UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SHENZHEN TUOZHU TECHNOLOGY CO., LTD.,

Petitioner

v.

STRATASYS, INC.

Patent Owner.

Case No. IPR2025-00354
U.S. PATENT NO. 8,747,097

PATENT OWNER'S PRELIMINARY RESPONSE

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35 U.S.C. § 314(a) 12

Regulations

37 C.F.R. § 42.107 1

37 C.F.R. § 42.108(c) 12

EXHIBIT LIST

Exhibit No.	Description
2001	Docket Navigator – Judge Rodney Gilstrap Motion Success for Stay Pending IPR and Time to Milestones
2002	United States District Courts — Judicial Caseload Profiles for Eastern District of Texas (Sept. 30, 2024 and Dec. 31, 2024), available at https://www.uscourts.gov/data-news/reports/statistical-reports/federal-court-management-statistics
2003	Minute Entry for proceedings held before District Judge Gilstrap on Nov. 7, 2024, *Stratasys, Inc. v. Shenzhen Tuozhu Technology Co. Ltd.*, No. 2:24-cv-00644-JRG (E.D. Tex. Nov. 14, 2024)
2004	Discovery Order, *Stratasys, Inc. v. Shenzhen Tuozhu Technology Co. Ltd.*, No. 2:24-cv-00644-JRG, Dkt No. 35 (E.D. Tex. Dec. 2, 2024)
2005	Protective Order, *Stratasys, Inc. v. Shenzhen Tuozhu Technology Co. Ltd.*, No. 2:24-cv-00644-JRG, Dkt No. 36 (E.D. Tex. Dec. 3, 2024)
2006	e-Discovery Order, *Stratasys, Inc. v. Shenzhen Tuozhu Technology Co. Ltd.*, No. 2:24-cv-00644-JRG, Dkt No. 41 (E.D. Tex. Dec. 19, 2024)
2007	Invalidity and Ineligibility Contentions, *Stratasys, Inc. v. Shenzhen Tuozhu Technology Co. Ltd.*, No. 2:24-cv-00644-JRG, (E.D. Tex. Jan. 30, 2025)
2008	Transcript of Hearing on the Nomination of Howard Lutnick, of New York, to be Secretary of Commerce (Jan. 29, 2025)
2009	Complaint for Patent Infringement, *Stratasys, Inc. v. Shenzhen Tuozhu Technology Co. Ltd.*, No. 2:24-cv-00645-JRG, Dkt No. 1 (E.D. Tex. Aug. 8, 2024)

I. INTRODUCTION

Pursuant to 35 U.S.C. § 313 and 37 C.F.R. § 42.107, Stratasys, Inc. ("Stratasys" or "Patent Owner") hereby submits this Preliminary Response to the Petition for *inter partes* review ("Petition" or "Pet.") filed by Shenzhen Tuozhu Technology Co., Ltd. ("Petitioner"), challenging claims 1-5 and 8-19 ("challenged claims") of U.S. Patent No. 8,747,097 ("the '097 Patent") (EX1001).

Petitioner alleges that the challenged claims are invalid based on 14 different grounds (1A-1H, 2A-2F). Petitioner argues that independent claim 1 is obvious over U.S. Patent No. 9,156,204 ("*Knighton*") (EX1005) in view of *Luo* (EX1006) and U.S. Patent Publication No. 2004/0207662 ("*Anderson*") (EX1012) in Ground 1A and over U.S. Patent No. 6,580,959 ("*Mazumder*") (EX1004) in view of U.S. Patent Publication No. 2006/0160250 ("*Bonassar*") (EX1010) in Ground 2A.

Petitioner has failed to meet its burden of showing a reasonable likelihood that it would prevail with respect to any of the challenged claims. As an initial matter, Petitioner has set forth numerous reasons why the Director should exercise her discretionary powers to deny institution in this proceeding in a co-filed brief. If the Director declines to exercise such powers, the Board should nonetheless deny institution because the Petition suffers from fatal defects in the asserted grounds, which provides an independent basis to deny institution.

The challenged claims and the '097 Patent are directed to solutions that include a three-dimensional scanner that capture three-dimensional information from an object within a build volume of a three-dimensional printer during a print job, a machine vision system that captures and analyzes image content from the scanner, thereby providing a status of the print job, and a web server that transmits the status of the print job for display at a remote client through a network interface.

The primary reference in Grounds 1A-1H (*Knighton*) provides for an automated system that handles monitoring and modifications to the print job without user input rather than providing a status of the print job to a user. Further, the secondary references in Grounds 1A-1H (*Luo* and *Anderson*), alone and in the combination, do not teach providing a status of the print job by capturing and analyzing image content from a three-dimensional scanner. The second set of grounds (Grounds 2A-2F) fare no better. The primary reference (*Mazumder*) fails to teach a three-dimensional printer that includes a build volume, three-dimensional scanner, and machine vision system that captures and analyzes image content from the scanner thereby providing a status of the print job. The secondary reference (*Bonassar*) fails to remedy this deficiency. Similar to *Knighton*, *Bonassar* teaches an automated system rather than providing a status of the print job. The combination of *Mazumder* and *Bonassar* ignores references' express teachings and resorts to impermissible hindsight.

In summary, the Board should not institute IPR if the Director declines discretionary denial because each of Petitioner's grounds are deficient and thus Petitioner cannot satisfy its burden to prove unpatentability.

II. THE '097 PATENT AND THE CHALLENGED CLAIMS

A. Summary of the '097 Patent (EX1001)

The '097 Patent "relates to three-dimensional fabrication using networked resources." EX1001 at 1:15-16. The patent explained that "a more recent trend has emerged toward low-cost three-dimensional prototyping devices suitable for hobbyists and home users. As these resources become more readily and widely available, a need has emerged for networking capabilities and network management for three-dimensional printers." *Id.* at 1:21-29.

Figure 3 of the '097 Patent shows a networked three-dimensional printing environment 300 that includes multiple 3-D printers 304 interconnected with multiple devices via a data network 302.

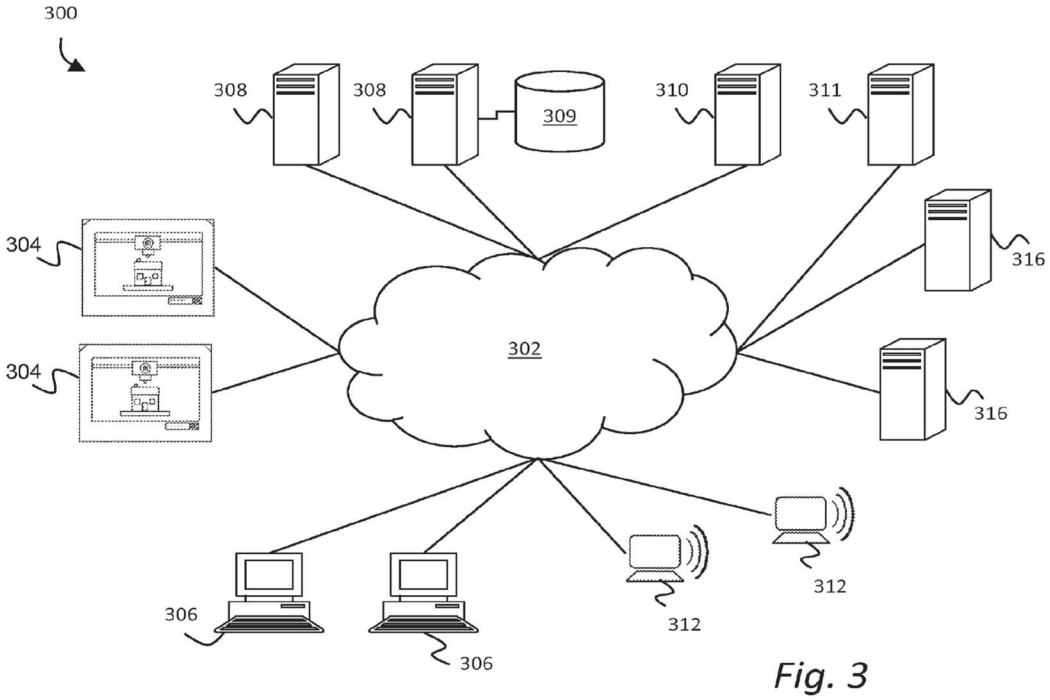


Fig. 3

Id. at 8:7-15, Fig. 3. The devices in Figure 3 include servers (e.g., print server 308, content sources 310, web server 311, other resources 316) and devices (e.g., client devices 306 and mobile devices 312). *Id.* at 8:12-15, 12:28-39, Fig. 3.

A diagram of a 3-D printer 100 is shown below in Figure 1 with a build platform 102, extruder 106, positioning assembly 108, and controller 110 "that cooperate to fabricate an object 112 within a working volume 114." *Id.* at 2:18-22.

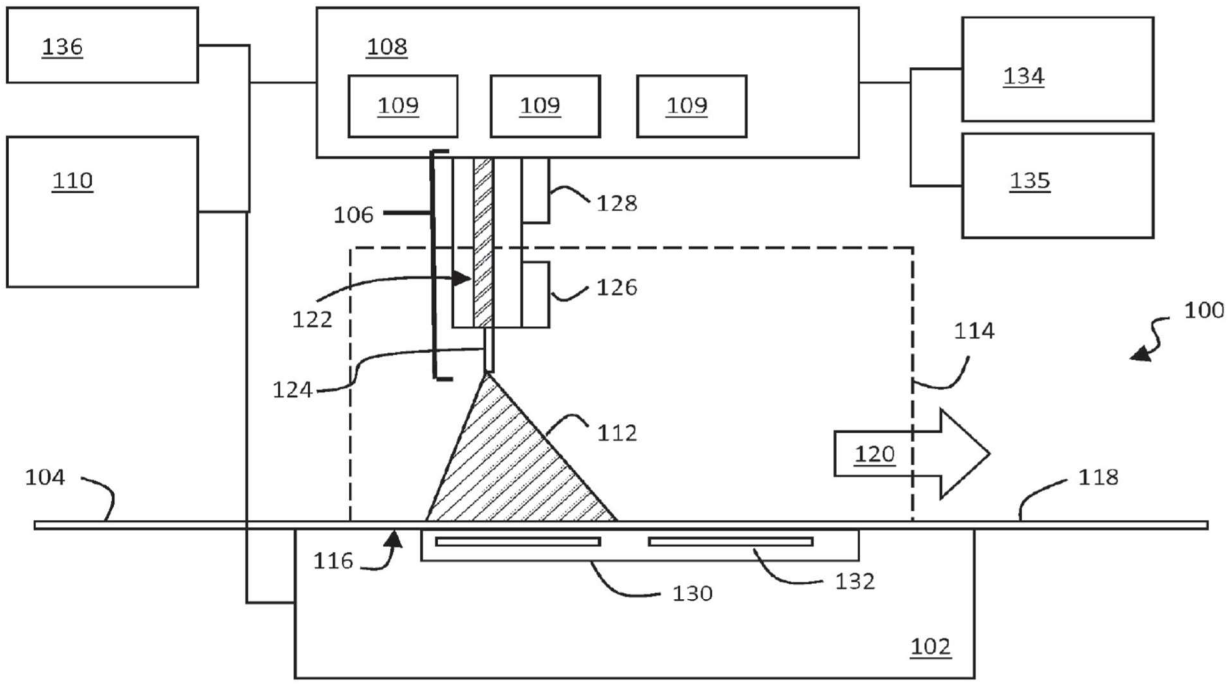


Fig. 1

Id. at Fig. 1. The printer includes one or more sensors 134, such as a three-dimensional scanner that uses sensing and processing hardware to capture three-dimensional information. *Id.* at 6:34-40. A "two-dimensional projection may be dynamically updated to correspond to a state of physical completion of the object in order to provide real time, or quasi-real time visual status information." *Id.* at 24:58-65. For example, the two-dimensional projection may be obtained from the three-dimensional scanner to visualize the model and current state of completion. *Id.*

In addition, the sensors 134 may include a machine vision system that captures and analyzes "image content to obtain information about the status of a

job, working volume 114, or an object 112." *Id.* at 6:40-50. In addition to providing status by capturing and analyzing image content, the machine vision system can support a variety of imaging-based automatic inspection, process control, and/or robotic guidance functions, including "pass/fail decisions, error detection (and corresponding audible or visual alerts), shape detection, position detection, orientation detection, [and] collision avoidance." *Id.*

To operate the 3-D printer with a video, the '097 Patent illustrates a flowchart in Figure 7. *Id.* at 24:24-28.

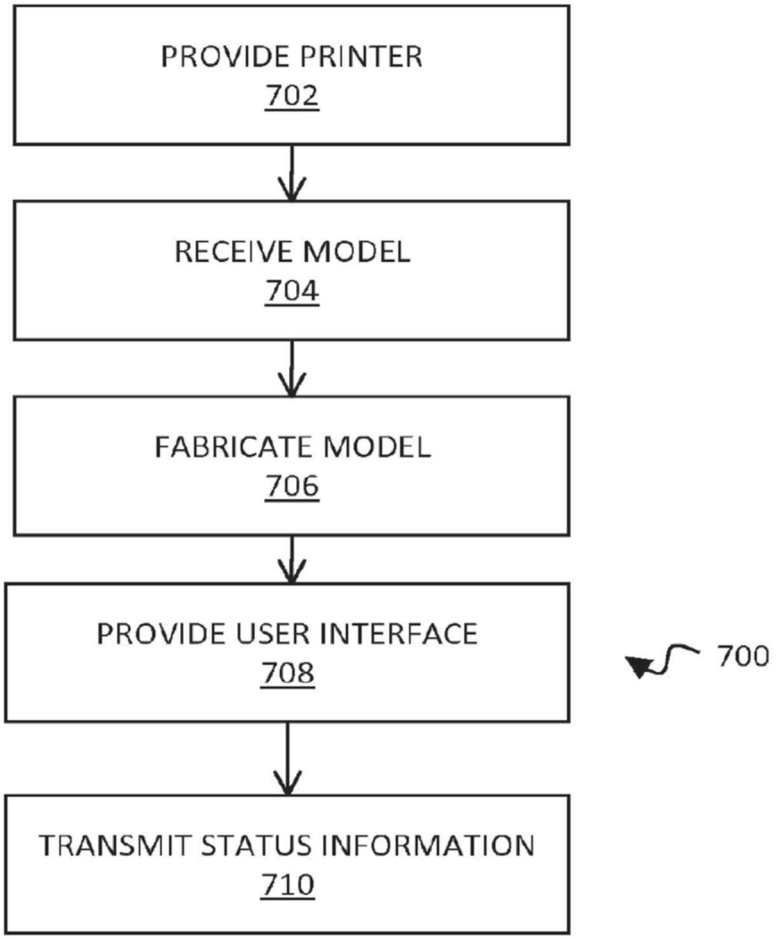


Fig. 7

Id. at Fig. 7. At step 702, a printer is provided. *Id.* at 24:29-35. At steps 704 and 706 the model is received by the printer and fabricated, and at Step 708, the method includes "providing a user interface to a remote user accessing the device through the network interface" where the interface presents "a two-dimensional projection of the three-dimensional model." *Id.* at 24:47-52. For example, the two-dimensional projection can be a "visualization of the model and its current state of

completion." *Id.* at 24:58-61. The projection may be obtained from a "three-dimensional scanner" (*id.* at 24:61-64) and may be "dynamically updated to correspond to a state of physical completion of the object" (*id.* at 24:64-25:3). At step 710, status information is transmitted over the data network. *Id.* at 25:6-17. A user interface may show the status information during a build process. *See id.* 25:62-26:4.

Numerous claims embody these solutions, including independent claim 1. For instance, claim 1 recites "a three-dimensional scanner configured to capture three-dimensional information from an object being fabricated within the build volume during a print job executing on the three-dimensional printer," "a machine vision system configured to capture and analyze image content from the three-dimensional scanner thereby providing a status of the print job executing on the three-dimensional printer," and "a web server configured to transmit the status of the print job for display at a remote client through the network interface." EX1001 at 27:21-34.

As explained below, the asserted grounds fail to teach the elements of claim 1. Because claims 2-5 and 8-19 depend from claim 1, the asserted grounds also fail to teach the elements of dependent claims 2-5 and 8-19 for at least the same reasons.

B. Summary of the Prosecution History of the '097 Patent (EX1002)

During prosecution of the application leading to the '097 Patent, the Patent Office reviewed *Anderson* and other cited art and found the '097 Patent patentable. In particular, the examiner initially rejected the claims as obvious over *Adusumilli* (US2009/0287332) and *Anderson*, alone or in view of additional references. EX1002, 88–94. The examiner asserted that *Adusumilli* teaches a 3D printer with a 3D scanner and machine vision system, but relied on *Anderson* for the remaining claim elements, including the network interface, web server, and providing status. In particular, the examiner asserted that *Anderson* teaches a "system for fabricating 3D objects" that connects to an interface controller that "receives information from the printer and then provides this information to a user's computer via a web page." EX1002, 89 (citing Anderson (EX1012) at [0016], [0018]). On this basis, the examiner initially concluded that it "would have been obvious to one having ordinary skill in the art at the time of the invention to include a network interface and a web server motivated by a desire to give remote users access to the 3D printer." *Id.* The examiner also asserted that "Fig. 1 of Anderson shows the GUI of a remote user connected to the 3D printer through network interface 104" and that "Anderson teaches a print server that polls the status of the printer [0018] and teaches the use of a remote interface (fig 1). The information in the interface is

updated with respect to the information gained in the polling process." EX1002 at 89–90 (citing EX1012, Fig. 1).

In response, the applicant explained to the examiner that the applicant devised a 3-D printing system with a scanner that captures 3-D information from an object being fabricated within the build volume during a print job, a machine vision system that captures and analyzes image content from the scanner to provide the status of the print job, which is viewable through a web server and network interface by a remote user. EX1002, 106. The applicant also pointed out that *Anderson* does not obtain information about the status of the print job with a three-dimensional scanner, explaining that the "'print progress information' in *Anderson* is determined by a status register that uses the 'number of passes completed by the printhead' and compares this to 'how many passes are required to complete the job.'" *Id.* at 106–07 (quoting EX1012 at [0018]). These teachings of *Anderson* of a progressively filled-in wireframe model based on the number of passes completed by the printhead did not lead to the claims, which require a three-dimensional scanner and a machine vision system configured to capture and analyze image content from the scanner to provide a status of the print job executing on the printer for remote display. *See id.*

Thereafter, the examiner dropped the rejection of the claims under obviousness grounds and asserted non-statutory double patenting based on a

related patent in the same family as the '097 Patent, U.S. Patent No. 8,562,324. EX1002, 121–23. The claims were allowed with the filing of a terminal disclaimer. *Id.*, 168.

As explained below, the combinations in the Petition suffer from the same deficiencies as those raised during prosecution and do not teach all elements of independent claim 1 of the '097 Patent.

III. LEVEL OF ORDINARY SKILL

For the purpose of this Preliminary Response, a personal of ordinary skill in the art (a "POSITA") in relation to the subject matter of the '097 Patent would have had a bachelor's degree in Mechanical Engineering, Computer Engineering, Electrical Engineering, Materials Science, or a comparable field and at least two years of experience related to 3D printing, with additional experience potentially being a substitute for a formal degree or training (and vice versa).

As explained below, the Petition has failed to show that the claims of the '097 Patent are unpatentable irrespective of the level of skill of a skilled artisan.

IV. CLAIM CONSTRUCTION

For the purposes of this Preliminary Response, Patent Owner submits that the Board does not need to construe any claim terms in any particular way to conclude that the Petition is deficient and thus institution of review is not warranted. *See Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed.

Cir. 2011) ("need only be construed 'to the extent necessary to resolve the controversy'").

V. APPLICABLE LEGAL STANDARDS FOR DETERMINING PATENTABILITY

Institution of *inter partes* review is discretionary under 35 U.S.C. § 314. At a minimum, Petitioner must show there is a reasonable likelihood of prevailing with respect to at least one challenged claim. *See* 35 U.S.C. § 314(a); 37 C.F.R. § 42.108(c); Practice Guide at 3 ("The Board, acting on behalf of the Director, may institute a trial where the petitioner establishes that the standards for instituting the requested trial are met . . . .")

Each of Petitioner's grounds relies on obviousness under 35 U.S.C. § 103. A claim cannot be considered obvious if even one element of the claim is absent from the prior art. *See CFMT, Inc. v. YieldUp Int'l Corp.*, 349 F.3d 1333, 1342 (Fed. Cir. 2003) ("Obviousness requires a suggestion of all limitations in a claim.") (citing *In re Royka*, 490 F.2d 981, 985 (C.C.P.A. 1974)); *In re Rijckaert*, 9 F.3d 1531, 1534 (Fed. Cir. 1993) (reversing obviousness rejection as not all claim elements were taught or suggested); *Garmin Int'l, Inc. v. Patent of Cuozzo Speed Techs. LLC*, IPR2012-00001, Paper 15 at 15 (PTAB Jan. 9, 2013) (denying institution of IPR in part as prior art did not disclose all claim limitations in obviousness challenge).

Obviousness is resolved based on several factual determinations including the scope and content of the prior art, any differences between the claimed subject matter and the prior art, and the level of ordinary skill in the art. *See Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). IPR petitions "must address the *Graham* factors." *Eizo Corp. v. Barco N.V.*, IPR2014-00358, Paper 11 at 29-30 (PTAB July 23, 2014) (citing *Graham*, 383 U.S. at 17-18) (faulting Petitioner for its failure to identify differences between the claimed subject matter and the prior art and its conclusory assertions about the teachings of the prior art); *see also Moses Lake Indus., Inc. v. Enthone, Inc.*, IPR2014-00243, Paper 6 at 18 (PTAB June 18, 2014); *Moses Lake Indus., Inc. v. Enthone, Inc.*, IPR2014-00246, Paper 6 at 17 (PTAB June 18, 2014); *eBay, Inc. v. Paid, Inc.*, CBM2014-00125, Paper 15 at 21 (PTAB Sept. 30, 2014).

The conclusion of obviousness based on the combination of references must be supported by an explicit analysis of a reason to combine such references. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007). Mere conclusory statements are insufficient. Instead, "there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006); *see also LG Elecs., Inc. v. Cellular Commc'ns Equip. LLC*, IPR2016-00197, Paper 7 at 7-11 (PTAB Apr. 29, 2016) (petition's

conclusion of obviousness lacked sufficient articulated reasons with rational underpinnings for modifying references to achieve specific elements of the claims).

The reason to combine references in the combination should not resort to hindsight bias. It is hindsight to use "the invention to define the problem the invention solves" because "when someone is presented with the identical problem and told to make the patented invention, it often becomes virtually certain that the artisan will succeed in making the invention." *Mintz v. Dietz & Watson, Inc.*, 679 F.3d 1372, 1377 (Fed. Cir. 2012); *see also AT&T Services Inc. et. al. v. Innovative Sonic Ltd.*, IPR2024-01143, Paper 15 at 38 (PTAB Feb. 11, 2025) (denying institution after finding no motivation to combine because of an overly broad conclusion that "suffers from hindsight bias").

VI. THE PETITION DOES NOT SHOW THAT CLAIMS 1-2, 4-5, 9-10, 12, 15-16, AND 18-19 ARE UNPATENTABLE UNDER GROUND 1A

A. Overview of *Knighton* (EX1005)

Knighton discloses a hybrid scanner fabricator. EX1005, Title, Abstract.

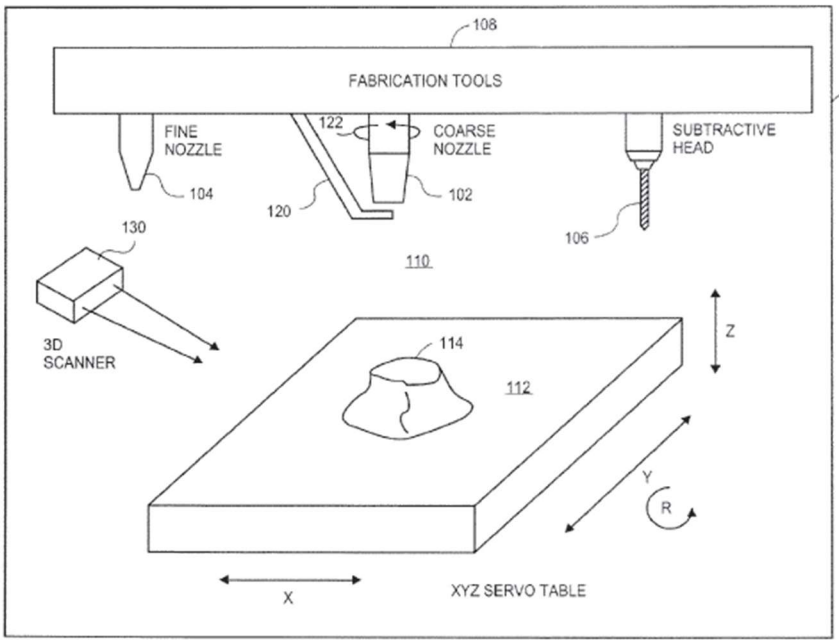


FIG. 1

Id. at Fig. 1. Knighton explains that the data from the scanner, known as scan data, is provided to monitoring software to "conduct an analysis" to automatically determine whether to modify the build, such as by doing additional detailing with fine nozzle 104. *Id.* at 3:1–18; *see also id.* at 3:42–43, Fig. 3; 4:58-67 (claim 5).

B. Overview of *Luo* (EX2006)

Luo discloses an Internet accessible rapid prototyping system. EX1006, Title. Figure 1 of *Luo* shows a hardware configuration of the system.

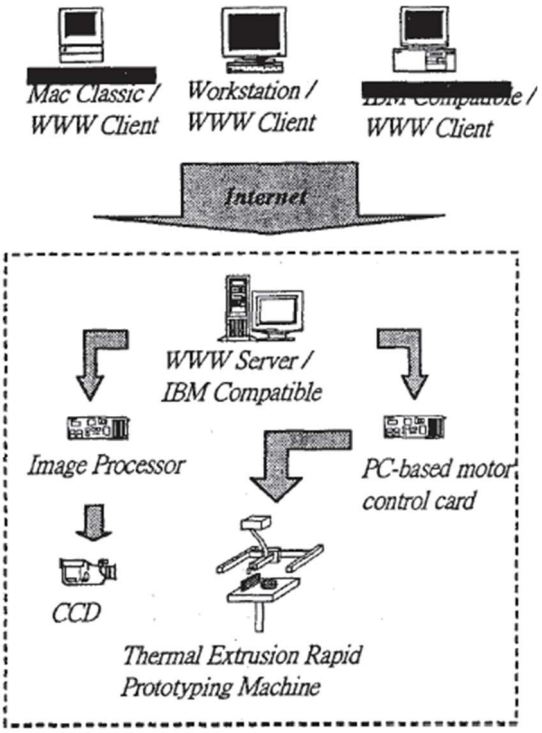
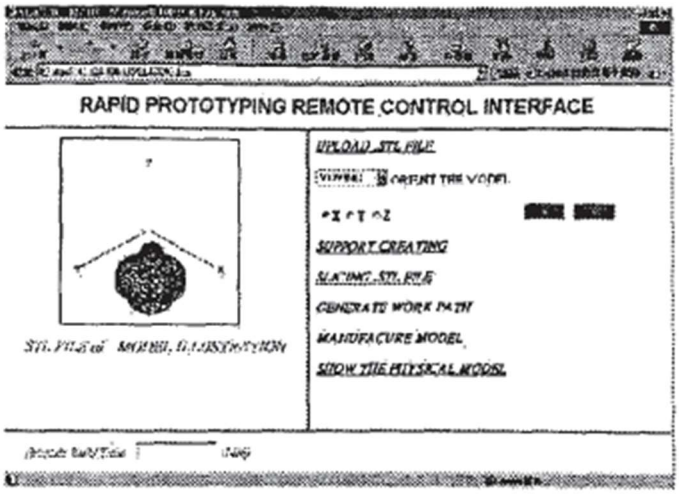


Figure 1. The Hardware Configuration of The Automated Tele-Manufacturing System.

Id. at Fig. 1. The system includes a thermal extrusion rapid prototyping machine, WWW server, CCD cameras, as well as "remote computer accesses" and "several computers." *Id.* at 1. As shown below, a user interface in *Luo* includes a link to show the physical model.



Id. at Fig. 3. When selected, the user interface links to a separate CGI program that "can show live images captured by the CCD." *See id.* at 4.

C. Overview of *Anderson* (EX1012)

Anderson discloses a user interface, method, and apparatus for providing three-dimensional object fabrication status. EX1012 at Title. Figure 1 of *Anderson* illustrates an interface controller and graphical user interface (GUI).

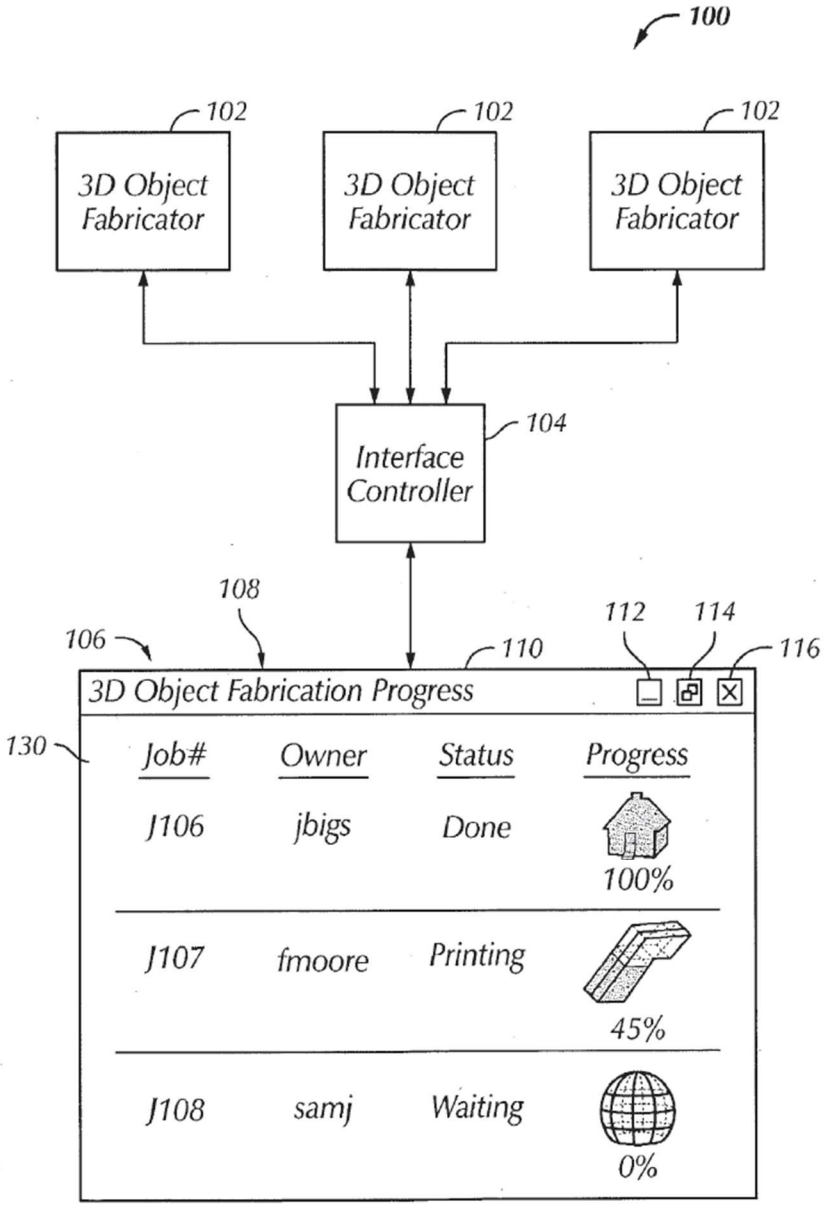


FIG. 1

Id. at Fig. 1. The GUI 108 provides a "visual representation of progress . . . in the form of one or more progressively filled-in wireframe model representations of the three-dimensional object(s)." *Id.* at [0017]. In particular, "[a]fter each pass of the printheads, the printer updates a status register" with a pass number "which is the number of passes completed by the printhead." *Id.* at [0018]. Based on this

information, the system renders the wireframe model "to show the completed portion as a filled-in." *Id.* An example of this rendering for a job is show in Figure 2A of *Anderson* below.

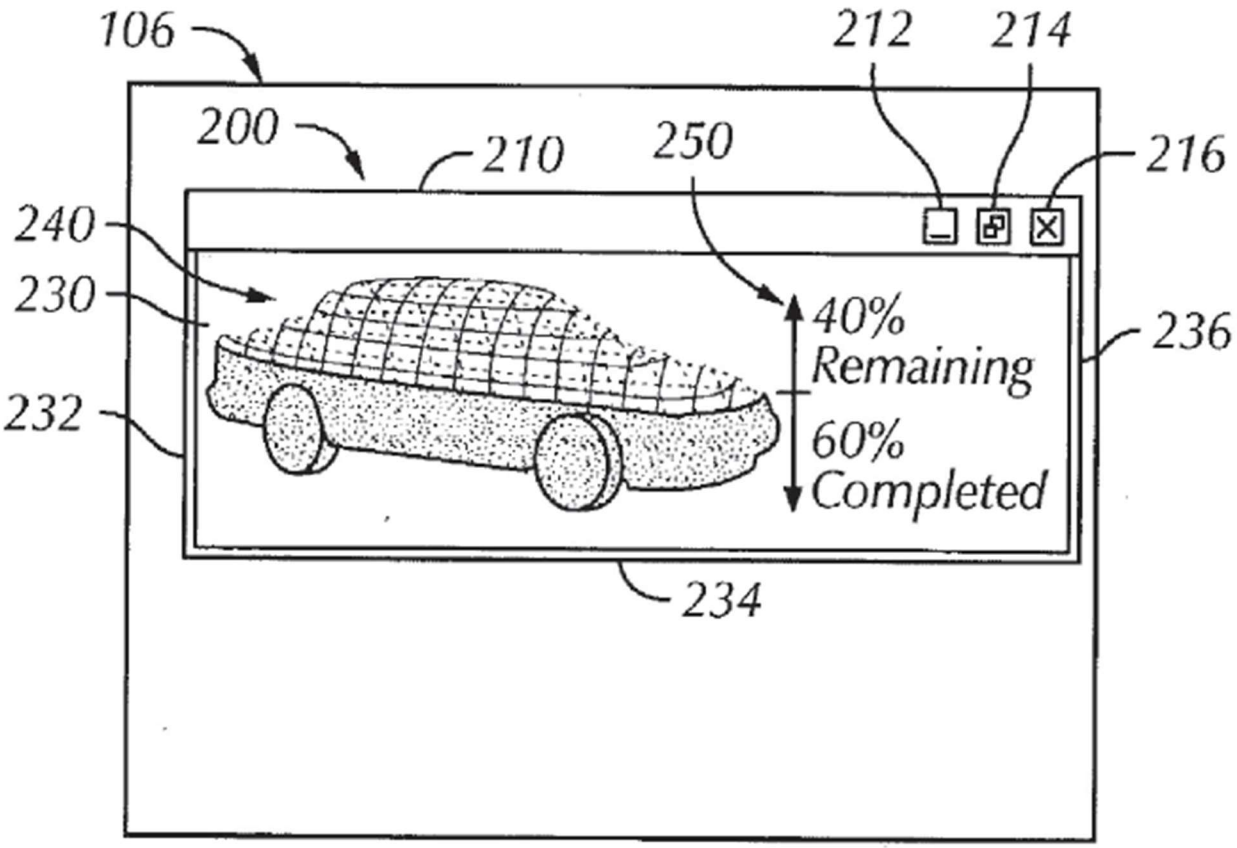


FIG. 2A

Id. at FIG. 2A.

D. Ground 1A Does Dot Render Claim 1 Unpatentable

The combination of *Knighton-Luo-Anderson* does not teach or suggest all elements of independent claim 1. Claim 1 recites "a machine vision system configured to capture and analyze image content from the three-dimensional

scanner, thereby providing a status of the print job executing on the three-dimensional printer" and "web server configured to transmit the status of the print job for display at a remote client through the network interface."

Petitioner relies on the combination of *Knighton*, *Luo*, and *Anderson* (Pet. at 12–29), but these references, whether considered individually or in the combination, fail to teach a machine vision system "providing a status of the print job executing on the three-dimensional printer" by capturing and analyzing image content from a scanner.

According to the Petition, the combination involves applying "Luo's suggestions to Knighton's 3D printer system to allow for remote control and monitoring of the fabrication process over the Internet and to present status information in a user interface to the remote user" (Pet. at 12) and implement "Anderson's suggestions with the predictable Knighton-Luo combination so that the remote user interface (at the remote user's computer) advantageously included helpful status information, such as indication of whether a model is waiting/printing/completed, the percentage of the object completed, and a visual comparison of the portion fabricated against a model frame in the user interface" (Pet. at 16).

Petitioner relies on *Knighton* for the "three-dimensional scanner" (Pet. at 21–23) and the combination for the machine vision system (Pet. at 23–29).

Petitioner asserts that the combination would have included the teachings of *Luo* related to Internet connectivity (Pet. at 24–25) and an "Image of the Physical Model" (Pet. at 27). Petition also asserts that the combination would have included the teachings of *Anderson* related to a visual representation of progress. *See* Pet. at 27–28. When incorporating the teachings of *Luo's* "Image of the Physical Model" and *Anderson's* visual representation of progress, Petition asserts that the visual information would have been based on information from the 3-D scanner. *See* Pet. at 27–28.

Petitioner's assertions about the combination ignore the teachings of the references themselves and concoct a combination unsupported by record evidence and motivated by hindsight to reach a mistaken conclusion that the status information of the combination is provided by capturing and analyzing image content from a three-dimensional scanner.

As an initial matter, none of the asserted references teach providing status for display on a remote client by capturing and analyzing image content from a three-dimensional scanner. *Knighton* teaches the opposite approach of automatically analyzing scan data, performing evaluations to determine what actions to take, and taking such actions, such as detailing the object. *See* EX1005, 2:37–40, 3:1–18, 3:42–43, 4:58-67. Thus, there is no reason for a user, whether

local or remote to the system, to see information related to the scan data because *Knighton's* software automatically takes action without user input.

Luo does not disclose the use of a three-dimensional scanner, much less capturing and analyzing image content from a three-dimensional scanner to provide status information. Indeed, the "Image of the Physical Model" in *Luo* "show[s] lives images captured by the CCD" camera and not from a three-dimensional scanner. *See* EX1006 at 4; *see also* 3 ("Show Image of the Physical Model in the Process Control Window"), Fig. 4 ("Get live image of physical model"), Fig. 9, 5–6.

Even if *Knighton* were modified "apply Luo's suggestions to Knighton's 3D printer system to allow for remote control and monitoring of the fabrication process over the Internet and to present status information in a user interface to the remote user" as Petitioner argues (Pet. at 12–13), there is no support for using a three-dimensional scanner to provide a "visual display" of the three-dimensional model. *See* Pet. at 14 (citing EX1005, 2:37-40; EX1003, ¶89[1]). Petitioner cites to a portion of *Knighton* that says a "a scanner 130 may use laser ranging to create the three dimensional model of the work in process 114." EX1005, 2:37-40. But Petitioner ignores what *Knighton* says about the use of such a model. Namely,

[1] Paragraph 89 of Petitioner's expert declaration simply repeats what the Petition states without further explanation. *Compare* EX1003, ¶89 *with* Pet. at 14.

Knighton says the "model may be analyzed to determine whether corrective measures may be deferred until later in the fabrication process where such deferral would improve the efficiency of the fabrication." *Id.* at 2:41–44; *see also id.* at 2:48–52 (explaining when "correction action" may need to "be taken"). As explained, *Knighton* teaches a solution that automatically takes corrective action without user interaction, so there is no report of status to the user. *See* EX1005, 3:1–18, 3:42–43.

Rather than address *Knighton*'s contrary teachings, Petitioner resorts to impermissible hindsight and asserts "displaying the three dimensional model of the work in process captured by Knighton's 3D scanner in place of or in addition to a video image of the object as it is being fabricated would have allowed the user to more readily visually identify contours or physical inconsistencies in the object that may be difficult to identify in an image due to the interplay of light and shadow with the object." Pet. at 52. In support, Petitioner relies on *Luo* and another reference *Crampton* (EX1009). But, Petitioner misinterprets *Luo* in stating that it discloses "capability for displaying such three-dimensional models" and *Crampton* in stating that "displaying such models of scanned three-dimensional data was well-known in prior art systems."

To be clear, *Luo* does not disclose any capability for displaying three-dimensional models based on three-dimensional data scanned during a print job.

Rather, *Luo* is concerned with other types of models, such as a digital model provided before fabrication and a physical model that is the result of fabrication. *See* EX1006 at 1, 3. As *Luo* explains, there are four basic steps to the process. First, a "[u]ser can upload . . . files of models they have designed." *Id.* at 1. Second, several pre-processes are performed. Third, "[a]fter completing these pre-processes, [the] user can send a model building command to the server and the server can then control the rapid prototyping machine to build up a physical model locally." *Id.* Fourth, "[w]hen the RP model [i.e., the physical model] is completed, the remote user can examine the RP model through live image via Internet transmitted form the CCD camera mounted on the RP machine." *Id.* Nowhere does *Luo* suggest that a three-dimensional model is based on three-dimensional data scanned during a print job.

Similarly, *Crampton* does not teach (or provide a motivation to use) the display of a three-dimensional model based on three-dimensional data scanned during a print job. Rather, *Crampton* describes scanning any object to provide a computer model of it. *See* EX1009, 6:43-60, 8:3-15 (cited by Pet. at 15[2]). There is no teaching of displaying a three-dimensional model based on three-dimensional data scanned during a print job. In particular, *Crampton* discloses a method of

[2] The Petition also cites Paragraph 90 of its expert's declaration. *See* Pet. at 15. However, the cited portion of the declaration merely repeats what is argued in the Petition without any explanation. *Compare* EX1003, ¶90 *with* Pet. at 15.

"manually scanning the object," "detecting the reflected signal," "generating intermediate data structures," "combining the intermediate data structures to provide the model, and "displaying the data." EX1009, 6:43-60; *see also* EX1009, 8:3–15 (describing scanning apparatus to perform scanning). There is no teaching cited by Petitioner that would support displaying a three-dimensional model based on three-dimensional data scanned during a print job, much less to display status of a print job by showing such a model.

In addition to the deficiencies of *Knighton* and *Luo* in the combination, *Anderson* fails to teach providing status by capturing and analyzing image content from a three-dimensional scanner. As explained by the applicant during prosecution, *Anderson* teaches a wireframe model with a completion percentage based on the number of passes completed by the printhead. EX1012, [0018]; *see also* EX1002 at 107. *Anderson* explains that at a "specified interval," the "3D wireframe model representation is re-rendered to show the completed portion as filled-in" based on a status register specifying "the number of passes completed by the printhead." EX1012, [0018]. Notably, the wireframe model is based on a digital model on which the fabrication of an object is based; it is not an actual depiction of the object being fabricated. These deficiencies in *Anderson* mirror those identified by the applicant and accepted by the examiner during prosecution. *Supra* § II.B (Summary of the Prosecution History). In particular, the applicant

argued that *Anderson* alone or in combination with *Adusumilli* did not disclose or suggest a three-dimensional scanner that captures three-dimensional information during a print job in order to provide information about the status of the print job that can be viewed by a remote user. EX1002, 107. In reaching that conclusion, the applicant explained that *Anderson* provided a progressively filled-in wireframe model representation of the three-dimensional object that was determined by a status register that uses the number of passes completed by the printhead, not by any scanner. *Id.*

Further, there is no teaching in *Anderson* that the 3D wireframe model is re-rendered using information from three-dimensional scanner, that the completion percentage is determined using information from three-dimensional scanner, or that the status register in *Anderson* is somehow updated using information from three-dimensional scanner. Thus, *Anderson* does not remedy the deficiencies of *Knighton* and *Luo* that fail to teach providing status information for remote display by capturing and analyzing image content from a three-dimensional scanner.

The *Knighton-Luo-Anderson* combination also suffers from the same deficiencies. Petitioner argues that the combination would include a "visual representation of progress" as *Anderson* suggests. *See* Pet. at 27–28. But Petitioner ignores *Knighton's* teaching, as explained above, of an automated solution that automatically takes correction action without user interaction, and thus does not

report status to the user. *See* EX1005, 2:41-44, 2:48 –52, 3:1–18, 3:42–43. Thus, there is no motivation to provide *Anderson's* visual representation of progress.

Further, even if the combination does transmit *Anderson's* visual representation of progress (it does not), such a visual representation as *Anderson* teaches would be based on the number of printhead passes and not any three-dimensional scanner. *See* EX1012, [0018], [0025], Figs. 1-2A. Petitioner has not explained why a person of ordinary skill would modify *Anderson's* teachings to generate its visual representation using a three-dimensional scanner as opposed to using printhead passes as *Anderson* teaches or how information captured by the three-dimensional scanner would be used to determine a completion percentage or progressively filled-in wireframe model. *See* Pet. at 12–19, 26–29.

VII. THE PETITION DOES NOT SHOW THAT THE CHALLENGED CLAIMS ARE UNPATENTABLE UNDER GROUNDS 1B THROUGH 1H

In addition to Ground 1A, the Petition includes seven additional grounds (Grounds 1B–1H) that rely on Ground 1A's combination of *Knighton*, *Luo*, and *Anderson* in further view of additional asserted art to challenge claims that depend from independent claim 1. *See* Pet. at 1–2. Accordingly, Grounds 1B through 1H fail to teach all elements of dependent claims for at least the reasons discussed above for Ground 1A with respect to independent claim 1. Thus, Petitioner has also

failed to show unpatentability for any of the claims challenged in Grounds 1B through 1H.

VIII. THE PETITION DOES NOT SHOW THAT CLAIMS 1-5, 9-19 ARE UNPATENTABLE UNDER GROUND 2A

A. Overview of *Mazumder* (EX1004)

Mazumder discloses a system and method for remote direct material deposition fabrication. EX1004 at Abstract, Title. *Mazumder's* "fabrication process is recorded by video or television camera and [is] shown in real-time on a screen display connected to the remote computer." *Id.* at Abstract. The "video or TV camera 65 records the laser-aided DMD process and transmits the images to the local computer 70" which then sends the images "to the remote computer 95 to be displayed preferably on a TV screen or shown on the remote computer monitor as streaming video." *Id.* at 6:36-43. The remote computer has "two monitors, one with a graphical user interface and the other for image and video observation of the laser-aided direct material deposition process." EX1004, 2:27-33.

Mazumder's system also incorporates "acoustic sensors [that] operate on the principle that during material deposition strains and other physical changes, such as phase transformation changes, or crack/defect initiation produce sound waves which can be picked up." *Id.* at 5:39-43; *see also id.* at 5:58-63 (explaining that acoustic sensors can be used "to distinguish strain from other sources of acoustic emission from the product, such as crack initiation, defect formation, and phase

transformation, during the fabrication of the product fabrication through laser-aided material deposition.") Accordingly, "[w]hen the designer perceives a defect, an abnormality or some other undesirable characteristic . . . , the designer may pause or abort the fabrication process." *Id.*at 2:34-39.

B. Overview of *Bonassar* (EX1010)

Bonassar discloses modular fabrication systems and methods. EX1010, Title. The system has multiple deposition tools and a material deposition device with a tool interface for receiving one of the material deposition tools. *Id.*, Abstract. A system controller is connected to the material deposition device to control operation. *Id.* The system controller "is designed to store data about system performance and to improve the system automatically by updating data and models which it uses for manufacturing planning, manufacturing simulation, manufacturing plan execution, and operation control." *Id.*at [0095].

Additionally, *Bonassar* explains that "for the manufacturing planning and control system to be able to automatically monitor the progress of a fabrication operation, to identify and locate objects placed in the build environment, and to measure the geometry of the finished product, the system may include a non-contact ranging sensor device which can be scanned by the positioning system across the build surface (i.e. substrate)." *Id.* at [0104]. The "resulting data" is used "in feedback control of the deposition tool." *Id.* In particular, "the manufacturing

planning software [] compensate[s] for variability in the properties of the materials being employed, or other deposition errors." *Id.* This compensation is achieved "by automatically generating modified manufacturing plans which compensate for the errors, for instance by depositing material into undesired gaps, or by modifying subsequent deposition paths so that they do not collide with excess material that was accidentally deposited." *Id.*

C. Ground 2A Does Not Render Claim 1 Unpatentable

1. The *Mazumder–Bonassar* combination does not teach or suggest a three-dimensional printer that includes a build volume

The preamble of claim 1 of the '097 Patent requires a "three-dimensional printer including a build volume." Both the "three-dimensional printer" and its "build volume" are referenced in the body of the claim. For instance, the claim recites "a three-dimensional scanner configured to capture three-dimensional information from an object being fabricated within the build volume during a print job executing on the three-dimensional printer." Thus, the preamble is a limiting part of the claim because it recites elements of the claim and is necessary to give life and meaning to the claim. *Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1305 (Fed. Cir. 1999) ("If the claim preamble, when read in the context of the entire claim, recites limitations of the claim, or, if the claim preamble is 'necessary to give life, meaning, and vitality' to the claim, then the claim preamble should be construed as if in the balance of the claim.").

With respect to the preamble, Petitioner asserts that *Mazumder* discloses a "material deposition system" and that a person of skill "would have recognized that the substrate (and the work space immediately above) is a build volume." Pet. at 53. Petitioner does not rely on *Bonassar* for this claim element (alone or in the combination with *Mazumder*). *See* Pet. at 50–53.

However, there is no teaching in *Mazumder* of a three-dimensional printer that includes a build volume. *Mazumder* discloses its subsystems in Figure 1, reproduced below.

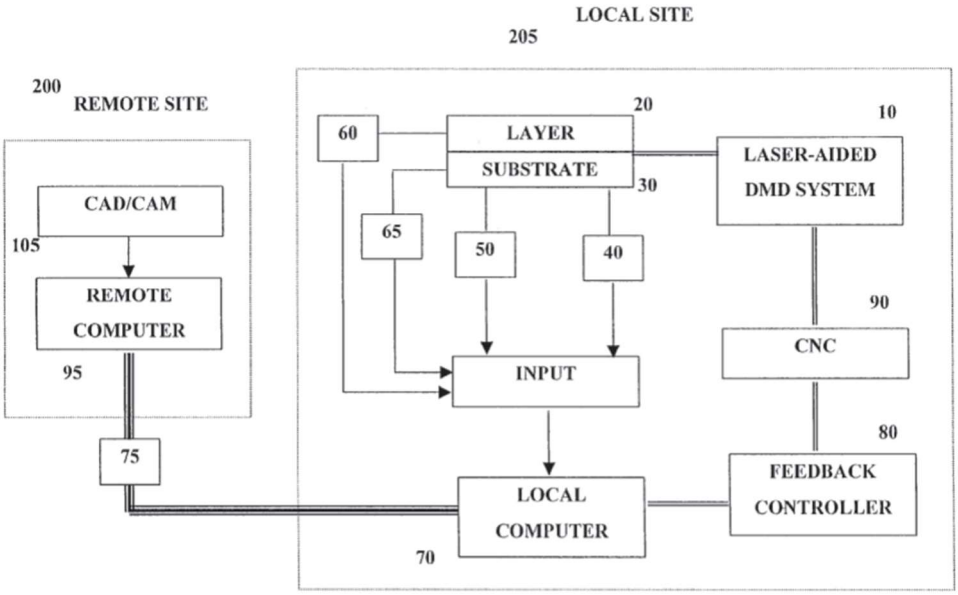


FIG - 1

EX1004, Fig. 1. Although Petitioner points to the substrate in Figure 1 and "the work space immediately above" (Pet. at 53), *Mazumder* expressly states that Figure 1 is a simply "block diagram" of its subsystems. *Id.* at 2:61-62. Nowhere does *Mazumder* suggest that Figure 1 illustrates the physical aspects of the three-

dimensional printer, and it clearly does not. In fact, *Mazumder* expressly admits that the "details of the laser-aided, computer controlled direct material deposition system," which operates as a 3-D printer according to Petitioner (Pet. at 53), "are not all explicitly shown in FIG. 1." EX1004 at 3:22-25. Although Petitioner relies on *Mazumder's* disclosure that "[t]he laser source (not shown) of the DMD system is mounted above the substrate 30, and a layer of material 20 is deposited according to the description of the product, which is incorporated in the deposition tool path" (EX1004 at 4:7-10 (cited by Pet. at 53)), this is not a teaching of a build volume. As the '097 Patent explains, the build volume limits the size of an object that may be printed using the 3D printer. *See, e.g.*, EX1001 at 9:40-46, 19:37-44, 24:1-6. There is no teaching or suggestion in *Mazumder* of limiting the size of an object made with the 3D printer or anything structure or design that limits the bounds of what is printed.

Additionally, there is no reference to the terms "work" or "space" or the combined term "work space," as Petitioner suggests. *See* Pet. at 53 ("a POSITA would have recognized that the substrate (and the work space immediately above) is a build volume").

Further, *Mazumder's* sole reference to the term "volume" refers to data transfer and not a build volume. *See* EX1004 at 1:26 ("the transfer of large volumes of data"). When referring to size, *Mazumder* repeatedly focuses on the

size of data and not an object. *See* EX1004 at 4:44-47 ("The tool path files are typically files of the coordinates of many points along the tool path and, for a realistic part or product, have size of the order of 100 MB."), 4:55-58 ("Several commercial compression codes are available and can reduce the size of the files by compressing them before transmittal. In addition, some common sense rules and recent techniques have been developed to shorten the size of the tool path files, especially for blocks of dense data near tightly curved geometric features."), 5:1-10 ("Recent techniques for reducing tool path file size include circular interpolation and NURBS"), 7:33-34 ("remote computer system includes software for minimizing the size of the deposition tool path file"), 8:11-12 ("deposition tool path file is compressed to reduce its size at the remote computer system"), 8:46-47 ("the file of the deposition tool path is compressed to reduce its size"). While Petitioner also relies on its expert to support its conclusion, Petitioner's expert simply repeats the same conclusory statement as the Petition without any explanation or support. *See* Pet. at 53 (citing EX1003, ¶ 166).

To the extent Petitioner attempts to rely on alleged knowledge of a POSITA or common sense to supply this claim element, resorting to common sense or a POSITA's knowledge alone is improper. *See Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1361 (Fed. Cir. 2016) ("common sense is typically invoked to provide a known motivation to combine, not to supply a missing claim limitation"). As the

Federal Circuit explained in *Arendi*, the Court's cases "repeatedly warn that references to 'common sense'—whether to supply a motivation to combine or a missing limitation—cannot be used as a wholesale substitute for reasoned analysis and evidentiary support, especially when dealing with a limitation missing from the prior art references specified." *Id.* at 1362. In the rare case where common sense "is used to supply a missing limitation" the search for "a reasoned basis for resort[ing] to common sense must be searching" and "this is particularly true where the missing limitation goes to the heart of an invention." *Id.* Relying on the knowledge of a POSITA or common sense to supply this claim element would be improper where it is admittedly missing from *Mazumder* in the asserted combination and there is no evidence that a build space must necessarily be present.

Thus, the Ground 2A combination does not teach or suggest a three-dimensional printer that includes a build volume.

2. The *Mazumder–Bonassar* combination does not teach or suggest a three-dimensional scanner configured to capture three-dimensional information from an object being fabricated

Claim 1 also requires "a three-dimensional scanner configured to capture three-dimensional information from an object being fabricated within the build volume during a print job executing on the three-dimensional printer." Petitioner's conclusion that the combination teaches this element of the claim is grounded in a

flawed understanding of *Mazumder's* disclosure and a failure to explain the combination in light of *Mazumder's* and *Bonassar's* teachings. In particular, Petitioner asserts that *Mazumder's* system includes optical scanners that can detect defects and that *Bonassar* discloses optical sensors that include a 3D scanner that can collect 3D data on the "current state" during fabrication. Pet. at 54-55.

As an initial matter, *Mazumder* does not teach a three-dimensional scanner. *See* EX1004 at 3:31-33, 5:56-6:1. Petitioner ignores the shortcomings of *Mazumder's* disclosure and instead attempts to modify *Mazumder's* optical sensors to include a 3D scanner from *Bonassar*. *See* Pet. at 54-55. And as discussed in the following section, *Bonassar's* use of an automated solution to modify a manufacturing process does not support Petitioner's alleged motivations for the combination.

Additionally, *Mazumder* does not teach that its optical sensors can detect "defect formation" as Petitioner asserts. *See* Pet at 54 ("'The optical sensors 50 include a variety of devices' that can detect 'defect formation…of the product fabrication.'"), 56 ("*Mazumder* describes that its optical sensors detect . . . 'defect formation…of the product fabrication.'"), 50 ("Mazumder describes the option of using additional 'optical sensors' for detecting 'crack initiation, defect formation, and phase transformation, during the fabrication of the product fabrication, and

Bonassar advantageously provides the details of one such sensor (at 3D scanner) to achieve the goal of detection defect formation.").

Instead, *Mazumder* teaches that *another* type of sensor is used to detect defect formation ("and other sources of acoustic emission"). According to *Mazumder*, "acoustic sensors, in particular, require careful calibration to distinguish strain from other sources of acoustic emission from the product, such as crack initiation, defect formation, and phase transformation, during the fabrication of the product fabrication through laser-aided material deposition." EX1004 at 5:58-63. These acoustic sensors are not calibrated against optical sensors, but "independent (mechanical) strain-gage measurements." *Id.* at 5:57-58. *Mazumder* explains that "acoustic sensors operate on the principle that during material deposition strains and other physical changes, such as phase transformation changes, or crack/ defect [sic] initiation produce sound waves which can be picked up by the acoustic sensors." *Id.* at 5:39-43.

Nowhere does *Mazumder* teach or suggest that its optical sensors, as opposed to acoustic sensors, can be used to detect defect formations. Petitioner's misunderstanding of *Mazumder's* teachings is evident from its flawed conclusions regarding the motivation for the combination (*see* Pet. at 50–52) and Petitioner's discussion of various elements of claim 1 (*see* Pet. at 54, 56). In both instances, Petitioner relies on the detection of defect formations in *Mazumder*, which uses

acoustic sensors instead of optical sensors as Petitioner mistakenly believes. It is Petitioner's burden to explain why a POSITA would have been motivated to modify *Mazumder's* 3D printing system to replace its acoustic sensors that detect defect formation with a 3D scanner from *Bonassar*. Because Petitioner has failed to carry its burden, the combination does not teach or suggest a three-dimensional scanner configured to capture three-dimensional information from an object being fabricated.

3. The *Mazumder–Bonassar* combination does not teach or suggest a machine vision system configured to capture and analyze image content from the three-dimensional scanner to provide a status of the print job

Claim 1 further requires "a machine vision system configured to capture and analyze image content from the three-dimensional scanner thereby providing a status of the print job executing on the three-dimensional printer" in which "the status of the print job" is transmitted by a web server "for display at a remote client through the network interface." Petitioner's conclusion that the combination teaches these elements of the claim resort to impermissible hindsight driven by a misunderstanding of the references.

Petitioner does not rely on *Mazumder* for disclosure of "a machine vision system configured to capture and analyze image content from the three-dimensional scanner thereby providing a status of the print job executing on the

three-dimensional printer."[3] *See* Pet. at 56–57. Rather, Petitioner asserts that *Bonassar* uses "machine vision sensing technologies" including "machine vision software" to analyze the image content from the 3D scanner to provide a status of the print job. Pet. at 56. Petitioner points out that *Bonassar's* scanner acquires the geometry of deposited material and uses data for feedback control and to detect flaws. *See id.*

However, *Bonassar* does not teach using such a machine vision system in conjunction with a three-dimensional scanner. Rather, *Bonassar* teaches using machine vision to process the output from conventional cameras, such as CCD cameras, CCD microscopes, microscopic video capture, and color detection. *See* EX1010, [0085] ("Appropriate sensors include, without limitation, CCD cameras with machine vision software, "electronic nose," mechanical probes with force instrumentation, and fluorescence CCD microscopes with machine vision software."), [0105] ("Other machine vision sensing technologies are also available, including microscopic video capture at the point of deposition."), [0110] ("For instance, given a deposit of a chemically reactive material which changes color as

[3] To the extent Petitioner asserts that *Mazumder* does provide such a status, there is no teaching or suggestion in *Mazumder*, alone or in the combination with *Bonassar*, that a status is provided by "a machine vision system configured to capture and analyze image content from a three-dimensional scanner." Among other reasons provided below, *Mazumder* does not even teach a three-dimensional scanner, and *Bonassar* does not teach a machine vision system for a three-dimensional scanner.

it reacts, a machine vision sensor can detect that the color of a region of deposited material is not what is expected for this material given the data present in the materials/tools/substrates database"). Because *Bonassar* does not teach using a machine vision system with a three-dimensional scanner and because *Mazumder* does not disclose any machine vision system, the combination cannot teach a machine vision system configured to capture and analyze image content from the three-dimensional scanner.

4. There is no motivation to combine *Mazumder's* manual solution with *Bonassar's* automated solution

In addition to the deficiencies of the *Mazumder-Bonassar* combination addressed above, there is no motivation to combine *Mazumder* and *Bonassar* in the manner that Petitioner proposes. When discussing the references and the purported motivation to combine, Petitioner acknowledges that *Mazumder* teaches a manual solution with remote control by a "designer" to modify of the manufacturing process (*see* Pet. at 47–48) and that *Bonassar* teaches an automated solution that automatically modifies the manufacturing process. *See* Pet. at 47–48, 62 (citing EX1004, Abstract, 1:62-2:2, 1:10-13, 1:16-20, 2:13-42, 6:44-67, 4:19-29), at Pet. at 49, (citing EX1010, [0104]). And, in describing the combination, Petitioner repeatedly relies upon the purported benefits of *Bonassar's* automated solution. *See, e.g.*, Pet. at 50–51 ("Bonassar suggested an improvement that beneficially

allowed '[d]iscrepancies [to] be remedied by generating modifications to the manufacturing plan which replace or circumvent the error.'"), 51 (*Bonassar's* "manufacturing planning software to design compensating material deposits which can be executed in a timely fashion, without compromising the properties of materials which are sensitive to the time since deposition"), 52 (*Bonassar's* "manufacturing planning software to compensate for variability in the properties of the materials being employed, or other deposition errors by automatically generating modified manufacturing plans which compensate for the errors"). However, Petitioner fails to satisfy its burden to explain the motivation to combine the teachings of *Mazumder* and *Bonassar* by failing to address the conflicting teachings of *Bonassar* and *Mazumder*.

Specifically, Petitioner's rationale for the combination of *Mazumder* and *Bonassar* ignores the references contrary solutions (i.e., *Mazumder's* manual solution and *Bonassar's* automated solution) and resorts to impermissible hindsight to assert that the combination would both automatically generate modified manufacturing plans, as *Bonassar* teaches, and manually modify the same plans at a remote computer, as *Mazumder* teaches. There is no dispute that *Bonassar* teaches an automated process. As such, *Bonassar's* solution has no need to report status remotely. In particular, *Bonassar's* scanning functionality is for an automated, feedback process that controls manufacturing by "automatically

generating modified manufacturing plans which compensate for the errors" by modifying deposition paths. EX1010, [0104]. *Bonassar* explains that feedback control "allows the manufacturing planning software to compensate for variability in the properties of the materials being employed, or other deposition errors by automatically generating modified manufacturing plans which compensate for the errors, for instance by depositing material into undesired gaps, or by modifying subsequent deposition paths so that they do not collide with excess material that was accidentally deposited." *Id.* However, there is no teaching in *Bonassar* that status needs to be reported to a user or other explanation why one would need to report status when the system automatically generates modified manufacturing plans to compensate for errors.

In contrast with *Bonassar's* automated solution, *Mazumder* teaches a manual solution in which the transfer of information to a remote computer enables a "remote design team" (not an automated system) to modify the manufacturing process manually by modifying CAD or CAM files. *See* EX1004, 6:48-60; *see also* EX1004, 2:14-23, 2:34-42; Pet. at 62. *Mazumder* explains that while "data-processing is done locally" and "only processed information of actual temperature, strain and stress, as well as physical dimensions, composition and appearance of the product is transmitted to the remote computer," all "[m]odification of CAD and CAM files, as well as generation and compression of the tool path files is done at

the remote site 200 using the remote computer 95." *Id.* at 6:48-55. *Mazumder* clarifies that "according to the invention, the control of the manufacturing process lies with the remote site 200 that houses the design team." *Id.* at 6:58-60.

Given the conflicting approaches in *Bonassar* and *Mazumder*, it is Petitioner's burden to explain why its rationale for the combination would include both approaches. But the Petition fails to explain why a POSITA would need to report status when modifying *Mazumder*'s manual solution with *Bonassar*'s automated solution that automatically generates modified manufacturing plans to compensate for errors. *See* Pet. at 56, 60-62. Absent such an explanation, Petitioner's combination resorts to hindsight bias to assert that the combination would report status despite having no need to do so due to the use of an automated solution as taught by *Bonassar*. *Mintz*, 679 F.3d at 1377; *see also AT&T Services*, IPR2024-01143, Paper 15 at 38 (PTAB Feb. 11, 2025) (finding no motivation to combine because of an overly broad conclusion that "suffers from hindsight bias"). Thus, there is no motivation to combine *Mazumder* and *Bonassar* in the manner Petitioner proposes.

IX. THE PETITION DOES NOT SHOW THAT THE CHALLENGED CLAIMS ARE UNPATENTABLE UNDER GROUNDS 2B THROUGH 2F

In addition to Ground 2A, the Petition includes five additional grounds (Grounds 2B–2F) that rely on Ground 2A's combination of *Mazumder* and

Bonassar in further view of additional asserted art to challenge claims that depend from independent claim 1. *See* Pet. at 1–2. Accordingly, Grounds 2B through 2F fail to teach all elements of dependent claims for at least the reasons discussed above for Ground 2A with respect to independent claim 1. Thus, Petitioner has also failed to show unpatentability for any of the claims challenged in Grounds 2B through 2F.

X. ADDITIONAL COMMENTS

With respect to any arguments in the Petition that are not specifically addressed herein, Patent Owner does not concede the legitimacy of such arguments in the Petition and any underlying contentions in the Petition. If *inter partes* review is instituted, Patent Owner expressly reserves the right to rebut any such arguments and any such contentions at a later point, including in a Patent Owner Response. Patent Owner is not limited to the arguments presented here in this Preliminary Response and expressly reserves the right to raise further arguments, including claim construction arguments, not presented in this Preliminary Response.

XI. CONCLUSION

For the foregoing reasons, Patent Owner respectfully requests that the Board decline to institute *inter partes* review of the '097 Patent.

Respectfully submitted,

Dated: April 14, 2025

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CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), I certify that this Preliminary Response complies with the type-volume limits of 37 C.F.R. § 42.24(b)(1) because it contains 8,209 words, excluding the parts that are exempted by 37 C.F.R. § 42.24(a), according to the word processing system used in preparation of this Request.

Dated: April 14, 2025

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR § 42.6(e)(4), the undersigned certifies that on April 14, 2025, a complete copy of the foregoing Patent Owner's Preliminary Response was served on Lead and Back-up Counsel for Petitioner at the service address provided in Petitioner's Mandatory Notices:

Email: IPR56224-0012IP1@fr.com

Dated: April 14, 2025

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