

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SHENZHEN TUOZHU TECHNOLOGY CO., LTD.,

Petitioner

v.

STRATASYS, INC.

Patent Owner.

PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 9,421,713

Case No. IPR2025-00321

PATENT OWNER'S RESPONSE

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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, <i>Stratasys, Inc. v. Shenzhen Tuozhu Technology Co. Ltd.</i> , No. 2:24-cv-00644-JRG (E.D. Tex. Nov. 14, 2024)
2004	Discovery Order, <i>Stratasys, Inc. v. Shenzhen Tuozhu Technology Co. Ltd.</i> , No. 2:24-cv-00644-JRG, Dkt No. 35 (E.D. Tex. Dec. 2, 2024)
2005	Protective Order, <i>Stratasys, Inc. v. Shenzhen Tuozhu Technology Co. Ltd.</i> , No. 2:24-cv-00644-JRG, Dkt No. 36 (E.D. Tex. Dec. 3, 2024)
2006	e-Discovery Order, <i>Stratasys, Inc. v. Shenzhen Tuozhu Technology Co. Ltd.</i> , No. 2:24-cv-00644-JRG, Dkt No. 41 (E.D. Tex. Dec. 19, 2024)
2007	Invalidity and Ineligibility Contentions, <i>Stratasys, Inc. v. Shenzhen Tuozhu Technology Co. Ltd.</i> , 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	U.S. Patent No. 6,645,412 (“ <i>Priedeman-412</i> ”)
2010	Declaration of Gary Larson
2011	Declaration of Paul Leavitt
2012	Complaint, <i>Stratasys, Inc. v. Shenzhen Tuozhu Technology Co. Ltd.</i> , No. 2:24-cv-00644-JRG, Dkt No. 1 (E.D. Tex. Aug. 8, 2024)
2013	Declaration of Dr. Tim A. Osswald related to IPR2025-00321
2014	Amended Declaration of Gary Larson
2015	Amended Declaration of Paul Leavitt
2016	Transcript of August 29, 2025 Deposition of Dr. Hickner related to IPR2025-00321
2017	Image from combined file representing EX1014 and EX1015

2018	Osswald, T.A., UNDERSTANDING POLYMER PROCESSING, Hanser Publishers (2011)
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I. INTRODUCTION

Patent Owner hereby submits this Response to the Petition for *inter partes* review (“Petition” or “Pet.”) filed by Shenzhen Tuozhu Technology Co., Ltd. (“Petitioner”), challenging claims 1, 2, 5-7, 9, 16, and 17 (“challenged claims”) of U.S. Patent No. 9,421,713 (“the ’713 Patent”) (EX1001).

The challenged claims are directed to solutions that print layers of a 3-D part and support structure from multiple print heads or deposition lines using additive manufacturing and perform a purge operation that includes printing a purge tower in a layer-by-layer manner, in which the layers of the purge tower are printed from the print head or deposition line switched to the operating mode.

The Petition relies on several references (*RepRap Article*, *RepRap Video*, and *Boyer*) in Grounds 1, 2B, and 3 that are not prior art as the challenged claims were reduced to practice before the references’ critical dates.

The Petition also relies on several secondary references (*RepRap Article*, *RepRap Video*, and *KISSlicer*) in Grounds 1, 2A, and 2B that Petitioner has failed to show are printed publications. Even if considered, the secondary references in their combinations each fail to teach the purge tower of the challenged claims. The primary references (*Leavitt* and *Priedeman*) in the combinations fail to remedy this deficiency. Finally, the Petition relies on an alleged anticipatory reference *Boyer* in Ground 3 that fails to disclose multiple limitations.

In summary, the Petition is fatally deficient for multiple independent reasons. Petitioner cannot satisfy its burden for anticipation or obviousness.

II. '713 PATENT (EX1001)

The '713 Patent is related to “additive manufacturing systems” to print 3D parts and support structures using “purge operation techniques.” EX1001 at 1:6-13. The patent explains that “part material is extruded through an extrusion tip or nozzle carried by a print head of the system, and is deposited as a sequence of roads.” *Id.* at 1:30-32. In making 3D parts, “supporting layers or structures are typically built underneath overhanging portions or in cavities of 3D parts under construction.” *Id.* at 1:40-44.

The specification of the '713 Patent discloses such additive manufacturing systems “with the use of a purge tower (or multiple purge towers).” EX1001 at 3:41-44. In particular, “the additive manufacturing system may utilize multiple print heads or deposition lines, where a first print head or deposition line may be used to print the 3D part, and a second material print head or deposition line may be used to print the support structure.” *Id.* at 3:52-56. “When printing with multiple print heads (or multiple deposition lines), each print head or deposition line is preferably switchable between an ‘operating mode’ and a ‘stand-by mode’.” *Id.* at 4:1-4.

The '713 Patent explains that when a print head or deposition line switches to an operating mode, it can undergo a purge operation, such as extruding material into

a purge station or bucket. EX1001 at 4:39-45; *see also id.* at 4:46-62. However, there are numerous issues with the purge station or bucket, such as requiring “a sufficient amount” of material to be extruded “to have enough weight to fall away” and “into a purge bucket,” reducing the useable build volume due to the sizeable footprint of the purge station, and need for the purge station or bucket to be emptied periodically. *See id.* at 4:63-5:6.

Unlike the purge station or bucket, the '713 Patent discloses a process that prints one or more purge towers “during the purge operations.” *Id.* at 5:7-10. As a result, there is no need to use a separate purge station and thus use of the purge tower can increase the useable build volume, reduce the materials consumed during purge operations, and allow automated operation of an additive manufacturing system. *See id.* at 5:10-17.

The '713 Patent illustrates and describes several figures that further detail the use of a purge tower. Figure 1 shows system 10 in use with consumable assemblies 12 to print 3D part 20, support structure 22, and purge tower 24.

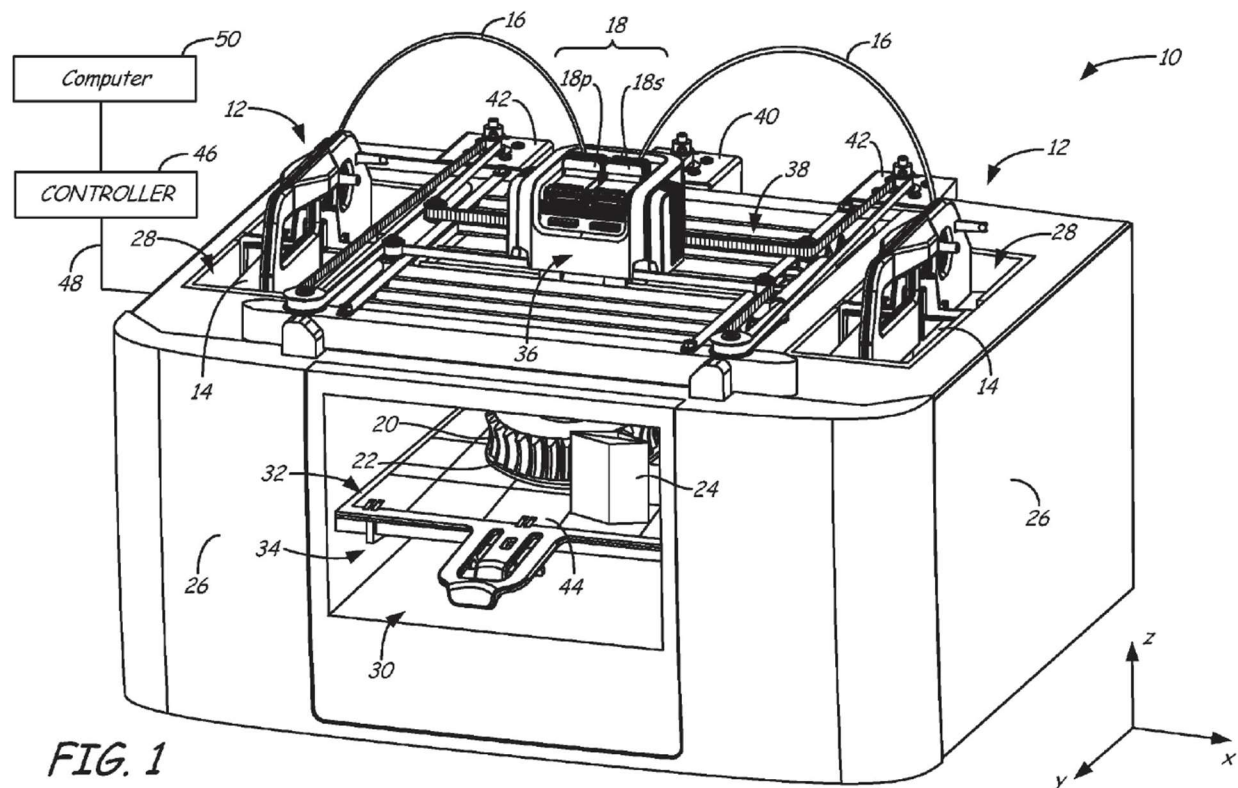
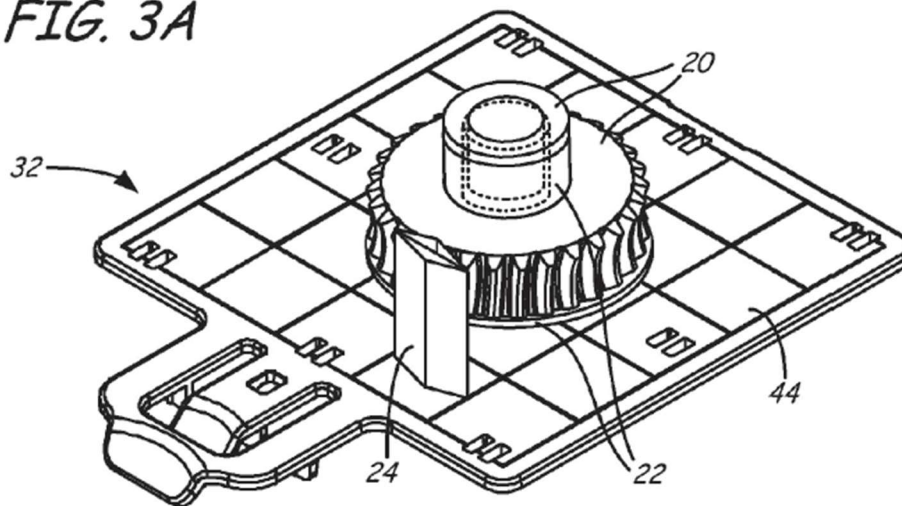
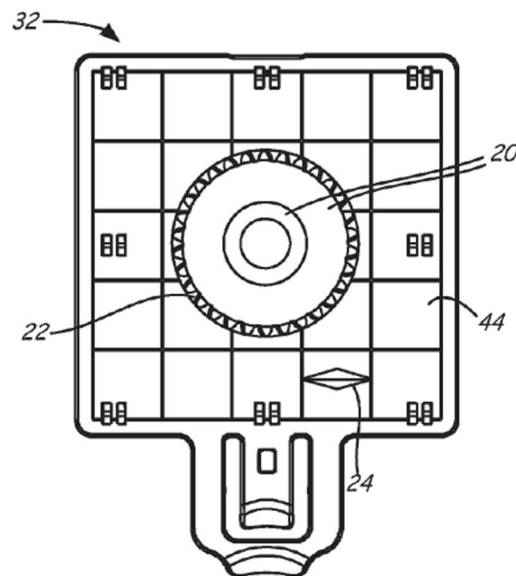


FIG. 1

EX1001 at Fig. 1, 5:18-30, 5:60-67. As shown, there are two consumable assemblies 12, one for part material and the other for support material. *See id.* at 5:25-30. Head carriage 36 includes “one or more [] print heads,” such as part print head 18p that draws consumable part material filament and support print head 18s that draws consumable support material filament. *Id.* at 5:31-35, 6:51-53. Within chamber 30 of system 10, 3D part 20, support structure 22, and purge tower 24 are printed in a layer-by-layer manner. *See id.* at 8:6-9. “After the print operation is complete, the resulting 3D part [] and support structure [] may be removed from chamber 30, and support structure 22 may be removed from 3D part 20. Purge tower 24 itself may be then recycled or otherwise discarded as desired.” *Id.* at 8:24-28.

“[E]ach layer of purge tower 24 is printed by either the part material or by the support material depending on when print heads 18 switch between their operating modes and their stand-by modes and perform the purge operations.”

FIG. 3A**FIG. 3B**

Id. at Figs. 3A-3B, 8:34-38; *see also id.* at Figs. 7-8, 12:5-14:41.

Numerous claims embody these solutions, including independent claims 1 and 16. Among other things, claim 1 recites “switching the print heads or deposition line

between stand-by modes and operating modes in-between the printing of the layers of the three-dimensional part and the support structure;” and “performing a purge operation for each print head or deposition line switched to the operating mode, the purge operation comprising printing at least one purge tower in a layer-by-layer manner, wherein the layers of the at least one purge tower are printed from the print head or deposition line switched to the operating mode.” EX1001 at 15:49-58.

Similarly, claim 16 recites a “method for printing a three-dimensional part with an additive manufacturing system, the method comprising: (a) printing a first layer of a support structure from a support material for the three-dimensional part; (b) printing a first layer of a purge tower from a part material; (c) printing a first layer of the three-dimensional part on at least a portion of the first layer of the support structure from the part material after printing the first layer of the purge tower; (d) printing a second layer of the purge tower from the support material; and (e) printing a second layer of the support structure on at least a portion of the first layer of the three-dimensional part from the support material after printing the second layer of the purge tower.” *Id.* at 17:26-18:11.

As explained below, the asserted grounds fail to disclose or teach the elements of independent claims 1 and 16. In addition these grounds fail to disclose or teach additional elements of dependent claims 5, 6, and 17. Claims 5 and 6 depend from claim 1 and require that “the at least one purge tower has a cross-sectional area that

reduces in height along an axis that is perpendicular to a build plane” and “the at least one purge tower is stopped at a highest layer at which there is a material change for the printed layers of the three-dimensional part and support structure,” respectively. EX1001 at 16:18-24. Claim 17 depends from claim 16 and requires “repeating steps (b)-(e) for at least a portion of the three-dimensional part and support structure.” *Id.* at 18:13-15.

III. LEVEL OF ORDINARY SKILL

For the purpose of this Response, a person of ordinary skill in the art (a “POSITA”) in relation to the ’713 Patent would have had a bachelor’s degree in Mechanical Engineering, Computer Engineering, Chemical 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). EX2013, ¶24. Petitioner advances a similar level of skill in the art. *See* Paper 10 at 16-17 (discussing both levels of skill).

As explained below, the Petition has failed to show that the claims of the ’713 Patent are unpatentable irrespective of the level of skill of a skilled artisan. EX2013, ¶25.

IV. CLAIM CONSTRUCTION

A. Petitioner fails to identify how the claims are to be construed

Petitioner has failed to identify how the claims should be construed. *See* 37 CFR § 42.104(b)(3); *see also* CTPG at 42 (A “petitioner must . . . *provide a claim construction for the challenged claims*”).

Petitioner instead improperly proposes two positions as to the scope of the claims, defining those positions by which structures are covered as opposed to an actual construction. *See* Pet. at 5-7. By merely addressing what structures and use thereof would be covered under the claims, Petitioner has failed to satisfy its burden to “include a statement identifying *a proposed construction of the particular term*” where it believes a term requires an express construction. CTPG at 44. Petitioner’s flawed attempt at claim construction is insufficient because Petitioner must identify its proposed construction and because Petitioner cannot transform a question of fact (whether a structure is covered by the claims) into a question of law (the proper scope of the claims). *TRUSTID, Inc. v. Next Caller, Inc.*, No. 2022-1433, 2023 WL 2298748, at *5 (Fed. Cir. Mar. 1, 2023).

V. APPLICABLE LEGAL STANDARDS

Grounds 1–2B of the Petition each rely 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 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). 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. *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006).

Ground 3 of the Petition relies on anticipation under 35 U.S.C. § 102. “[I]n order to anticipate under 35 U.S.C. § 102 [the reference] must not only disclose all elements of the claim within the four corners of the document, but must also disclose those elements arranged as in the claim.” *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008) (internal quotation marks omitted); *see also In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009) (requiring “each and every element of the claimed invention” be disclosed “explicitly or inherently”).

VI. *REPRAP* ARTICLE, *REPRAP* VIDEO, AND *BOYER* ARE NOT PRIOR ART

Contrary to Petitioner's assertions, the *RepRap Article* (EX1005), *RepRap Video* (EX1006), and *Boyer* (EX1008) references are not prior art. *See* Pet. at 2 (asserting critical dates on or after Sept. 21, 2012). As explained below, the invention of the '713 Patent was reduced to practice before the critical dates of these Section

102(a) and 102(e) references and thus antedates them. *See Fox Grp., Inc. v. Cree, Inc.*, 700 F.3d 1300, 1304 (Fed. Cir. 2012) (“[Patentee] needs only prove either that it reduced its invention to practice first *or* that it conceived of the invention first and was diligent in reducing it to practice.”) (emphasis added); *Janssen Pharms. Inc. v. Tolmar, Inc.*, No. CV 21-1784-WCB, 2023 WL 11963383, at *2 (D. Del. Sept. 8, 2023) (Bryson, J.) (“If reduction to practice is established, then evidence of conception is not necessary.”).

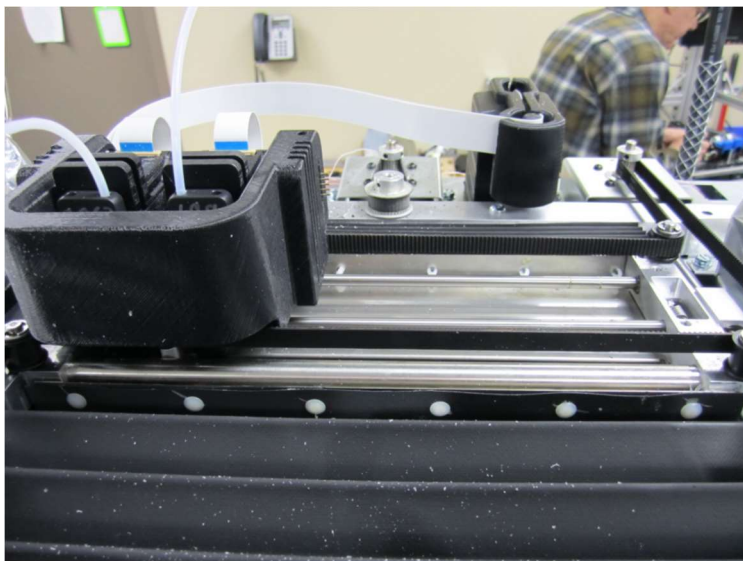
As explained in the accompanying declarations from an inventor of the '713 Patent (*see* EX2014) and a corroborating non-inventor witness who worked with the inventors (*see* EX2015), the inventors conceived of the invention during the research into a new dual-extruder 3-D desktop printer by September 2010. EX2014, ¶8; EX2015, ¶8.



EX2014, ¶10 (citing Ex. B); EX2015, ¶10 (same).

During the subsequent development of the printer in the following year, the inventors with their colleagues reduced the invention to practice by, among other things, studying the implementation details of the invention, creating binary (CBM) files representing the generation of tool path instructions to build the three-dimensional part, support structure, and purge tower(s), and creating purge towers during a purge operation to enable the development of the printer. *See* EX2014, ¶¶15, 16, 18, 24 (discussing purge towers printed while developing printer); EX2015, ¶¶9, 15, 16, 18, 24 (same); *see also* EX2014, ¶¶9-24, 26, 29 (discussing Exhibits B, C, E-G to EX2014); EX2015, ¶¶9-24, 26, 29. The accompanying declarations explain that purge towers were printed in a manner that practiced each of the challenged claims. *See id.*; *see also* EX2014, ¶¶27-28 (discussing claim chart in Exhibit A); EX2015, ¶¶27-28 (same).

[1pre, 1a, 16pre]: Depicted below are the part and support print heads and deposition lines of the developmental printer used to print the layers of the three-dimensional part and support structure using a layer-based additive manufacturing technique.

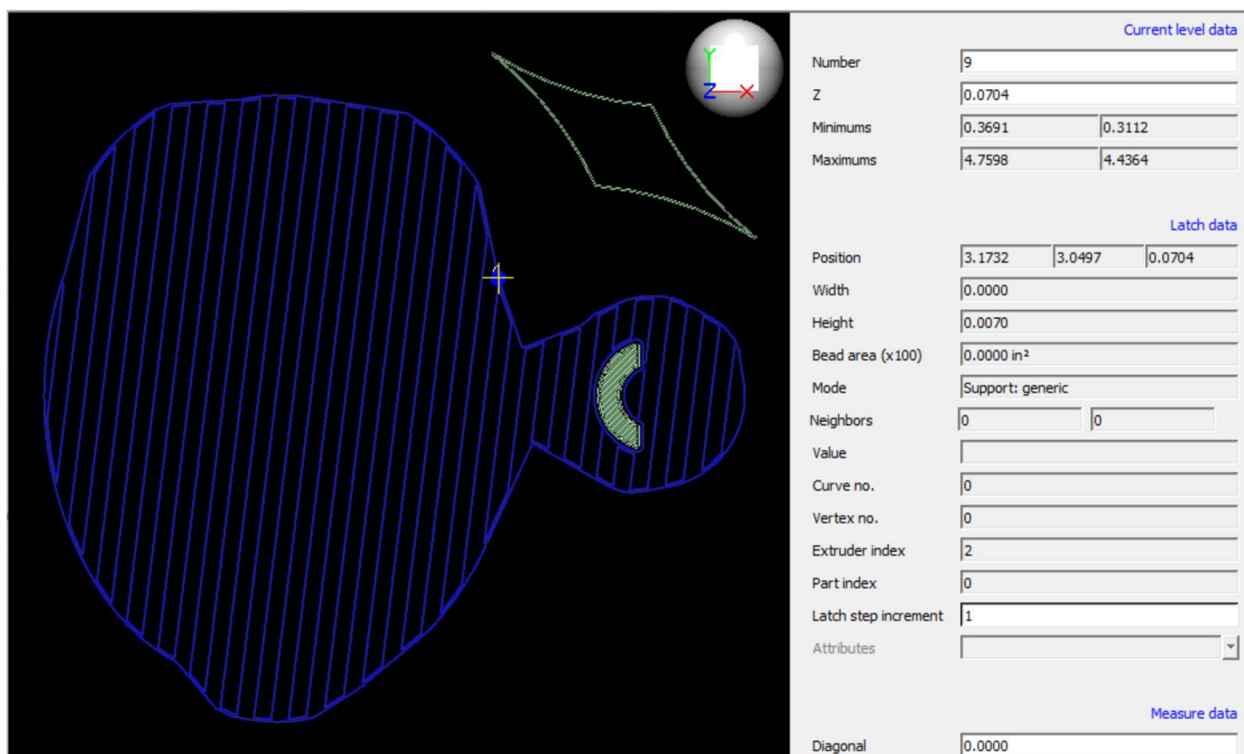


EX2014, ¶12 (citing (Ex. C)); EX2015, ¶12 (same).

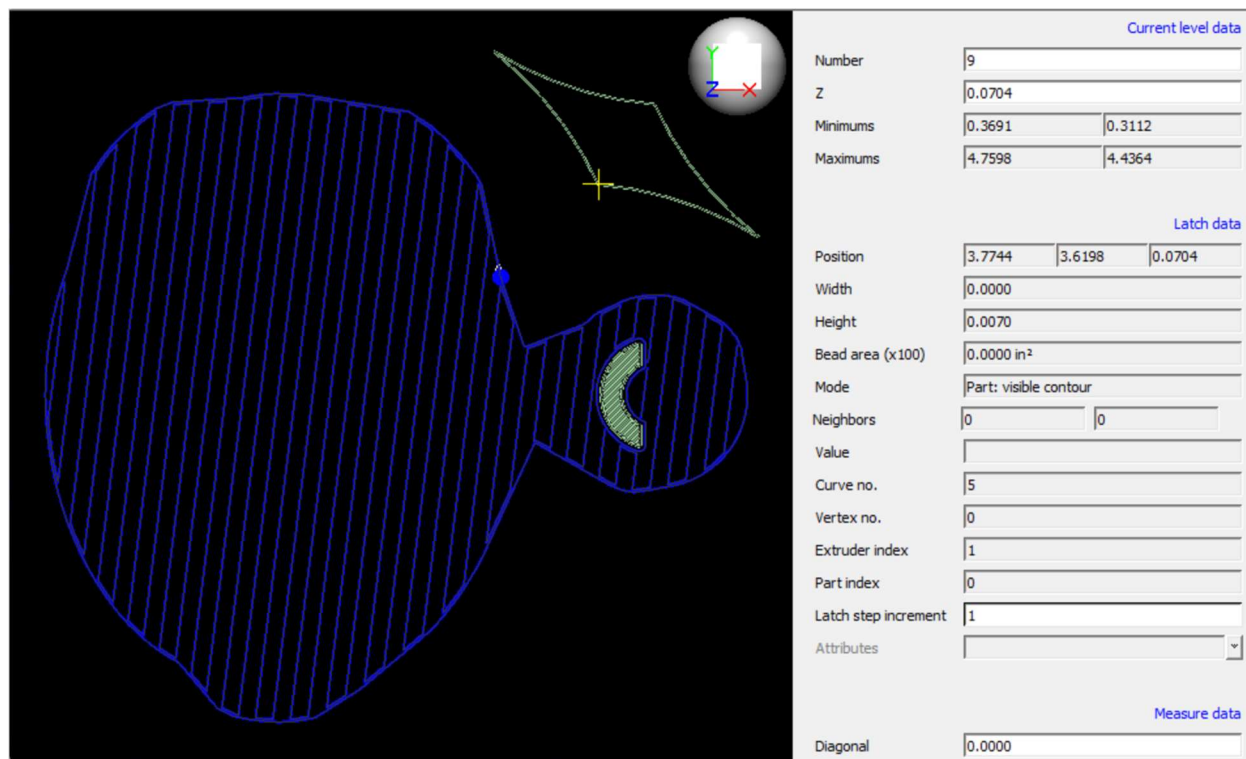
[1b-1c, Claim 2]: As explained by the inventor and corroborating witness, the printer switched between stand-by modes and operating modes for the print heads and deposition lines in-between the printing of the layers of the three-dimensional part and the support structure. EX2014, ¶¶13, 17; EX2015, ¶¶13, 17. When one print head / deposition line was in the operating mode, the liquefier assembly would be heated to its operating temperature during which time it would print the material layer. *Id.* During that time, the other print head and deposition line would be in stand-by mode at which time it would not be printing material and it would be cooled down from its operating mode temperature to a stand-by temperature. *Id.* The printer also performed a purge operation comprising printing purge tower(s) in a layer-by-layer manner for each print head / deposition line switched to the operating mode. EX2014, ¶14; EX2015, ¶14.

As discussed, the inventors created CMB files containing the tool path instructions for the 3-D part, support structure, and purge tower(s), which were used to print those items. EX2014, ¶15; EX2015, ¶15. The screenshots below from a July 5, 2011 CMB file depict the printing process of the challenged claims. EX2014, ¶16; EX2015, ¶16.

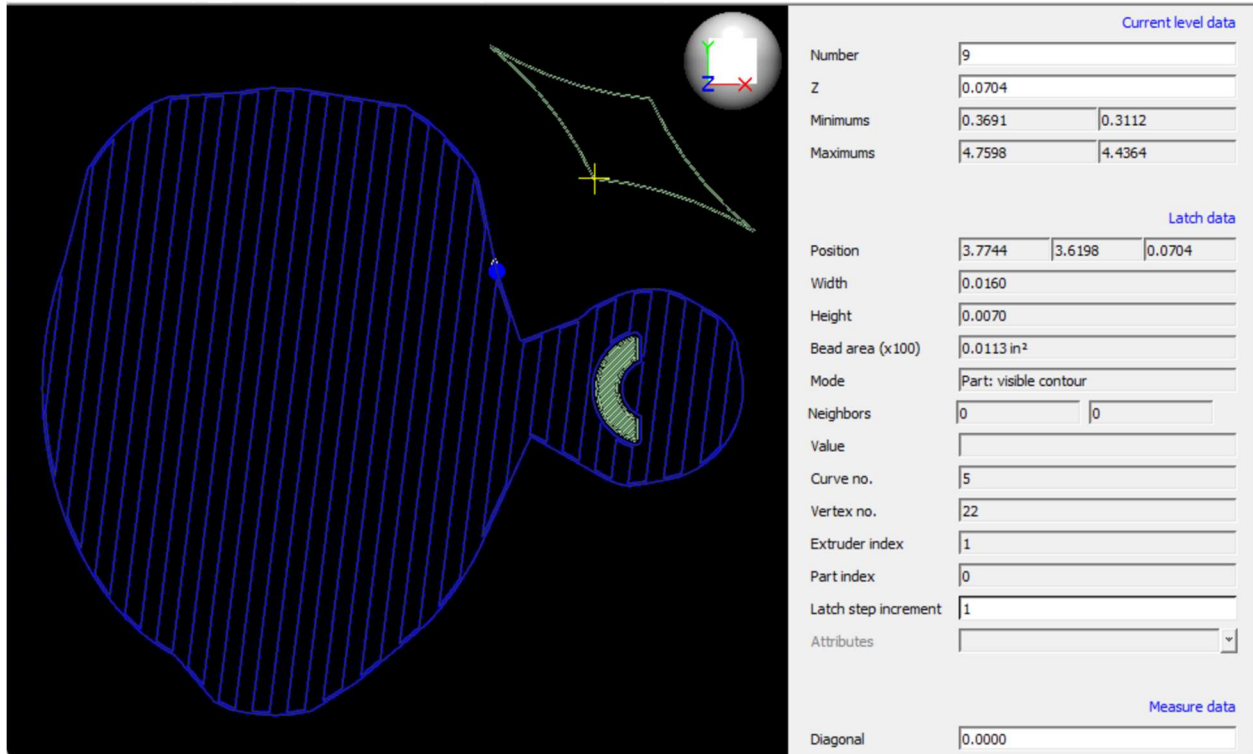
As shown by the example of CMB layer 9 below, the blue lines in the CMB file indicate support material and the green lines indicate part material:



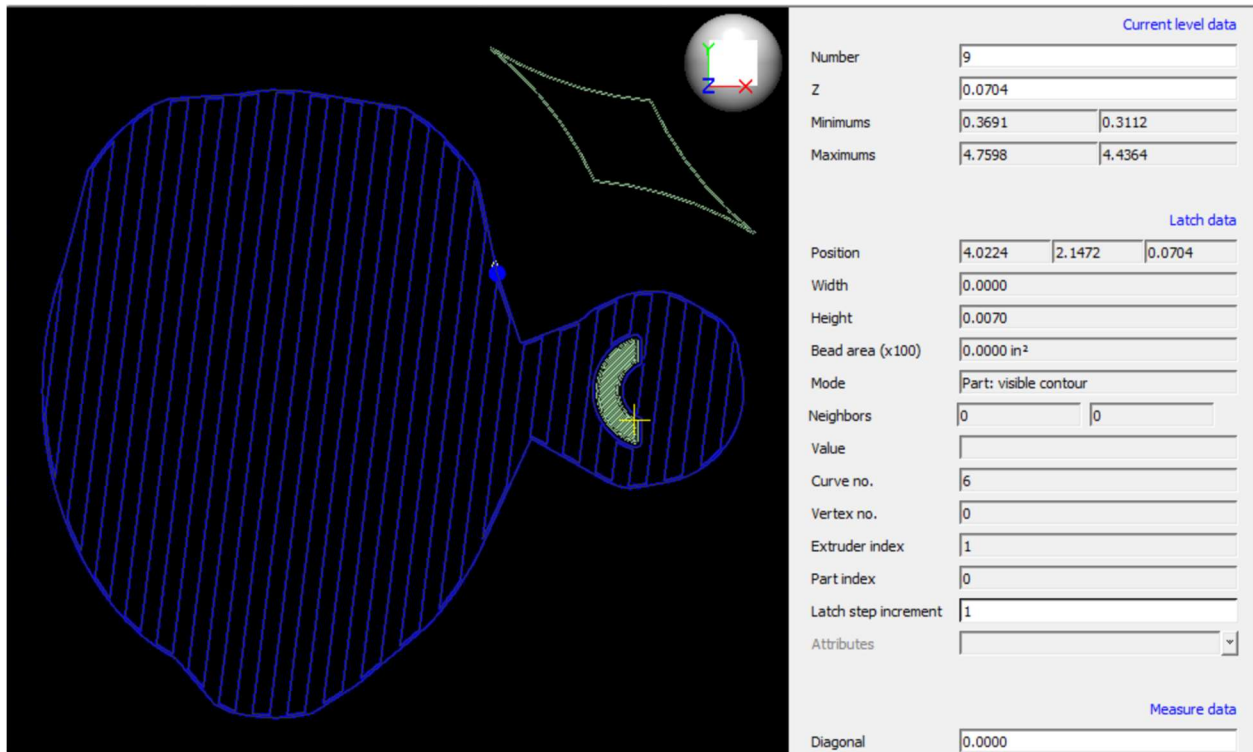
EX2014, ¶16 (Ex. E, 21); EX2015, ¶16.



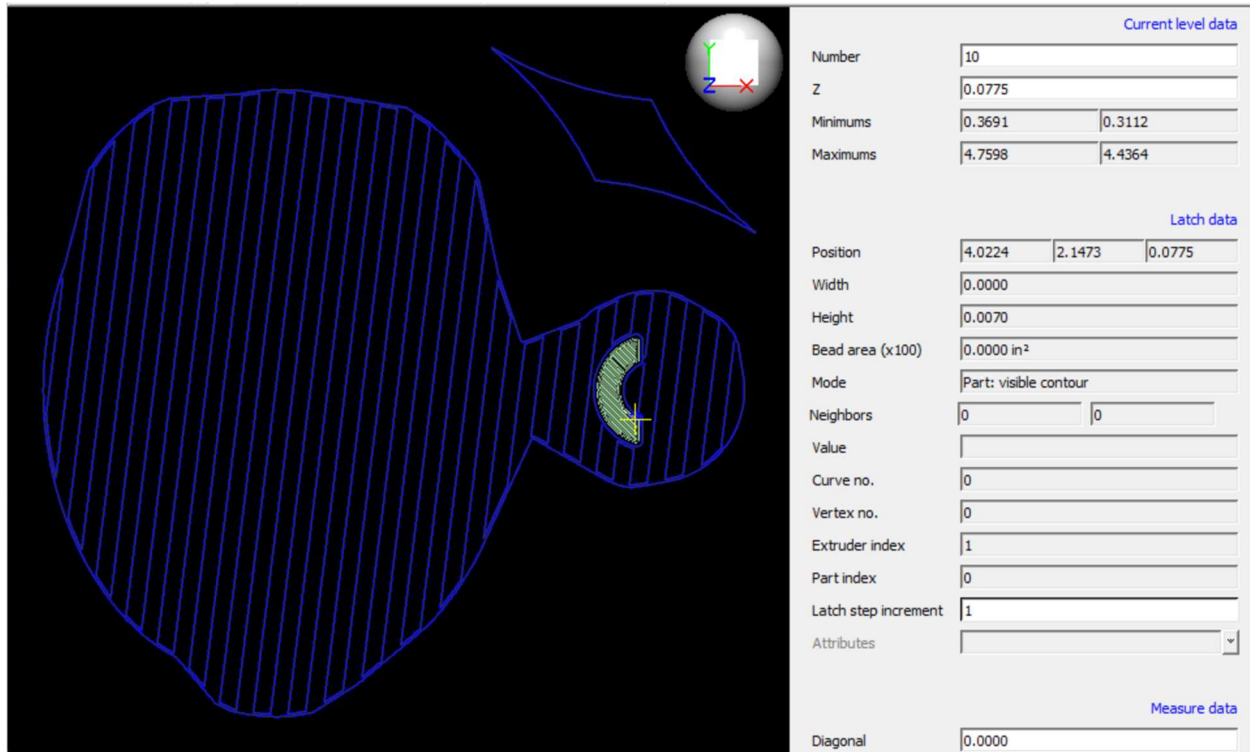
Id. (Ex. E, 23). The support structure (starting with curve 0, vertex 0) is printed first, followed by the diamond-shaped purge tower (starting curve 5). EX2014, ¶16; EX2015, ¶16. The blue lines correspond to the support structure, as confirmed by the “Extruder index” being “2,” and the mode being “Support: generic.” *Id.* The layer of the purge tower (green) is printed with part material, as confirmed by the “Extruder index” of “1” and the mode being “Part: visible contour.” *Id.* Printing of this layer commences until the final point of the purge tower layer (curve 5, vertex 22), with the next point being the start of printing the three-dimensional part with part material (curve 6, vertex 0) as shown below.



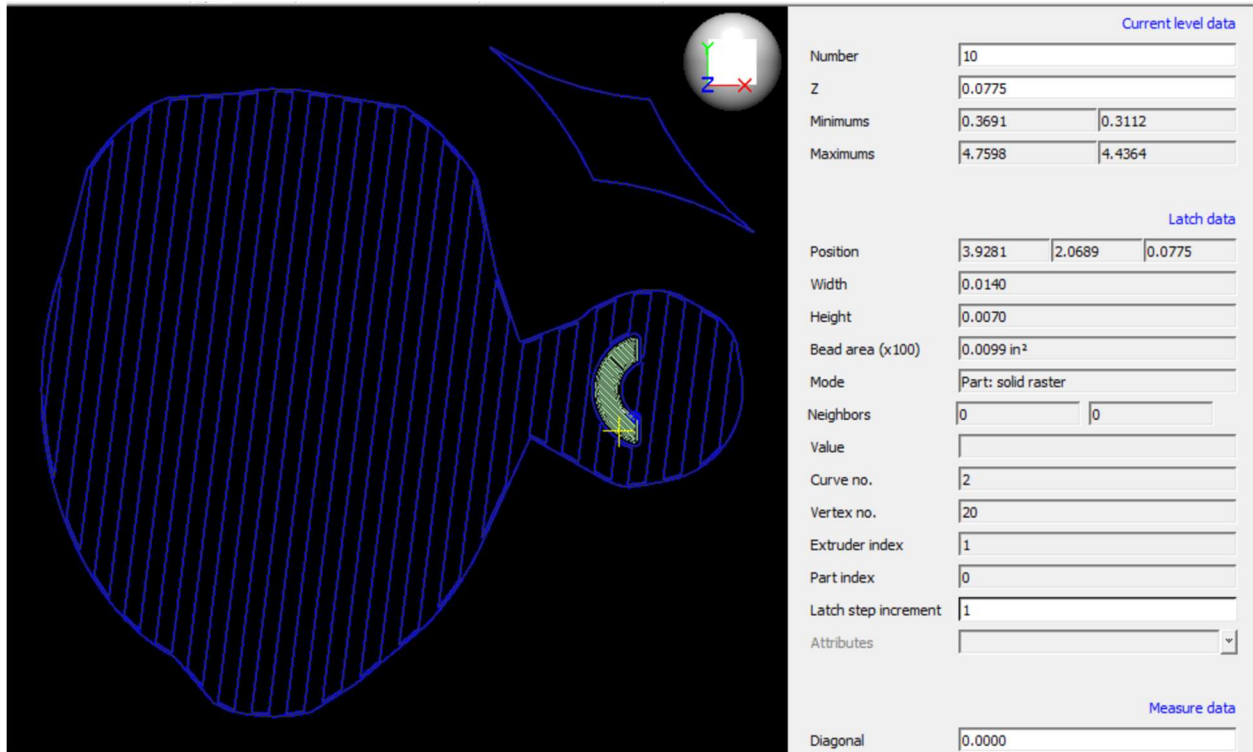
Id. (Ex. E, 24).



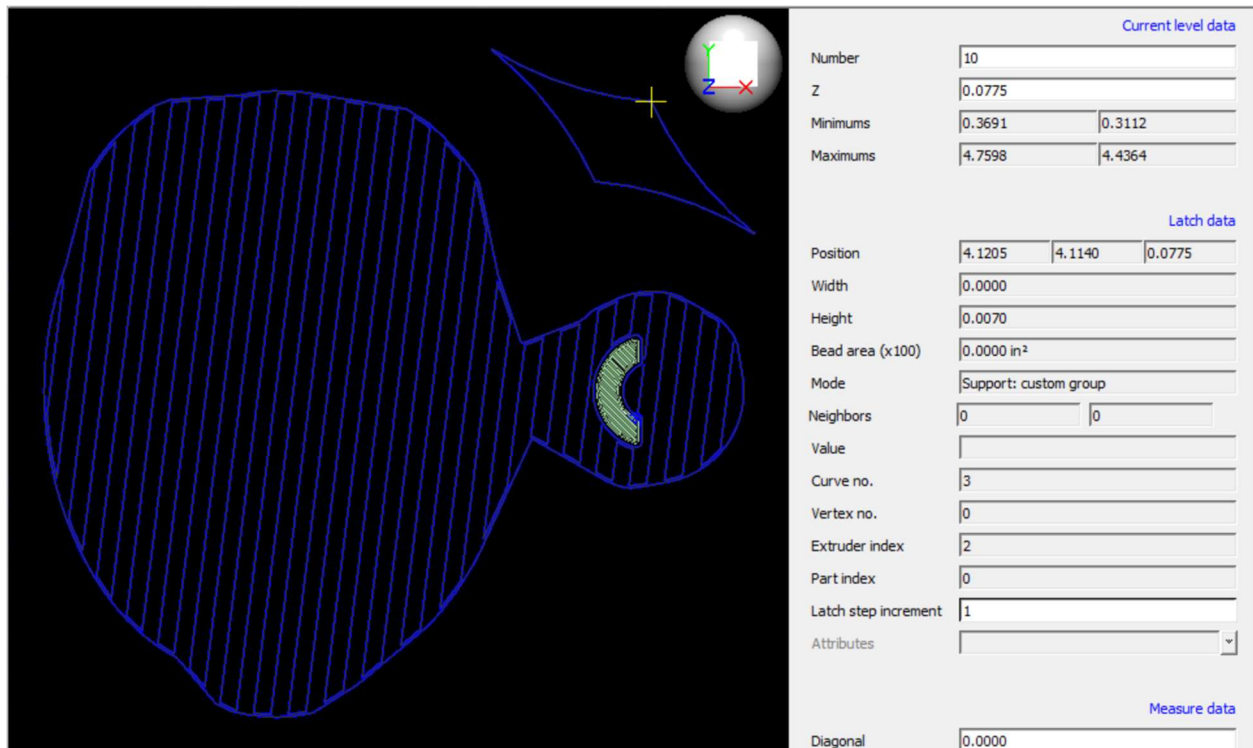
Id. (Ex. E, 25). In the next layer of the CMB file (layer 10) the first point (curve 0, vertex 0) is a continuation of the printing the three-dimensional part (ending at curve 2, vertex 20).



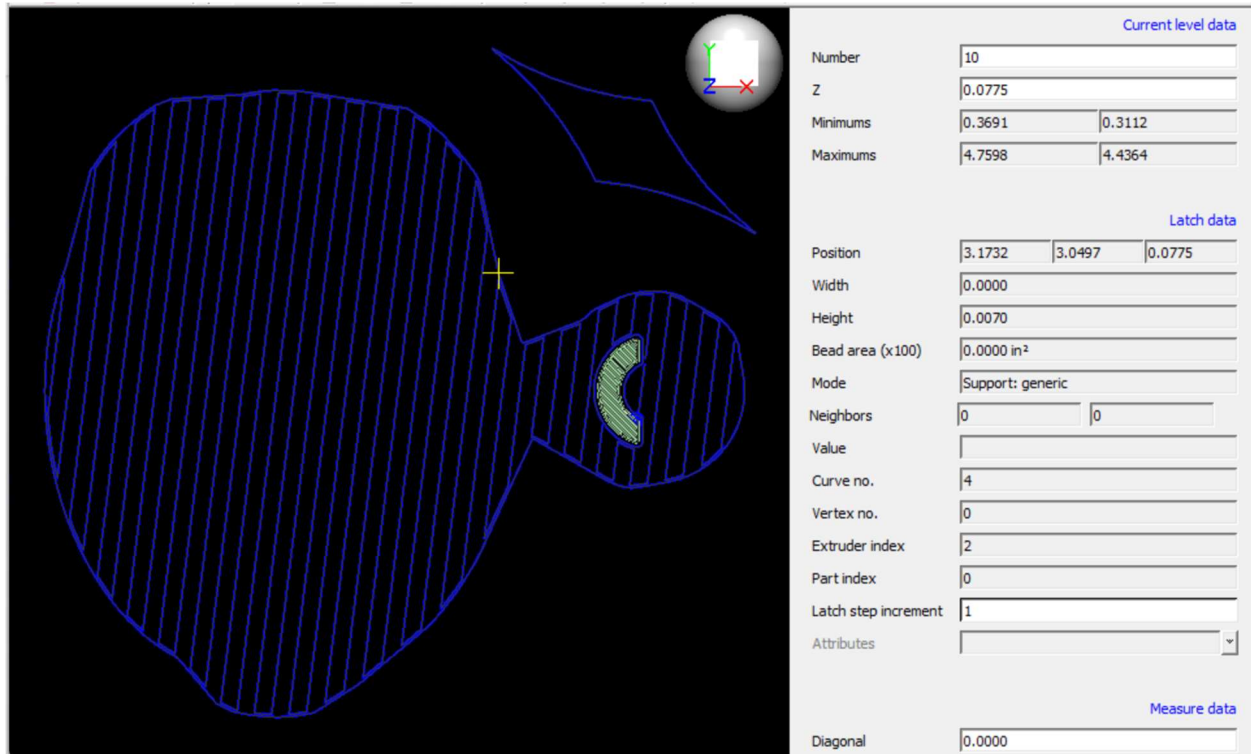
Id. (Ex. E, 26).



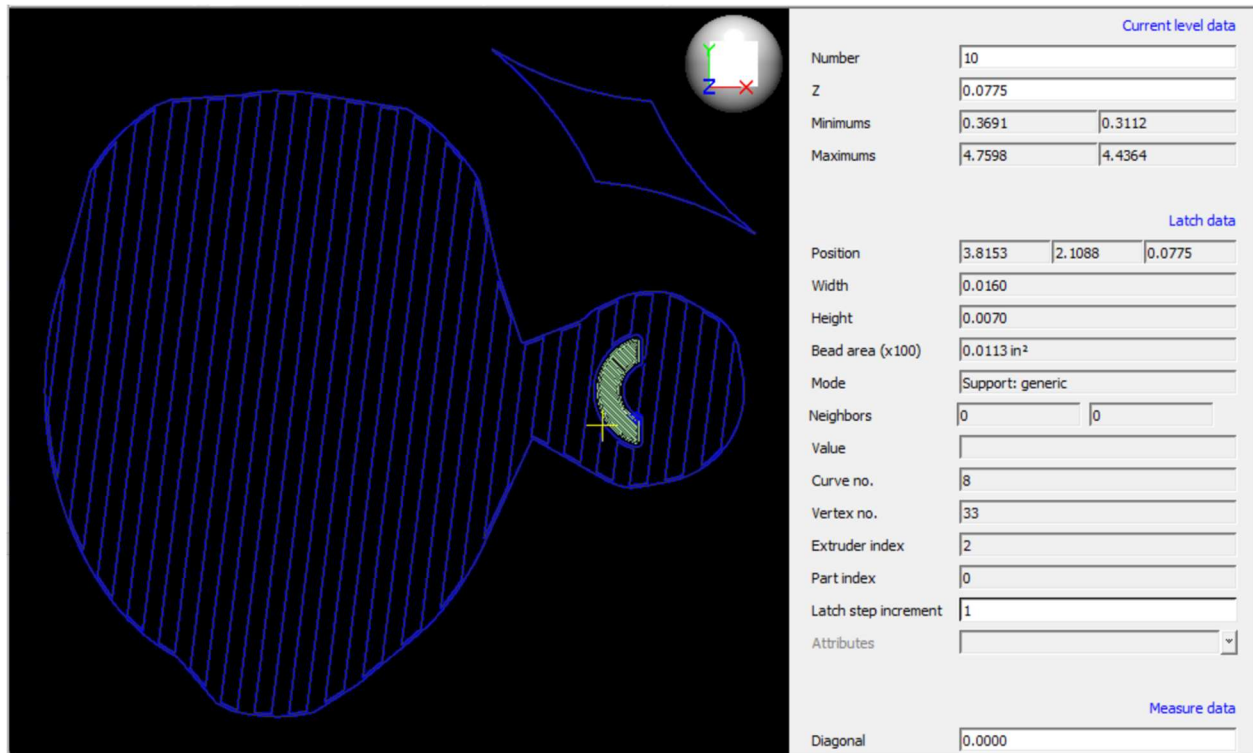
Id. (Ex. E, 27). The next point (curve 3, vertex 0) corresponds to the switch to printing the layer of the purge tower with support material.



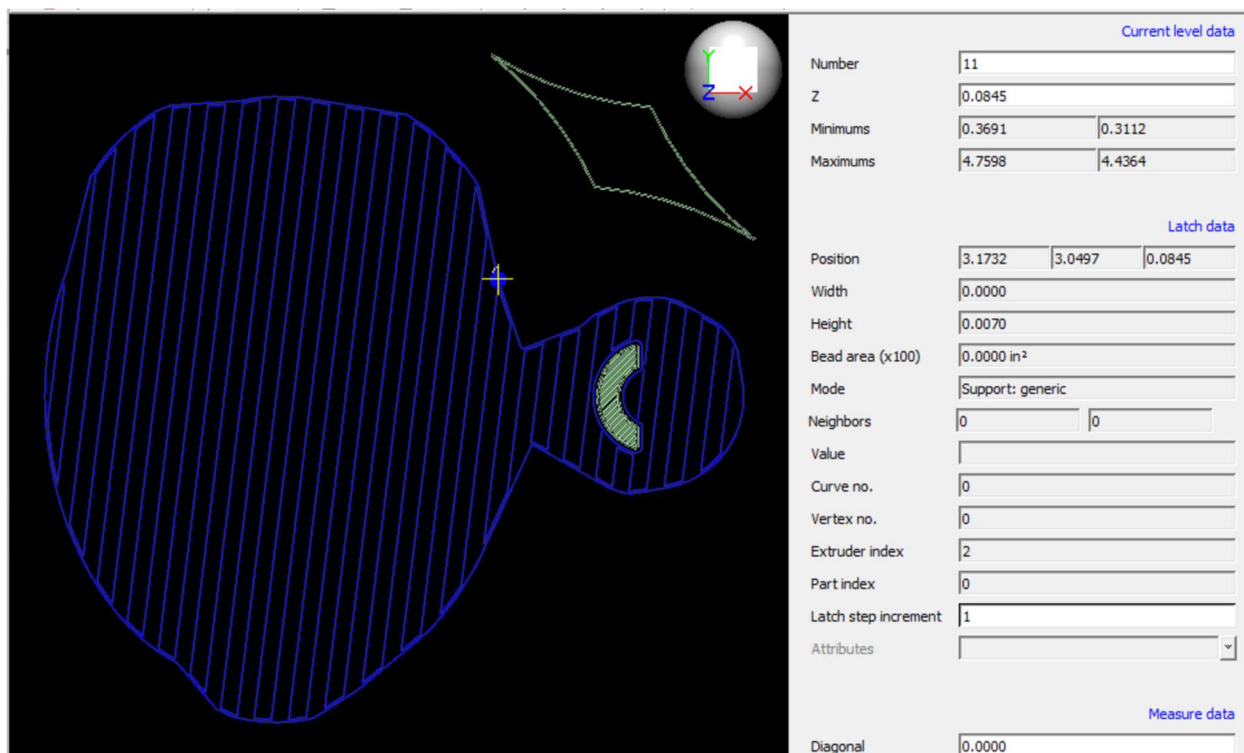
Id. (Ex. E, 28). After the layer of the purge tower completes, the printing of the support structure commences (curves 4-8):



Id. (Ex. E, 30).



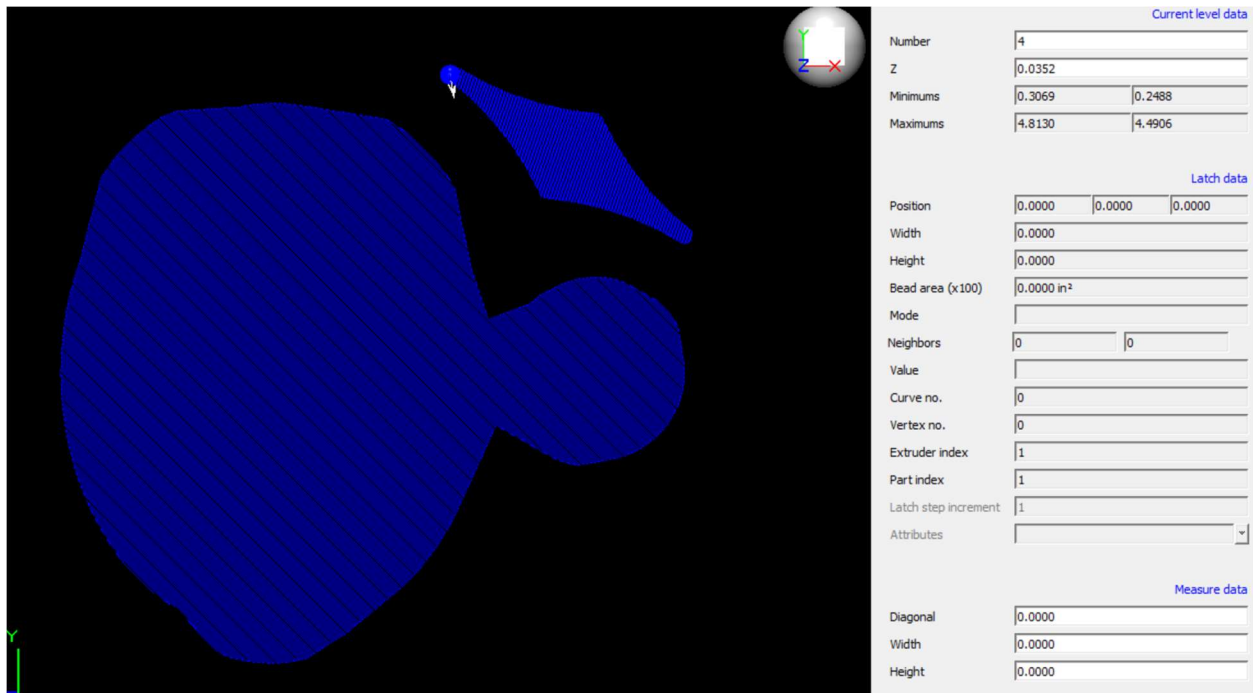
Id. (Ex. E, 31). This process is repeated for the other layers in the CMB file, as shown by the following layer (layer 11), where the layer of the purge tower is printed with part material.



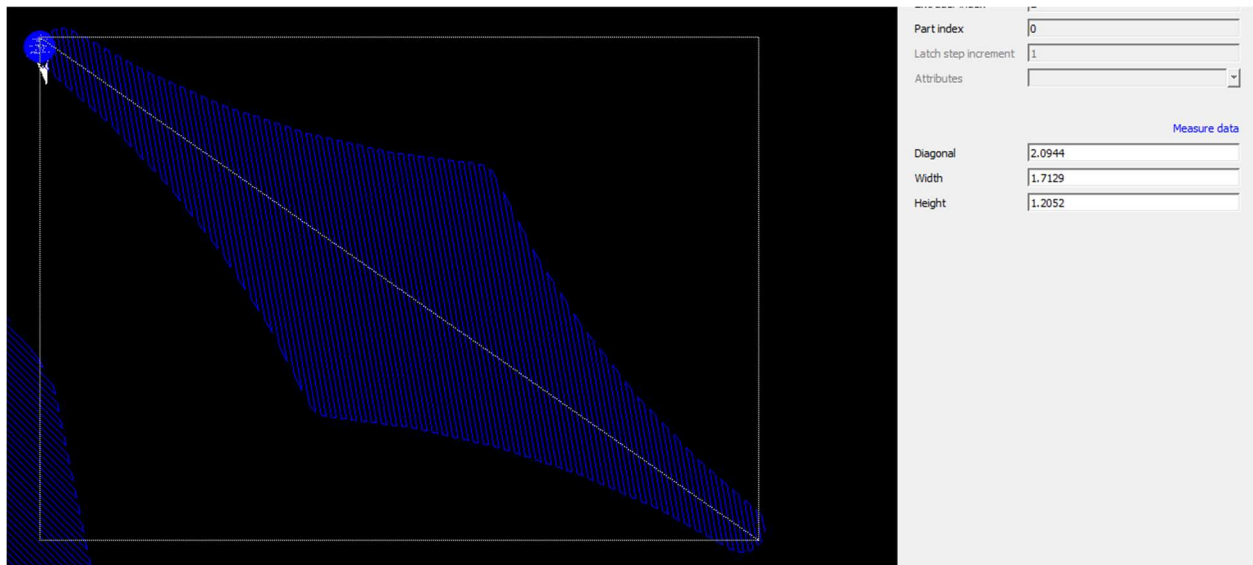
Id. (Ex. E, 32). These images show that when switching the material being printed within each layer of the CMB file, each print head / deposition line (part and support material) begins with printing the layer of the purge tower followed by printing the respective layer of the part or support structure. *Id.* As such, every limitation of claims 1 and 2 were reduced to practice before *RepRap* and *Boyer*.

Additional layers of Exhibit E show that the unique aspects of the other challenged claims were also reduced to practice (see EX2014, ¶¶17-22; EX2015, ¶¶17-22):

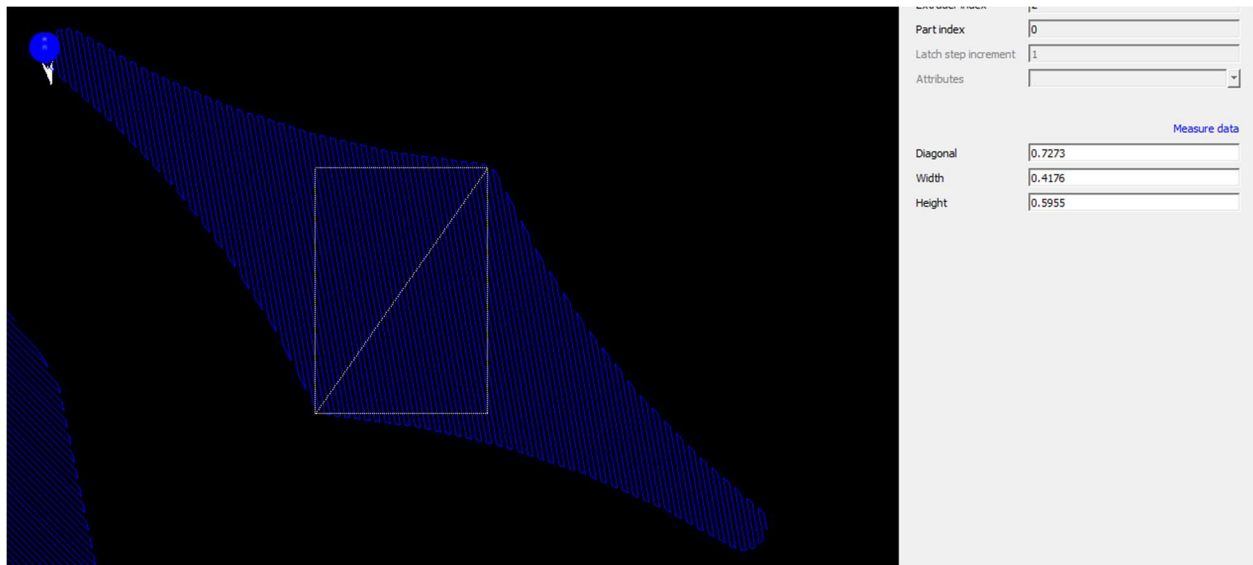
Claim 5: the purge tower has a cross-sectional area that reduces in height along an axis perpendicular to a build plane.



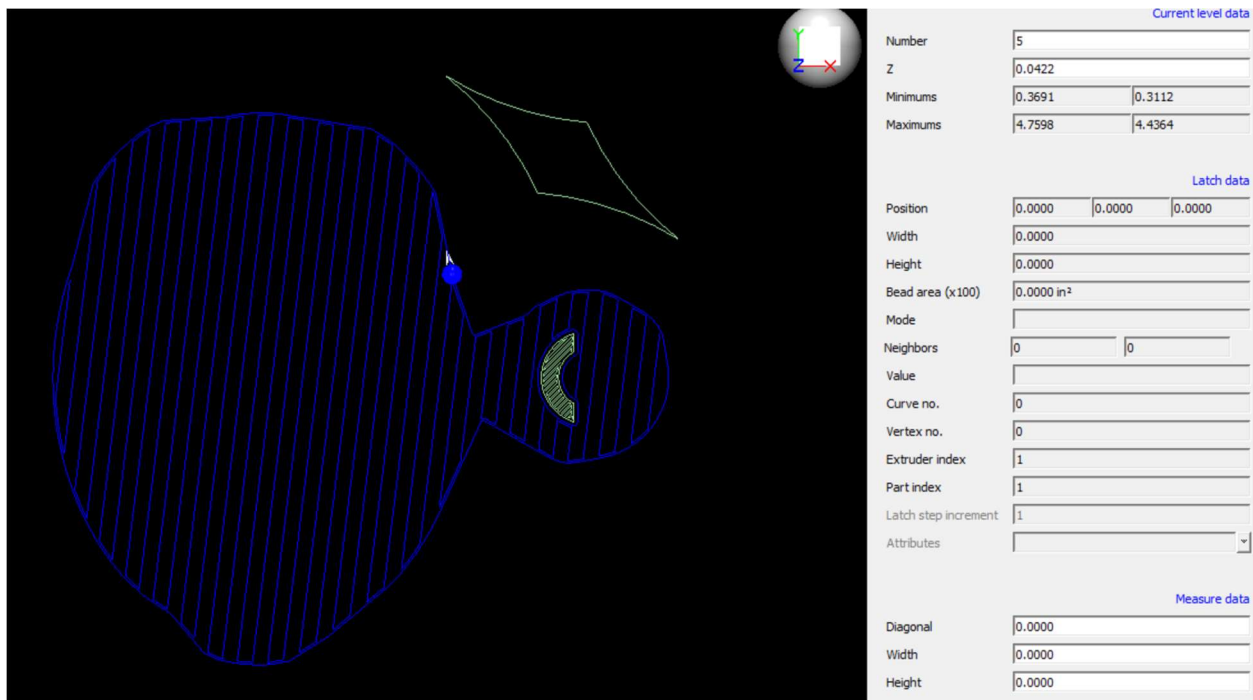
EX2014, ¶18 (Ex. E, 3); EX2015, ¶18. The purge tower in layer 4 has a length of 2.0944 inches and a width of 0.7273 inches.



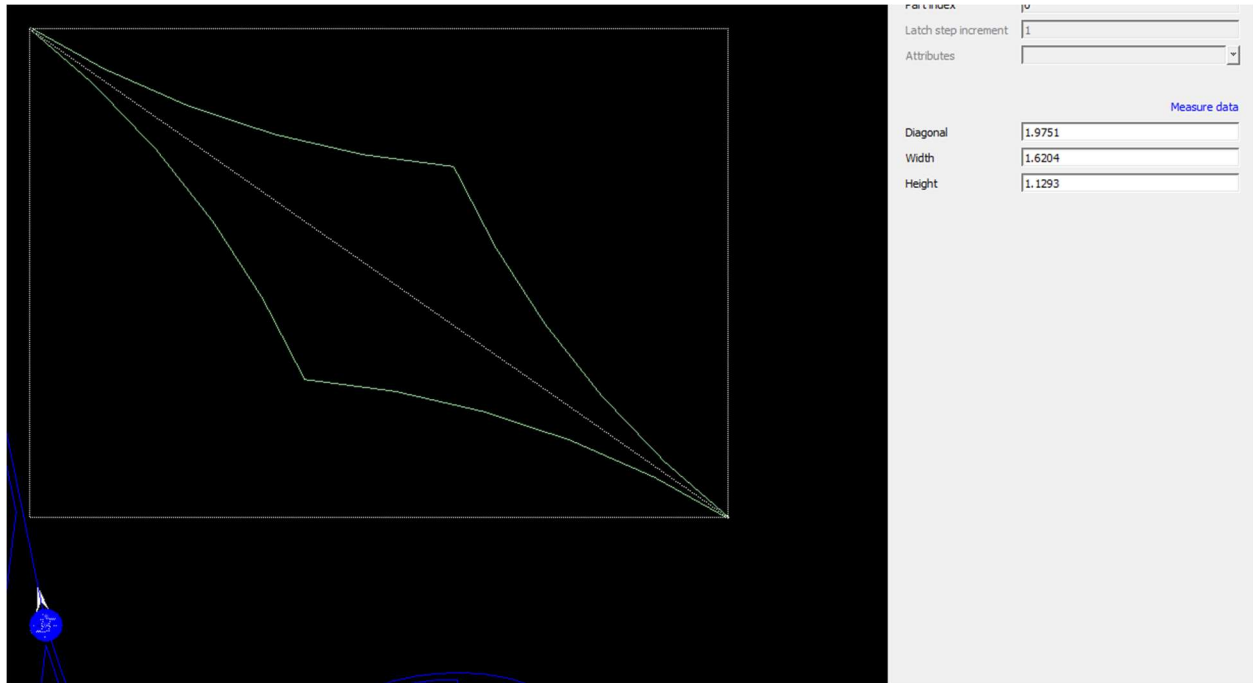
Id. (Ex. E, 4).



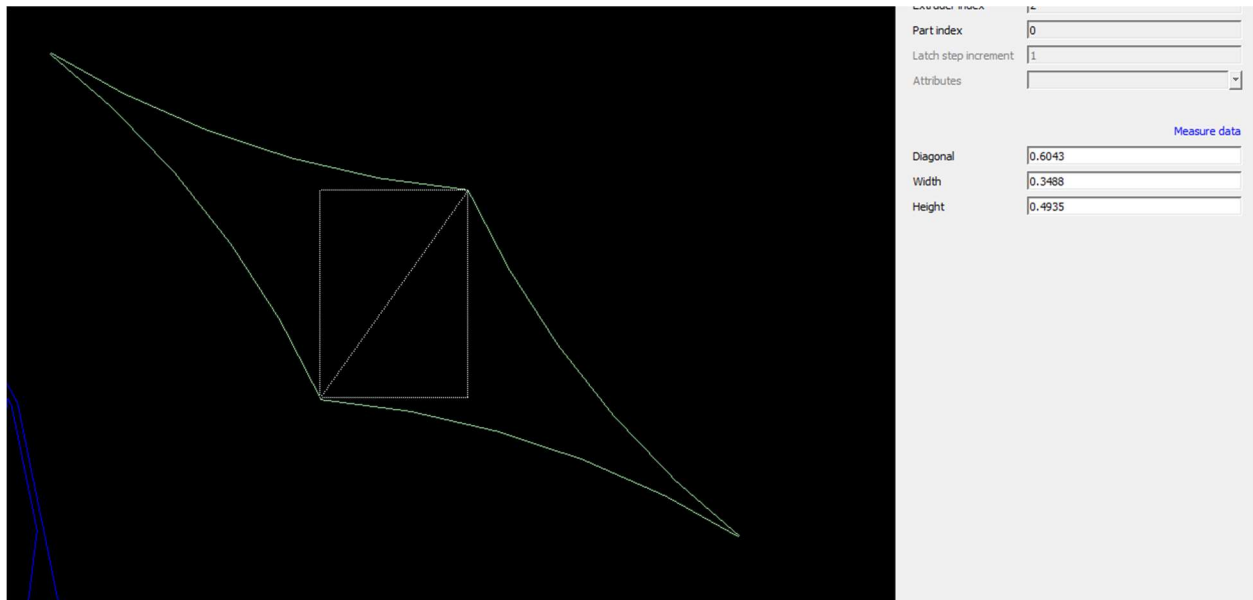
Id. (Ex. E, 4). Layer 5 is shown below:



Id. (Ex. E, 5). The purge tower in layer 5 has a smaller cross-sectional area than layer 4, with a length of 1.9751 inches and a width of 0.6043 inches.

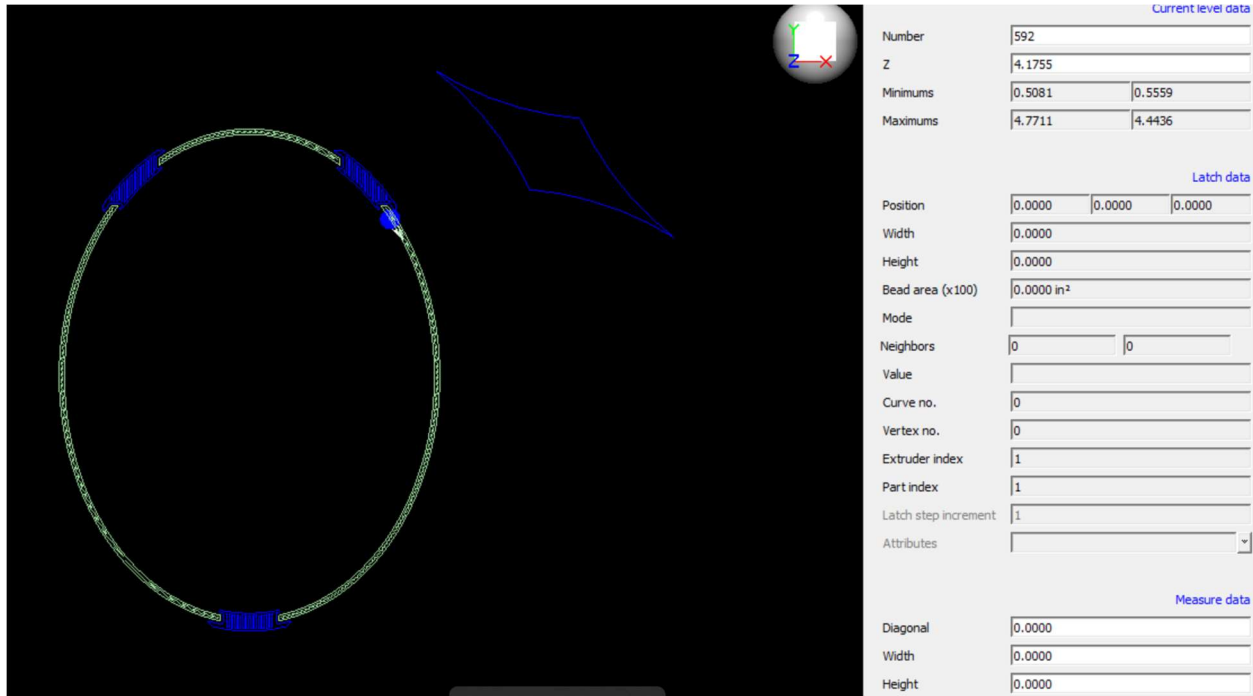


Id. (Ex. E, 6).

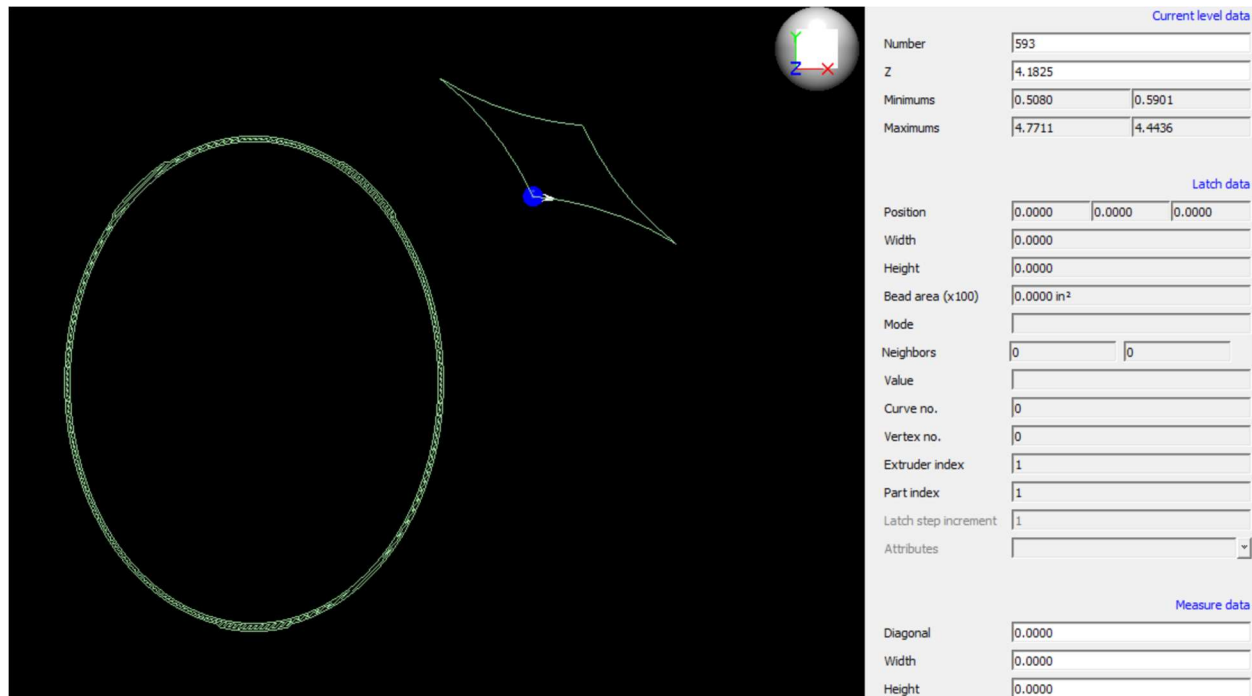


Id. (Ex. E, 7). The cross-sectional area in layer 5 is continued for the remaining layers (ending on layer 593). *Id.*

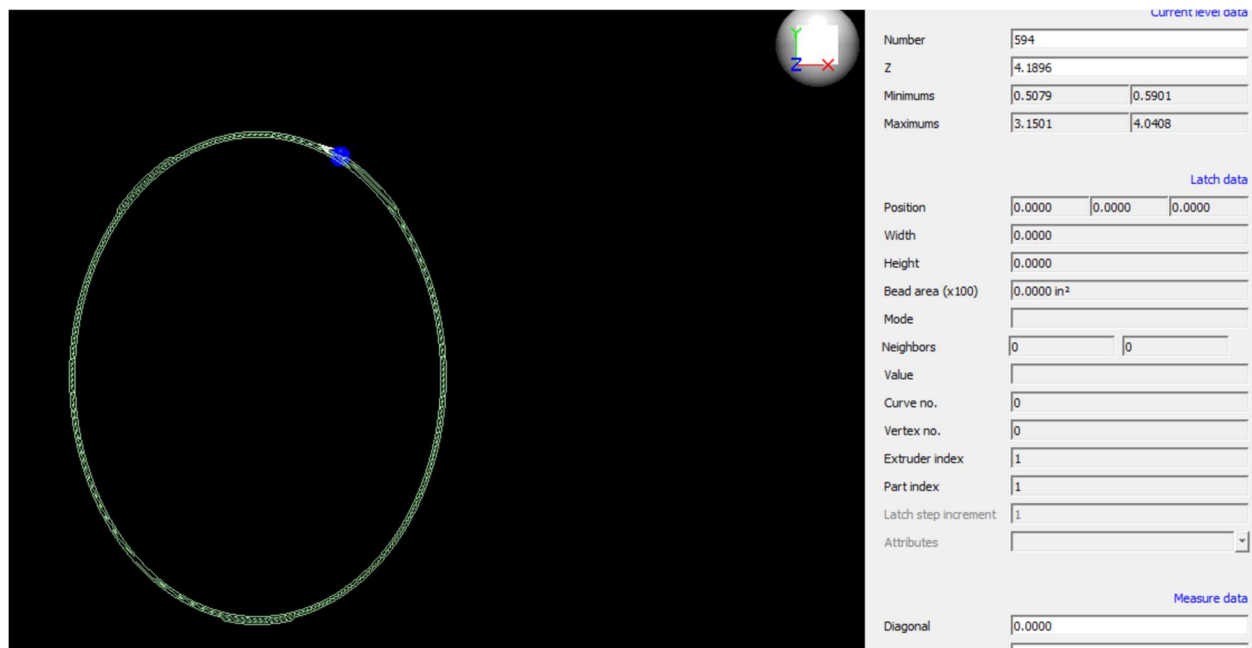
Claim 6: The purge tower is stopped at a highest layer at which there is a material change (layer 593) for the printed layers of the three-dimensional part and support structure:



EX2014, ¶19 (Ex. E, 16); EX2015, ¶19.



Id. (Ex. E, 17).

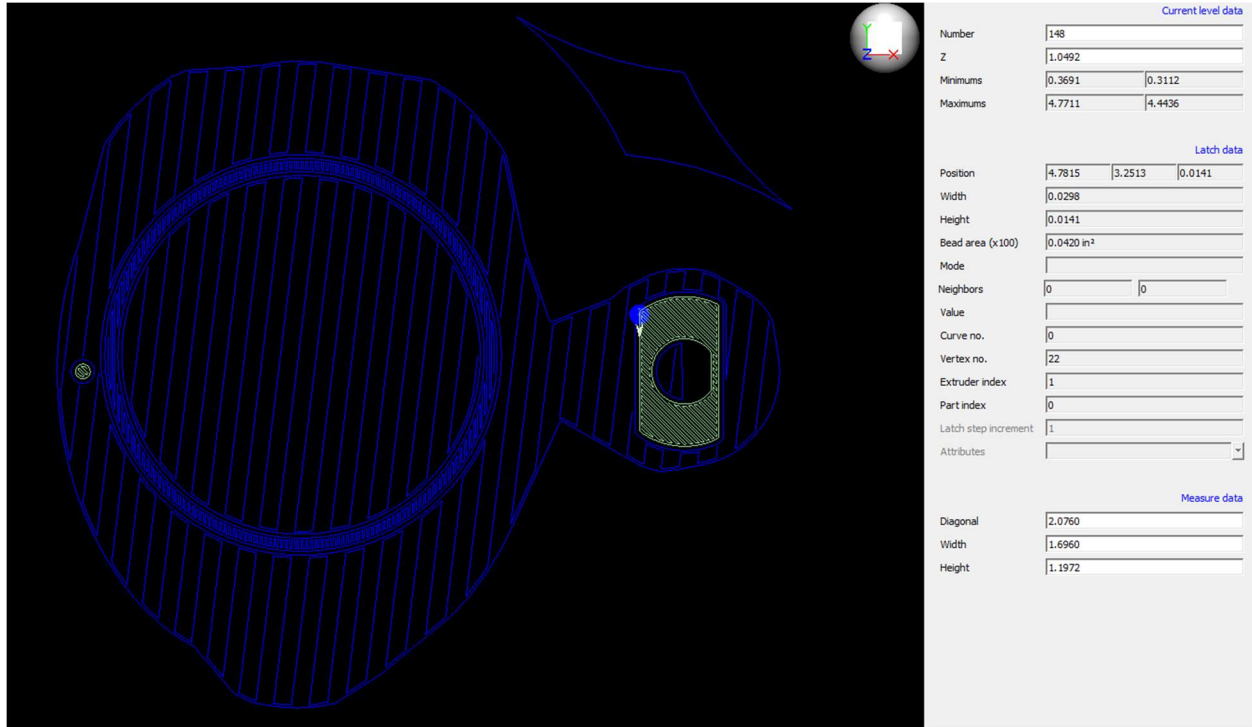


Id. (Ex. E, 18). No higher layers of the purge tower were printed. *Id.*

Claims 16-17: Exhibit E also shows the specific ordering of steps recited by claims 16-17, including in layers 148-152 and 207-210. EX2014, ¶22; EX2015, ¶22.

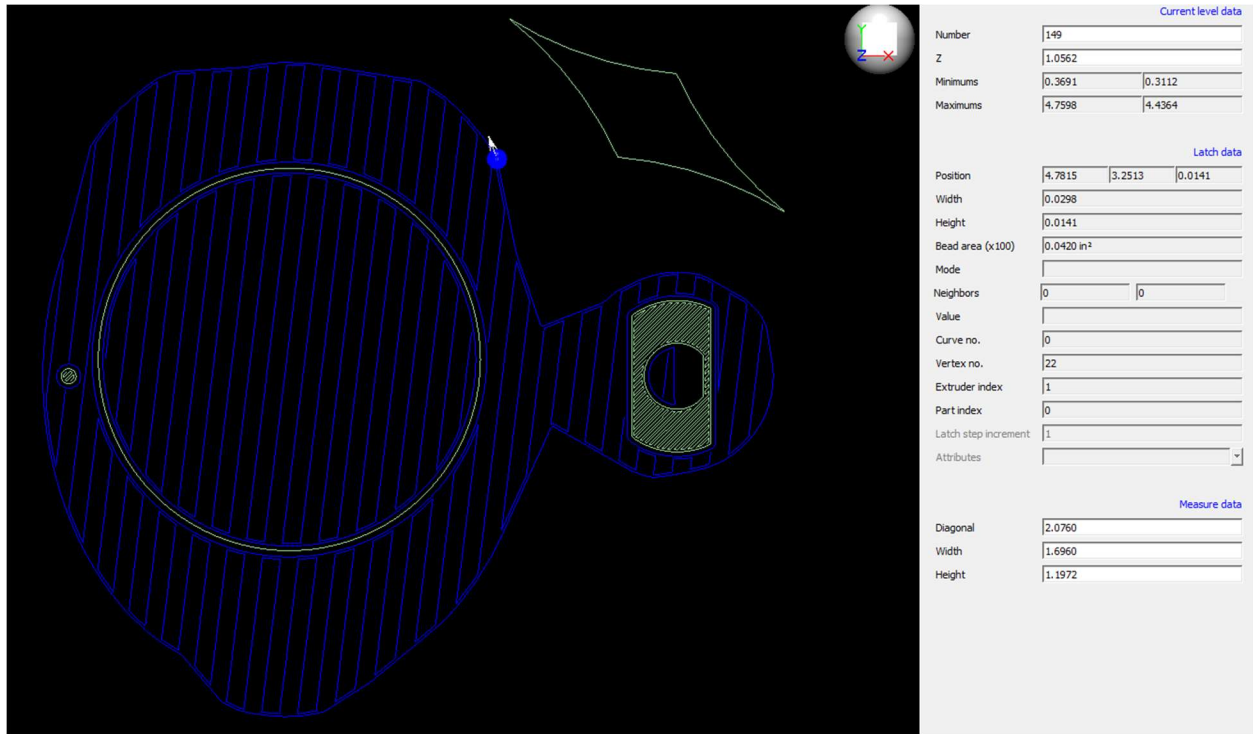
Layers 148-152:

[16a]:



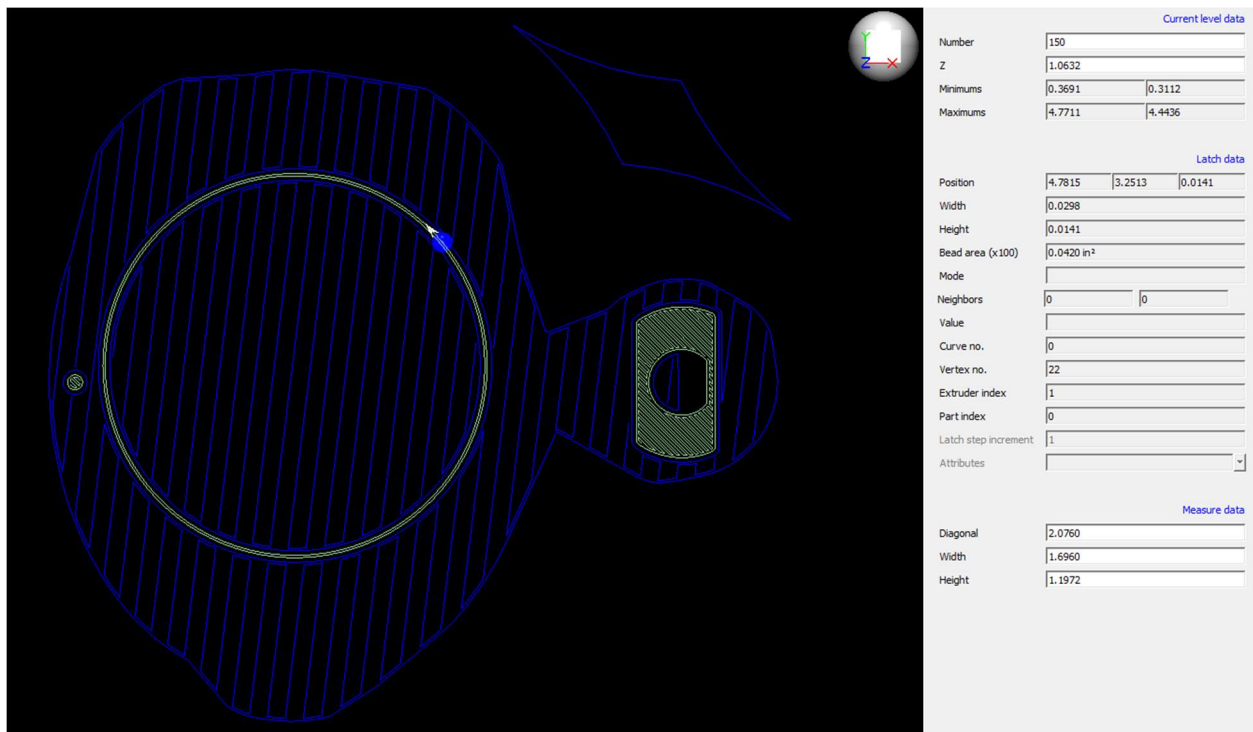
Id. (Ex. E, 11).

[16b-16c]:



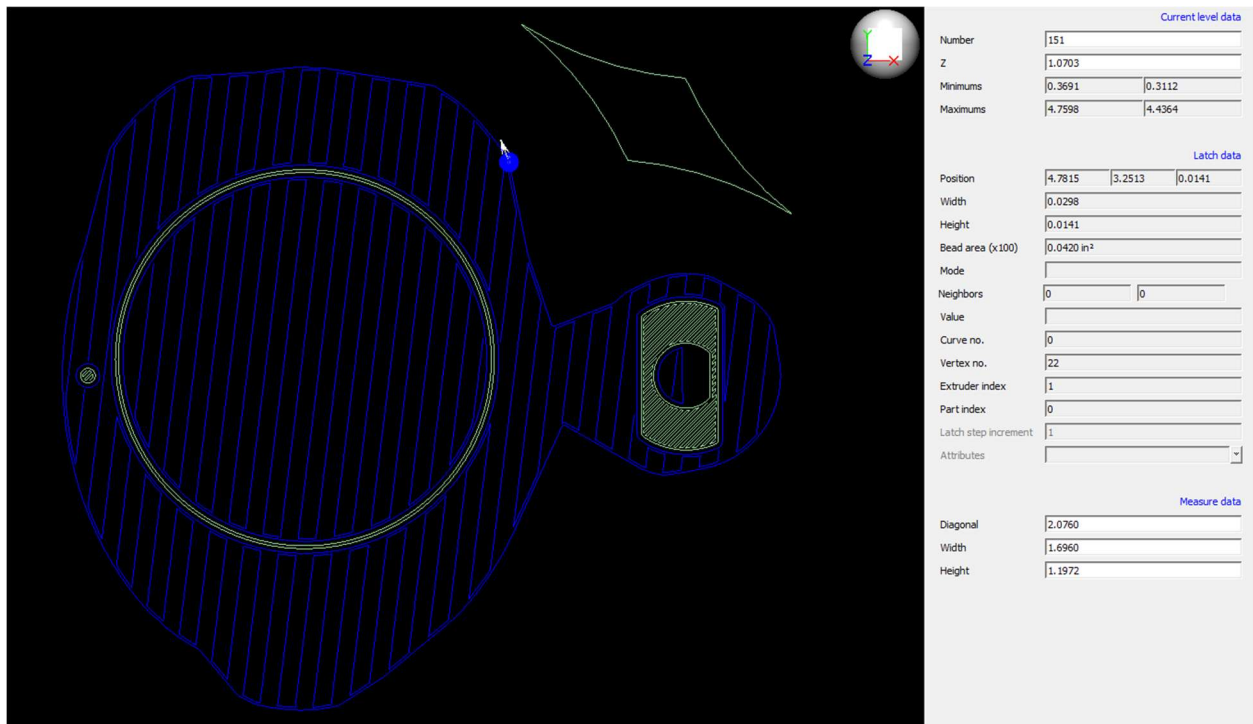
Id. (Ex. E, 12).

[16d-16e]:

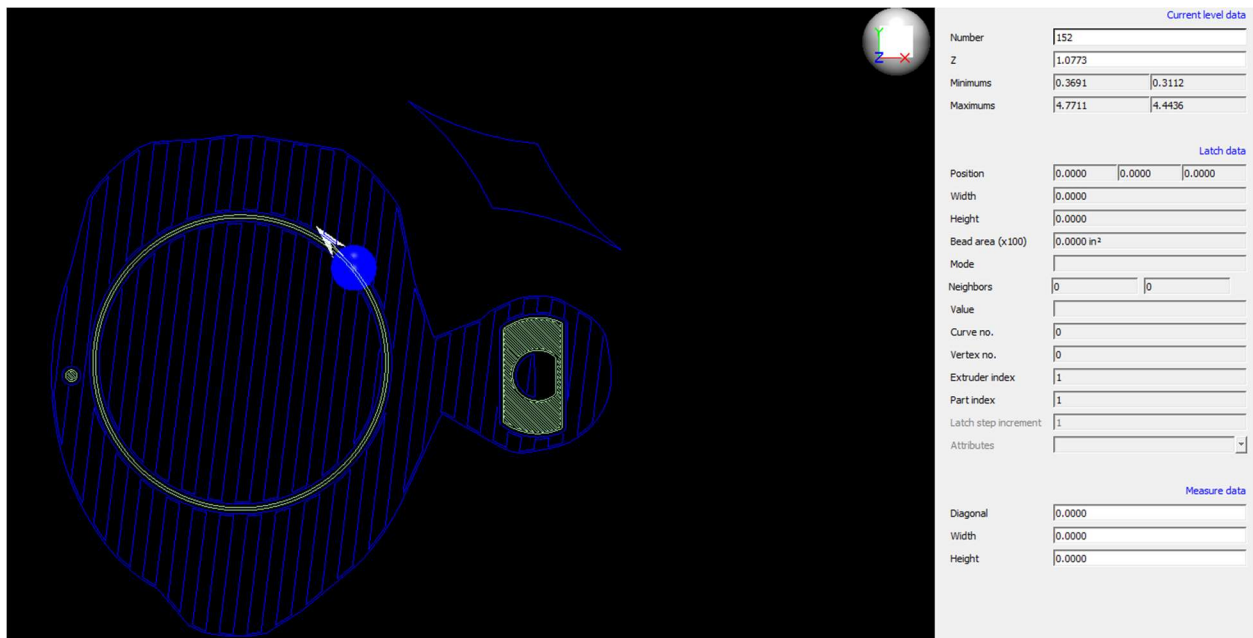


Id. (Ex. E, 13).

[17]:



Id. (Ex. E, 14).

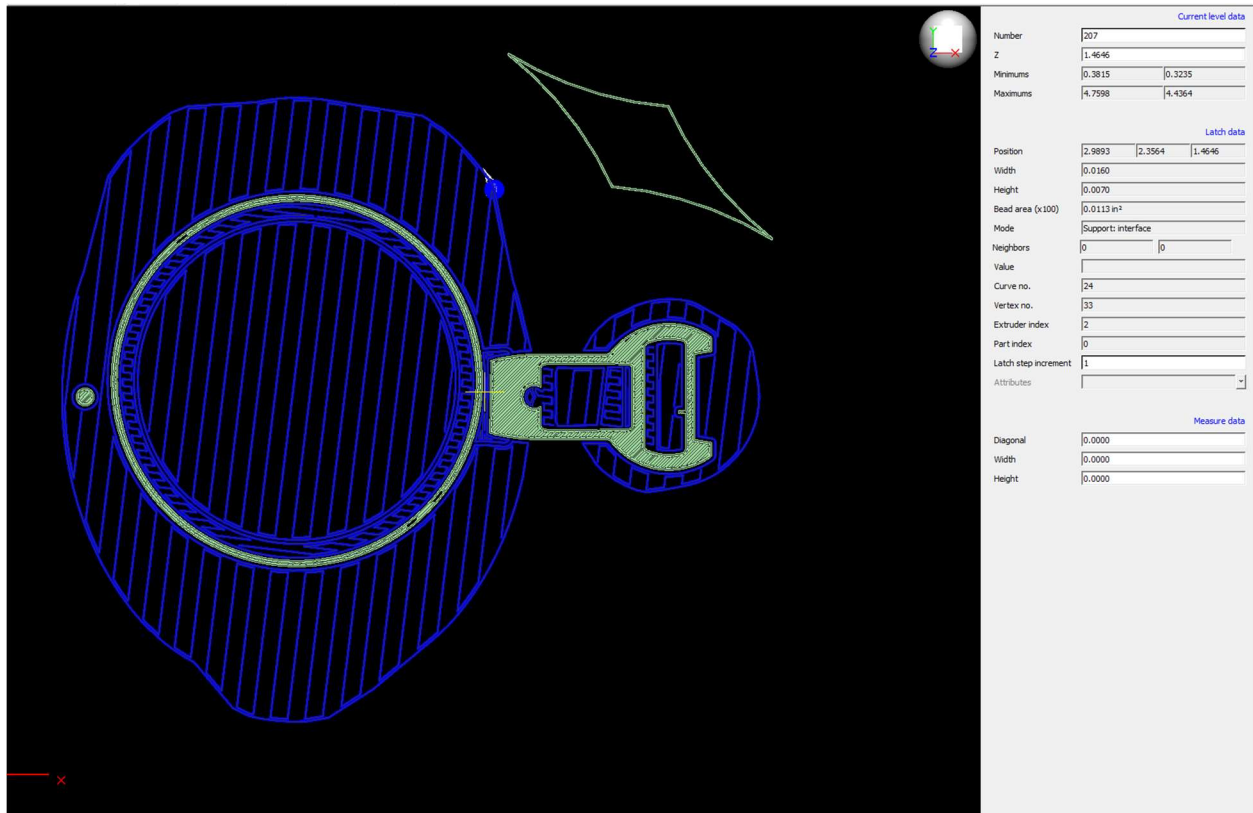


Id. (Ex. E, 15).

Layers 207-210:

[16a]:

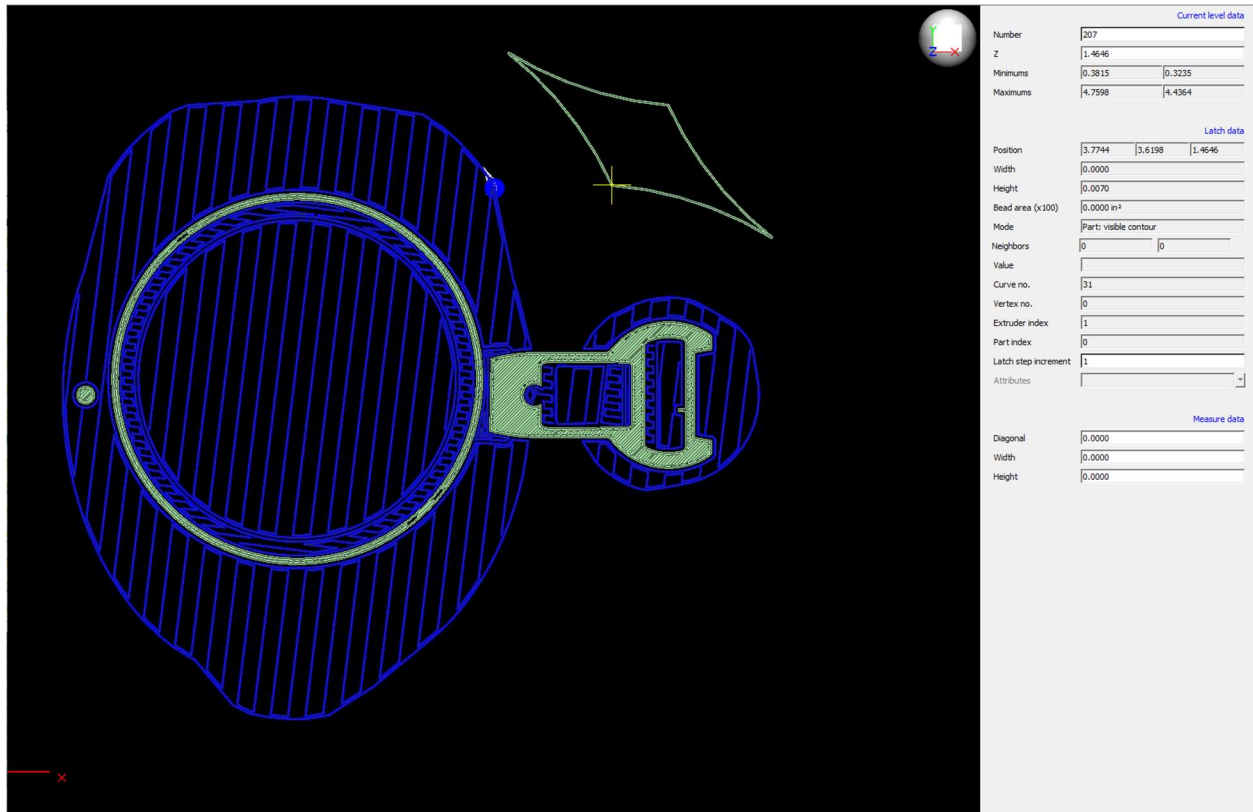
Support structure layer (blue):



Id. (Ex. E, 33).

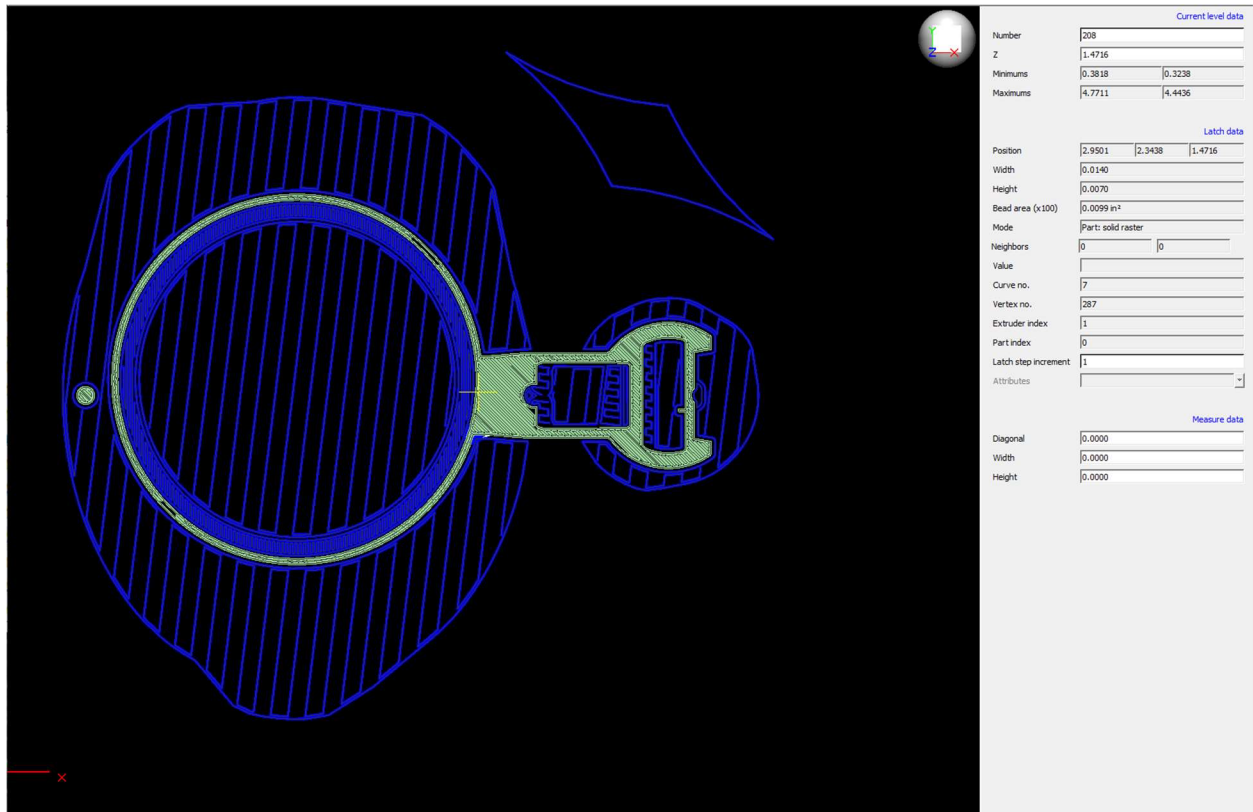
[16b]:

Purge tower layer (green):

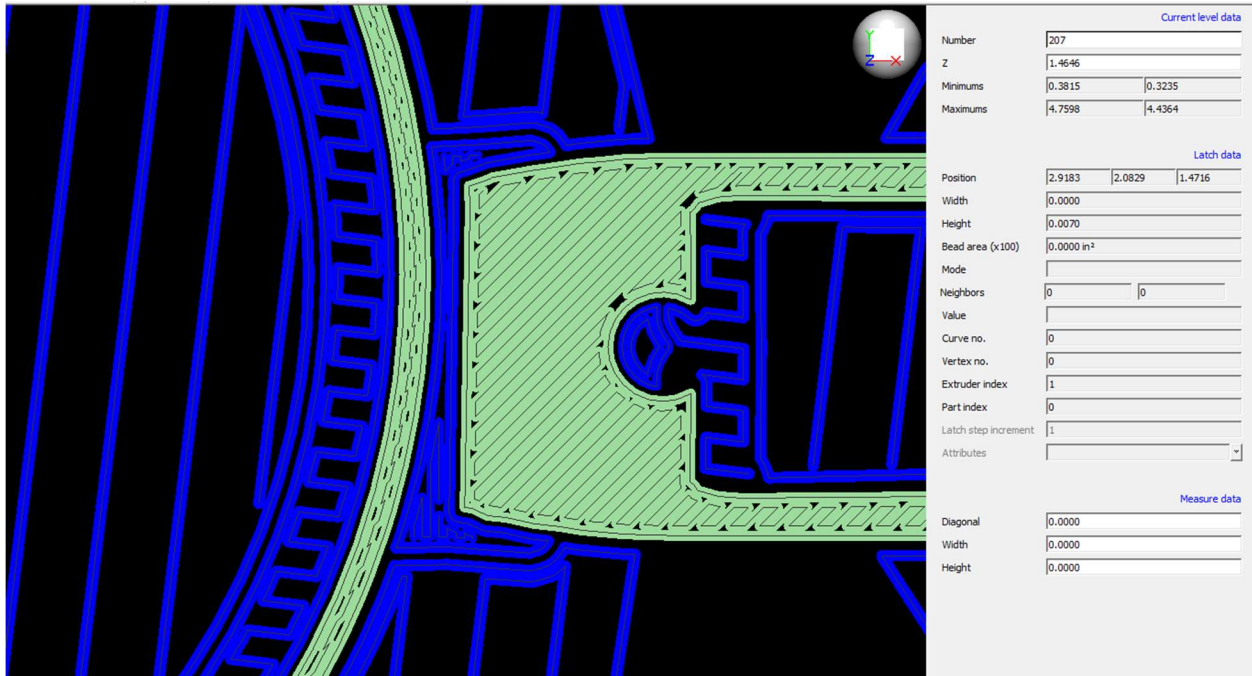


Id. (Ex. E, 34).

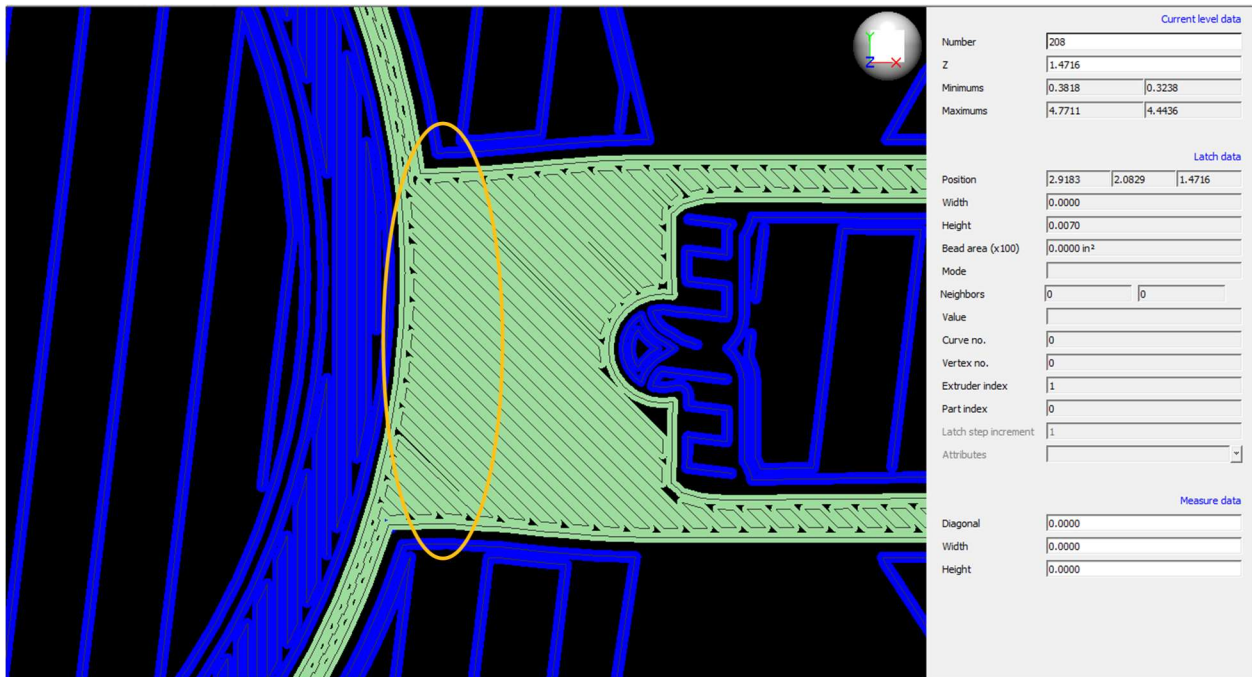
[16c]:



Id. (Ex. E, 35). A close-up comparison between layers 207 and 208 shows the printing of a layer of the part on the previous layer of the support structure (after printing layer of purge tower with part material):



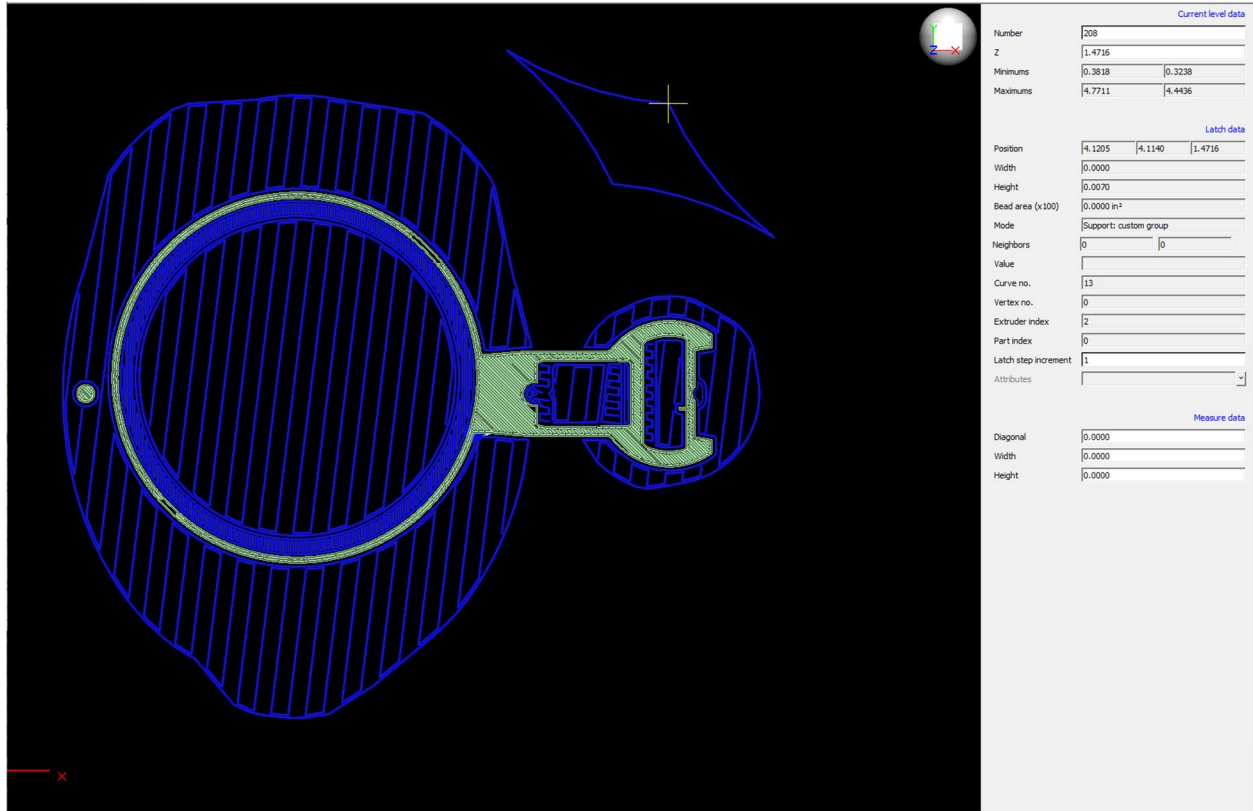
Id. (Ex. E, 36).



Id. (Ex. E, 37) (annotated).

[16d]:

Then purge tower layer is printed with support material:



Id. (Ex. E, 38).

[16e]:

Next a second layer of the support structure is printed on at least a portion of the first layer of the three-dimensional part.

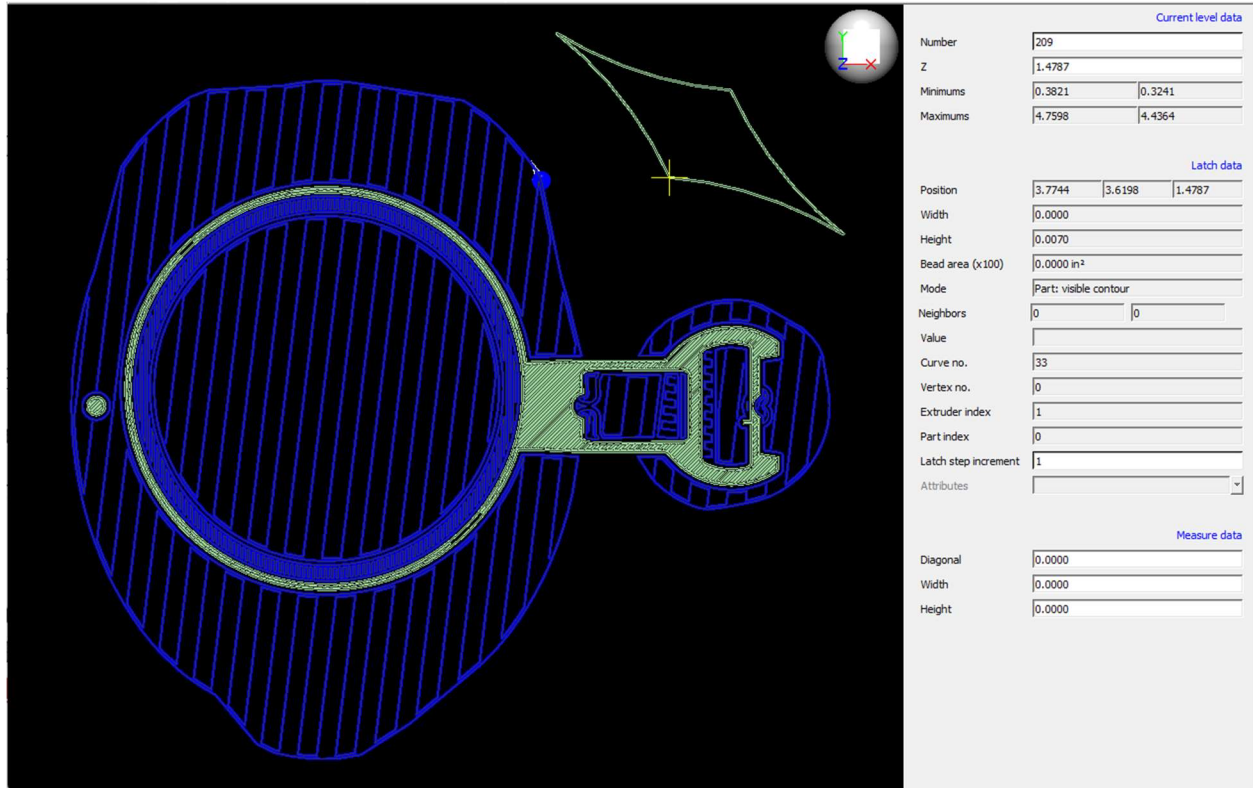


Id. (Ex. E, 41).

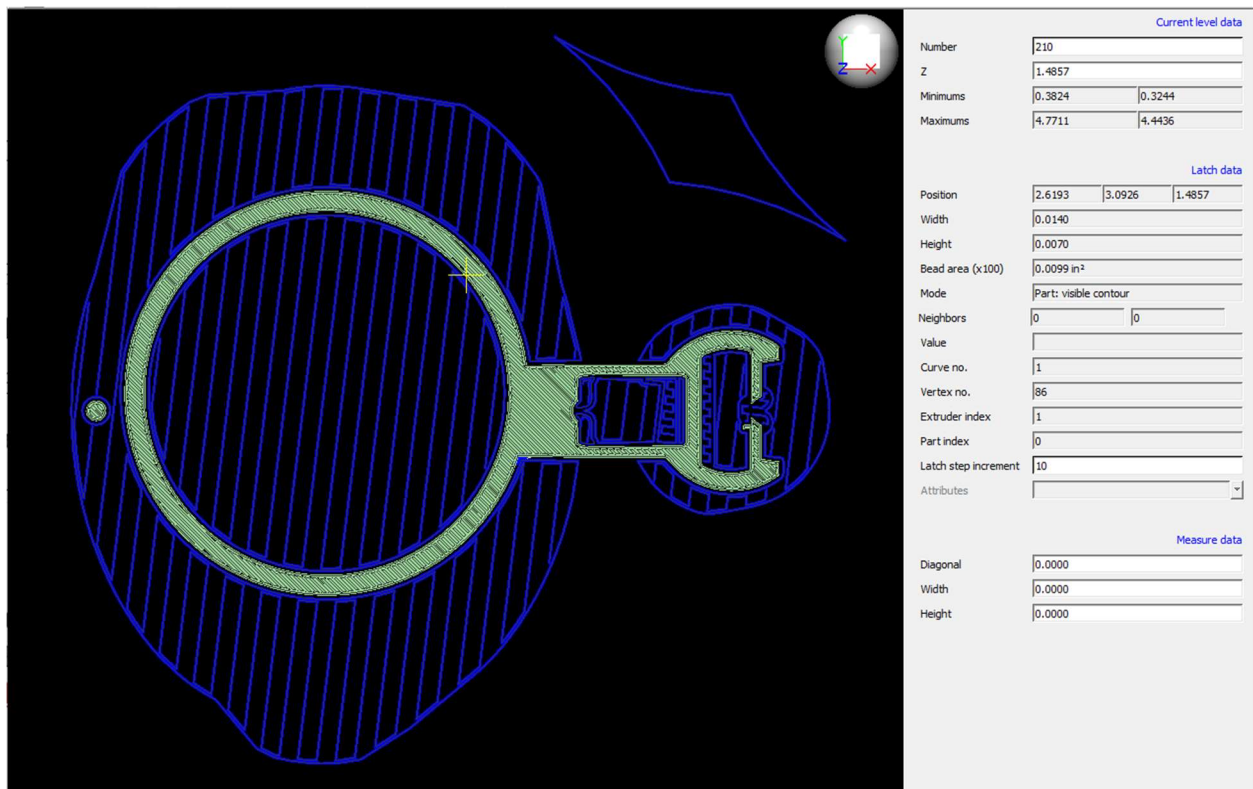


Id. (Ex. E, 42) (annotated).

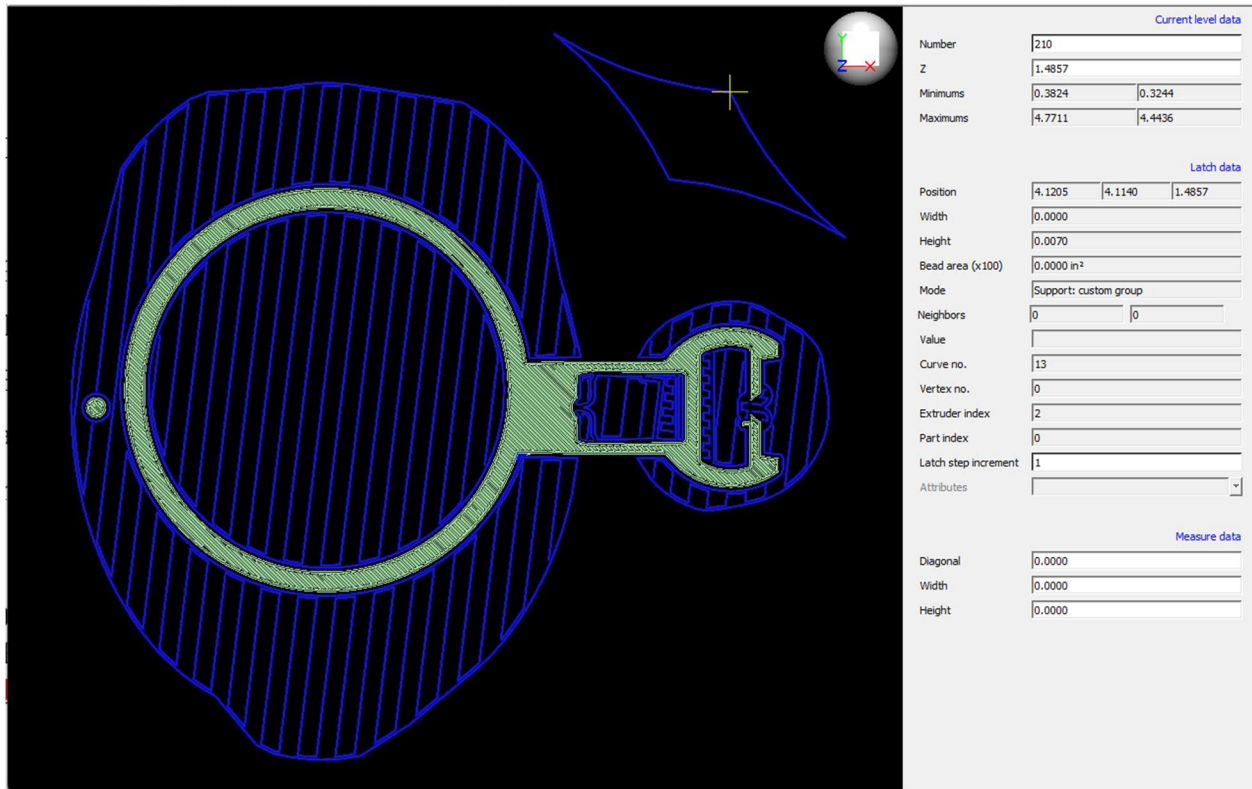
[17]: Printing of the support structure continues on layer 209, followed by printing of a purge tower layer with part material and then printing of the three-dimensional part on at least a portion of the previous layer of support structure, then printing the purge tower layer with support material:



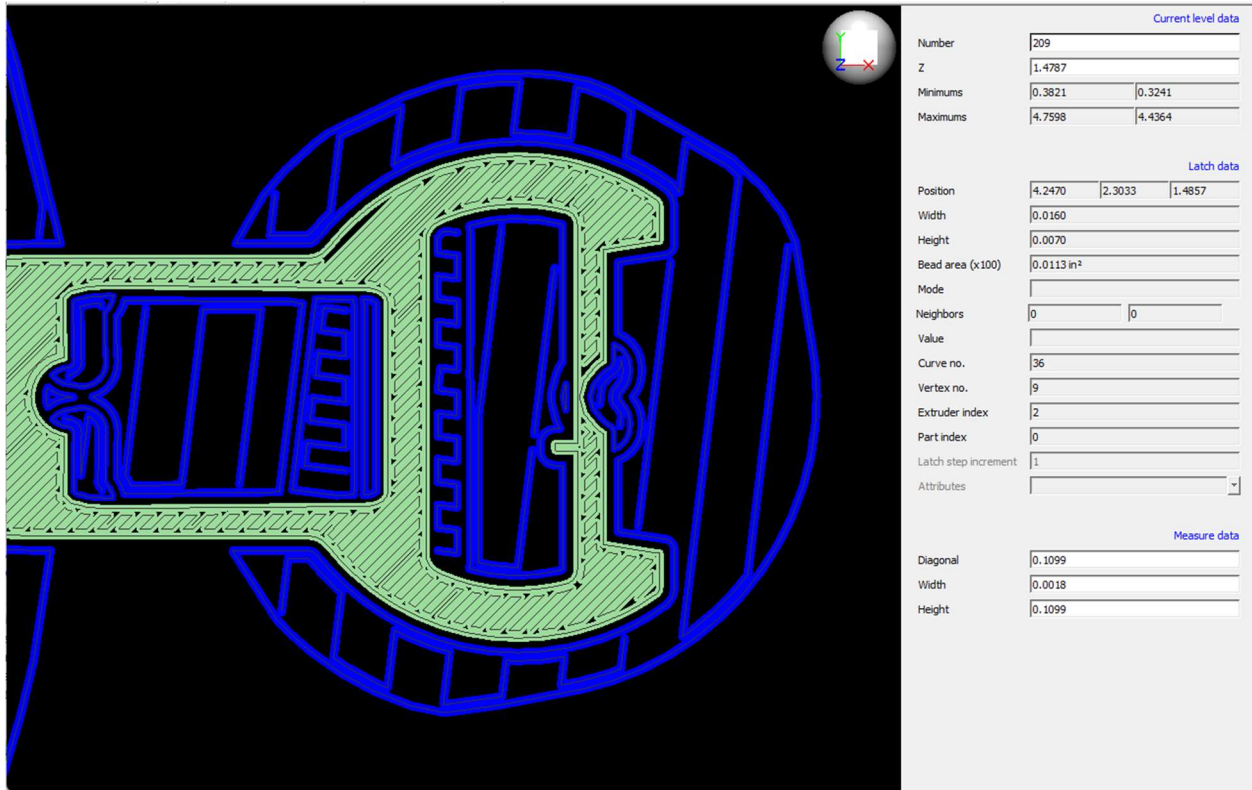
Id. (Ex. E, 43).



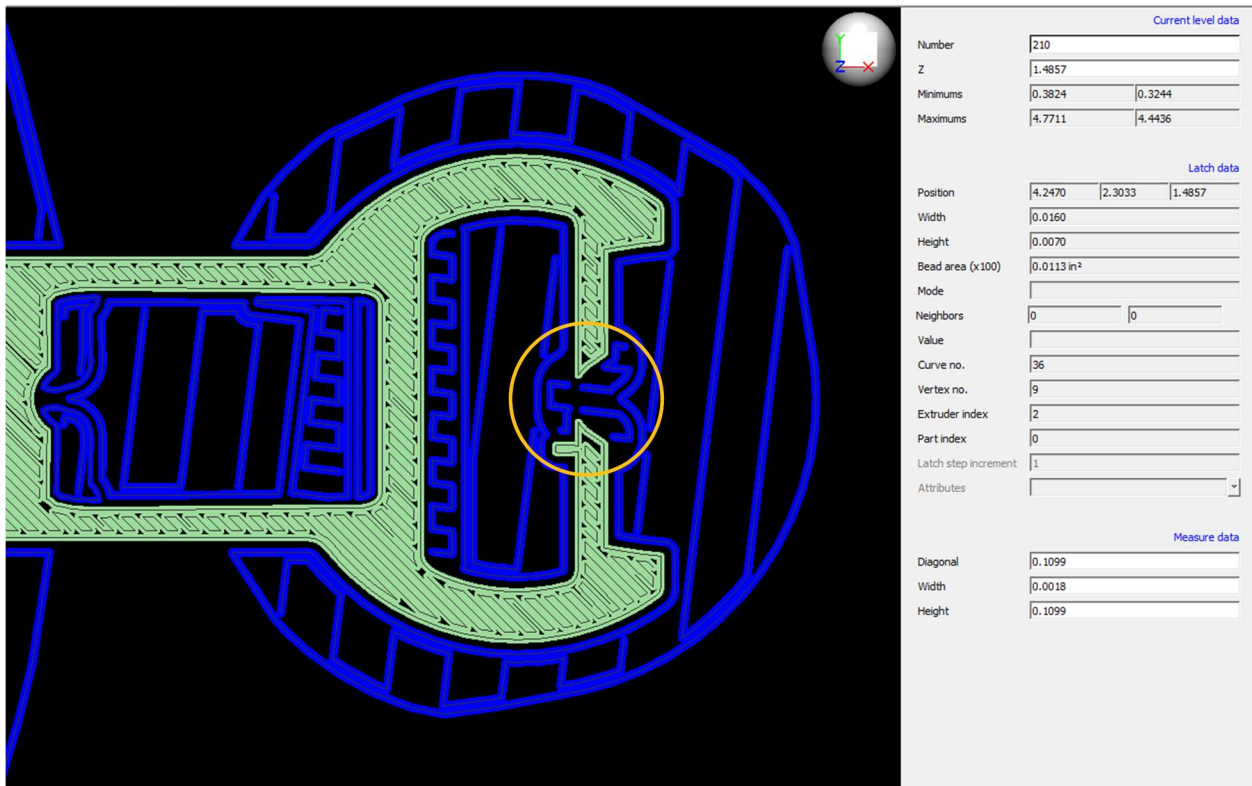
Id. (Ex. E, 44).



Id. (Ex. E, 45). Next a layer of the support structure is printed on at least a portion of the layer of the three-dimensional part from the support material:



Id. (Ex. E, 48).



Id. (Ex. E, 49) (annotated).

Claims 7 and 9:

Software such as Insight™ and Control Center™ was used in conjunction with the developmental printer to generate the tool path instructions shown above prior to printing. EX2014, ¶¶20-21; EX2015, ¶¶20-21.

The developmental printer and process worked for their intended purpose to support purge operations that enabled continued product development of the printer. *See* EX2014, ¶24; EX2015, ¶¶9, 16, 24; *see also* EX2014, ¶¶11-22; EX2015, ¶¶11-22. As a result, there was an actual reduction to practice of the challenged claims by November 2011, before September 21, 2012. *Id.*; *see also* EX2014, ¶28 (Ex. A, ¶¶5-24); EX2015, ¶28 (same).

VII. *REPRAP* ARTICLE, *REPRAP* VIDEO, AND *KISSLICER* ARE NOT PRINTED PUBLICATIONS

A. The Petition fails to present any arguments on public accessibility

As a threshold matter, the Petition fails to present any arguments as to why the *RepRap Article*, *RepRap Video*, and *KISSlicer* (EX1010) were published and publicly accessible. Instead, Petitioner provides only conclusory statements and citations to three declarations. *See* Pet. at 2 (citing Exhibits 1016–18). For each reference, the Petition merely includes a bare assertion regarding public accessibility with a wholesale citation to one or more declarations. *Id.*

However, Petitioner's attempt to incorporate arguments by reference violates the PTAB's rules. *See Medivis, Inc. v. Novarad Corp.*, IPR2023-00042, Paper 37 at 10 (PTAB Apr. 23, 2024) (PTAB "rules prohibit parties' incorporation of arguments by reference"); *see also* 37 C.F.R. § 42.6(a)(3). In *Medivis*, the petitioner included wholesale citations to two declarations without any discussion, which the Board found constituted "improper incorporations by reference." *See* IPR2023-00042, Paper 37 at 10. As the Federal Circuit has repeatedly recognized, "incorporating argument by reference 'cannot be used to exceed word count'" because "[i]t is 'fundamentally unfair to allow a party to use incorporation to exceed word count.'" *Medivis*, IPR2023-00042, Paper 37 at 11 (quoting *Promptu Sys. Corp. v. Comcast Cable Comm's, LLC*, 92 F.4th 1384, 1385 (Fed. Cir. 2024)).

Similar to the petitioner in *Medivis*, the Board should reject Petitioner's wholesale incorporation by reference. Absent such incorporation, the Petition has failed to show that the *RepRap Article*, *RepRap Video*, and *KISSlicer* are printed publications.

B. Petitioner cannot require the Board to piece together its potential arguments on whether the references are printed publications

Even if the Board were to sanction Petitioner's attempted incorporation by reference, Petitioner's wholesale citations to the declarations fail to show how exactly the *RepRap Article*, *RepRap Video*, and *KISSlicer* support its conclusory argument. Additionally, much like the Petition, the declarations do not set forth the

legal standard for printed publications to be publicly accessible, much less present Petitioner's legal theories, such as whether the reference was actually disseminated or otherwise made available to certain individuals exercising reasonable diligence. *See* EX1017 at 1-2. Thus, Petitioner implicitly asks the Board to "piece together" potential arguments that might be made based on the facts alleged in those declarations.

However, it is not the Board's responsibility to piece together evidence or speculate as to Petitioner's position beyond the bare conclusions presented in the Petition. *See TCL Communication Technology Holdings Ltd. v. DataQuill Ltd.*, IPR2020-00746, Paper 21 at 22 (PTAB Sept. 18, 2020) (explaining that it is "Petitioner's responsibility to cite specific evidence to support its arguments, not the Board's responsibility to piece together evidence or speculate as to Petitioner's position"). Thus, the Petition has failed to show that the *RepRap Article*, *RepRap Video*, and *KISSlicer* are printed publications.

C. Petitioner fails to show that the *RepRap Article* and *RepRap Video* are publicly accessible

Even if the declarations are considered in full, Petitioner has failed to show that the *RepRap Article* and *RepRap Video* were publicly accessible. Petitioner must show that a "document has been disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art[,] exercising reasonable diligence, can locate it." *SRI Int'l, Inc. v. Internet Sec. Sys.*,

Inc., 511 F.3d 1186, 1194 (Fed. Cir. 2008). Petitioner does not provide any evidence of actual dissemination and the declaration provided fails to show that interested persons and ordinary skilled artisans could locate the references when exercising reasonable diligence.

For the *RepRap Article* and *RepRap Video*, the Petition provides a wholesale reference to the declarations of Kathryn Talbot (EX1018) and Denis Bakin (EX1016). *See* Pet. at 2.

The Talbot declaration asserts that the declarant is a social media expert. *See* EX1018, ¶7; *see also id.*, ¶¶6, 8–9. The declarant asserts that “[i]n my opinion, persons interested in and ordinarily skilled in the relevant subject matter *would have been familiar with YouTube and would have used it to research features of 3D printers, including the 3D printer demonstrated in Exhibit EX1006.*” *Id.*, ¶12. According to the declarant, “[a]nyone interested in and ordinarily skilled in 3D printing would have been able to *use keyword searching to search for various terms used in the title and description of the video corresponding to Exhibit EX1006 to find them on YouTube.*” *Id.*, ¶20.

However, the declarant never explains why she is qualified to speak about such interested persons or skilled artisans given her limited qualification as a social media expert. *See id.*, ¶¶6–9. There is no testimony or suggestion that the declarant has any qualification or experience related to 3D printers. *See id.* Instead, it appears

that the declarant is speaking about public accessibility of social media or YouTube generally. *See, e.g., id.*, ¶15 (“each video accessible via YouTube”), ¶21 (“my knowledge of and experience with YouTube”).

Moreover, there is no evidence submitted or argument that interested members of the public would have actually been able to locate the video with reasonable diligence. *See Blue Calypso, LLC v. Groupon, Inc.*, 815 F.3d 1331, 1350–51 (Fed. Cir. 2016) (petitioner “failed to carry its burden of proving public accessibility” of an asserted reference as it must provide “a sufficiently definite roadmap” leading to the reference); *see also MHL Custom, Inc. v. Waydoo USA, Inc.*, No. CV 21-0091-RGA, 2023 WL 5748755, at *4 (D. Del. Sept. 6, 2023) (indexing / technical accessibility, by itself, is “not sufficient to prove public accessibility”). In both *Blue Calypso* and *MHL Custom*, the testimony only confirmed technical accessibility and failed to show that any actual search was performed or what a sufficient search would require to locate the reference. *See Blue Calypso*, 815 F.3d at 1350 (rejecting argument that “an internet search engine would have been able to locate” the reference in part because there was no “evidence that a query of a search engine before the critical date, using any combination of search words, would have led to [the reference] appearing in the search results”); *see also MHL Custom*, 2023 WL 5748755, at *4. Similarly, the declaration here fails to show that any actual search was performed or what a sufficient search would have been

required to locate the *RepRap Video*. In fact, there is no explanation why interested members of the public would know how to search for the particular title or description of the *RepRap Video* to locate the video with reasonable diligence. *See* EX1018, ¶¶12-21.

The Bakin declaration suffers from similar deficiencies. It asserts that “YouTube included search functionality that would have allowed members of the public to search for this video based on the title and the description.” EX1016, ¶5. Like the Talbot declaration, the Bakin declaration provides no explanation why interested members of the public would know to search for the title or description of the *RepRap Video* to locate the video with reasonable diligence. *See id.*; *see also Blue Calypso*, 815 F.3d at 1350; *MHL Custom*, 2023 WL 5748755 at *4. Nor is there any evidence submitted that interested members of the public would have actually been able to locate the video. *See id.*

With respect to the *RepRap Article*, the declarant asserts that “any member of the public can access my blog posts on the website” for three reasons:

- the website “allows visitors to browse blog posts by category (including a 3D printing category) or to search for specific blog posts using keyword searching,”

- “interested members of the public would have been able to locate this blog post via keyword searching using popular search engines available at the time such as Google or Yahoo,” and
- “archived forum discussions on okob.net, including discussion threads regarding 3D printing, demonstrate that members of the public were able to access and identify subject matter of interest on the website.”

Id., ¶7. As an initial matter, the second rationale provided in the declaration—generally locating the article by using a search engine—is insufficient to show public accessibility. As the Federal Circuit has cautioned, technical accessibility does not show that an interested person would have located the reference with reasonable diligence. *Guardian Alliance Technologies, Inc. v. Tyler Miller*, IPR2020-00031, Paper 23 at *8 (PTAB Mar. 26, 2020) (“Public accessibility requires more than technical accessibility.”) (citing *Samsung Elecs. Co. v. Infobridge Pte. Ltd.*, 929 F.3d 1363, 1369 (Fed. Cir. 2019) and *Acceleration Bay, LLC v. Activision Blizzard Inc.*, 908 F.3d 765, 773 (Fed. Cir. 2018)). The Bakin declaration fails to show that any actual search was performed or what a sufficient search would have been to locate the *RepRap Article*. See *Blue Calypso*, 815 F.3d at 1350; *MHL Custom*, 2023 WL 5748755 at *4.

Moreover, the declaration’s first and third rationales—browsing by category, searching within the website, and referencing forum discussions—are also

insufficient to show public accessibility of the *RepRap Article*. Indeed, there is no explanation whatsoever of how interested members of the public would have accessed the website (okob.net), much less when exercising reasonable diligence. *See Blue Calypso*, 815 F.3d at 1349-50 (“[T]he present case lacks any testimonial evidence that a person interested in [the field] would be independently aware of the web address for [the] personal page.”). As the Bakin declaration admits, the website at issue (okob.net) is the declarant’s “personal website where [he] post[s] thoughts, discussions, and information about my various interests.” EX1016, ¶7. Those interests appear to be diverse, from harvesting peaches (“Peaches Getting Destroyed before Harvesting, Brown Rot?”) to keyboard issues (“Keyboard Input Problem with nedit under Ubuntu 18.04 in Virtual Box”). *See* EX1016 at 6; EX1005 at 1. Thus, there is no evidence that an interested person and skilled artisan would know of the declarant’s “personal website” or “various interests” or its web address.

Even if an interested member of the public could somehow have located the website (okob.net) with reasonable diligence, there is no explanation or evidence of how such individuals would have been specifically directed to the particular *RepRap Article* or *RepRap Video*, such as using keyword searching or forums. *See Blue Calypso*, 815 F.3d at 1350; *see also* EX1016, ¶7.

Thus, even if Petitioner were allowed to improperly incorporate the Talbot and Bakin declarations by reference and the Board were to piece together what

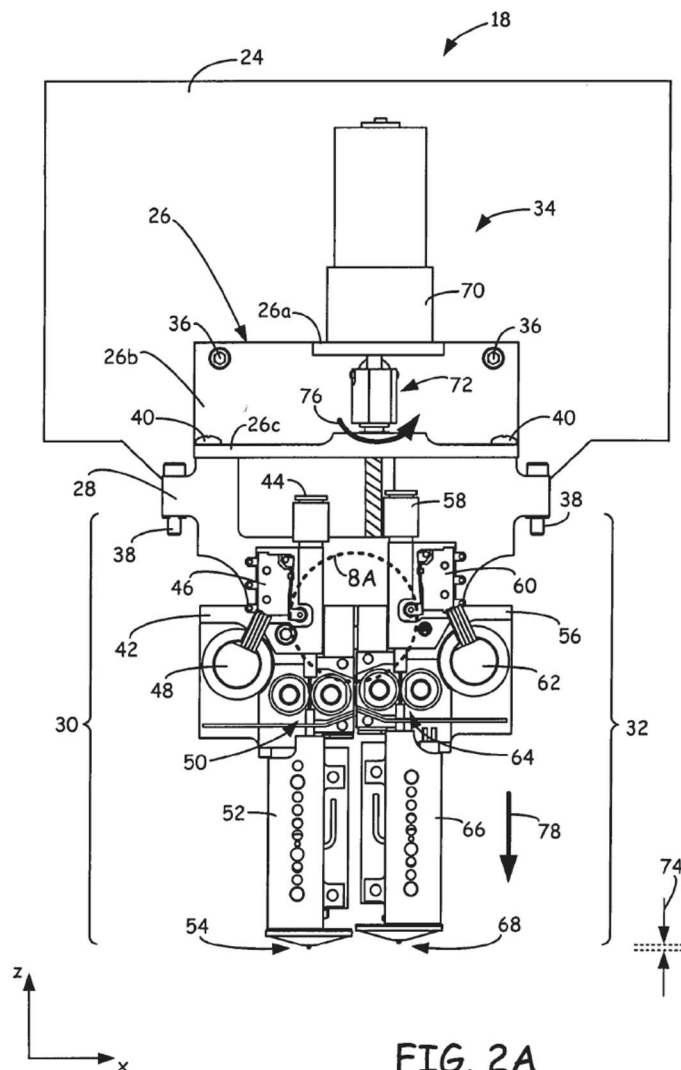
Petitioner's argument could be, the alleged facts fail to show, at a minimum, that the *RepRap Article* and *RepRap Video* were publicly accessible.

VIII. THE PETITION DOES NOT SHOW THAT CLAIMS 1, 2, 5-7, 9, 16, AND 17 ARE UNPATENTABLE UNDER GROUND 1

A. Overview of *Leavitt* (EX1004)

Leavitt is directed to an extrusion head that deposits multiple materials by toggling between a build and support state for depositing build and support materials, respectively. EX1004, ¶[0022], Title, Abstract; EX2013, ¶73.

Leavitt addresses the risk that “residual support material comes into contact with the layer of 3D object 20 being formed” by positioning one tip for a material (e.g., support tip 68) higher than another tip for a second material (e.g., build tip 54), by a raised offset distance (e.g., 74 in Figure 2A or 80 in Figure 2B). *Id.*, ¶¶[0032], [0035].



Id. at Fig. 2A. The offset distance allows the lower tip to extrude material without interference from the higher tip. *Id.*, ¶¶[0032], [0035]; EX2013, ¶¶74-75.

The examiner allowed the claims of the '713 Patent over numerous cited references, including *Leavitt*. See EX1002 at 175 (citation no. A45).

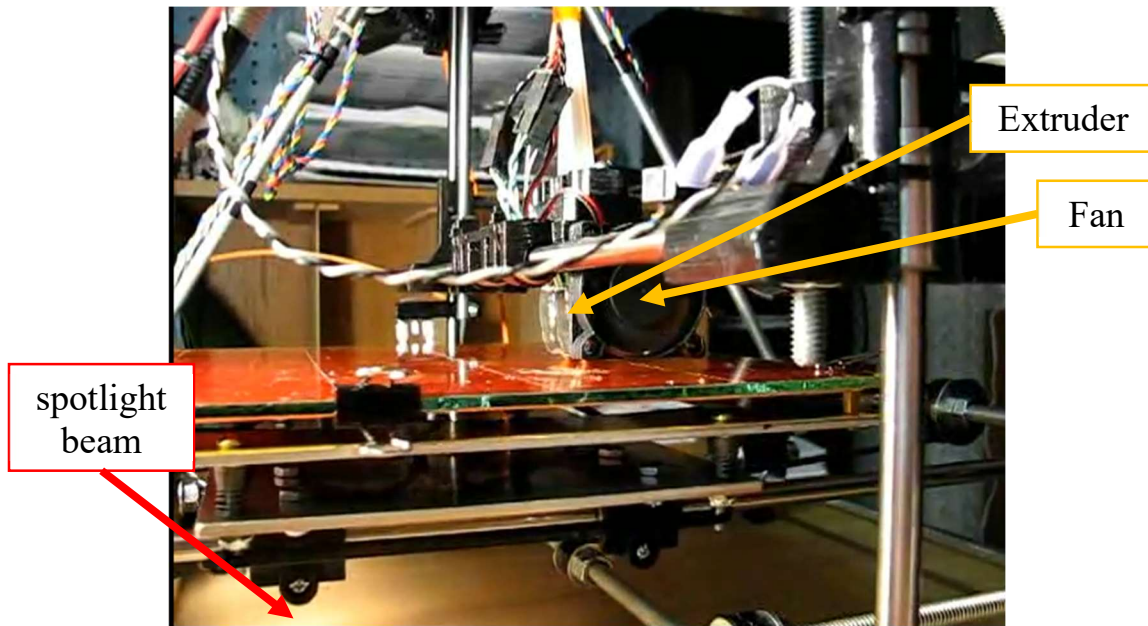
B. Overview of *RepRap Article* (EX1005)

The *RepRap Article* is a printout from a blog post related to temperature changes when lowering and restoring the temperature of an idle extruder. See

EX1005 at 1; EX2013, ¶76. It discusses printing a parking space that plugs both nozzles during a temperature change and primes the extruders before printing to “establish the consistent flow of plastic.” *Id.* The *RepRap Article* describes that its “technique works the best for printing a few layers of color, for example a colored text on the top and bottom of the object,” and states that “the time needed to adjust the temperatures [] slows down the print substantially when there are a lot of layers requiring extruder switching.” *Id.* It also purports to link to a video that describes “a dual color whistle” with what appears to be links to a whistle body and text. *See id.* (“Whistle X2 body” and “Whistle X2 text”); EX1014-EX1015.

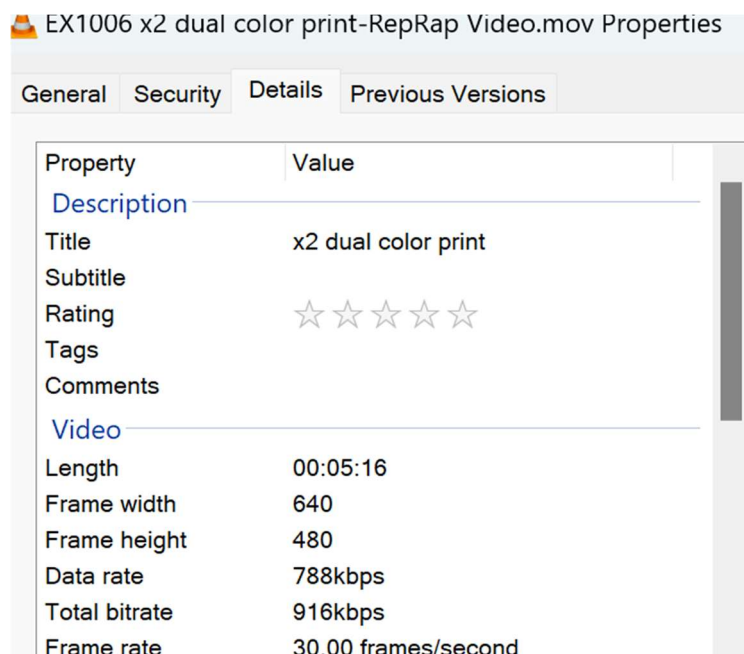
C. Overview of *RepRap Video* (EX1006)

The *RepRap Video* appears to be a video that is linked in the *RepRap Article*. *See* EX1005 at 1; EX2013, ¶¶77-79. The video records excerpts of someone using a printer in a dim environment with what appears to be a spotlight on the left side of the frame.



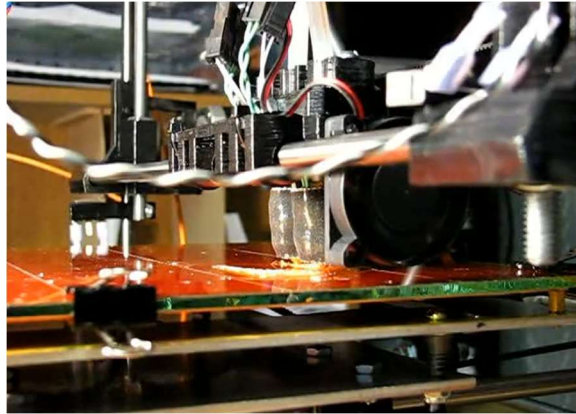
EX1006 at 0:04. The view of what is being printed is obstructed by an extruder, as well as what appears to be a large fan that is proximate to the camera. *Id.*

The properties of *RepRap Video* indicate that it has a very low resolution of 640 x 480.



See EX1006 (file properties, Details).

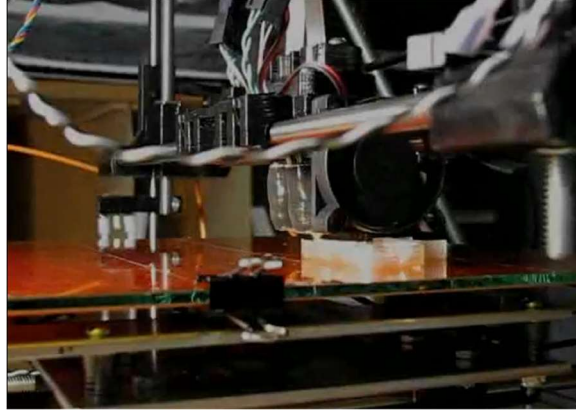
The *RepRap Video* is not a continuous recording. It fades out and back in around the 03:15 mark, at which point the printed object looks substantially different.



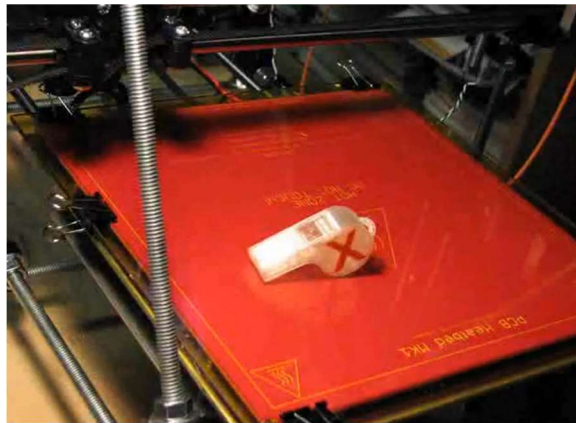
Id. at 03:14.



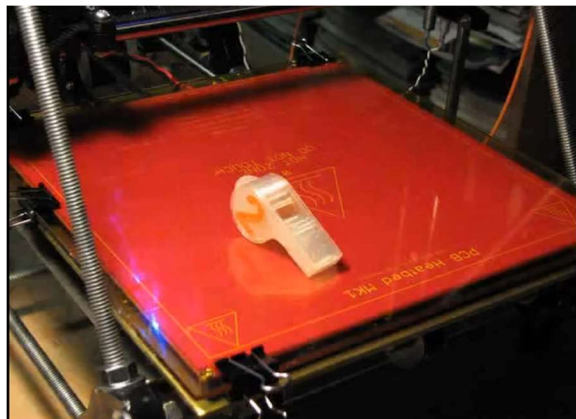
Id. at 03:15.



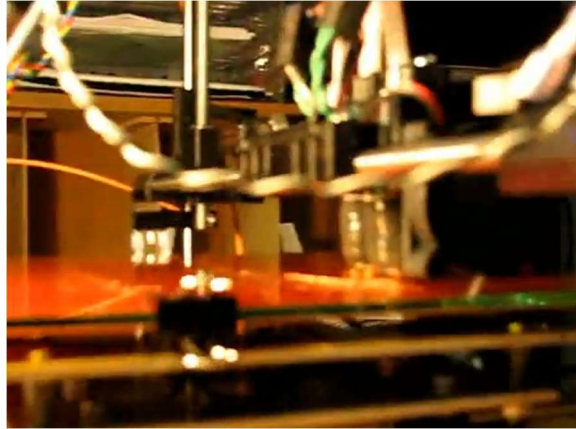
Id. at 03:16. Other discontinuous sequences occur around the 04:03, 04:20, 05:00, and 05:06 marks. A different object appears to be shown from various perspectives but without any printing at the 05:08 and 05:16 marks.



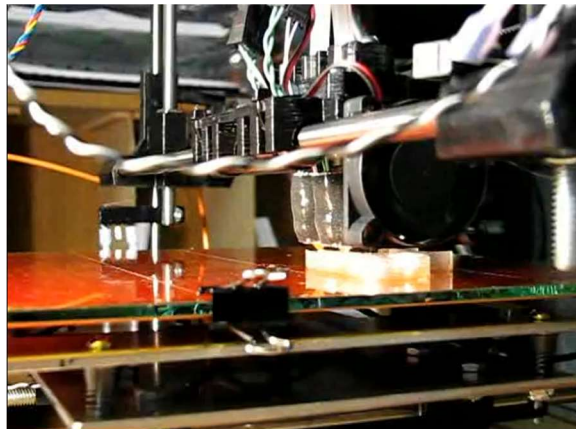
Id. at 05:08.



Id. at 05:16. Additionally, several portions of the *RepRap Video* appear to be blurry or out of focus, as shown below.



Id. at 02:26.



Id. at 03:17.

D. No Motivation/Reasonable Expectation of Success in Combining *Leavitt* and *RepRap*

A POSITA would not have been motivated to combine *Leavitt* and *RepRap* to achieve the inventions claimed by the '713 Patent, nor have had a reasonable expectation of success in doing so. EX2013, ¶¶86-95. Each reason advanced by

Petitioner relies on a misunderstanding of the art and/or would not lead the POSITA to the '713 Patent's claimed inventions.

First, Petitioner contends that “a POSITA would have been prompted to implement Leavitt’s system with the purge tower suggestion of RepRap because doing so would result in Leavitt’s deposition lines 30 and 32 advantageously ‘priming’ their nozzles” because “the material at the nozzle tip of the idle liquefier pump would have an inconsistent texture” and “‘priming’ of such material into the suggested purge tower would have advantageously avoided uneven deposition or defects imposed upon the 3D part.” Pet. at 12–13 (EX1003, ¶53). However, a POSITA would not understand that the material at the nozzle tip would “have an inconsistent texture” or that *Leavitt*’s system would result in “uneven deposition or defects imposed upon the 3D part.” EX2013, ¶¶87-88. First, *Leavitt* does not mention anything about “an inconsistent texture” or “uneven deposition.” See EX1004. Second, Paragraph 32 of *Leavitt* (cited by Petitioner for support), specifically describes how *Leavitt*’s method of raising the extruder head solves the problem of “defects imposed upon the 3D part”: “Raised offset distance **74** allows build liquefier pump **30** ... to form a layer of 3D object **20** without interference from support tip **68**” and “reduces the risk of support material becoming embedded in 3D object 20.” EX1004, ¶32. Using purge operations to “prime” the extruders in general was already known in the art and would not require or motivate combination with

RepRap's parking space technique. *See* EX1001 at 4:41-62. A POSITA would not be motivated to combine *Leavitt* with *RepRap* to solve the issue already resolved by *Leavitt*. EX2013, ¶88.

Second, Petitioner asserts that the combination of *Leavitt* with *RepRap* “provid[es] a time savings as compared to other purging procedures.” Pet. at 13 (citing EX1003, ¶54). However, a POSITA would not have been motivated to combine *Leavitt* and *RepRap* for such purported “time savings” when *RepRap* expressly teaches the opposite. EX2013, ¶¶89-90. Specifically, the *RepRap Article* describes that its “technique works the best for printing a few layers of color, for example a colored text on the top and bottom of the object,” and states that “the time needed to adjust the temperatures [] **slows down the print substantially when there are a lot of layers requiring extruder switching.**” EX1005 at 1 (emphasis added). As such, a POSITA would not be motivated to combine *RepRap*'s parking space with *Leavitt* as *Leavitt* explains that “[f]or even a single 3D object and corresponding support structure ..., extrusion head 18 toggles between the build state and the support state numerous times,” and “[t]his number is multiplied when fabricating large quantities of 3D objects and support structures.” EX1004, ¶24; *see also id.*, ¶36 (describing intent to “reduce[] time required during a build operation.”). As a result, a POSITA would in fact be taught ***away*** from the combination. EX2013, ¶90.

Third, Petitioner contends that the combination “provide[s] an improved approach for preventing the idle extruder from leaking oozed material while positioned over the 3D part.” Pet. at 13-14 (citing EX1003, ¶55) (discussing “dripping [of] oozed material”). However, a POSITA would not have been motivated to combine *Leavitt* and *RepRap* to address issues of “leaking” or “dripping” of “oozed material.” EX2013, ¶¶91-92. A POSITA would have understood that polymer melts would not “leak” or “drip” from the extruder head onto the part because of their high viscosity and surface tension. EX2013, ¶92 (citing EX2018). The '713 Patent itself acknowledges that material will not drip, stating that “a sufficient amount of the part or support material [must] be extruded from the print head to have enough weight to fall away from the given print head.” EX1001 at 4:63-66. A POSITA would understand that *Leavitt*'s reference to “ooze” relates to support material oozing and collecting on the extruder tip, which would not “leak” or “drip” onto the 3D part due to the aforementioned properties of the polymer material. EX2013, ¶92. As already discussed, *Leavitt* expressly teaches a solution related to the issue of ooze: raising the extruder head when that extruder is not printing. EX1004, ¶32; EX2013, ¶92.

Finally, Petitioner asserts that a “POSITA would have applied RepRap Video's teaching to print a purge tower on the substrate to Leavitt's system ... because doing so would provide an efficient way to concentrate waste material for

rapid disposal in the compact purge tower.” Pet. at 14 (citing EX1003, ¶56). However, *Leavitt* describes no such issues with disposing waste material. See EX1004. Moreover, Petitioner ignores that the conventional methods of conducting purge operations, like using a purge bucket, already “provid[ed] an efficient way to concentrate waste material for rapid disposal.” Pet. at 14; see EX1001 at 4:42-45, 4:62–5:3 (describing use of purge buckets in the art). As such, a POSITA would not have been motivated to combine *Leavitt* with *RepRap*, as the combination would not result in a more “efficient way to concentrate waste material for rapid disposal” than already conventional in the art. EX2013, ¶¶93-94.

For the foregoing reasons, a POSITA would not have been motivated to combine *Leavitt* with *RepRap* to achieve the inventions claimed in the '713 Patent. EX2013, ¶95. For the same reasons and those discussed below with respect to *RepRap*'s implementation (*see infra* §§VIII.E-VIII.G), a POSITA also would not have had a reasonable expectation of success in combining *Leavitt* and *RepRap*. EX2013, ¶95.

E. Ground 1 does not teach or suggest all elements of claim 1

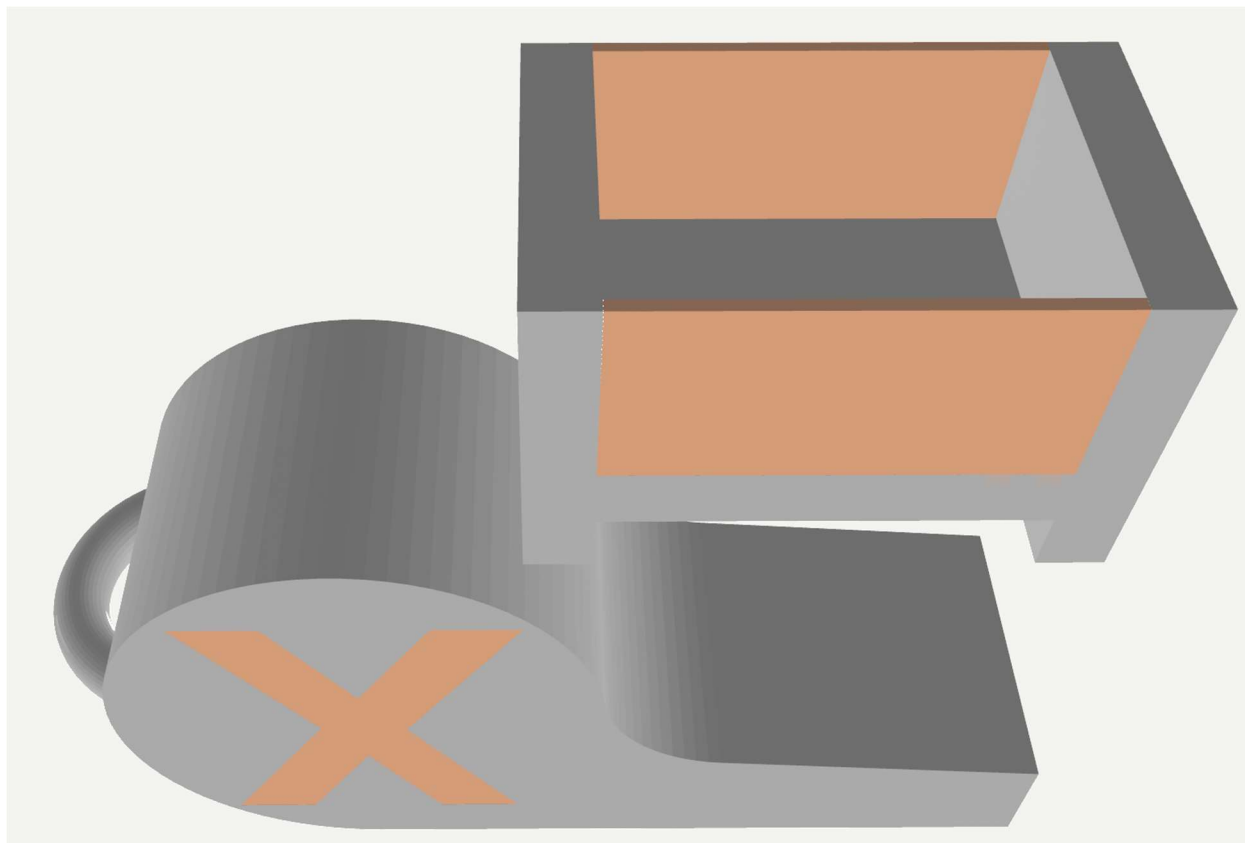
Ground 1 of the Petition asserts that claim 1 is obvious over *Leavitt* in view of the *RepRap Article* and *RepRap Video*. Pet. at 1. Even if the *RepRap Article* and *RepRap Video* are printed publications (*see supra* §VII), Petitioner's challenge in Ground 1 fails to teach or suggest all elements of claim 1. EX2013, ¶¶83-85.

Claim 1 of the '713 Patent requires “performing a purge operation for each print head or deposition line switched to the operating mode, the purge operation comprising printing at least one purge tower in a layer-by-layer manner, wherein the layers of the at least one purge tower are printed from the print head or deposition line switched to the operating mode.” EX1001 at 15:53-58.

Petitioner asserts that *RepRap* (referring collectively to the *RepRap Article* and *RepRap Video*) discloses a purge operation performed for each deposition line switching to the operating mode. Pet. at 24–27. According to Petitioner, the extruders are “configured to print a 3D part by depositing” two materials “using a layer-by-layer technique where the printer alternates between depositing one material using ‘extruder 0’ and depositing the other material using ‘extruder 1.’” Pet. at 25 (citing EX1005 (*RepRap Article*) at 1). By moving the extruder head away from the 3D part and lowering the temperature within an idle extruder, Petitioner asserts that the *RepRap Article* addresses a problem regarding the oozing of residual material from the nozzle of an idle liquefier pump. Pet. at 24–26 (citing EX1004 (*Leavitt*), ¶¶0032], EX1005 at 1; EX1003, ¶¶79). On this basis, Petitioner asserts that RepRap’s purported “purge tower is printed in a layer-by-layer manner through purge operations occurring when one of the extruders is switched to the operating mode.” Pet. at 27–28 (citing EX1006 (*RepRap Video*) at 05:04); *see also* Pet. at 28

(asserting that the combination “print[s] at least one layer of the purge tower in response to switching from a stand-by mode to an operating mode”).

Contrary to Petitioner's assertions, *RepRap* discloses a parking space used to address temperature changes rather than a layer-by-layer purge tower. EX2013, ¶97. There is no disclosure or teaching in the *RepRap Article* that the parking space is printed in a layer-by-layer manner, in which the layers are printed from the print head or deposition line switched to the operating mode. The *RepRap Article* discloses that, at any given point in a print process, the same parking space serves two purposes. EX1005 at 1. One purpose is to plug the nozzles while the temperature changes to address “plastic leaking from the idle extruder” and the other purpose is to “prime” both extruders to “establish the consistent flow of plastic” “before printing the actual object after the temperature change.” *Id.* As a result, the parking space, at any given point, includes both leakage from one plugged nozzle / extruder and material extruded from both nozzles / extruders. EX2013, ¶97. In fact, when the *RepRap* STL files represented by EX1014 and EX1015 are merged together, it becomes clear that multiple layers contain multiple materials and that RepRap does not print the parking space in the layer-by-layer manner required by the claims.



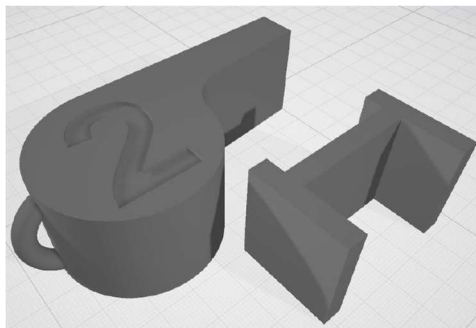
EX2013, ¶¶98-99 (excerpting EX2017).

The *RepRap Video* fails to remedy the deficiencies with the *RepRap Article* and provides little clarity regarding what occurs during a print process. EX2013, ¶100. As explained, the video is a poor-quality recording in a dim environment with a spotlight creating severe reflections off of a glass surface (*see* EX1006 at 0:04), a view obstructed by an extruder and large fan (*id.*), a low-resolution (*see* EX1006), discontinuities showing different objects from different views (*see id.* at 03:15, 04:03, 04:20, 05:00, and 05:06, 05:08, and 05:16), and several blurry or out of focus portions (*see id.* at 02:26, 03:17). *Supra* §VIII.C. The video fails to provide much clarity on how exactly the parking space is printed. *See* EX2016 (Hickner Dep. Tr.)

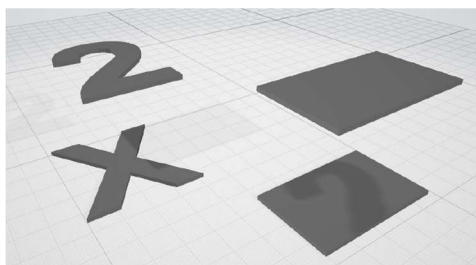
at 126:9-20 (admitting that aspects of the parking space are “difficult to tell from the color figure or the excerpted figure from the video”). For instance, the view of the object after printing is completed shows many characteristics inconsistent with Petitioner's assertions.



Pet. at 28 (EX1006 at 05:04). As shown, the parking space barely resembles the purported model shown in Exhibits 1014 and 1015. *See* Pet. at 36 (asserting that EX1014 and EX1015 purportedly corroborate that build data is generated for each layer of a model); EX1005 at 1 (describing base and text).

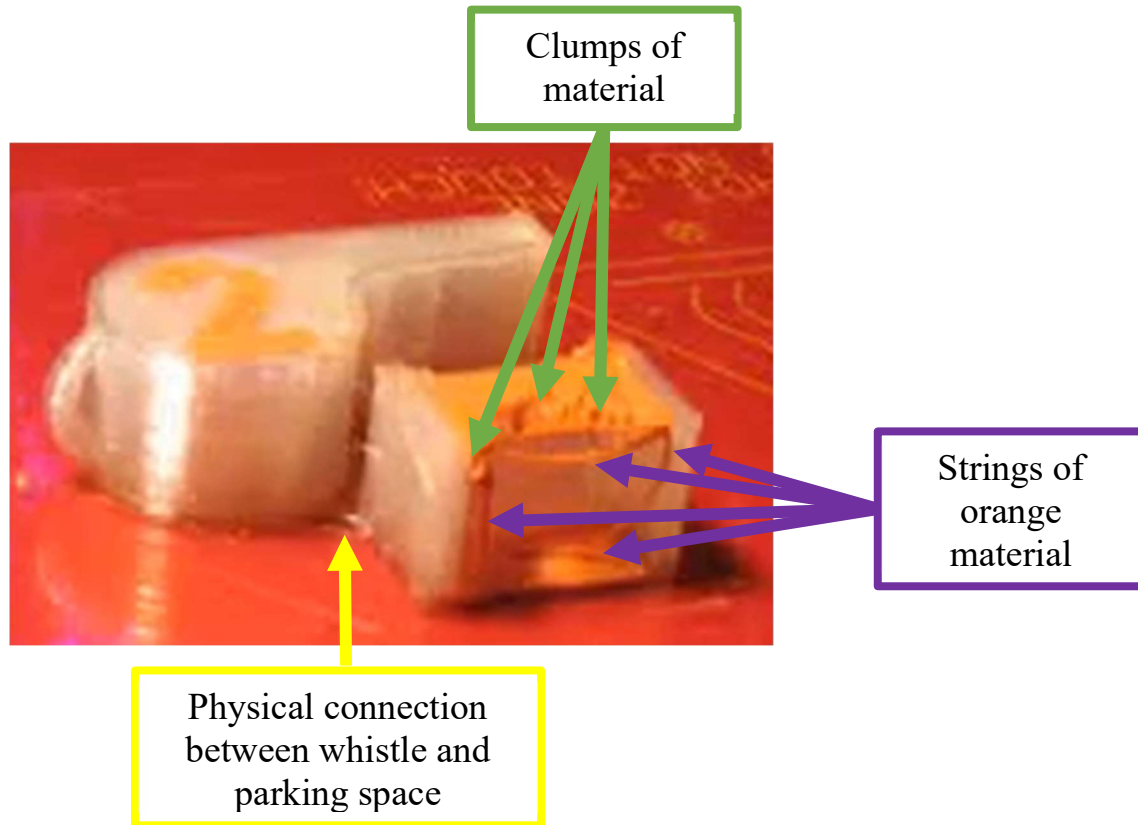


EX1014 (base).



EX1015 (text). As shown in Exhibit 1014, the parking space is supposed to be separate from the whistle and has two vertical surfaces connected together with a third vertical surface. Exhibit 1015 shows that the two ends of the parking space are supposed to be equal-sized plates. EX2013, ¶100.

Contrary to Exhibits 1014 and 1015, the *RepRap Video* illustrates that there are many strings of orange-colored material all across the object (annotated in purple), with clumps of orange-colored material on top (annotated in green).



EX1006 at 05:04 (annotated). The parking space is also *physically connected* to the whistle to form a single object, as shown by the annotations in yellow in the screenshots above and below.



Physical connection
between whistle and
parking space

EX1005 at 4:22. A POSITA would not have considered a structure physically connected to the print object, such *RepRap*'s parking space, to teach the claimed purge tower. EX2013, ¶101. Indeed, Dr. Hickner confirmed that a POSITA would understand the "purge tower" is a "separate physical object" from the three-dimensional part. EX2016 (Hickner Dep. Tr.) at 64:1-9 ("[T]he part is something that a POSITA, if a POSITA is performing this operation, that's the desired component that one would take and use. And the purge tower is a separate physical object[.]"); *see also id.* at 28:8-10 ("The patent clearly shows separate components, the 24 components separated from --sorry, the 24 purge tower separated from the part."). The *RepRap Video* does not explain how the parking space is made or why the result of the print is different than the *RepRap Article* and Exhibits 1014 and 1015. *See* EX1014, EX1015, EX1006 at 04:22, 05:04. Thus, the whistle (alleged 3D

part) and parking space (alleged purge tower) are printed as a single interconnected structure and there is no teaching in the combination of “printing layers of the three-dimensional part” and also “performing a purge operation” that comprises “printing at least one purge tower.” EX2013, ¶101.

In addition, the *RepRap Video* does not teach that a layer of the parking space is printed when an extruder or a deposition line is switched into operation. EX2013, ¶102. Between the video's low-resolution capture, obstructions, reflections, blurry images, and discontinuous sequences, there is no indication whether the whistle or parking space is printed first when an extruder or a deposition line is switched into operation. *Id.*

For the foregoing reasons, there is no teaching in the combination of “performing a purge operation for each print head or deposition line switched to the operating mode, the purge operation comprising printing at least one purge tower in a layer-by-layer manner, wherein the layers of the at least one purge tower are printed from the print head or deposition line switched to the operating mode.” EX2013, ¶103.

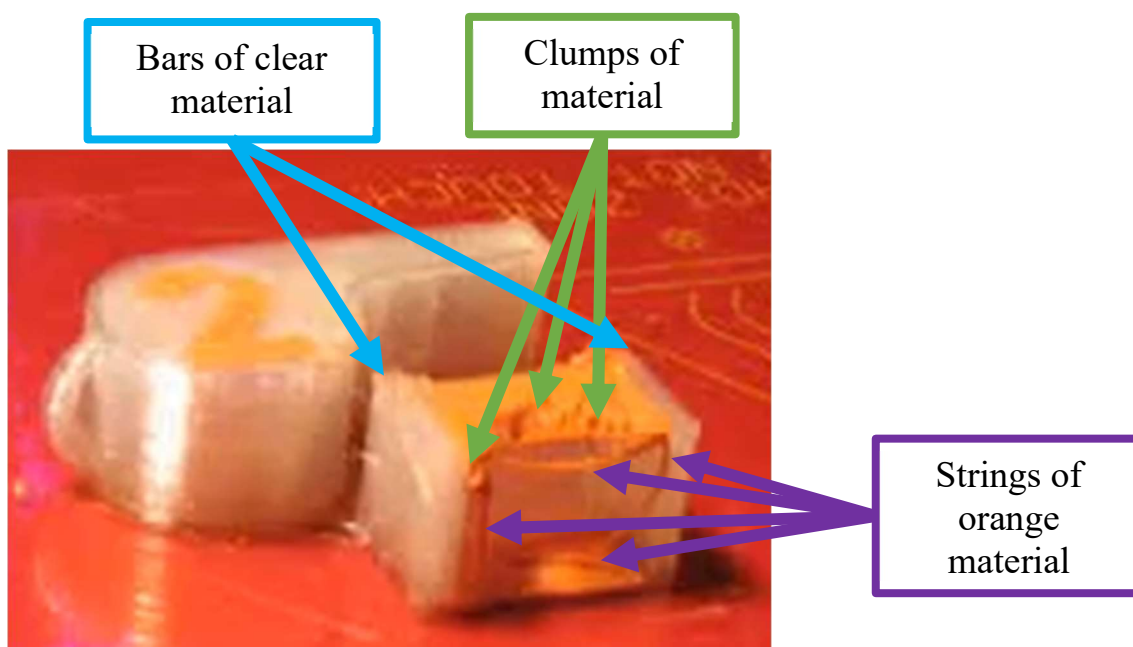
F. Ground 1 does not teach or suggest all elements of claim 16

Ground 1 of the Petition also asserts that claim 16 is obvious over the *Leavitt-RepRap Article-RepRap Video* combination. Independent claim 16 of the '713 Patent requires “printing a first layer of a support structure from a support material for the

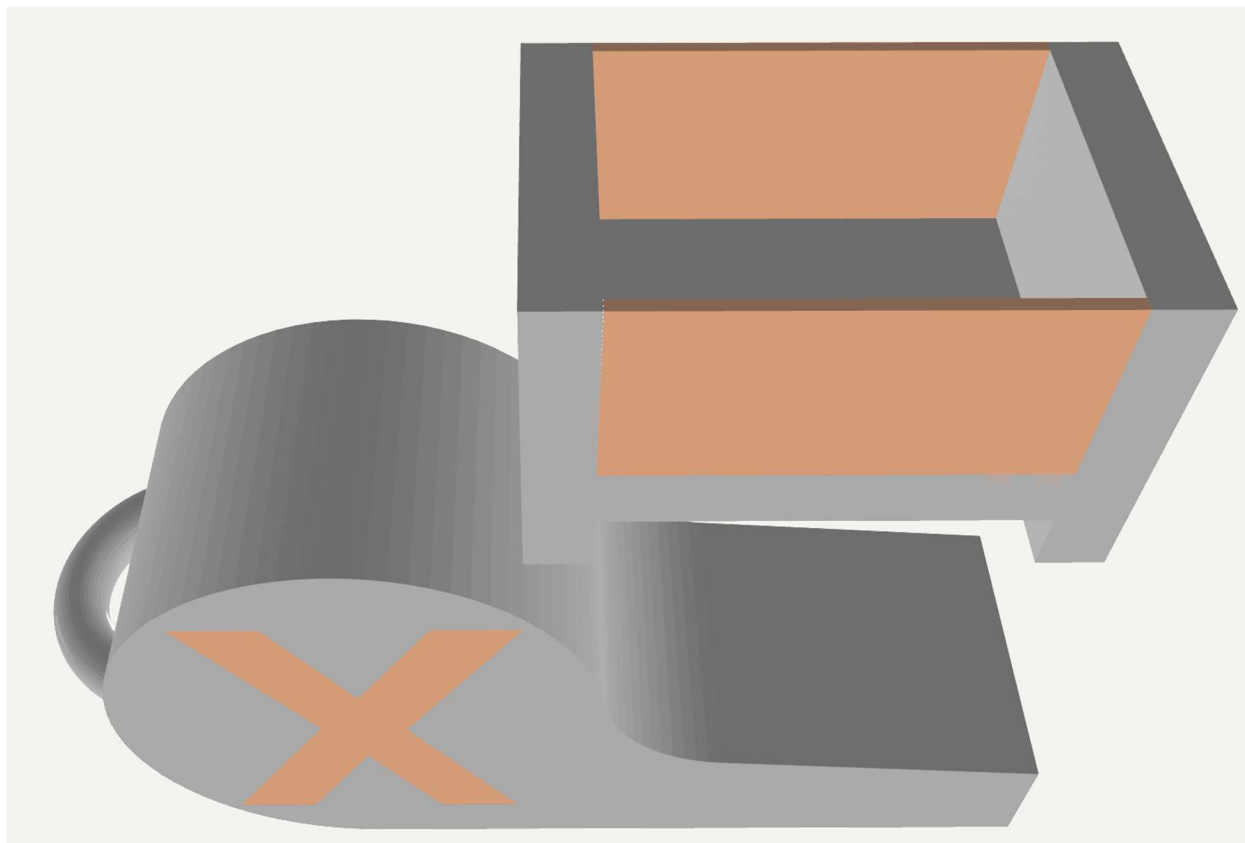
three-dimensional part,” “printing a first layer of a purge tower from a part material,” and “printing a first layer of the three-dimensional part on at least a portion of the first layer of the support structure from the part material after printing the first layer of the purge tower.” EX1001, 18:1-6. Petitioner argues the combination teaches that the extruder “prints a layer of the purge tower each time that build liquefier pump 30 transitions from an idle state to an active state as taught by RepRap.” Pet. at 37. On this basis, Petitioner contends that the extruder in the combination “prints a first layer of the purge tower from the part material when the build liquefier pump 30 transitions from the idle state to the active state.” *Id.*

However, Petitioner's conclusion that the transition from idle to active is the first transition when a first layer of the tower is printed is unsupported and conclusory. EX2013, ¶¶104-105. As discussed above for claim 1, the combination does not teach printing a purge tower in a layer-by-layer manner in which the layer of the tower is printed when a print head or deposition line is switched into an operating mode. *Supra* §VIII.E. For at least the same reasons, the combination also does not teach printing a first layer of a purge tower from part material after a first layer of a support structure is printed from a support material. Neither the *RepRap Article* nor *RepRap Video* show such a layered approach to printing the parking space. EX2013, ¶105.

The *RepRap Article* describes a parking space that has a dual purpose to handle leakage from one nozzle while handling priming for multiple nozzles. See EX1005 at 1; *supra* §VIII.E; EX2013, ¶106. Thus, at any given point, the parking space contains *a mixture of materials* from both nozzles. *Id.* For example, the top layer of the parking space shown in the *RepRap Video* includes strings and clumps of orange-colored material and two bars of clear material.



EX1006 at 05:04 (annotated); *supra* §VIII.E. The merged STL files clearly show that the orange plates are embedded within the parking space structure itself, such that individual layers at the top and bottom incorporate material from both extruders.



EX2017; EX2013, ¶106. Additionally, nearly every given point of the parking space or purported layer includes strings of orange-colored material with the other material. *See* EX1006 at 05:04. As a result, there is no indication whether the whistle or parking space is printed first with part material when a print head or a deposition line is switched to an operating mode. *See id.*; *see also* EX1005 at 1 (dual-purpose of parking space). For these reasons, *RepRap* does not teach printing a first layer of a support structure from a support material, printing a first layer of a purge tower from a part material, and printing a first layer of a 3-D part from the part material on at least a portion of the first layer of the support structure after printing the first layer of the purge tower. EX2013, ¶106.

Leavitt does not address these deficiencies with *RepRap* in the combination. EX2013, ¶107. Indeed, *Leavitt* does not teach printing a purge tower, which was confirmed by Petitioner's expert. EX2016 (Hickner Dep. Tr.) at 121:22–122:1 (“*Leavitt* does not have any depictions or explanations of a purge tower”). In addition, Figure 1 of *Leavitt* shows that the bottom of an object has both support material 22 and part material 20.

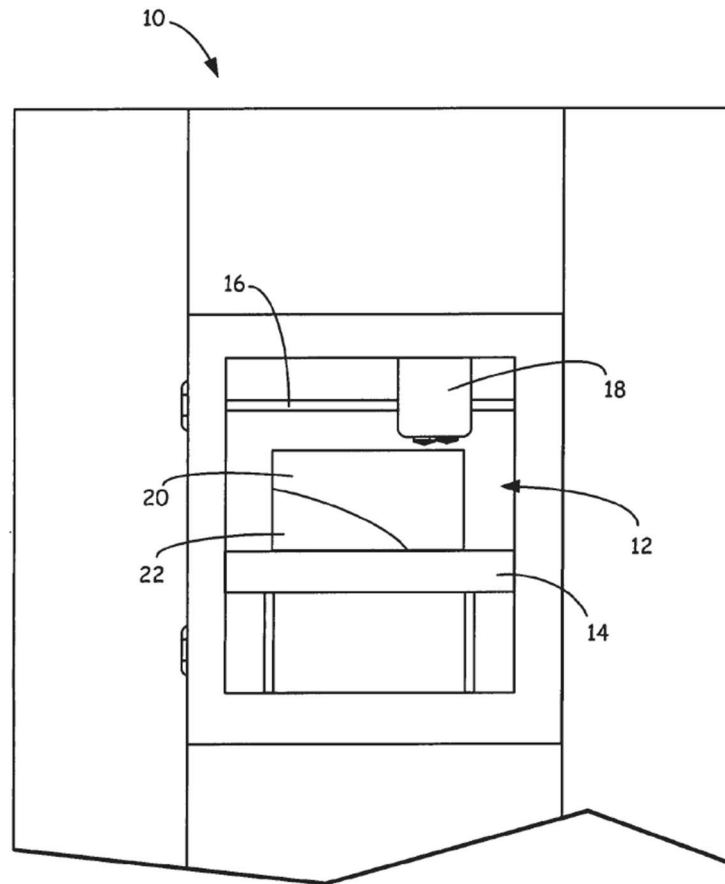


FIG. 1



EX1004 at Fig. 1, ¶[0023] (“After the layer of 3D object 20 is complete, extrusion head 18 then toggles to the support state, which allows extrusion head 18 to deposit the support material in a sequence of roads to form a layer of support structure 22.”). Thus, the combination does not teach printing a first layer of a support structure,

printing a first layer of a purge tower from part material, and then printing a first layer of a 3-D part from part material. EX2013, ¶107.

Moreover, the POSITA would never have been motivated to combine the *RepRap Article* and *RepRap Video* with *Leavitt* to practice this claim, which requires printing successive layers of part and support material. EX2013, ¶108. The *RepRap Article* teaches away from such a solution. As discussed previously (*supra* §VIII.D), *RepRap* states that its method “slows down the print substantially when there are a lot of layers requiring extruder switching.” EX1005 at 1. Meanwhile, *Leavitt*’s system “toggles between the build state and the support state numerous times” “[f]or even a single 3D object and corresponding support structure,” and “[t]his number is multiplied when fabricating large quantities of 3D objects and support structures.” EX1004, ¶24. Thus, a POSITA would have been expressly taught away from combining *RepRap*’s parking space with *Leavitt*’s system to print using part and support material in the alternating method of claim 16. EX2013, ¶108.

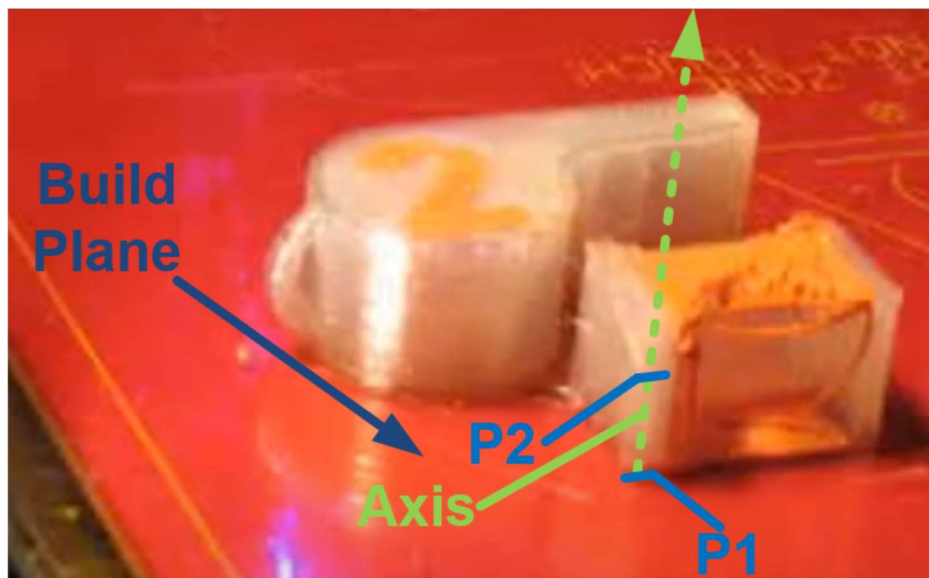
Accordingly, the combination in Ground 1 fails to provide all the elements of claim 16. EX2013, ¶109.

G. Ground 1 does not teach or suggest additional elements of the dependent claims

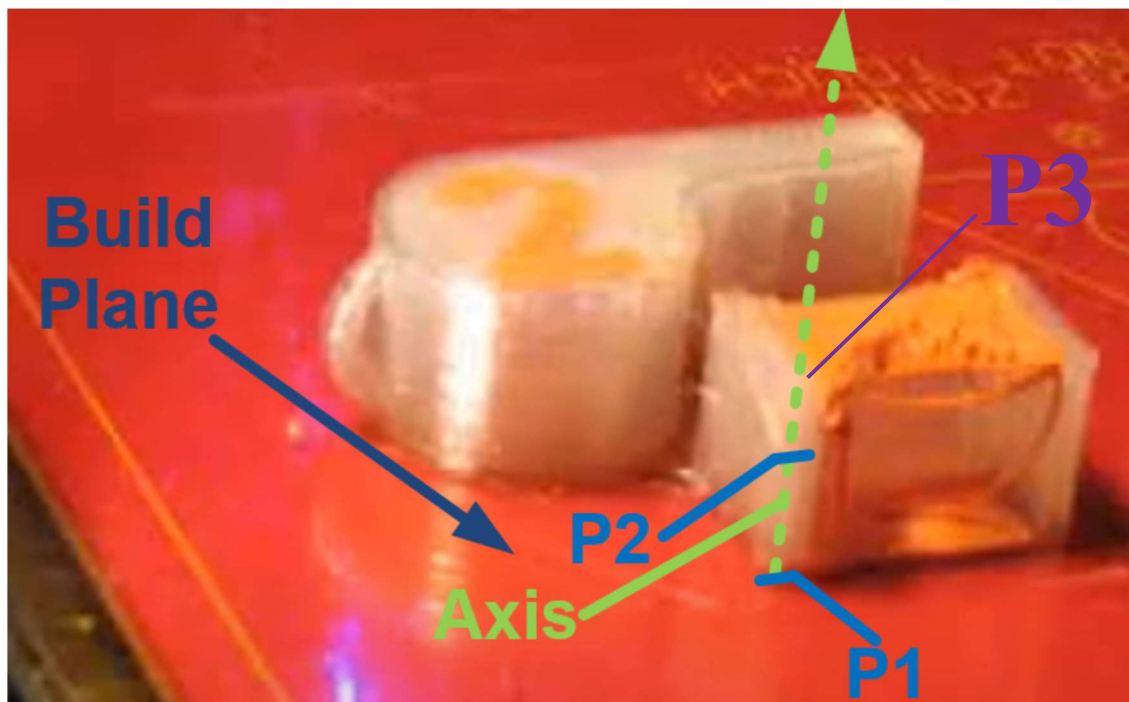
Ground 1 further fails to teach or suggest the additional limitations of dependent claims 5 and 17. EX2013, ¶¶110-114.

1. Claim 5: “wherein the at least one purge tower has a cross-sectional area that reduces in height along an axis that is perpendicular to a build plane”

Petitioner contends that RepRap's parking space “has cross-sectional areas that differ between a first cross-sectional position (P1) at a base of the purge tower and a second cross-sectional position (P2) above P1 relative to the build plane” with reference to following annotated image:



Pet. at 31 (excerpting EX1006, 5:04 (annotated)). However, Petitioner ignores that the cross-sectional area of *RepRap*'s parking space *increases* again at point P3 (annotated below) to be the same cross-sectional area as P1.



Pet. at 31 (excerpted EX1006, 5:04 (annotated)) (further annotated to add P3 marking); EX2013, ¶¶111-112. During deposition, Petitioner's expert admitted that "the orange layer at the bottom of the parking space has the same cross-sectional area as the orange layer at the top of the parking space" and that "both of those layers have a larger cross-sectional area than the layer corresponding to P2." EX2016 at 126:2-20.

Notably, the *RepRap Video* itself demonstrates the problems with the parking space *not* reducing in cross-sectional area as the height increases (e.g., orange material has fallen down during the printing operation). See EX1001 at 9:61–10:3 (explaining that the purpose of reducing the cross-section with height is to prevent "wobbling ... which can otherwise impair the printing of subsequent layers"). As such, *RepRap* does not teach or suggest claim 5. EX2013, ¶¶111-112.

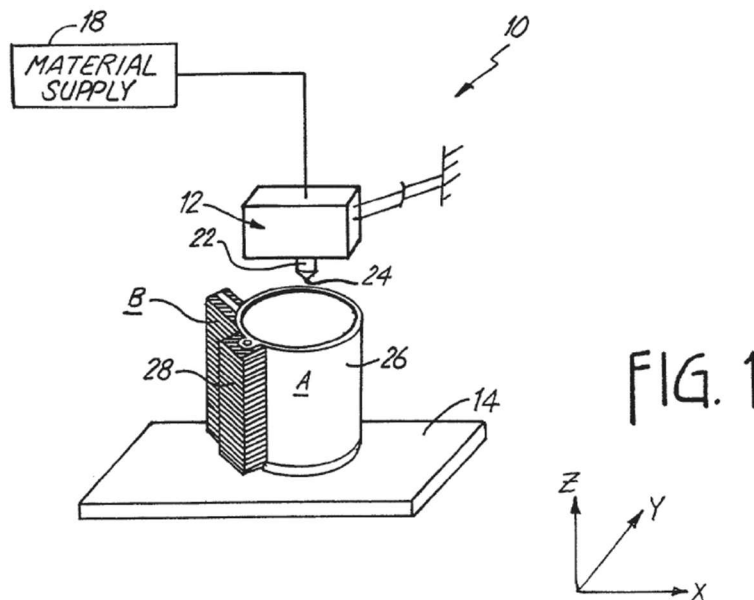
2. Claim 17: “The method of claim 16, and further comprising repeating steps (b)-(e) for at least a portion of the three-dimensional part and support structure.”

For claim 17, Petitioner relies on the same flawed rationale as for claim 16. For the reasons discussed above for claim 16 (*supra* §VIII.F), Ground 1 does not teach printing a first layer of a support structure, printing a first layer of a purge tower from part material, and then printing a first layer of a 3-D part from part material. In addition, *RepRap* teaches away from this repeated alternation between printing part and support material because its method “slows down the print substantially when there are a lot of layers requiring extruder switching.” EX1005 at 1; *supra* §VIII.F. As such, the POSITA would not have been motivated to combine *RepRap*'s teachings with *Leavitt* to additionally “repeat[e] steps (b)-(e) [of claim 16] for at least a portion of the three-dimensional part and support structure.” EX2013, ¶¶113-114.

IX. THE PETITION DOES NOT SHOW THAT CLAIMS 1, 2, 6, 7, 9, 16, AND 17 ARE UNPATENTABLE UNDER GROUND 2A

A. Overview of *Priedeman* (EX1007)

Priedeman relates a method for three-dimensional modeling that forms a support structure and/or model. EX1007 at Abstract, Title; EX2013, ¶80. Figure 1 shows an extrusion apparatus 10 for building a model 26 supported by a support structure 28.



Id. at Fig. 1, ¶[0016]. A material supply 18 supplies material to the extrusion head 12, and a liquefier 22 heats and melts the material for extrusion through an orifice 24. *Id.*

B. Overview of *KISSlicer* (EX1010)

KISSlicer is a short “Quick-Start Guide” for creating a “first print file.” EX1010 at 1; EX2013, ¶82. The guide describes an overview of settings (EX1010 at 2-6), loading a file and viewing and positioning a part (*id.* at 6-8), setting printer parameters (*id.* at 8-9), and a parameter quick reference guide (*id.* at 9-11). Included in the settings is an optional “wipe pillar” used to “clean the extruder tip” to “reduce[] hairing.” *Id.* at 9.

C. Ground 2A does not teach or suggest all elements of claims 1 and 16

Ground 2A of the Petition asserts that claims 1 and 16 are obvious over *Priedeman* in view of *KISSlicer*. Pet. at 1. Even if *KISSlicer* is a printed publication

(*see supra* §VII), Petitioner's challenge in Ground 2A fails to teach or suggest all elements of claims 1 and 16. EX2013, ¶¶115-124.

Claim 1 of the '713 Patent requires "performing a purge operation for each print head or deposition line switched to the operating mode, the purge operation comprising printing at least one purge tower in a layer-by-layer manner, wherein the layers of the at least one purge tower are printed from the print head or deposition line switched to the operating mode." EX1001 at 15:53-58. Similarly, claim 16 of the '713 Patent requires "printing a first layer of a support structure from a support material for the three-dimensional part," "printing a first layer of a purge tower from a part material," and "printing a first layer of the three-dimensional part on at least a portion of the first layer of the support structure from the part material after printing the first layer of the purge tower." *Id.* at 18:1-6.

Petitioner tacitly admits that *Priedeman* does not disclose a purge tower. *See* Pet. at 42-43; *see also* EX2016 (Hickner Dep. Tr.) at 128:9-11 (admitting "there [are] no examples of purge towers in [*Priedeman*]"). Instead, Petitioner asserts that the *Priedeman-KISSlicer* combination teaches a purge operation after warm up. *See* Pet. at 50-51 (citing EX1010 at 9-10); *see also* Pet. at 43-46. However, *KISSlicer* does not teach a purge operation that prints a purge tower in the manner recited in claims 1 and 16. Rather, the reference discloses a "wipe pillar," which a POSITA would understand from *KISSlicer*'s teachings is used to "clean the extruder tip" to

“reduce[] hairing,” which is unrelated to a purge operation, let alone one comprising the steps recited by claims 1 and 16. EX1010 at 9; EX2013, ¶118. This understanding is corroborated by the '713 Patent, which teaches that “tip-wipe operation[s]” are distinct and optional processes that could be performed after purging. *See* EX1001 at 15:53-58, 18:1-6; *see also id.* at 4:41-45 (describing a purge operation optionally followed by a tip-wipe operation), 9:47-59 (“optionally” performing a separate tip-wipe operation, “as illustrated by tool path segment 58f” between vertices 64 and 66 in Figure 5), Fig. 5. As described by the '713 Patent, a POSITA would understand that a “purge operation” is performed for a variety reasons related to ensuring the print head is ready to print, none of which have to do with eliminating hairing after printing. EX1001 at 4:46-62; EX2013, ¶118.

In addition, *KISSlicer* fails to teach the specific requirements of claims 1 and 16 that the purge tower is printed in a layer-by-layer manner from the print head or deposition line switched to the operating mode (such as a first layer of the purge tower printed from part material before printing a first layer of the 3D part from the same material). EX2013, ¶119. First, a POSITA would understand that in Petitioner's proposed combination the wipe pillar is printed after—not before—that print head prints the part or support structure. EX2013, ¶119. Because a POSITA would understand that a “wipe pillar” is a structure used to clean the extruder tip to eliminate hairing on the 3D part, a POSITA would also understand that the wipe

pillar is printed *after* the extruder has finished printing the part/support structure, not before as Petitioner suggests. Pet. at 51-52 (arguing “[*KISSlicer*’s] extruder prints one or more layers of the [wipe pillar] before printing the three-dimensional part or support structure”); EX2013, ¶119; *see also* Paper 8 at 5. Hairing results when an extruder has stopped printing on a given layer and is moved to a different location. EX2013, ¶119; EX1013 at 19. As the material in the extruder head is stretched away from the material just extruded, small strands (i.e., hairs) of the material may be formed until the two materials completely separate. EX2013, ¶119. These hairs can become stuck to the extruder tip. *Id.*; EX2016 at 132:16–133:5 (“it’s possible that a hair is stuck to the extruder tip or the extrusion nozzle.”). A POSITA would understand that one way to deal with the problem of hairs on the extruder tip is by taking the extruder that has just *finished printing* the part/support structure and printing a “wipe pillar” to capture these hairs off the end of the extruder. EX2013, ¶119. While *KISSlicer* states that the “wipe pillar” is printed “before every layer to clean the extruder tip,” a POSITA would understand that in “dual head prints” the extruder that just completed its print operation would generate its wipe pillar before the other extruder begins printing on the same layer. *Id.* Doing so removes the hairs on the tip of the inactive extruder so they will not contact the build while the other active extruder performs its print operation. *Id.* As such, a POSITA would

understand that for dual extruder operations, *KISSlicer* teaches printing a wipe pillar *after* printing the part / support structure on a given layer, not before. *Id.*

Second, *KISSlicer* teaches that an entire structure (“a cylinder”) is printed before every layer, which suggests that many cylinders are printed as layers are printed, not a structure printed in a layer-by-layer manner as claimed. EX1010 at 9; EX2013, ¶119.

Furthermore, Petitioner's reliance on a “Wipe” setting in *KISSlicer* is misplaced. EX2013, ¶120. *KISSlicer* does not describe its wipe setting as being related to its wipe pillar. *See* EX1010 at 10 (“Wipe [mm]: after a warm up the printer will push (prime) this amount of filament to ensure the printer is ready.”). In particular, *KISSlicer*'s wipe setting is only performed “after warm up” and is “to ensure the printer is ready,” (EX1010 at 10), whereas *KISSlicer*'s wipe pillar is printed for “every layer” and is used “to clean the extruder tip” (*id.* at 9). *See also id.* at 3 (showing separate settings for “Prime” and “Wipe”), 9-10 (describing separate “destring” suck/prime setting to address “oozing”). In other words, a POSITA would understand that the priming of the “Wipe” setting happens only once at the beginning of the print “after warm up” of the printer. EX2013, ¶120. There is no teaching in *KISSlicer* that the priming after warm-up of the printer is related to switching a particular print head or deposition line to an operating mode, nor is there any teaching that a wipe pillar is printed in relation to warming-up the printer. *See*

Pet. at 50; EX2013, ¶120. In fact, as discussed above, a tip wipe operation, such as by using *KISSlicer*'s wipe pillar, is different from a priming operation performed on the printer "after a warm up . . . to ensure the printer is ready," (EX1010 at 10), which are both different from the layer-by-layer purge tower printing required by claims 1 and 16. EX2013, ¶120. Thus, the combination fails to teach performing a purge operation comprising printing a purge tower in a layer-by-layer manner, in which the layers of the purge tower are printed from the print head or deposition line switched to the operating mode, such as printing a first layer of a support structure from a support material, printing a first layer of a purge tower from part material, and then printing a first layer of the three-dimensional part on at least a portion of the first layer of the support structure from the part material. EX2013, ¶¶120-121.

D. Ground 2A does not teach or suggest the additional element of claim 6

Ground 2A also fails to teach or suggest the additional element of dependent claim 6. EX2013, ¶122.

1. Claim 6: "wherein the at least one purge tower is stopped at a highest layer at which there is a material change for the printed layers of the three-dimensional part and support structure"

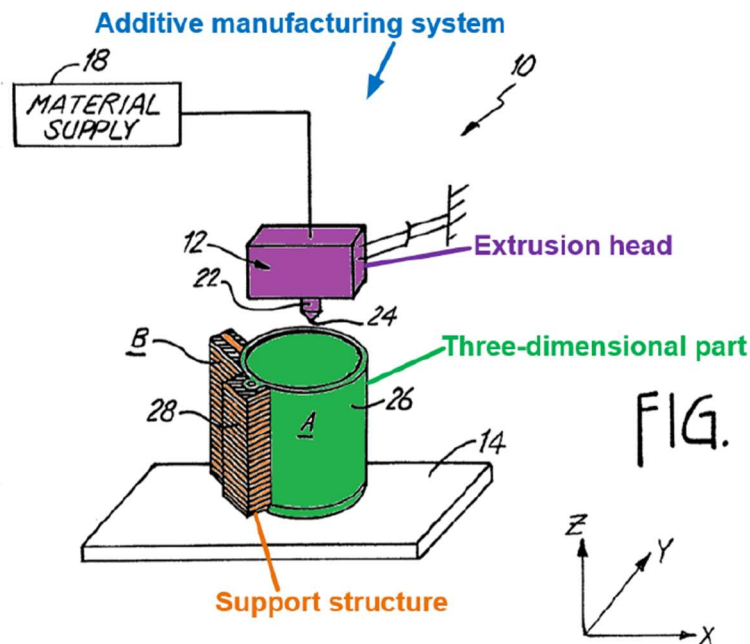
As discussed above for claims 1 and 16, there is no teaching in *KISSlicer* of a "purge tower," let alone one that "stopped at a highest layer at which there is a material change for the printed layers of the three-dimensional part and support structure." EX2013, ¶¶123-124. To the contrary, *KISSlicer* specifically states that

the “wipe pillar” is printed for “*every layer*,” regardless of material change. EX1010, 9. A POSITA would understand *KISSlicer* to teach printing the wipe pillar on “every layer,” agnostic as to material changes. EX2013, ¶124. As such, the *Priedeman-KISSlicer* combination in fact teaches *not* to stop the printing of the wipe pillar at the last material change. *Id.*

X. THE PETITION DOES NOT SHOW THAT CLAIM 5 IS UNPATENTABLE UNDER GROUND 2B

Ground 2B of the Petition asserts that claim 5 is obvious over the combination of *Priedeman*, *KISSlicer*, *RepRap Article*, and *RepRap Video*. Pet. at 1. For at least the reasons discussed above for Ground 2A with respect to claim 1, Ground 2B fails to teach all elements of claim 5. *See supra* §IX.C; EX2013, ¶¶125-126.

In addition, as discussed for Ground 1 (*see supra* §VIII.D), a POSITA would not have been motivated to implement *RepRap*, which “slows down the print substantially when there are a lot of layers requiring extruder switching,” (EX1005 at 1), with a system like *Priedeman* that teaches extruder switching at every layer:

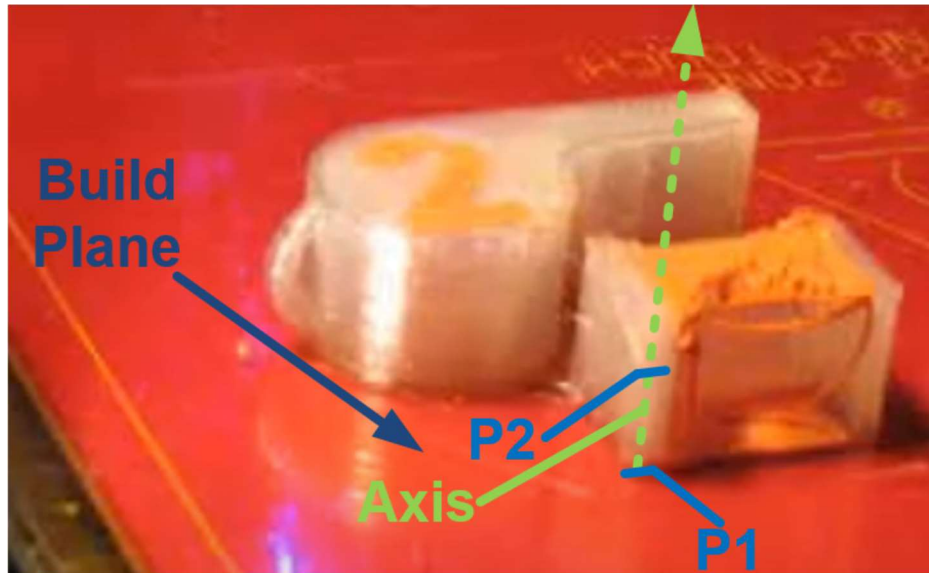


Pet. at 48 (citing EX1007 at Fig. 1 (annotated)); *see also* EX1007, ¶¶17-18; EX1003, ¶174 (“... [Priedeman’s] extruder head 12 must alternate between printing layers of the model 26 and printing layers of the support structure 28 to achieve the multi-material build.”); EX2013, ¶127.

Even if a POSITA made the combination advance by Petitioner, *RepRap* does not teach claim 5’s additional limitation as previously discussed. *Supra* §VIII.G.1; EX2013, ¶128.

Furthermore, Petitioner’s assertion that, based on *RepRap*’s parking space, “a POSITA would have been motivated in implement the resulting purge tower of the *Priedeman-KISSlicer* combination (Ground 2A) ... to advantageously construct a more stable, less top-heavy tower” is unsupported. Pet. at 62. *RepRap*’s parking

space itself is neither “stable” nor a “less top-heavy tower,” as shown by the image below of *RepRap*’s partially collapsed parking space.

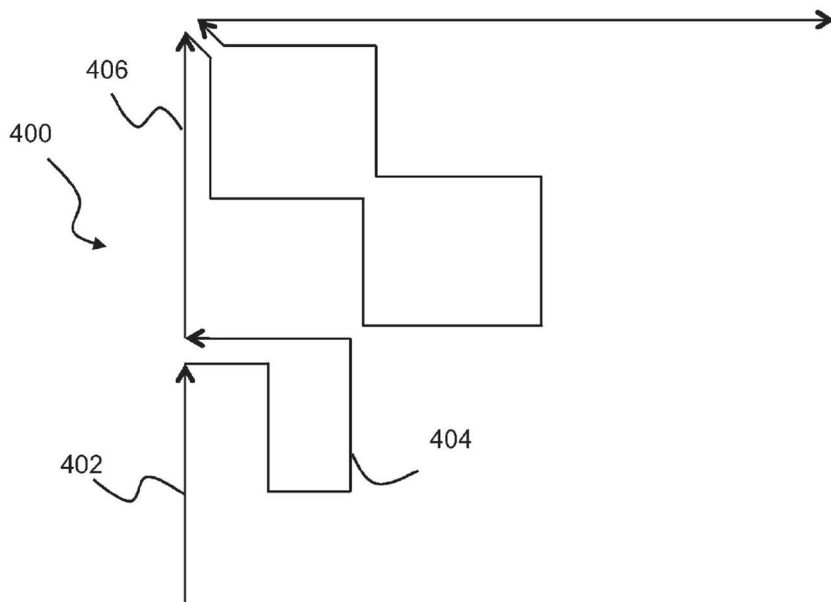


Supra §VIII.G.1 (EX1006 at 5:04 (annotated)); EX2013, ¶129. Thus, Petitioner has also failed to show unpatentability under Ground 2B.

XI. THE PETITION DOES NOT SHOW THAT CLAIMS 1, 2, 6, 7, 9 ARE UNPATENTABLE UNDER GROUND 3

A. Overview of *Boyer* (EX1008)

Boyer relates to multi-color 3-D printing. EX1008 at Abstract, Title; EX2013, ¶81. Figure 4 of *Boyer* shows a cross section of a multi-color object.



Id. at Fig. 4, ¶[0032]. The tool path 400 of the object has first (402), transition (404), and third segments (406). *Id.* The first segment traverses a portion of the object's exterior surface with a first color (e.g., red) and the third segment traverses a different portion of the exterior with a second color (e.g., blue). *Id.* Between the first and third segments is a transition segment 404 that “turn[s] in toward an interior of the object and infill[s] with” a transition between the first and second colors. *Id.*

B. Ground 3 does not anticipate all elements of claim 1

Ground 3 fails to satisfy the exacting standards for anticipation, which require that the reference “disclose all elements of the claim within the four corners of the document” and “disclose those elements arranged as in the claim.” *Net MoneyIN*, 545 F.3d at 1369. Indeed, Petitioner fails to even address the anticipation standard and repeatedly relies on obviousness-style arguments (discussed below) that fall far short of meeting Petitioner's burden to show anticipation. *See* Pet. at 63-77. Because

Petitioner at best only identifies “multiple, distinct teachings that the artisan might somehow combine to achieve the claimed invention,” “anticipation is not proven.” *Microsoft Corp. v. Biscotti, Inc.*, 878 F.3d 1052, 1069 (Fed. Cir. 2017); EX2013, ¶¶130-149.

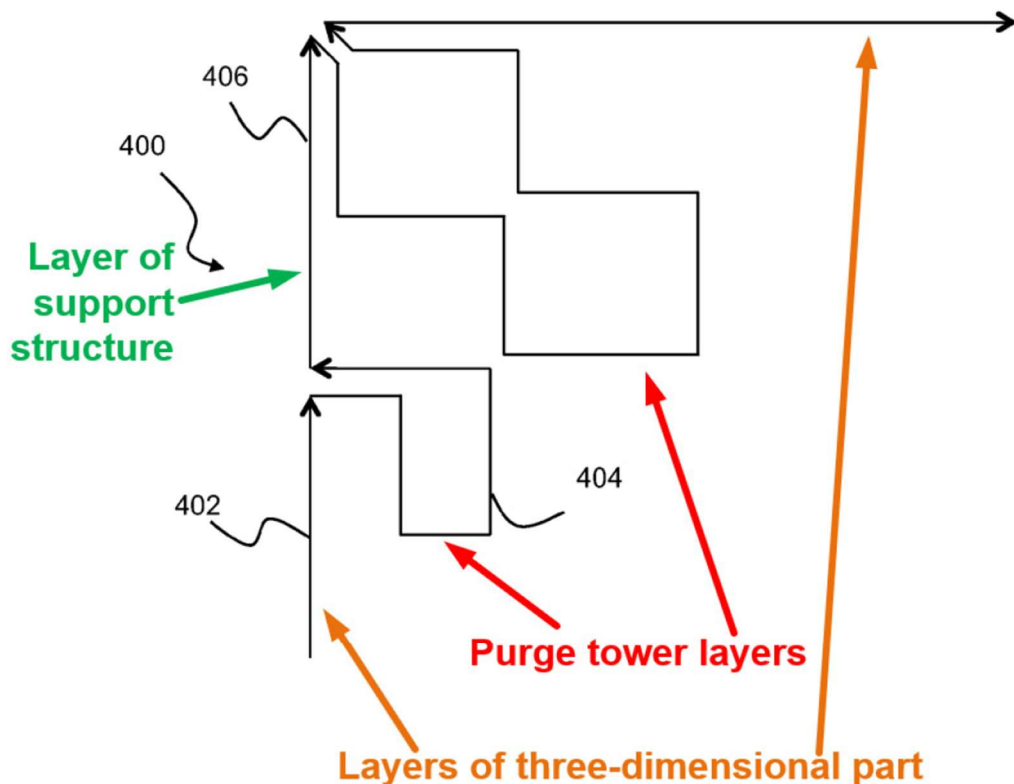
1. Limitation [1a]: “printing layers of the three-dimensional part and of a support structure for the three-dimensional part”

Boyer does not disclose printing layers of the three-dimensional part and support structure in the manner identified by Petitioner. EX2013, ¶132. The sole reference in *Boyer* to “support” structures discloses that “sacrificial support structures may be fabricated from materials that are lower in cost, or that dissolve or break away easily from the main structure of an object.” EX1008, ¶[0044] (cited by Pet. at 65, 70, 73). There is no disclosure in *Boyer* that support material is used to print the transition segment (404) or exterior segments (e.g., first segment 402 or third segment 406) in Figure 4, as Petitioner asserts. *See* Pet. at 72; EX2013, ¶132. As *Boyer* explains, Figure 4 simply shows the use of “multiple build materials to obtain *different colors* on an exterior of an object.” EX1008, ¶[0032].

While the Board noted that “the disclosure of *Boyer* that Petitioner cites is not limited to different colors of material,” and that “the same techniques may be employed to switch between multiple build materials for a variety of other reasons,” *Boyer*’s general teaching of other building materials and “sacrificial support structures” is not sufficient to find claim 1 anticipated. Paper 10 at 24-25. For

anticipation, “it is not enough that the prior art reference discloses part of the claimed invention, which an ordinary artisan might supplement to make the whole, or that it includes multiple, distinct teachings that the artisan might somehow combine to achieve the claimed invention.” *Net MoneyIN*, 545 F.3d at 1371. However, that is exactly what Petitioner offers.

While *Boyer* generally references other building materials and “sacrificial support structures,” it fails to disclose the use of such support structures in the manner proposed by Petitioner. EX2013, ¶¶133-134. Specifically, to establish disclosure of claim 1, Petitioner relies heavily on Figure 4 of *Boyer* and asserts that the POSITA would understand that segment 406 constitutes a “[l]ayer of support structure”:

**Fig. 4**

EX1008, FIG. 4 (annotated).

Pet. at 72. Petitioner has to adopt this interpretation of *Boyer* to find “disclos[ure] of th[e] elements arranged as in the claim,” *Net MoneyIN*, 545 F.3d at 1369, as the claim requires “switching the print heads or deposition line between stand-by modes and operating modes in-between the printing of the layers of the three-dimensional part and the support structure” and “performing a purge operation for each print head or deposition line switched to the operating mode ... wherein the layers of the at least one purge tower are printed from the print head or deposition line switched to the operating mode.” EX1001 at 15:53-58.

However, a POSITA would not understand that segment 406 constitutes a “[l]ayer of support structure.” EX2013, ¶134. Instead, a POSITA would understand from *Boyer* itself that the exterior segments in Figure 4 of *Boyer* (including 406) form the outside or “main structure of the object,” and that such exterior segments cannot be made from sacrificial support structures that “dissolve or break away easily.” See EX1008, ¶[0032], [0044]; see also EX2013, ¶134; EX1001 at 1:50-53. Doing so would compromise the object’s structural integrity and expose the internal infill. EX2013, ¶134. In Dr. Hickner’s own words: “a part is made of part material and a support structure is made of support material.” EX2016 at 110:11–111:1. Here, Boyer explains that segment 406 is a differently-colored portion of the three-dimensional part, not a support structure. EX1008, ¶[0032]. Because segment 406 is a portion of the part, a POSITA would certainly not understand that this very same segment could be printed from a support material instead of part material. EX2013, ¶134. If the part as printed with segment 406 as a differently-colored portion of the part has sufficient support without the need for any support material, then there would be no reason to replace the differently-colored portion of part material with a support material. *Id.*

In addition, if Petitioner’s position discussed below (*see infra* §XI.B.2) is adopted—namely, that subsequent “similar” layers are printed on top of the cross section shown in Figure 4 such that the “purge tower” is printed in a “layer-by-layer”

manner—then the purported support structure 406 would serve no function as it would never contact (and thus provide no support for) the layers of the three-dimensional part. EX2013, ¶135; EX2016 (Hickner Dep. Tr.) at 17:11-20 (“And so the meaning of ‘support structure’ in its plain language is it’s just supporting another section of the [three-dimensional] part.”). Conversely, if the positions of the segments shown in Figure 4 change, then the switch location—and therefore the ‘purge tower’ position—would also change, preventing layer-by-layer construction of a purge tower. EX2013, ¶135. As such, a POSITA would not understand *Boyer* to disclose, explicitly or inherently, that segment 406 is a “support structure for the three-dimensional part” as Petitioner contends. EX2013, ¶¶135-136.

2. Limitation [1c]: “performing a purge operation for each print head or deposition line switched to the operating mode, the purge operation comprising printing at least one purge tower in a layer-by-layer manner ... from multiple print heads or deposition lines”

Petitioner asserts that *Boyer*’s extruder performs “a purge operation by printing transition segment 404” because the extruder will “in some cases, perform a purge operation each time there is a material change where one of the deposition lines transitions from the stand-by mode to the operating mode.” Pet. at 70-72. In Petitioner’s view, layers can be printed above and below the cross-section shown in Figure 4 and thus the transition segments in Figure 4 correspond to purge towers

printed in a layer-by-layer manner. Pet. at 72-73. Petitioner's annotated version of *Boyer*'s figure depicting such "purge tower layers" is reproduced below:

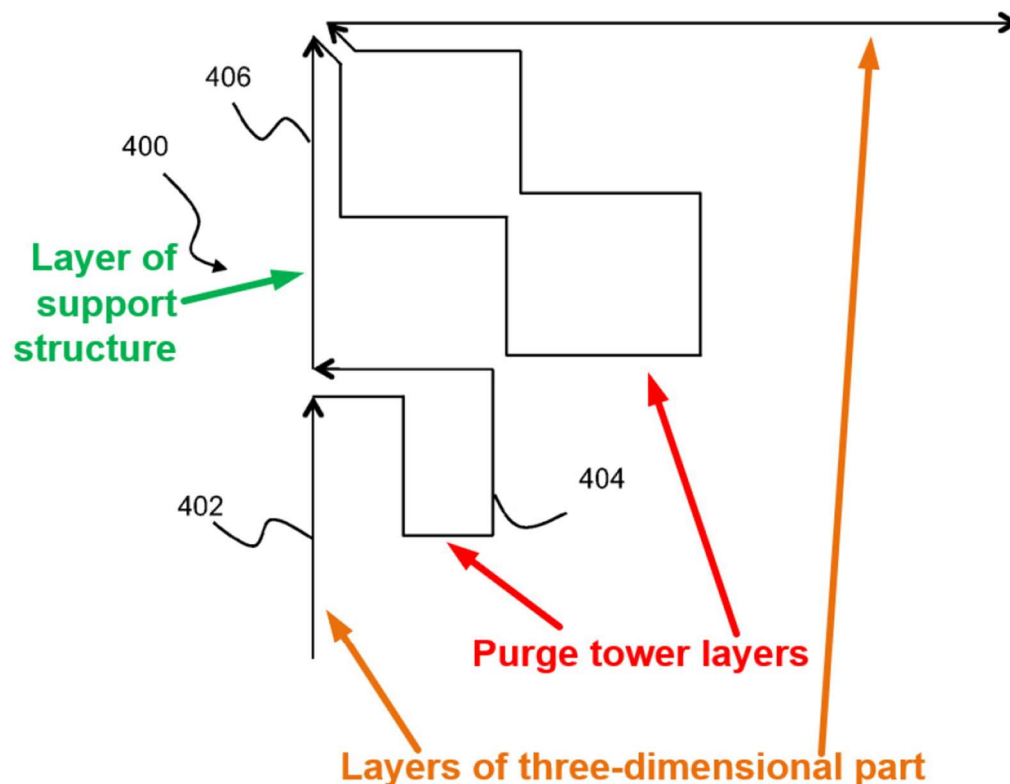


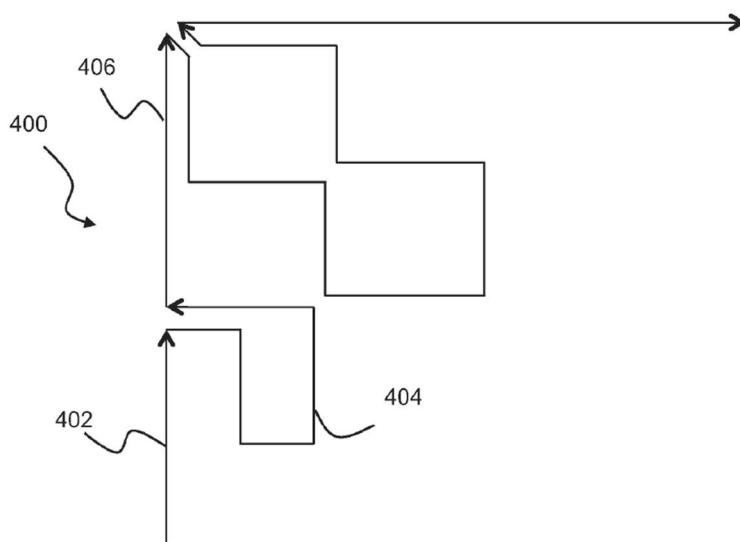
Fig. 4

EX1008, FIG. 4 (annotated).

Pet. at 72. Petitioner further contends that "two-dimensional layers such as the one depicted in FIG. 4 [of *Boyer*] are stacked on top of one another so that the transition segments of FIG. 4 correspond to purge towers printed in a layer-by-layer." Pet. at 73. As explained below, *Boyer* does not support Petitioner's assertions. EX2013, ¶¶137-149.

a) **Boyer does not disclose a purge tower**

Boyer does not describe both a three-dimensional part and “purge tower.” EX2013, ¶138. *Boyer* describes only a single object. Figure 4 of *Boyer* shows “a portion of a tool path [400] using multiple build materials to obtain different colors on an exterior of an object.”



EX1008, Fig. 4, ¶¶[0008], [0032]. The first segment 402 and third segment 406 of tool path 400 traverse portions of the exterior surface of the object and then tool path 400 “turn[s] in toward an interior of the object and infill[s] with a transition segment 404.” *Id.*, ¶[0032]. *Boyer* describes that the first segment is a first color, the transition segment is a mixture of a first and second color, and the third segment is the second color. *Id.* A POSITA would understand that an “infill” like “transition segment 404” is used to “help[] support the sides of the model” and “provide[] enough of a structure for the model to print well and hold up,” (EX1013 at 62, 64), and that

“infill” does not constitute a “purge operation.” EX2013, ¶138; *see* EX2016 at 44:1-11, 56:6-9 (Dr. Hickner stating that he was “not prepared to analyze infill and its correspondence or not to purge operations” even though he was “familiar with the term ‘infill’ in the context of 3D printing” and “a POSITA would understand what infill means in the context of additive manufacturing”). While *Boyer* generally acknowledges that transitional lengths can be positioned on the outside of the object (*see id.*, ¶[0003]), there is no disclosure in *Boyer* that transition segment 404 of the tool path 400 forms a *different object* than the 3D object itself, much less a *purge tower*. EX2013, ¶138.

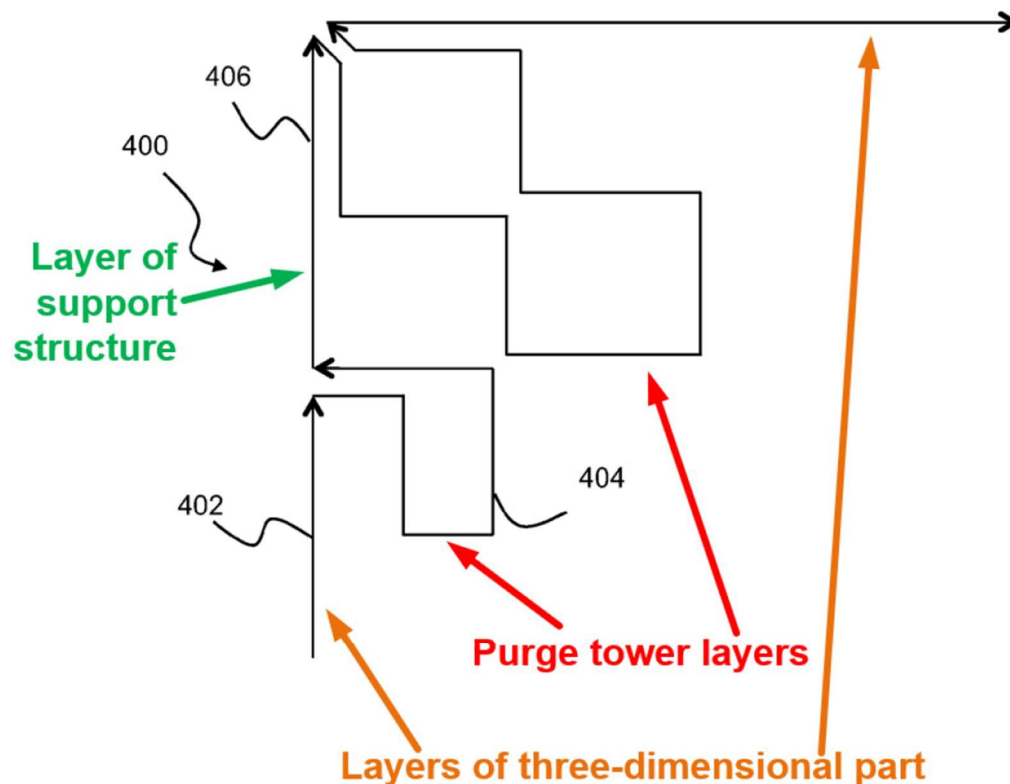
The Board states in the Institution Decision that it is “not persuaded, on the present record, that a purge tower must be a structure that is separate from the object being printed, as opposed to encompassing either a separate structure or a structure printed within the interior of the part.” Paper 10 at 22. However, that the purge tower is separate from the three-dimensional part and support structure is precisely what the claims require—specifically, claim 1 requires “a three-dimensional part,” “a support structure for the three-dimensional part,” and “at least one purge tower.” EX1001, cl. 1. These are all separate and distinct elements. As the Federal Circuit has held, “where a claim lists elements separately, the clear implication of the claim language is that those elements are distinct components of the patented invention.”

Regeneron Pharms., Inc. v. Mylan Pharms. Inc., 130 F.4th 1372, 1379 (Fed. Cir. 2025).

The specification confirms that the “purge tower” is a distinct structure from the “three-dimensional part.” EX2013, ¶139. Indeed, as the Board recognized, “[t]he figures of the ’713 patent all depict the purge tower as a separate structure.” Paper 10 at 22. The specification explicitly states that the purge tower is printed “at any location in the x-y build plane *not occupied by 3D part 20 or support structure 22.*” EX1001 at 8:31-34 (emphasis added). The ’713 Patent further explains that the “[p]urge tower 24 itself may be then recycled or otherwise discarded as desired,” which would not be possible if the purge tower was part of the three-dimensional part. EX1001 at 8:27-28; EX2013, ¶139. Dr. Hickner agreed during deposition that a POSITA would understand the “purge tower” is a “separate physical object” from the three-dimensional part. EX2016 at 64:1-9 (“[T]he part is something that a POSITA, if a POSITA is performing this operation, that’s the desired component that one would take and use. And the purge tower is a separate physical object[.]”); *see also id.* at 28:8-10. That should end the inquiry as *both* sides’ experts agree that a purge tower must be separate from the three-dimensional part and the supposed “purge tower” of *Boyer* is not.

A POSITA would understand that if the purge tower was not a separate and distinct structure from the three-dimensional part and support structure, it would fail

to accomplish its fundamental purpose of allowing a purge operation to occur while mitigating issues inherent in conventional purge operations. EX2013, ¶140. That is especially true in the case of *Boyer* where the purported “purge tower” corresponds to transition segments that contain both the first material and second material. *See, e.g.*, EX1008, ¶[0032]; EX2016 (Hickner Dep. Tr.) at 105:1-5 (“there can be mixing in segment 404”). Such a transition segment, if contiguous with the three-dimensional part as shown in *Boyer*’s Figure 4 below, would adhere to the three-dimensional part and not be easily removed and disposed of without compromising both cosmetic and structural integrity. EX2013, ¶140.

**Fig. 4**

EX1008, FIG. 4 (annotated).

Pet. at 72.

In addition, even if the purge tower could “encompass[] either a separate structure or a structure printed within the interior of the part,” *Boyer* still does not disclose such a purge tower expressly or inherently. EX2013, ¶141. The “purge tower layers” identified by Petitioner are not “a structure printed within the interior of the part” but rather are contiguous with the part itself. *See* EX2016 (Hickner Dep. Tr.) at 107:7-9 (“The start and ends of 402, 404, and 406 are depicted in Figure 4 as in close proximity or touching in Figure 4.”); *see also id.* 107:15-19. Finally, a

POSITA would have recognized that printing a purge tower “within the interior of the part” would not have been advisable due to the reasons elaborated above.

EX2013, ¶141. As such, *Boyer* does not disclose a “purge tower.”

b) *Boyer does not disclose layer-by-layer printing of a purge tower*

Boyer does not disclose printing transition segment 404 “in a layer-by-layer manner” for multiple layers of a purge tower, as Petitioner asserts. *See* Pet. at 73; EX2013, ¶¶142-143. *Boyer* simply says that one can “position different segments,” including transition segments, “at suitable locations along a tool path in order to achieve specific colors (or more generally build materials) at specific locations.” EX1008, ¶[0033]. A POSITA would not understand *Boyer* to disclose that the transition segments are stacked on top of each other “in a layer-by-layer manner” to create a purge tower. EX2013, ¶143.

In the Institution Decision, the Board stated that: “Petitioner cites to evidence of record that a person of ordinary skill in the art would have interpreted *Boyer*’s disclosure to include stacked layers above and below those shown in Figure 4, including in the transition segments.” Paper 10 at 23 (citing Pet. 73). In support, the Board identified “the testimony of Dr. Hickner that, ‘[b]y describing tool path 400 as a “cross section” of a multi-material build, *Boyer* teaches that layers printed using a similar two-dimensional tool path can exist above and/or below FIG. 4’s cross section.’” Paper 10 at 23 (quoting EX1003, ¶237).

However, Dr. Hickner's explanation is insufficient to support finding that *Boyer anticipates* claim 1. In contrast with obviousness, "[a]nticipation requires that a single prior art reference disclose each and every limitation of the claimed invention, either expressly or inherently." *SRI Int'l, Inc. v. Cisco Sys., Inc.*, 930 F.3d 1295, 1306 (Fed. Cir. 2019). While Dr. Hickner concludes that "layers printed using a similar two-dimensional tool path can exist above and/or below FIG. 4's cross section," (EX1003, ¶237) that does not constitute an express or inherent disclosure that the transition layers are actually printed on top one another in a layer-by-layer manner. EX2013, ¶¶144-145. Indeed, during his deposition, Dr. Hickner admitted that "a POSITA would understand that Figure 4 shows one layer of a cross-section;" but "there's different cross-sections of a three-dimensional object depending on the height." EX2016 at 101:5-19; *see also id.* at 118:17-20 ("there are different cross-sections of three-dimensional parts. And so the arrangement of segments 402, 404, and 406 could be different in different examples."). As the Federal Circuit has explained, "[t]he possibility of [an element being met] does not legally suffice to show anticipation." *MEHL/Biophile Int'l Corp. v. Milgraum*, 192 F.3d 1362, 1365 (Fed. Cir. 1999) ("Inherency...may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient."). Indeed, *Boyer* itself recognizes that the "transition segment" can be placed in a variety of locations other than that shown in Figure 4,

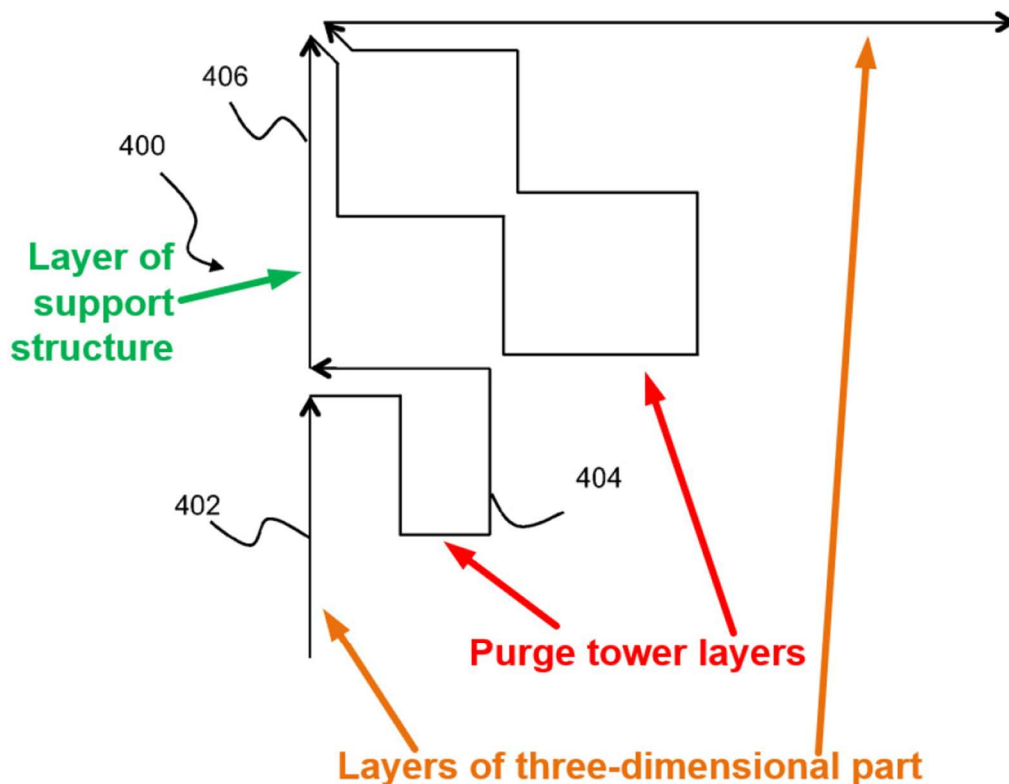
including “an excursion outside an exterior of the object, or along infill structures, or between the infill in interstitial void space.” EX1008, ¶40; *see also id.*, ¶¶34, 39; EX2013, ¶145. Even Dr. Hickner appears to recognize this as he merely says that “*similar* two-dimensional tool path[s] can exist above and/or below FIG. 4’s cross-section.” EX1003, ¶237. However, *similar* tool paths in successive layers do not expressly or inherently disclose “printing at least one purge tower in a layer-by-layer manner.” EX2013, ¶145. As Dr. Hickner admitted during deposition, nothing in *Boyer* teaches that the exact same layer shown in Figure 4 is repeated for any other layers. EX2016 at 101:1-19.

C. Ground 3 does not disclose claim 6’s additional element

Boyer also does not disclose claim 6’s requirement that “the at least one purge tower is stopped at a highest layer at which there is a material change for the printed layers of the three-dimensional part and support structure.” EX2013, ¶¶146-149. Petitioner contends that “[b]ecause Boyer discloses that the printer deposits a transition segment in response to each material change, this means that the printer stops printing transition segments (and therefore stops printing the purge tower) at the highest layer at which there is a material change” Pet. at 75. However, a POSITA would not understand “the printer stops printing transition segments ... at the highest layer at which there is a material change” (Pet. at 75) to disclose that “*the at least one purge tower* is stopped at a highest layer at which there is a material

change for the printed layers of the three-dimensional part and support structure.” EX2013, ¶148. Notably, when asked during his deposition about this claim, Dr. Hickner stated that he “didn’t analyze Boyer in the context of the final material change.” EX2016 at 120:7-12.

As previously discussed, *Boyer* teaches that the “transition segment” can be placed in a variety of locations other than that shown in Figure 4. EX1008, ¶40; *see also id.* ¶¶34, 39. In addition, *Boyer* teaches using multiple transition segments even within the same layer:

**Fig. 4**

EX1008, FIG. 4 (annotated).

Pet. at 72. As such, *Boyer* does not disclose that the transition segment at a highest layer where there is a material change will be printed on top of an existing set of transition segments that have been printed in a layer-by-layer manner. EX2013, ¶149. The mere possibility that something could occur is not sufficient to show explicit or inherent disclosure. *MEHL/Biophile*, 192 F.3d at 1365.

XII. CONCLUSION

For the foregoing reasons, Patent Owner respectfully requests that the Board reject Petitioner's unpatentability challenges against the '713 Patent.

Respectfully submitted,

Dated: September 10, 2025

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CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), I certify that this Response complies with the type-volume limits of 37 C.F.R. § 42.24(b)(1) because it contains 13,985 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 Response.

Dated: September 10, 2025

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR § 42.6(e)(4), the undersigned certifies that on September 10, 2025, a complete copy of the foregoing Patent Owner's Response was served on Lead and Back-up Counsel for Petitioner at the service address provided in Petitioner's Mandatory Notices:

Email: IPR56224-0005IP1@fr.com

Dated: September 10, 2025

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