable computers. They concerned how to connect and secure the computer's display housing to the computer while meeting certain size constraints^{*1482} and functional requirements. The prior art cited by the examiner discloses various means of connecting a cover (or lid) to a device so that the cover is free to swing radially along the connection axis, as well as means of securing the cover in an open or closed position. We agree with the Board that given the nature of the problems confronted by the inventors, one of ordinary skill in the art "would have consulted the mechanical arts for housings, hinges, latches, springs, etc." Thus, the cited references are "reasonably pertinent" and we therefore conclude that the Board's finding that the references are analogous was not clearly erroneous.

Pet. Reply, 22

Grounds 1E, 1F, 3E, 3F: Claim 17

FISH.

Grounds 1E, 1F, 3E, 3F: Claim 17

1. A method, comprising:
providing a three-dimensional printer that includes a tag sensor;
receiving a request from a client over a network to fabricate an object on the three-dimensional printer, the three-dimensional printer coupled to a supply of a build material including a tag that stores at least one property of the build material;
reading data from the tag with the tag sensor;
providing the data from the tag to the client over the network, the data including at least one property of the build material;
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
fabricating the object with the build material according to the one or more operational parameters.

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.

'466 Patent Specification

In another aspect, the determination of operational parameters may include preliminary diagnostic tests such as whether the diameter of the build material, size of a build material pellet, build material fluid viscosity, or the like is appropriate for the three-dimensional printer 306. Additional diagnostic test may be performed such as whether the correct build material 312 is provided on the supply 302, whether the correct color or color lot build material 312 is on the supply, or any other appropriate preliminary diagnostic build material test used to determine, as a threshold matter, whether a desired fabrication can be performed with the supply 302.

EX1001, 15:53-64; Pet. Reply, 25

FISH.

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Grounds 1E, 1F, 3E, 3F: Claim 17

Menchik's amount of support material required is an operational parameter

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

EX1009, [0027]; Pet., 39, 78

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

EX1009, [0048]; Pet., 39, 78-79

Grounds 1E, 1F, 3E, 3F: Claim 17

Menchik's and Dahlin's determination of whether the amount of support material is sufficient to complete the object is a diagnostic test

Menchik

[0049] 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. The controller may also determine, for example, based on expected usage of material and actual availability of materials, for example, the length of time remaining until one or more cartridges may be expected to empty, and should therefore be replaced. The relevant information may be displayed on, for example, a computer screen.

EX1009, [0049]; Pet., 40, 78-79

Dahlin

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. Also at the outset of a job, the CPU verifies that the modeling filament material on the spool is the same material specified in object data. If these materials are not the same, an operator notification is provided via touch screen display 21, providing the operator an opportunity to switch spools.

EX1011, 5:26-37; Pet., 40, 79

Grounds 1E, 1F, 3E, 3F: Claim 17

The Menchik-Dahlin combination teaches determining an operational parameter distinct from performing the diagnostic test

PATENT OWNER'S SUR-REPLY

That is not enough. Menchik discloses computing required material, determining whether available cartridges are sufficient, and then controlling cartridge/valve usage or displaying information. (EX1009, ¶¶[0048]-[0051]). Dahlin

PO Sur-reply, 24

Step 2

SECOND DECLARATION OF DR. MICHAEL HICKNER

43. Menchik's and Dahlin's determination of whether the amount of support material is sufficient to complete the object is a diagnostic test. EX1003, ¶¶172-176. As explained in the '466 patent, a diagnostic test is used to determine "whether a desired fabrication can be performed with the supply." EX1001, 15:53-64. Determining whether there is enough supply to complete the object is a diagnostic test to determine "whether a desired fabrication can be performed with the supply." EX1003, ¶¶172-176.

EX1042, ¶43; Pet. Reply, 25

SECOND DECLARATION OF DR. MICHAEL HICKNER

amount of material needed for each layer). In Menchik, the amount of support material required (indicating how much material to extract) is an operational parameter that controls printer operation during fabrication because Menchik chooses whether and when to use a cartridge based on the amount required. EX1009, [0007] ("control the supply of the building material from two or more cartridges according to the supply parameters"), [0027] ("whether or not to use building material from at least one selected cartridge or other source" and "when to extract building material from one or more cartridges").

EX1042, ¶42; Pet. Reply, 25

FISH.

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Grounds 1E, 1F, 3E, 3F: Claim 17

'466 Patent

1. A method, comprising:
providing a three-dimensional printer that includes a tag sensor;
receiving a request from a client over a network to fabricate an object on the three-dimensional printer, the three-dimensional printer coupled to a supply of a build material including a tag that stores at least one property of the build material;
reading data from the tag with the tag sensor;
providing the data from the tag to the client over the network, the data including at least one property of the build material;
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
fabricating the object with the build material according to the one or more operational parameters.

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.

'464 Patent

1. [p] A method comprising:
[a] reading data from a tag included on a supply of a build material using a tag sensor in communication with a controller of a three-dimensional printer, the data including at least one property of the build material;
[b] determining an operational parameter of a fabrication process using the three-dimensional printer based upon 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;
[c] performing a diagnostic test to determine whether the operational parameter is suitable for the three-dimensional printer; and
[d] when the operational parameter is suitable for the three-dimensional printer according to the diagnostic test, controlling operation of the three-dimensional printer during the fabrication process with the controller according to the operational parameter to fabricate an object with the three-dimensional printer.

FISH.

Grounds 1C, 1D, 3G, 3H: Claim 5

FISH.

Grounds 1C, 1D, 3G, 3H: Claim 5

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

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

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

Grounds 1C, 1D, 3G, 3H: Claim 5

KISSlicer teaches receiving a selection of one of the first build material and the second build material from the user

Download and install KISSlicer

Go to the download page: <http://www.kisslicer.com/download.html>

Select the version matching your Operating System (at the moment Windows and Linux versions are available) and save it locally. You can unzip the executable directly into the desired folder. For example, under Windows you can use "C:\KISSlicer" or "C:\Program Files\KISSlicer". No installation is required. At the first run the executable will create support files in the same folder.

If you downloaded the KISSlicerQuickStart.pdf file and/or Glasswalker's sample settings, simply place them all into the same directory as the executable. Under Windows you can place a shortcut to 'KISSlicer.exe' in your 'Send To' folder, allowing you to right-click on any model(s) in the Windows File Explorer, and [Send To]->KISSlicer.

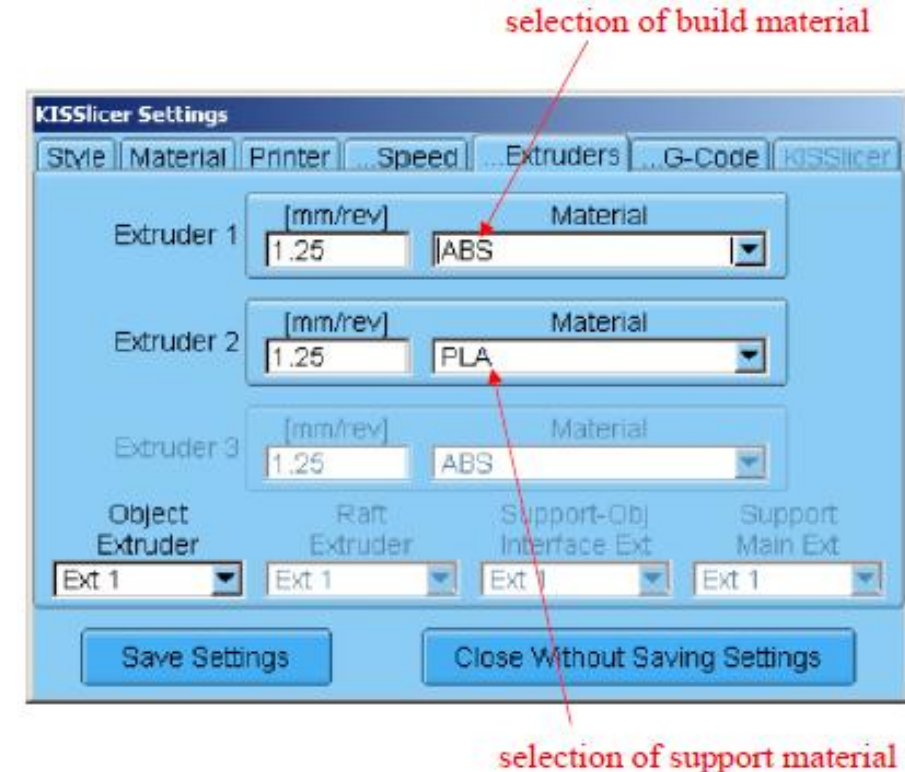
EX1018, 1; Pet. Reply, 26

DECLARATION OF JONATHAN DUMMER

I, Jonathan Dummer of Redding, California, being of sound mind, declare the following to be true to the best of my knowledge, information and recollection:

1. I am the creator of KISSlicer, a powerful software tool that facilitates the conversion of 3D object models to specific path instructions for 3D printing by slicing STL files into 3D printer-ready G-code files.

EX1017, 1; Pet. Reply, 26



EX1018, 5; Pet., 38

Grounds 1C, 1D, 3G, 3H: Claim 5

KISSlicer in combination with Loughran-Dubois or Menchik teaches receiving a selection of one of the first build material and the second build material from the client

DECLARATION OF DR. MICHAEL HICKNER

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

EX1003, ¶101; Pet., 37

[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,

EX1003, ¶177; Pet., 81

SECOND DECLARATION OF DR. MICHAEL HICKNER

layers.” EX1045, 81:17-23. In the combinations of Grounds 1C/1D/3G/3H, software such as that disclosed in KISSlicer would be executed by the client (Loughran-Dubois’s client that generates fabrication jobs from CAD information (EX1004, [0027], [0051], [0055]; *see* §IV.B) or Menchik’s client/controller that converts CAD data to instructions for the printer (EX1009, [0024]; *see* §VI.A)), and therefore the selection of one of two tagged build materials would be received from the client.

EX1045, 73:23-74:17 (agreeing that in Dubois “the slicer software is executing on a personal computer”); 81:24-82:23 (testifying that both Dubois and KISSlicer “will generate the slice geometry”); EX1003, ¶¶101 (“allow the user of the client system to select”), 177 (same).

EX1042, ¶44; Pet. Reply, 27
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FISH.

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Grounds 1C, 1D, 3G, 3H: Claim 5

Claim 5 does not require “tag-driven selection”

PATENT OWNER'S SUR-REPLY

tag-to-client-to-printer workflow. (EX2015, 25:17-26:11). Petitioner, not Patent Owner, departs from the claim language by treating slice-level material assignment—which Petitioner asserts applies to “every 3D model”—as the specific client-based, tag-driven selection required by claim 5. That reading would render

PO Sur-reply, 4-5

PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE

PO does not dispute that this fact that such slices would specify a selection of build material. POR, 23-25.¹ Instead, PO argues that “‘slice-level material assignment’ is not the claimed step of receiving from the client a selection of one of the two tagged supplies” without any evidence/analysis for this implicit claim construction. POR, 23-25. Worse yet, PO’s argument ignores that, in the Loughran-

Pet. Reply, 8

'466 Patent Claims

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

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

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

NOT
DISPUTED

Grounds 1C, 1D, 3G, 3H: Claim 5

Motivation to apply KISSlicer's teachings:

- "...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."
- "...given the user greater control over the final product."
- "...would have allowed the user to fabricate the desired object to their specific specifications."
- "...allow the user to select materials for desired traits such as weight, strength, elasticity, color, etc."
- "...would have also made the resulting system more desirable to users."
- "...application of known techniques to a known system to achieve predictable results."

FISH.

The background of the slide is a light gray technical drawing or blueprint. It features various geometric shapes, lines, and symbols, including circles, rectangles, and crosshairs, which are typical of architectural or engineering plans. The drawing is centered around a large dark blue rectangle.

Thank you

FISH.