

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SHENZHEN TUOZHU TECHNOLOGY CO., LTD.,
Petitioner,

v.

STRATASYS, INC.,
Patent Owner.

Case IPR2025-00321
Patent 9,421,713

SECOND DECLARATION OF DR. MICHAEL HICKNER

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I, Dr. Michael Hickner, declare as follows:

I. INTRODUCTION AND SCOPE OF WORK

1. On December 17, 2024, I submitted a First Declaration in IPR2025-00321. *See* EX1003. I submit this Second Declaration for purposes of responding to Patent Owner's Response to Petition (POR) submitted on September 10, 2025, the declaration testimony of Dr. Osswald (EX2013), the declaration testimony of Mr. Larson (EX2013), and the declaration testimony of Mr. Leavitt (EX2015). In this Second Declaration, I provide additional analysis regarding the claims of U.S. Patent No. 9,421,713 (the '713 Patent) and the relied-upon prior art references.

2. My analysis is based upon my education, training, and experience in the relevant field, including my professional experience and additional experience working with persons of ordinary skill in the art as of the earliest alleged priority date of the '713 Patent. I am familiar with the technology described in the '713 Patent, and I am also familiar with the knowledge of a person of ordinary skill in the art (POSITA) with respect to this technology as of the earliest alleged priority date of the '713 Patent (Mar. 8, 2013).

3. I am being compensated for my work in connection with this IPR proceeding at my standard hourly rate. My compensation is not in any way contingent on the substance of my opinions or the outcome of these proceedings.

II. EXPERIENCE AND MATERIALS CONSIDERED

4. My analysis set forth in this Second Declaration is based on my education, training, and experience as summarized in my First Declaration and detailed in my CV (*see* EX1003), as well as my review of the '713 Patent, its prosecution history, and the prior art references relied-upon in this PGR proceeding. I have also reviewed the Patent Owner's Preliminary Response to the Petition (POPR), the Patent Owner's Response to Petition (POR), each of the accompanying exhibits submitted with the POPR and POR, the Board's Decision Instituting IPR ("Institution Decision"), and the deposition transcripts of Dr. Osswald (EX1025), Mr. Larson (EX1029), and Mr. Leavitt (EX1030).

III. TECHNICAL DISCUSSION

5. The analysis provided in my First Declaration fully addresses why each and every feature of the Challenged Claims of the '713 Patent is provided in the prior art. I understand that Patent Owner and Dr. Osswald have considered my analysis and offered their own proposals, some of which are inconsistent with my analysis. I will address some of those points below. The fact that I do not address all the opinions of Patent Owner and Dr. Osswald should not be interpreted as agreement with them.

6. I have noted that the POR does not address, much less rebut, much of the analysis I provided in my First Declaration. Indeed, rather than squarely

confronting the substantial evidence of unpatentability offered in my First Declaration, Patent Owner and Dr. Osswald sometimes mischaracterize my testimony, the disclosure of the '713 Patent, and the cited prior art. As I previously explained with reference to the applied prior art, each of Grounds 1-3 renders obvious the Challenged Claims. I need not repeat that analysis here. Rather, this declaration is intended to respond to particular arguments presented in the POR and the testimony of Dr. Osswald, Mr. Larson, and Mr. Leavitt, including testimony from the declarations submitted with Patent Owner's briefing (EX2010, EX2011, EX2013, EX2014, EX2015) and testimony provided during depositions (EX1025, EX1029, EX1030).

IV. CLAIM CONSTRUCTION

A. Petitioner clearly identified which proposed claim constructions apply to each ground

7. In my first declaration, I identified a "first construction" and an "alternative construction" for the term "printing layers...from multiple print heads or deposition lines" (element [1a]). Pet. 6.; EX1003, ¶¶33-35. I have explained exactly which grounds apply to each construction. Pet. 6. It is clear from my first declaration that if the Board adopts the first construction grounds 1-2B are applicable and if the Board adopts the alternative construction all the grounds are applicable. There is no ambiguity in this position, and I have explained that if the Board decides

to use the first construction, ground 3 would fail, but if the Board decides to use the alternative construction, ground 3 should succeed.

B. The purge tower need not have no contact with the part (Elements [1a] and [1c])

8. Stratasys seeks to improperly inject unclaimed limitations into Element [1c] by demanding that the at least one purge tower *have no physical contact with* the three-dimensional part or the support structure. *See e.g.*, POR, 62-63, 92-93. Element [1c] never requires that the at least one purge tower be in physical contact with the three-dimensional part, and nothing in the claims or specification indicate that importing such a limitation into Element [1c] is proper.

9. Stratasys and Dr. Osswald identify no portions of the specification, prosecution history, or any other intrinsic or extrinsic evidence that would support reading such an unrecited limitation into the claims. Nor could they, because such evidence does not exist in the record. The claims simply do not require that the purge tower must have no physical contact with the three-dimensional part, and PO and Dr. Osswald have not indicated any portion of the claims that they consider to provide such a requirement. The mere fact that the “purge tower” is recited independently of the “three-dimensional part” does not mean that the claims prohibit any physical contact between the two. Indeed, the “three-dimensional part” is recited separately from the “support structure” yet Stratasys’s expert has stated that those two elements will generally be in physical contact. EX1025, 35:18-36:2; 36:21-37:6;

106:9-13 (admitting that claim 1 does “allow for physical contact between the three-dimensional part and the support structure”). Stratasys and Dr. Osswald have identified no reason for their position that the purge tower cannot have any physical contact with the three-dimensional part or support structure although they concede that the three-dimensional part and support structure often do have physical contact with one another.

10. The '713 Patent explains that “purge tower 24 may be printed at *any suitable free location* on build substrate 44 (i.e., at *any location* in the x-y build plane not occupied by 3D part 20 or support structure 22).”¹ EX1001, 8:30-38. There is no disclosure in the specification that the x-y location of the purge tower is prohibited from being adjacent to or otherwise in contact with the three-dimensional part so long as the purge tower *does not overlap with the footprint of the three-dimensional part and support structure*. That is, the '713 Patent's disclosure encompasses an example where the purge tower is immediately adjacent to the three-dimensional part or support structure such that there is physical contact, but the purge tower does not occupy the footprint of the three-dimensional part/support structure and vice versa. Nothing in the '713 Patent's specification precludes the purge tower from being in physical contact with the three-dimensional part or support structure at all. The mere fact that the '713 Patent describes some examples where physical contact

¹ All emphasis added unless otherwise noted.

is not present does not negate the fact that the '713 Patent does not require no physical contact.

V. Ground 1: Obviousness based on Leavitt in view of RepRap (Claims 1, 2, 5-7, 9, 16, and 17)

A. A POSITA Would Have Been Motivated to Combine Leavitt, RepRap Article, and RepRap Video

11. In my first declaration, I provided multiple distinct motivations to combine Leavitt, RepRap Article, and RepRap Video. Pet., 12-16; EX1003, ¶¶52-57. A POSITA would have been prompted to apply RepRap to Leavitt at least for the reasons discussed in the Petition and my first declaration. *Id.* Stratasys and Dr. Osswald made several allegations that the proposed combination or the motivations that I discussed in my first declaration are deficient. POR, 53-57; EX2013, ¶¶86-95. I disagree, and I will respond to the arguments of Stratasys and Dr. Osswald in more detail below.

12. Stratasys first contended that that the oozed material *would not have an inconsistent texture* as compared with other material that does not ooze out of the nozzle. POR, 53-54; EX2013, ¶¶86-88. To be clear, material that oozes from an idle nozzle in Leavitt's printer and material extruded from an active nozzle *would not have the same texture* because the oozed material outside of the nozzle cannot maintain or be reheated to the same temperature as material extruded when the nozzle is active. Dr. Osswald testified that this oozed material would remain on the

exterior of the extruder tip, further away from the heat source as compared with material that remains within the nozzle close to the heat source. EX1025, 21:23-22:10 (“It stays there on the tip.”). I agree with Dr. Osswald’s opinion here and submit that because the oozed material is more removed from the heat source than material within the nozzle, the oozed material does not maintain the same temperature as the material within the nozzle, leading to inconsistent texture. Applying RepRap’s suggestion to prime the nozzles would prevent the oozed material of inconsistent temperature from being deposited on the part and ensure that only material actively being extruded is deposited. This would provide greater consistency as compared with depositing oozed material directly onto the part.

13. Dr. Osswald also claimed that Leavitt’s technique for raising and lowering the deposition lines “solves the problem” relating to the oozed material so that a POSITA would not have looked to RepRap for a solution. POR, 54-55; EX2013, ¶88. I disagree with Dr. Osswald’s opinion here. Leavitt would actually result in a POSITA seeking **additional solutions** to the oozing problem. For example, Leavitt makes it clear that raising an inactive nozzle “**reduces** the risk that the residual support material comes into contact with the layer” of the three-dimensional part, but that raising the inactive nozzle **does not eliminate the risk**. EX1004, [0032]; EX1025, 26:13-17. What’s more, Leavitt’s process of raising an idle deposition line **does absolutely nothing to prevent oozing** from occurring in the

first place. Raising an idle deposition line does not prevent material from oozing from the nozzle at all, but does reduce a likelihood of the oozed material contacting the three-dimensional part because the idle nozzle is raised above a level at which the active nozzle is extruding material onto the part. Raising the idle nozzle as disclosed by Leavitt therefore manages the consequences of oozing without addressing the root cause of these consequences—the oozing itself.

14. Because Leavitt's raised nozzle (1) does not prevent oozing from occurring at all, and (2) reduces but does not eliminate the risk of oozed material coming into contact with a layer of the three-dimensional part or support structure, a POSITA would be even more motivated to look to other references that describe additional solutions for managing the oozed material. These include solutions for preventing oozing in the first place (which Leavitt does not provide) and solutions for decreasing even more the likelihood of oozed material coming into contact with the three-dimensional part or support structure. RepRap Article and RepRap Video are two such references that a POSITA would look to. RepRap Article, for example, explains that "[l]owering the temperature of the idle extruder while it is not needed...helps to deal with leaking." EX1005, 1. This solution disclosed by RepRap Article would prevent oozing from occurring or decrease an extent of oozing that occurs, because the lowered temperature would result in a lower likelihood that residual material leaks out of the nozzle. As such, Leavitt does not teach away from

considering solutions in other references because even though Leavitt's printer reduced the risk of defects, application of RepRap's purge tower teachings to Leavitt would have reduced the risks of defects even more. EX1003, ¶53.

15. In my first declaration, I explained that a POSITA would have been motivated to combine Leavitt, RepRap Article, and RepRap Video because doing so would be more time efficient than alternative options for purging and cleaning the nozzles. Pet., 13; EX1003, ¶54. I explained that implementing Leavitt's system to print a purge tower like the one described in RepRap would be more time efficient than using a purge bucket, which requires additional movement of the extruder to reach the purge bucket and therefore adds time to the print operation. *Id.* In his declaration, Dr. Osswald erroneously argued the opposite—that RepRap's purge operation **slows down** the printing process, thus discouraging a POSITA from implementing Leavitt's printer with RepRap's purging process. EX2013, ¶90; POR, 55. In doing so, Dr. Osswald takes RepRap's statements out of context and ignores that fact that all purge operations add time to the printing process.

16. In RepRap, it is apparent that printing the "parking space" is not inherently what "slows down the print," but rather the *act of switching extruders* creates a need for a purge operation and causes the slowdown. EX1005, 1. This means that *any printer* that switches between two different extruders to deposit two different materials would exhibit the same slowness described in RepRap, due to the

fact that switching between materials creates a need for a purge operation to prime the extruders and establish a consistent flow of material before printing again. EX1025, 33:9-34:10, 48:16-50:5; POR, 54-55 (“Stratasys admits that “[u]sing purge operations to ‘prime’ the extruders in general was already known in the art” and RepRap describes a specific purge operation that would result in faster printing as compared with other purge operations such as a purge bucket). POR, 54-55; EX1003, ¶54. Moreover, quality of the three-dimensional part is highly valued in three-dimensional printing, and a POSITA would consider implementing features that improve an overall finished quality of the build even if those features create inconveniences in other areas. For example, a purge operation that involves cooling an idle extruder and priming an extruder when it heats back up again before printing the part (as disclosed in RepRap Article and RepRap Video) would be a perfectly reasonable solution to a POSITA even if this purge operation adds time to the build process. This is because preventing oozing and priming to establish consistent flow would result in a significantly improved build quality, which a POSITA would value highly. Even if these techniques add some time to the build process, a POSITA would consider implementing these steps because of the significant quality improvements that would result.

17. In my first declaration, I explained that implementing Leavitt’s system with RepRap Article’s suggestion to lower the temperature of an idle extruder would

decrease a likelihood of material leaking from the idle extruder, and a POSITA would have been motivated to combine Leavitt and RepRap for this reason. Pet., 13-14; EX1003, ¶55. Dr. Osswald disagreed, stating categorically that “polymers...would not ‘leak’ or ‘drip’ from the extruder head onto the part *because of their high viscosity and surface tension*.” EX2013, ¶¶92-93; POR, 56; EX2015, 21:23-22:2. In other words, Dr. Osswald flatly rejected the idea that leaking and dripping from idle extruder would be a concern at all. Dr. Osswald acknowledged that the Priedeman reference discloses a scenario where material drains “uncontrollably from the liquefier into the build envelope,” but insisted that this scenario disclosed by Priedeman is not “something that is gonna happen.” EX2025, 25:9-26:3. But Dr. Osswald did not offer any explanation for why Stratasys’ own patent describes oozing in this way (which he claims is not possible). Such an explanation does not appear to exist, because multiple references in the record and additional references from around the time of the ’713 Patent reveal that not only was leaking from idle extruders a problem, but it was a **common problem** that many in the industry pursued solutions to address.

18. One such reference describes this problem almost exactly as I explained in my first declaration, namely that “when an active print head is made inactive, the filament in the heated nozzle continues to flow, drip, hang, or otherwise accumulate at the print head” and “the deactivated print head drips, leaks, or otherwise applies

undesirable filament material on the 3D object being printed.” EX1034, 2:43-3:3. Multiple other references describe the issue of dripping from idle nozzles. EX1033, 8:33-39 (describing techniques for limiting temperature to “avoid dripping”); EX1007, (“...materials will drain uncontrollably...‘ooze’”). It is clear to me, therefore, that Dr. Osswald’s categorical opinion that leaking and dripping does not occur from 3D printing nozzles does not reflect the actual experience of people in the 3D printing industry. Multiple industry players have described this very problem and proposed solutions for the problem in patent applications and other documents. I have witnessed such leaking and dripping from idle 3D printing nozzles myself in many instances, so I know from firsthand experience that leaking and dripping are common occurrences that many in the industry have experienced and strive to address. Leavitt is therefore no different from the many references that describe dripping and leaking and my own experience with such occurrences. Because Leavitt expressly discloses that material “may potentially ooze” from the nozzle, it is clearly possible for material to drip from the nozzle onto the build plane. EX1004, [0032].

19. The only evidence that Dr. Osswald cites in support of his opinions regarding leaking and dripping from 3D printer nozzles includes his own textbook, *Understanding Polymer Processing*. See EX2018. In his declaration, Dr. Osswald referred to several pages of this text as allegedly supporting that “inertial effects contributing to flow are negligible.” EX2013, ¶92 (citing EX2018 at 192, 193, 199,

226, and 260). Dr. Osswald's text describes inertia, viscosity, and their relation to each other but no part of this text explains that it is impossible for material to leak or drip from an idle extruder on a 3D printer. The text never mentions the terms "three-dimensional printer," "3D printer," or "deposition line." Beyond providing cursory cites to pages of the text, Dr. Osswald offered no explanation for why his text supports his position that dripping and leaking from a 3D printer nozzle is impossible. Nor could he, because as described above it is clear that leakage and dripping are common problems that were described by multiple different players in the 3D printing industry around the time of the '713 Patent.

20. A POSITA would have applied RepRap's purge operation to Leavitt to properly ready nozzles for printing by "establish[ing] the consistent flow of plastic." EX1005, 1; Pet., 14; EX1003, ¶56. It does not matter that other purging options such as purge buckets existed (POR, 56-57) at the Critical Date of the '713 Patent. This would not have dissuaded a POSITA from implementing Leavitt's printer with RepRap's suggested purge operation. Just because other possible solutions exist does not mean that it would not have been obvious to pursue a given solution.

B. The Leavitt-RepRap Combination Provides Element [1c].

21. As I described in my first declaration, the *combination* of Leavitt, RepRap Article, and RepRap Video provides every element of Element [1c]. Pet. 16-28, EX1003, ¶¶60-84. Stratasy's argued on numerous occasions in the POR that

Ground 1 should fail because RepRap Article and RepRap Video fail to disclose a limitation of Element [1c], without considering Leavitt at all. POR, 59 (“There is no disclosure or teaching in the RepRap Article that the parking space is printed in a layer-by-layer manner”), 59 (“when the RepRap STL files represented by EX1014 and EX1015 are merged together, it becomes clear that multiple layers contain multiple materials”), 62 (“the RepRap Video illustrates that there are many strings of orange-colored material all across the object”), 63 (“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.”). In so doing, Stratasys completely ignores the fact that the *combination* of Leavitt, RepRap Article, and RepRap Video provides all the elements of claim 1, and Petitioner does not rely only on the purge tower as depicted and described in RepRap.

22. It is clear that when the combination is properly considered, the Leavitt-RepRap combination provides “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,” as recited by Element [1c]. Pet., 24-28; EX1003, ¶¶76-86. Furthermore, many aspects of Element [1c] that Stratasys alleged are not disclosed by RepRap are indeed disclosed by RepRap, whether or not the combination with Leavitt is considered.

23. Dr. Osswald alleged in his declaration that “[t]here 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.” EX2013, ¶97. POR, 59. I strongly disagree with Dr. Osswald’s opinion here. RepRap Article describes a “dual extruder printing” system. EX1005, 1. This dual extruder printing system switches between two different materials, one material deposited by one extruder (“extruder 0”) and another material deposited by another extruder (“extruder 1”). *Id.* To switch between materials, the printer transitions between depositing the first material using extruder 0 and depositing the second material using extruder 1. *Id.* This means that extruder 0 sits idle while extruder 1 is actively printing, and vice versa. RepRap Article explains that the temperature of an idle extruder is lowered while it is not needed and restored “when it is time to start printing with that extruder again,” an action that “helps deal with leaking.” *Id.* To manage the effects of changing temperatures, the printer described by RepRap Article prints a “parking space” to prime an extruder “after the temperature change” and “before printing the actual object.” This means that the printer of RepRap does print the parking space in a layer-by-layer manner where the layers are printed from the extruder that is switched to the operating mode.

24. In addition to the clear disclosure provided by RepRap Article that the parking space is printed “layer-by-layer,” it is apparent that the parking space would

need to be printed in a layer-by-layer manner because of how three-dimensional printing works in practice. Three-dimensional printing is accomplished by depositing build material. To build a three-dimensional part, multiple layers of build material need to be deposited on one another in many cases to ensure that the object has an appropriate height. As the object grows in height, it follows that the height of the purge tower grows as well. This makes it so that a nozzle does not have to adjust its position on the z-axis to perform a purge operation and then proceed to print the three-dimensional part or support structure. My opinion here is supported by the fact that RepRap's parking space is depicted as having a height that is similar to the height of the three-dimensional part being printed. This ensures that at any point when an extruder comes online to print the three-dimensional part, the extruder can first perform a purge operation without adjusting its z-axis position.



EX1006, 5:04 (annotated).

25. In the combination of Leavitt and RepRap, it even more clear that a purge tower being printed in a “layer-by-layer manner” by the print head or

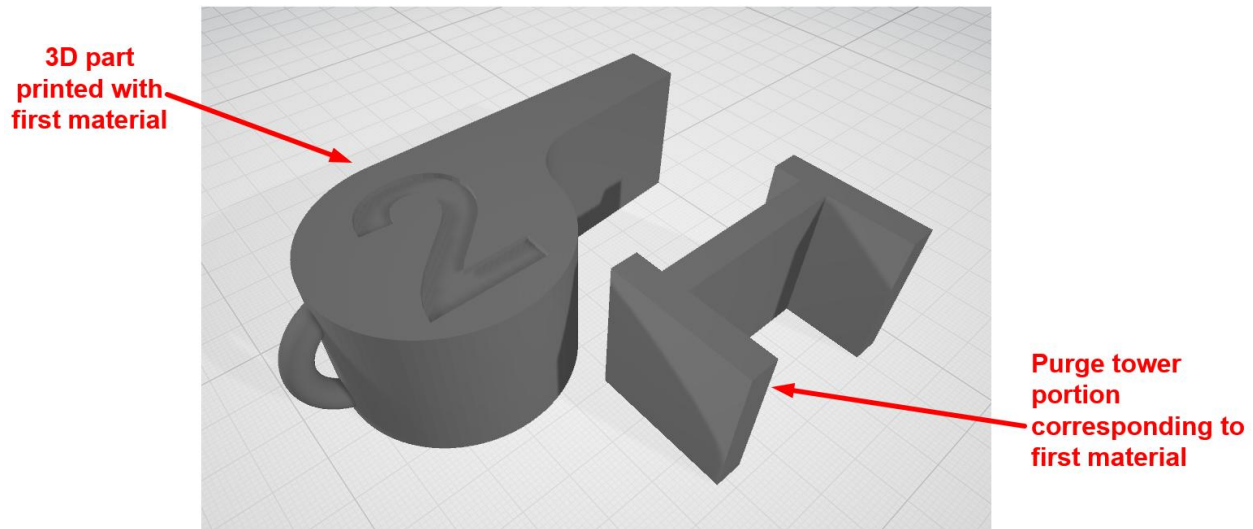
deposition line switched to the operating mode. Leavitt explains that extrusion head 18 toggles between depositing a build material to print a **three-dimensional part** and depositing a support material to print **support structure**. EX1004, [0022]-[0024]. Leavitt explains that this printing is done “on substrate 14 in a layer-by-layer manner.” *Id.* The layer-by-layer nature of the build is described by Leavitt in detail. First, “extrusion head 18” can “deposit the build material in a sequence of roads to form a layer of 3D object 20.” *Id.* After this, “extrusion head 18 then toggles to the support state, which allows extrusion head 18 to deposit the support material,” which can “vertically support subsequent layers of deposited build and/or support materials.” *Id.* This process can be “repeated until each layer of 3D object 20 and support structure 22 are complete. *Id.* This disclosure of Leavitt makes it clear that the extrusion head builds the part and support structure layer-by-layer according to an additive manufacturing process where deposition lines transition between the stand-by mode and the operating mode. This means that when Leavitt’s extrusion head is implemented with RepRap’s suggestion to perform a purge operation “before printing the actual object after the temperature change” to bring a deposition line into the operating mode, extrusion head prints a purge tower “in a layer-by-layer manner.” The layers of this purge tower “are printed from the print head or deposition line switched to the operating mode,” because just as RepRap explains the purge operation is done to prime an extruder before printing the actual object.

26. Dr. Osswald claimed that RepRap's parking space is deficient for providing certain claim 1 limitations relating to the purge tower and purge operation. POR, 62-64; EX2013, ¶¶101-103. These deficiencies alleged by Dr. Osswald and Stratasys do not preclude RepRap from providing the limitations of Element [1c]. For instance, Dr. Osswald noted that in the parking space depicted in RepRap Video, "clumps of material" exist on the top layer of the parking space and "strings of orange material" are located near areas of white material. *Id.* Neither of these features prevent the Leavitt-RepRap combination from providing "at least one purge tower in a layer-by-layer manner...printed from the print head or deposition line switched to the operating mode" as recited by Element [1c], because clumps, strings, and other imperfections in a final printed purge tower are not inconsistent with printing the purge tower in a "layer-by-layer" manner. Imperfections are common in 3D printing, especially on parts such as a purge tower that are meant to be sacrificed after the build is complete. RepRap Article plainly discloses techniques to "prime" an extruder "after a temperature change" to transition the extruder to the operating mode. When Leavitt's extrusion head 18 is implemented with RepRap's suggestion to purge, the extrusion head prints a purge tower in a layer-by-layer manner as described in claim 1, regardless of whether clumps and strings are present on the purge tower after the print is complete.

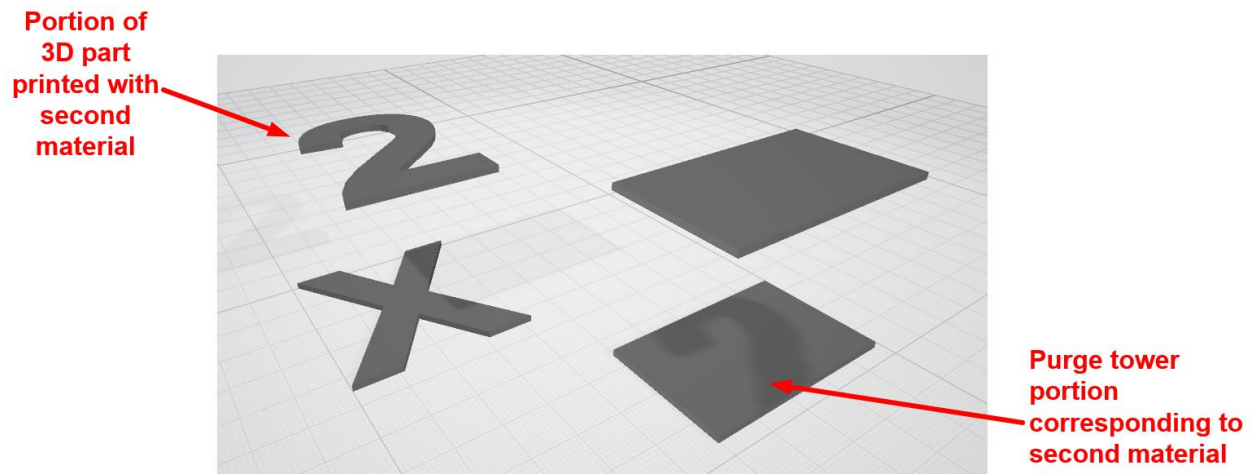
27. Stratasys asserts that RepRap's parking space serves "two purposes" including (1) "to plug the nozzles while the temperature changes" and (2) "to 'prime' both extruders to 'establish the consistent flow of plastic'". POR, 59; EX2013, ¶97. However, this does not mean that the parking space includes "leakage" from the plugged nozzles as Stratasys claims. *Id.* Rather, the nozzle plugging is achieved by cooling the temperature of the idle nozzles, and the priming is achieved to "establish the consistent flow of plastic" after an idle nozzle is re-heated. Even if leaking from idle nozzles did occur in the RepRap printer, this would not negate RepRap's express disclosure of printing layers of the parking space "before printing the actual object." EX1005, 1. The claims are not limited to printing a purge tower that serves only one function.

28. The "clumps of material" and the "strings of orange material" that Stratasys claims are visible on the parking space depicted in the RepRap Video do not negate the clear disclosure of RepRap Article that the parking space is printed in a layer-by-layer manner. POR, 62; EX2013, ¶101. These alleged "clumps" and "strings" of material are simply the result of a layer of orange material being printed over an area of the parking space that is not supported by other layers of material. The orange layer includes a portion that overhangs empty space. As a result, part of this top layer of orange material falls into the open space, and the unstable nature of the top orange layer leads to formation of the clumps. Nothing about this means that

the parking space depicted in RepRap is not printed layer-by-layer. The STL files for the parking space and three-dimensional part of RepRap demonstrate that the top orange layer is partially printed over empty space:



EX1014, 1 (annotated)



EX1015, 1 (annotated).

29. At least part of the top, orange layer is printed over a layer of translucent material and therefore the parking space is printed in a layer-by-layer manner.

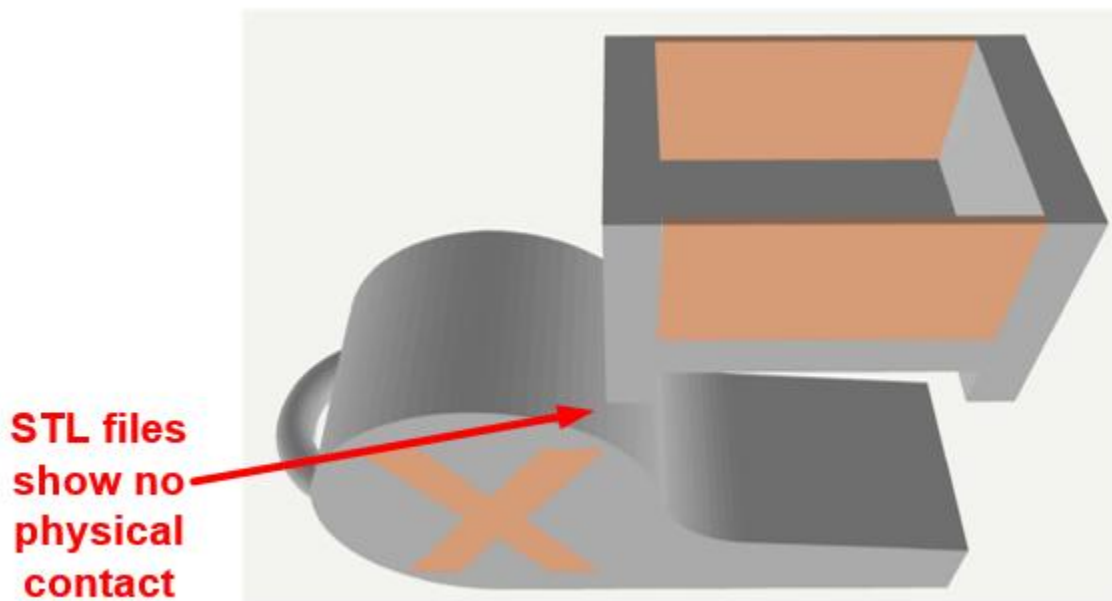
30. Many arguments of Dr. Osswald and Stratasys depend on an assertion that a “physical connection between whistle and parking space” exists, and this connection disqualifies the parking space as a purge tower. Stratasys argued that the RepRap does not providing the claimed parking space because of the alleged contact between the parking space and the object. POR, 62-64; EX2013, ¶¶101-103. As an initial matter, there is no requirement in claim 1 that the purge tower and three-dimensional part have no physical contact with one another. *Supra*, §IV.B. It is possible for two objects to be distinct but have physical contact with one another. This occurs in numerous contexts that I can think of. For example, Kuala Lumpur’s Petronas Towers have *two separate towers*, even though a skybridge exists between the towers 170 meters above the ground. EX1036, 1. The fact that the skybridge exists does not negate the fact that the towers are separate and distinct from one another. For two objects to be distinct does not require the objects to have no physical contact.

31. Dr. Osswald’s opinion that “a POSITA would not have considered a structure physically connected to the print object...to teach the claimed purge tower” appears to be central to Stratasys’ erroneous argument that the purge tower cannot have physical contact with the three-dimensional object and support structure. POR, 63; EX2013, ¶101. I disagree with Dr. Osswald’s opinion here. As I described above, an object can qualify as a “purge tower” even if the object shares physical contact

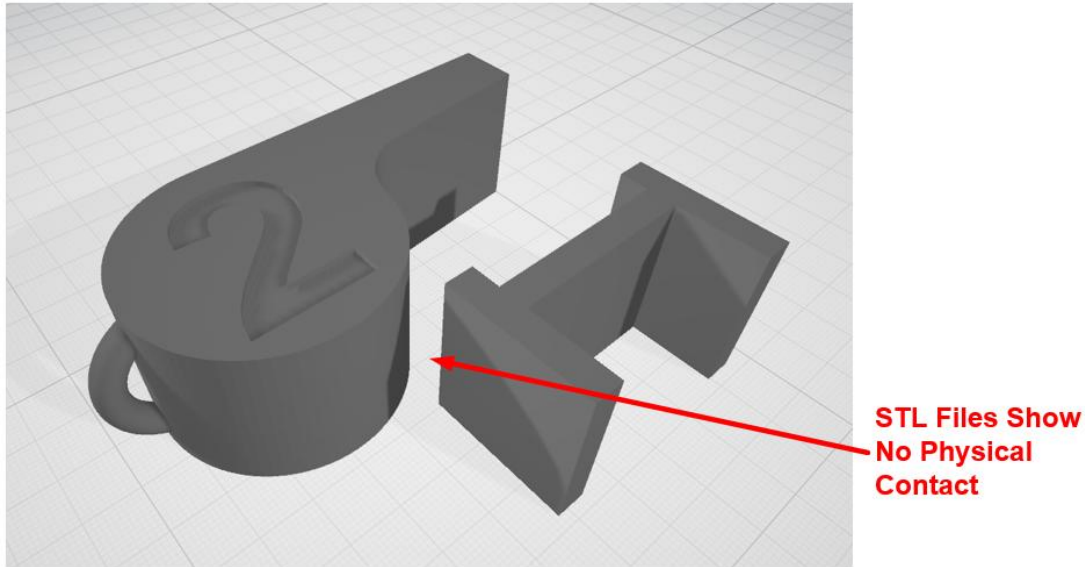
with other objects on the build surface. Neither the word “purge” nor the word “tower” imputes a requirement that the purge tower cannot have physical contact with other structures described in the claims. It is undisputed that a support structure and a three-dimensional part can be in contact with one another on the build plane, the support structure being separated from the three-dimensional part after the build is complete. EX1025, 35:18-36:2. A purge tower is no different. Nothing in claim 1 excludes an embodiment where a purge tower has physical contact with a three-dimensional part and support structure, the purge tower to be separated from the other components after the build is complete.

32. I was also disappointed to read that Stratasys mischaracterized my testimony to support its implausible reading of a no physical contact limitation into claim 1. I did testify that “a purge tower is a separate physical object,” but this testimony is consistent with my opinion—which I stand by—that physical objects can be separate while having some physical contact with one another. Also, for clarity, I explained in my deposition that RepRap’s parking space *is an example of a purge tower*, which Stratasys completely neglected to mention in their briefings. EX2016, 64:3-65:3. I maintain my opinion that the RepRap’s parking space provides the claimed purge tower, even if there is some physical contact between the purge tower and the object.

33. Even if there were a requirement of physical contact involving the purge tower (which there is not), the merged RepRap STL files provided by Stratasys and Dr. Osswald indicate clearly that RepRap contemplated a separate purge tower that had no physical connection with the three-dimensional part. POR, 60; EX2013, ¶99. This lack of a connection between the parking space and the object further supports my position that the purge tower and the object are distinct from one another. A POSITA would have been motivated to implement the extrusion head of Leavitt to print a purge tower that has no physical contact with the three-dimensional part and support structure, especially in view of the fact that the STL files depict two separate parts with no physical contact.



EX2013, ¶99 (annotated).



EX1014, 1 (annotated).

34. Stratasys also contended that the purge tower of RepRap does not qualify as a purge tower “printed in a layer-by-layer manner,” because some cross-sections of RepRap’s purge tower “contain multiple materials.” POR, 59; EX2013, ¶106. Again, Stratasys asserts that RepRap *alone* “does not print the parking space in the layer-by-layer manner required by the claims” while completely ignoring the *combination* of Leavitt with RepRap. *Id.* When the *combination* is properly considered, a POSITA would be motivated to implement the extrusion head of Leavitt with RepRap’s teaching to print a purge tower in a layer-by-layer manner. It is evident that the purge tower is printed in a layer-by-layer manner because Leavitt discloses alternating between printing layers of part and support material and RepRap discloses that, *in the combination*, the printer prints a layer of the purge tower (“parking space”) “before printing the actual object” for every switch of

material. EX1004, [0022]-[0024]; EX1005, 1. Moreover, it is clear that the parking space of RepRap is printed “layer-by-layer” because RepRap Video depicts layer-by-layer deposition of build material. *See* EX1006. The video depicts the extruders moving across the part in multiple passes, indicating that material is deposited in layers as the part grows in height from the build surface. *Id.*

35. Furthermore, it is undisputed that RepRap’s printer uses an STL file as a model for the three-dimensional part and the parking space. STL files include models that indicate the dimensions of one or more objects in three dimensions. The STL files in RepRap are used to generate instructions for printing the three-dimensional part and support structure. This involves “slicing” the STL file into layers and generating tool path instructions for each layer. EX1005, 1; EX1006, 1. RepRap Article refers to these tool path instructions as “G-Code.” RepRap Article also explains that the G-code for each layer is “merged layer-by-layer,” providing further confirmation that the printing of the parking space and the three-dimensional part are printed layer-by-layer. *Id.* Therefore, it is clear that the STL file of RepRap is sliced and merged into layers like is common in the 3D printer industry, resulting in too lath instructions that cause the printer to print the parking space and the three-dimensional part in a layer-by-layer manner.

36. Element [1c] requires that “*the layers* of the at least one purge tower are printed from the print head or deposition line switched to the operating mode.”

This means that when the purge tower is actively being printed, the printing is done by the deposition line switched to the operating mode. This is exactly what happens in RepRap. EX1005, 1 (“‘prime’...before printing the actual object after the temperature change”).

C. The Leavitt-RepRap Combination Provides Claim 16.

37. The arguments that Stratasys and Dr. Osswald made with regard to claim 16 again improperly attack the RepRap Video in isolation rather than addressing the *combination* of Leavitt, RepRap Article, and RepRap Video as I described in my first declaration. POR, 66-68; EX2013, ¶¶104-109. The combination of Leavitt, RepRap Article, and RepRap Video provide a method for “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 the three-dimensional part...from the part material after printing the first layer of the purge tower,” as recited by claim 16 and in the exact order recited by claim 16. Pet., 36-41; EX2013, ¶¶104-109. As Leavitt expressly discloses, “extrusion head 18 is configured to toggle between a ‘build state’ and a ‘support state’, where extrusion head 18 deposits a build material for 3D object 20 in the build state and deposits a support material for support structure 22 in the support state.” EX1004, [0022]. Leavitt also explains that “extrusion head 18 may *initially be positioned in the support state* for forming a layer of support structure 22, and then *toggle to the build*

state to form a layer of 3D object 20.” EX1004, [0023]. The extrusion head would print one or more layers of a purge tower “before printing” the layer of 3D object 20 when Leavitt’s extrusion head is implemented to perform a purge operation as disclosed by RepRap. EX1005, 1. It is my opinion that the Leavitt-RepRap combination therefore provides every step of claim 16, in the order required by claim 16.

38. In the POR, Stratasys contended that “the combination...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.” POR, 65; EX2013, ¶150. Not so. As I described above, Leavitt explains that extrusion head 18 can print a layer of support structure 22 and then “toggle” to print a layer of 3D object 20, leaving no doubt that a print can start with support material and toggle to part material. EX1004, [0023]. RepRap Article describes a purge operation where an extruder is primed before printing an “actual object,” meaning that the priming of the extruder would proceed in the order that the part and support structure are printed. EX1005, 1. When applied to Leavitt, this would result in a system that prints a part purge tower layer before every part layer disclosed by Leavitt and prints a support purge tower layer before every support layer disclosed by Leavitt to “prime” the extruder prior to “printing the actual object.” *Id.* The combination therefore provides “printing a first layer of a purge tower from a part material” and “printing a first layer of the three-

dimensional part...*after* printing the first layer of the purge tower” as recited by claim 16.

39. In its analysis of claim 16, Stratasys continued to fixate on features of the purge tower depicted in RepRap Video without considering the Leavitt-RepRap combination. POR, 66-67; EX2013, ¶106. Stratasys pointed to various deformities in RepRap’s purge tower—i.e., “[c]lumps of material,” “[s]trings of orange material”—claiming falsely that these features obscure the order that purging occurs relative to printing. *Id.* This is plainly false. RepRap Article discloses unequivocally that the temperature of an extruder is lowered when “it is not needed” and restored “when it is time to start printing,” and RepRap explains that the extruder is primed “after the temperature change” and “before printing the actual object.” EX1005, 1. There is no question that RepRap’s purge tower is printed by an extruder that transitions to the operating model *before that extruder prints the object*. The deformities that Stratasys references are typical defects that are common in three-dimensional printing. The fact that these defects are visible in RepRap video does not negate the fact that RepRap discloses the purge tower limitations of claim 1.

D. The Leavitt-RepRap Combination Provides Claim 5.

40. Claim 5 requires only 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.” EX1001, 16:21-24. Dr. Osswald argued that because the cross-sectional area

of RepRap's parking space increases at the top layer of orange material, the parking space of RepRap does not provide this limitation. EX2013, ¶¶111-112, POR, 71-72. I disagree with Dr. Osswald, and submit that a purge tower meets the limitation of claim 5 *if at any point along the axis* the cross-sectional area of the purge tower reduces. The purge tower would meet this limitation *even if the cross-sectional area increases at another point along the axis*. It is simply irrelevant that RepRap's parking space later increases in cross-sectional area after earlier decreasing in cross-sectional area. Claim 5 does not require that the cross-sectional area reduce at every point along the axis, and I disagree with Dr. Osswald's opinion that claim 5 has such a limitation.

E. The Leavitt-RepRap Combination Provides Claim 17.

41. Stratasys' arguments that the Leavitt-RepRap combination are similar to its attacks on the Leavitt-RepRap combination in relation to claim 16. POR, 53-57, 64-70. Stratasys also argues that RepRap "teaches away" from the limitations of claim 17 because RepRap explains that alternating between materials "slows down the print substantially." POR, 73. Claim 17 would have been obvious for each of the reasons described above, and RepRap only mentions slowing down the print in comparison to not switching materials. *Supra*, §§V.A-C.

42. Leavitt is clear that the printer "toggle[s] between a 'build state' and a 'support state'" to repetitively print "subsequent layers of deposited build and/or

support materials” and that “[t]his process may be repeated until each layer of 3D object 20 and support structure 22 are complete.” EX1004, [0022]-[0024]. In the combination, the printer “print[s]” a layer of parking space after each change of material to “‘prime’ the extruders...before printing” a layer with the new material, per RepRap’s teaching. EX1005, 1. The proposed combination therefore provides repeating steps (b)-(e) of claim 16. Pet., 41-42; EX1003, ¶138-141.

VI. Ground 2A: Obviousness based on Priedeman in view of KISSlicer (Claims 1, 2, 6, 7, 9, 16, and 17)

A. The Priedeman-Kisslicer Combination Provides Claims 1 and 16.

43. To dispute my position that the Priedeman-KISSlicer combination provides Claims 1 and 16, it appears that Stratasys and Dr. Osswald argued that a “wipe pillar” is “unrelated to a purge operation.” POR, 75-76; EX2013, ¶118 (“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 entirely unrelated to a purge operation, let alone one comprising the steps recited by claims 1 and 16”). Dr. Osswald also claimed in his declaration that “the ’713 Patent...teaches that ‘tip-wipe operation[s]’ are distinct and optional processes that could be performed after purging.” *Id.* I disagree with Dr. Osswald’s opinion here, and submit that the ’713 Patent teaches just the opposite. For example, the ’713 Patent teaches that “purge tower 24 *may also function as a tip wipe device*, which further *precludes the need for a separate purge station.*” EX1001, 9:57-59. This

means that contrary to Dr. Osswald’s testimony, the ’713 Patent clearly discloses that a purge tower can serve two concurrent purposes—purging and tip wiping—such that these purposes are *indistinct*. Kisslicer provides highly similar disclosure to the ’713 patent, explaining that the wipe pillar is a “cylinder *printed* before every layer” that does not constitute a separate tip wiping process. EX1010, 9. It is clear that Kisslicer’s printer prints the wipe pillar to include a specific cylinder shape, and performs the print in multiple layers. KISSlicer therefore provides a technique for printing the claimed purge tower printed in a layer-by-layer manner.

44. Dr. Osswald insists that Kisslicer’s print heads print the wipe pillar *after* printing the part or support structure, but KISSlicer’s disclosure is clear that the opposite is true. POR, 76; EX2013, ¶119. KISSlicer discloses that “[t]he wipe pillar is a cylinder printed *before* every layer to clean the extruder tip”—and not after the layer is printed, EX1010, 9. What’s more, KISSlicer explains that the “wipe” feature is performed to prime an extruder “to ensure the printer is ready”—indicating that priming occurs *before* printing. EX1010, 10. It appears that Stratasys and Dr. Osswald want the Board to believe that KISSlicer’s wipe pillar disclosure is meaningless, which it is not. KISSlicer unambiguously explains that the wipe pillar is printed *before* printing the part or support structure, and not *after* printing the part or support structure

45. Much of Dr. Osswald’s opinion here rests on the KISSlicer’s use of the term “hairing.” Dr. Osswald claims that a tip wipe operation to reduce “hairing” can only be done after the extruder has finished printing and cannot be done before the extruder starts printing. POR, 76; EX2013, ¶119. I disagree. Hairing can just as easily be reduced by performing a purge operation prior to the first use of a print head to remove hairing from a previous print or eliminate hairing prior to subsequent uses of the print head to remove hairing from a prior use. Because Kisslicer discloses a “Wipe [mm]” setting for controlling the wipe pillar and discloses that “*after a warm up the printer will push (prime) this amount of filament to ensure the printer is ready,*” this provides further confirmation that the wipe pillar is printed as part of a warm up sequence to ensure that the printer is ready. EX1010, 10. The wipe pillar disclosed by KISSlicer is clearly printed after every layer. In other words, priming or preparing the nozzle for printing the part involves printing the wipe pillar.

46. In an effort to explain the obvious disconnect between Stratasys’ position and the description of KISSlicer, Dr. Osswald claims that printing *before* every layer is practiced only when there is a *single print head*, and systems with two print heads would print the wipe pillar *after* every layer. EX2013, ¶119. I do not believe that this argument has merit. Immediately after explaining that the wipe pillar is printed after the part or support structure, KISSlicer discloses that the wipe pillar “is extremely important in *dual head prints.*” EX1010, 9. This indicates that

the other description of the wipe pillar in KISSlicer—including that the wipe pillar is “printed before every layer,” is a description of how the wipe pillar is printed in the dual head print embodiment. Stratasys and Dr. Osswald point to no disclosure in KISSlicer explaining that the wipe printer is printed after the part or support structure *only in single head prints*. Nor could they, because KISSlicer never even mentions the wipe pillar in the context of single head prints at all.

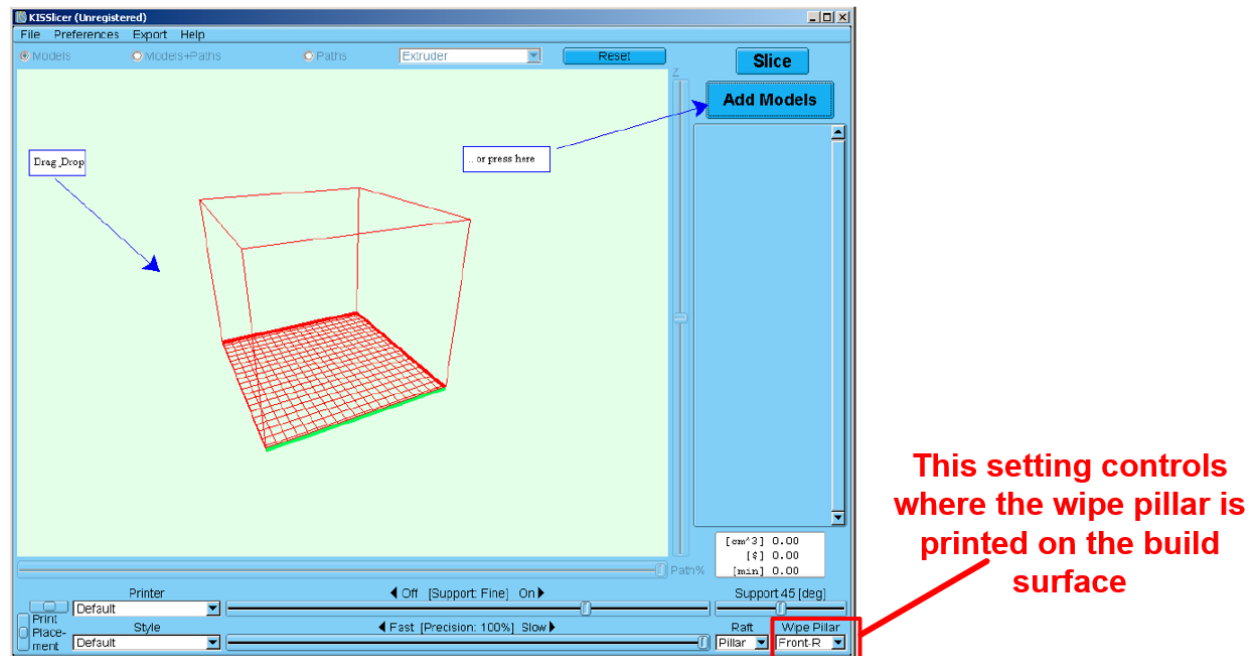
47. Moreover, wiping and purging are commonly performed *before* printing a layer of the three-dimensional part, and *not after* printing a layer of the three-dimensional part. The '713 Patent itself explains that a print head “preferably undergoes a purge operation prior to printing the next layer,” the purge operation optionally being followed by a “tip wipe operation.” EX1001, 4:39-45. Thus, the '713 Patent acknowledges that purge operations and tip wipe operations commonly occur *before* printing a layer, and *not after*. There is no support for Dr. Osswald’s insistence that tip wiping must occur after printing and cannot occur before, because there is none. Purging and wiping can and often do occur before printing.

48. Stratasys and Dr. Osswald also claimed that “KISSlicer teaches that an entire structure (“a cylinder”) is printed before every layer.” POR, 78. It appears that the Patent Owner is making this argument to contend that KISSlicer’s wipe pillar is therefore not printed in a layer-by-layer manner. When KISSlicer is read in light of its full disclosure, I do not believe that this reading is accurate. If the logic of

Stratasys and Dr. Osswald were applied to the '713 Patent, claim 1 would require printing an *entire purge tower* every time that a print head or deposition line is switched to the operating mode. EX1001, 15:53-58 (“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*”). But Stratasys does not argue that claim 1 is limited in this way. It is clear that KISSlicer’s description of “a wipe pillar...printed before every layer to clean the extruder tip” refers to a single purge tower printed layer-by-layer, just like the purge tower of the '713 Patent. KISSlicer’s depiction of the “Wipe[mm]” also supports my position here, because the wipe setting indicates an “amount” of filament that the printer “will push,” which aligns with layer-based deposition as opposed to a command to print an entire purge tower. What’s more, I do not even believe it would be feasible to print an entire wipe pillar between every layer. This would require altering the z-axis position of the extruder to build a tower and restore the position to print the next layer of the part or support structure. This would be cumbersome at best and potentially unworkable. Purge towers that are taller than the part would interfere with the movement of the extruder in the x-y plane.

49. Stratasys argues that KISSlicer’s disclosure of the “Wipe [mm]” setting (EX1010, 10) is completely unrelated to KISSlicer’s disclosure of the “Wipe pillar” (EX1010, 9). POR, 78-79. Based on the record it is clear this argument does not have

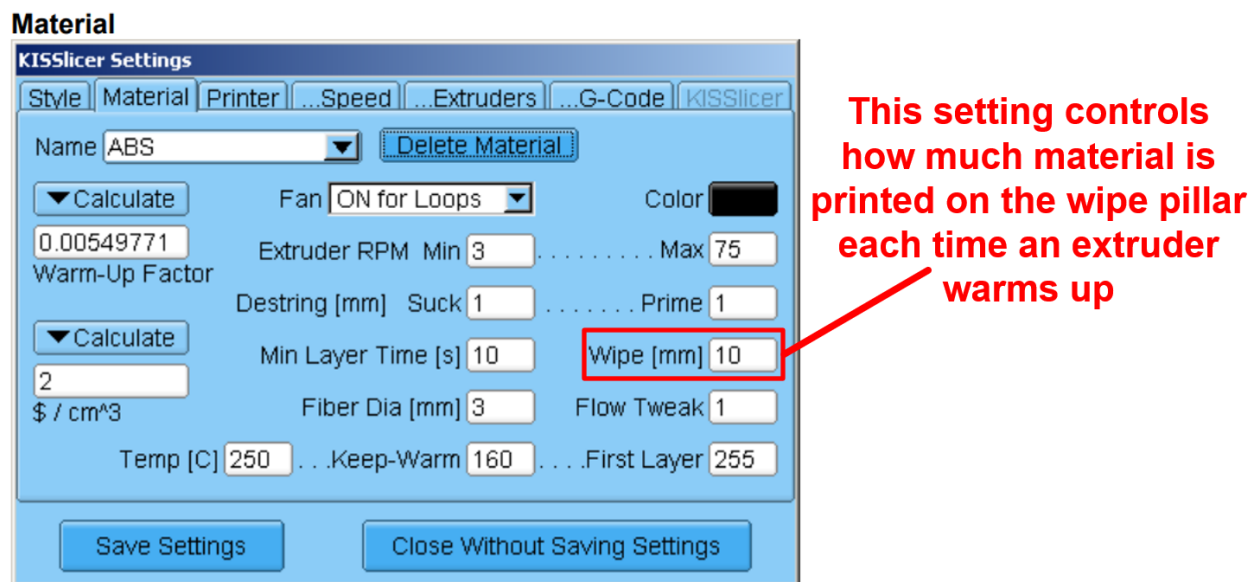
merit. The KISSlicer disclosure reveals that there are at least two settings on the interface of KISSlicer relating to the wipe pillar. One setting is a “Wipe Pillar” setting that specifies where on the build plane the “Wipe pillar” will be printed.



EX1010, 7 (annotated).

50. The “Wipe [mm]” setting states exactly how much material the extruder will “prime” in printing the wipe pillar *after the extruder warms up*, which indicates that this setting controls how much material is purged before printing the object. EX1010, 3, 10. Additionally, KISSlicer explains that the “Wipe [mm]” setting is to “ensure the printer is ready.” *Id.* This further supports my opinion that the “Wipe [mm]” setting describes a purge operation that occurs before printing an object. The “Wipe [mm]” setting is located on the same menu as the “Temp [C]” setting and the “Keep-Warm” setting. EX1010, 3. KISSlicer explains that the Temp [C]” setting

sets the temperature of the extruder in the operating mode when the extruder is actively extruding material to print a part or support structure. EX1010, 10 (“sets the temperature of the material for the main part”). The Keep-Warm” setting sets the temperature of the extruder in the idle mode when the extruder is not actively extruding material to print a part. EX1010, 10 (“when printing with multiple materials sets the idle temperature”). The fact that the wipe setting is listed on the same menu as the active and idle temperature settings provides further support for my position that the wipe setting is related to a purge operation for multi material builds where material is purged in response to an extruder transitioning from idle to active.



EX1010, 3 (annotated).

51. The word “wipe” is only used by KISSlicer to describe the wipe pillar and the settings relating to the Wipe pillar, and nothing suggests that wipe pillar

description is unrelated to any of the wipe settings. EX1010, 3, 7, 9, 10. Again, KISSlicer explains that “[t]he wipe pillar is...printed before every layer to clean the extruder tip” and “is extremely important in dual head prints.” EX1010, 9. KISSlicer’s description of the “Wipe [mm]” setting is fully consistent with the description of the wipe pillar, as the setting is described to “prime” to “ensure the printer is ready” meaning that the priming occurs before every layer just as the wipe pillar is described. EX1010, 10. The wipe pillar is clearly the result of the “Wipe [mm]” setting being set so the extruder primes material when an extruder warms up to transition to the operating mode in a dual head print. Nothing in KISSlicer suggests that the “Wipe [mm]” setting is unrelated to the wipe pillar description in that same document. All the evidence in the KISSlicer document points to these two features referring to the same purge operation.

B. The Priedeman-Kisslicer Combination Provides Claim 6.

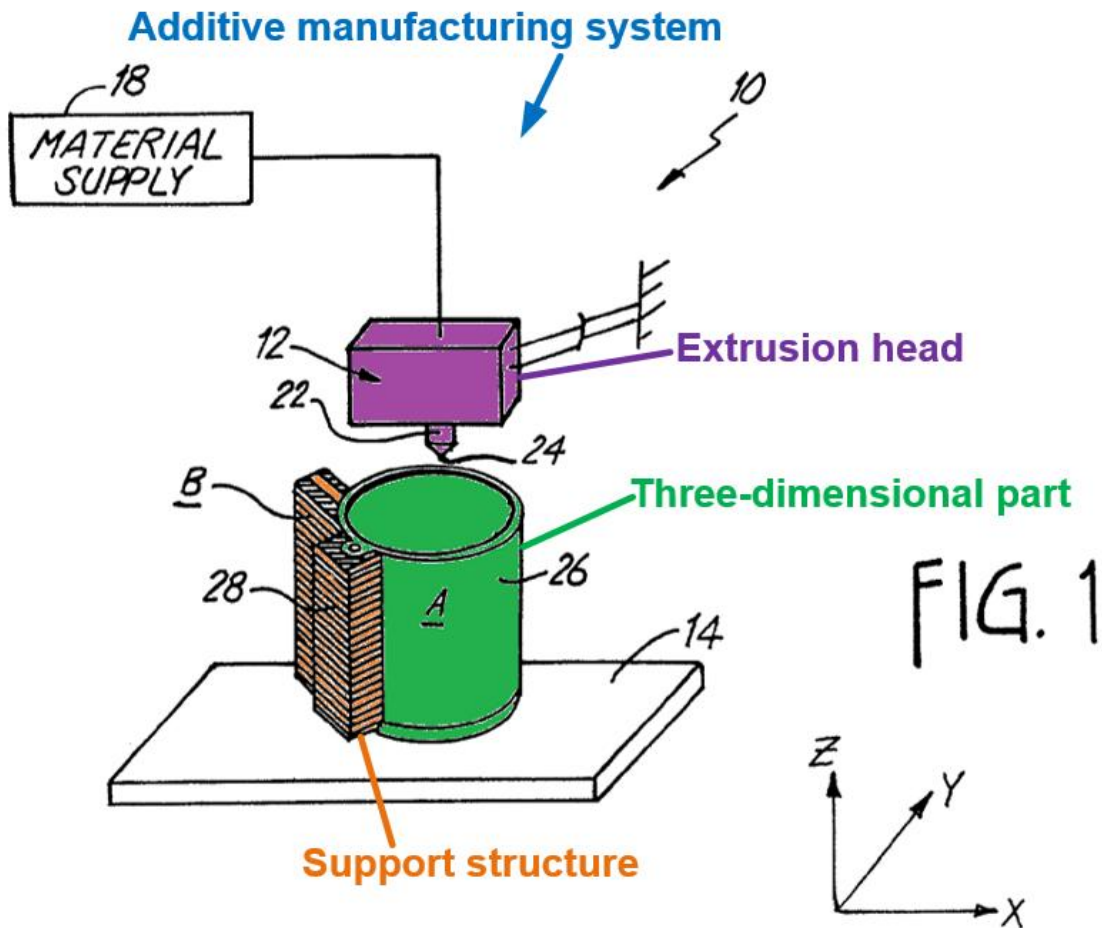
52. KISSlicer expressly discloses that when an extruder transitions from idle to active which involves a temperature increasing from a “Keep Warm” idle temperature to an active temperature, the wipe pillar is printed “after” the warm up occurs. EX1010, 9. KISSlicer also makes clear that the wipe pillar is printed “to ensure the printer is ready,” providing further confirmation that the printing is done before printing the object. A POSITA would understand KISSlicer’s explanation that “[t]he wipe pillar is a cylinder printed before every layer,” to mean a “layer”

includes everything that is printed by the extruder after it comes online and until the extruder goes idle again. This is true even if the extruder even if the extruder prints material at multiple different heights after coming online (e.g., printing two consecutive layers with the same material) and before going offline again. Indeed, it is clear that the entire mass of material printed by an extruder in one online session would form a “layer” on the part. KISSlicer explains unambiguously that the wipe pillar is printed in a purge operation “before every layer.” EX1010, 9.

53. When the Priedeman-KISSlicer combination is considered fully, it is clear that the at least one purge tower is stopped at a highest layer at which there is a material change. Becasue KISSlicer explains that the purge tower is printed “before every layer” that represents all material printed by an extruder that comes online, this means that the Priedeman-KISSlicer combination prints a purge tower that stops at the highest layer where an extruder switches to the operating mode and therefore stops at the highest layer in which there is a material change. Based on KISSlicer’s teachings, there would be no reason to continue printing the purge tower above the highest layer at which there is a material change because there would not be a need to “prime” an idle extruder because that idle extruder would not be needed again to print a layer.

54. Priedeman discloses an example where an extrusion head prints a three-dimensional part and a support structure on a substrate, the three-dimensional

part and support structure being approximately the same height. EX1007, FIG. 1. Priedeman's extrusion head 18 can "deposit material onto the base 14 in multiple passes and layers to build the three-dimensional model 26 and further to build the support structure 28." EX1007, [0017]. The extrusion head does this by alternating between depositing support material and depositing part material. For example, the example in Priedeman switches from support material (orange) to part material (green) at the top layer:



EX1007, FIG. 1 (annotated).

55. As such, when Kisslicer's purge operation is applied to this example in Priedeman, the wipe pillar "is stopped at a highest layer at which there is a material change." This is because the highest layer at which there is a material change in Priedeman appears to be the final layer where the extrusion head prints the highest layer of three-dimensional part and support structure. There would be no need to continue printing the purge tower after printing this highest layer, so it follows that the purge tower is stopped at the highest layer at which there is a material change.

VII. Ground 2B: Obviousness based on Priedeman, in view of KISSlicer, and further in view of RepRap (Claim 5)

A. A POSITA Would Have Been Motivated to Combine Priedeman-KISSlicer with RepRap Article and RepRap Video

56. A POSITA would have been motivated to combine Priedeman-Kisslicer with RepRap Article and RepRap video for at least the reasons I discussed above my analysis of the motivations to combine in Ground 1. *Supra*, §V.A. It is also clear that a POSITA would have been motivated to implement KISSlicer's purge tower with a purge tower having a cross-sectional area that decreases moving up from the build plane. This would provide a more stable purge tower, as seen in the example of KISSlicer where the part of the tower closest to the build plane has a much higher cross-section than parts of the purge tower immediately above the part closest to the build plane. In general, decreasing the cross-section of the purge tower

moving up the axis and away from the build plane makes the purge tower less top-heavy.

57. Stratasys disagrees with my position, arguing that the top of the KISSlicer parking space exhibits instability when the cross-sectional area increases near the top of the purge tower. POR, 80-81. A POSITA would be even more motivated to ensure that the purge tower's cross sectional area decreases because of this, especially considering that the top layer of the purge tower in RepRap is partially suspended over midair and appears to be unstable. Petitioner does not rely on RepRap alone but instead relies on the Priedeman-KISSlicer-RepRap combination. A POSITA would have been motivated to implement the purge operation of Priedeman-KISSlicer with a purge tower having a decreasing cross-section as suggested by RepRap to promote stability.

B. The Priedeman-Kisslicer-RepRap Combination Provides Claim 5.

58. The Priedeman-Kisslicer-RepRap combination provides claim 5 for at least the reasons that I described above in connection with Ground 1. *Supra*, §V.D. As I discussed in my analysis of the Leavitt-RepRap combination §V.A, *supra*, the act of switching materials is inherently what “slows down the print” rather than the act of printing the purge tower. EX1005, 1. The act of switching materials is already present in Priedeman's system, so the problem described in RepRap is already exhibited by Priedeman's extrusion head. As discussed in §V.D, *supra*, RepRap's

purge tower has a cross-sectional area that reduces in height along the axis and there is no requirement in claim 5 that the purge tower never again increase in cross-sectional area.

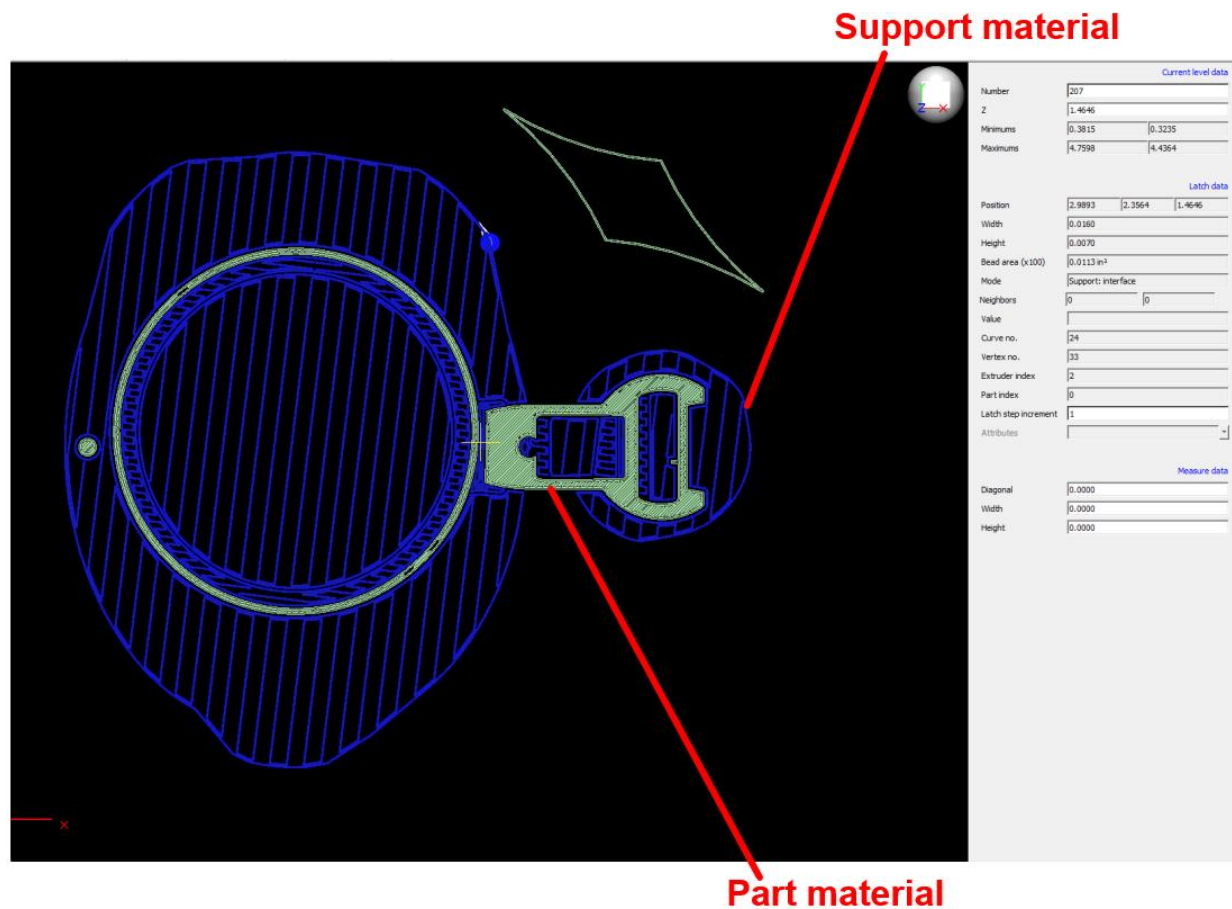
VIII. Ground 3: Anticipation based on Boyer (Claims 1, 2, 6, 7, and 9)

A. Boyer anticipates Claim Element [1a]

59. Boyer describes a printer that can “accommodate multi-material builds,” leaving no question that Boyer contemplates using two different materials. EX1008, [0024], *see also id.*, [0025] (“extruder for multiple build materials”). Boyer also explains that its printer can deposit a layer of a “transition segment” (purge tower) when switching between materials and that such techniques are applicable to “any such multi-material models” including those having both “object” and “support structure[.]” material. EX1008, [0032]-[0033], [0029], [0044]; *see also* Inst. Dec., 19, 24, 25. Although Boyer describes a multi-color build as a prominent embodiment, Boyer unambiguously explains that the printer can perform *many different* multi-material builds including a three-dimensional part and support structure. EX1008, [0029] (“techniques described herein may be usefully employed to enable switching of build materials *in any such multi-material models*”); [0044] (“support structures may be fabricated from materials that...break away easily from the main structure of an object”). In its decision granting institution of the IPR

petition challenging the '713 Patent, the Board agreed that Boyer's printer is *not limited to multi-color builds*. ID, 19, 24, 25.

60. Stratasys insisted that Boyer's FIG. 4 would not be implemented with part material and support material despite acknowledging that Boyer describes a multi-material build involving part material and support material. POR, 84-88. Specifically, Stratasys argued that exterior segments of a part (including segment 406) cannot be made of support material, because breaking away the support material would "compromise the object's structural integrity and expose the internal infill." POR, 87. This argument fails to hold water for at least two reasons. First, Boyer is explicit that FIG. 4 "is provided for purposes of illustration only...the tool path may include any number of excursions from the exterior surface, including excursions...outside the exterior of the object where sacrificial build material may be extruded during transitions" between materials. EX1008, [0034]. In such cases where there is no infill, the concern of exposing infill is eliminated. Second, it is common for support material to be located on the outside of part material in ways that do not compromise the structural integrity of the part. Stratasys cited such a build in its swear behind declarations.



EX2014, 23 (annotated)

61. Rather than analyzing Boyer’s disclosure as a whole, Stratasyss seemed to focus largely on the geometric shape and other characteristics of the example shown in FIG. 4 to the point of ignoring facts that are important to the analysis. For example, it clear that Boyer discloses printing a purge tower by depositing a “transition segment” when switching materials. EX1008, [0032]-[0035], [0037]-[0043], FIG. 4. Boyer is also clear that the materials used in printing can include object and support material in some implementations. EX1008, [0044]. Boyer’s printer also “deposit[s] successive layers of material” to form the disclosed

structures, and therefore prints the transition segment purge towers in a layer-by-layer manner. EX1008, [0018], [0022]. Even if Stratasys's assertions that the specific geometric shape shown in the example of FIG. 4 is not ideal for use with sacrificial support structure material were true (which Stratasys has not established), such an argument does not negate the express disclosures of Boyer that provide all elements of claims 1, 2, 6, 7, and 9.

62. FIG. 1 of Boyer, which depicts a different shaped object than FIG. 4, further emphasizes that Boyer's disclosures are not restricted to the specific geometry depicted in FIG. 4.

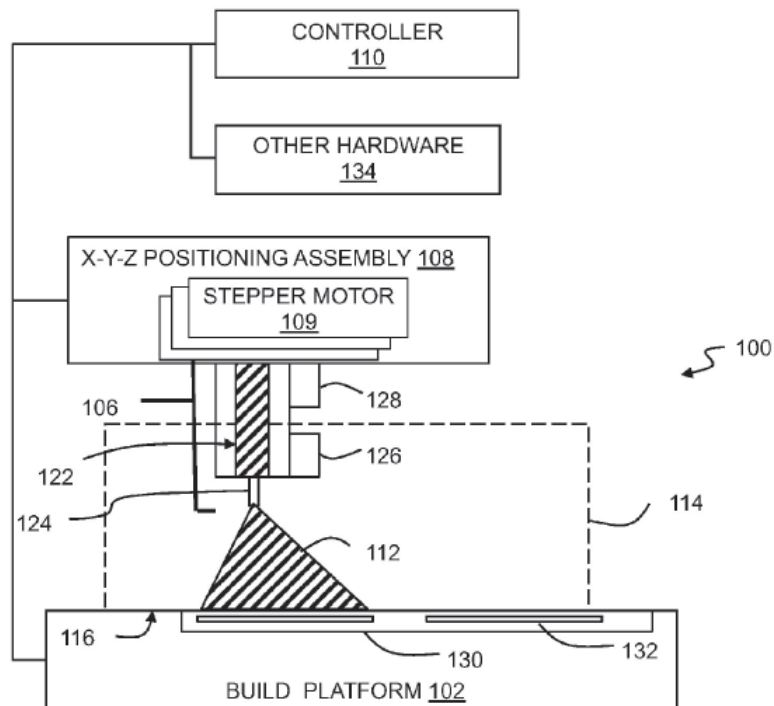


Fig. 1

EX1008, FIG. 1.

63. Stratasys contended that Boyer does not disclose the elements of claim 1 “arranged as in the claim.” POR, 83-86. This is false. Boyer explains clearly that the printer can deposit “layers of a three-dimensional part and of a support structure” as recited in Element [1a] using the same techniques disclosed for a multi-color print. Based on Boyer’s clear disclosure that “[t]he techniques described herein may be usefully employed to enable switching of build materials in any such multi-material models,” a POSITA would understand that Boyer discloses the exact embodiment depicted in the annotated version of FIG. 4 below.

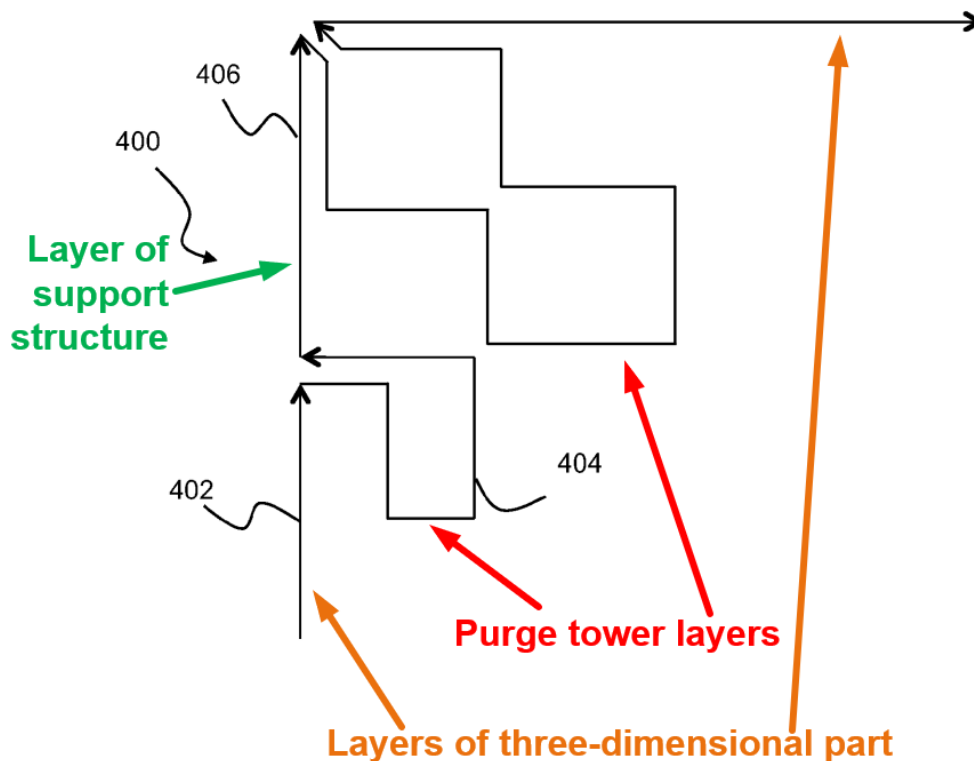


Fig. 4

EX1008, FIG. 4 (annotated).

64. Boyer discloses that “FIG. 4 depicts a cross section of a multi-material build,” clearly indicating that additional layers could exist above or below the layer depicted in Fig. 4. EX1008, [0032]. Not every layer of the multi-material build needs to be identical. The layer above FIG. 4 could, for example, include a layer of the three-dimensional part printed directly onto the layer of support structure represented by segment 406. This would mean that segment 406 supports the three-dimensional part. Changing successive layers of the multi-material build would not prevent “layer-by-layer construction of a purge tower,” as Stratasys suggests. POR, 88. Purge tower layers could alternate between support material and part material, or purge towers could lean, grow in cross-sectional area, or shrink in cross-sectional area.

B. Boyer anticipates Claim Element [1c]

65. Boyer’s printer clearly performs “a purge operation” that involves “printing at least one purge tower in a layer-by-layer manner,” as recited in Element [1c]. In the institution decision, the Board agreed. ID, 23 (“Boyer discloses the disputed limitation of claim 1.”).

66. In the POR, Stratasys maintained that Boyer’s transition segments are not part of any purge tower. POR, 90-95; EX2013, ¶¶138-141. Patent Owner’s position depends on the erroneous construction that a purge tower must have no physical contact with the three-dimensional part or support structure. *Id.* This

construction is improper for at least the reasons discussed above. *Supra*, §II.B. Contrary to Patent Owner’s erroneous construction, the Board’s first impression in the institution decision was correct. ID, 22. There is simply no requirement that the purge tower and the object being printed must be separate structures that have no physical contact with each other.

67. Boyer discloses a three-dimensional printer that includes an “extruder” for “multiple material builds.” EX1008, [0025], FIG. 2. Boyer’s extruder includes a single nozzle that transitions between two different feeds, each providing a different material. Every time that Boyer’s extruder transitions to a different feed (and therefore transitions to a new material), the extruder performs a purge operation by printing a “transition segment.” EX1008, [0032]-[0033]. Printing the transition segment removes any “mixing” between the materials. *Id.* Through building a three-dimensional object “by depositing lines of build material in successive layers,” the printer deposits transition segments in successive layers to form a purge tower. EX1008, [0032].

68. In an effort to support its improper construction of “purge tower,” Stratasys mischaracterized my deposition testimony. POR, 92. I never said in my deposition that a purge tower cannot have physical contact with the three-dimensional part and support structure. In response to one of the lawyers for Stratasys asking me what a purge tower is, I answered clearly that “Figure 3A, 3B,

Figure 8, and Figure 9 in patent '713 give *examples* of purge towers.” EX1006, 64:18-70:6. However, I certainly did *not* say that the meaning of purge tower in claim 1 is limited to any example described in the specification of the '713 patent. EX1006, 64:18-70:6. And I did state unequivocally in my deposition that RepRap describes a “parking space” I also consider to be an example of the purge tower recited in claim 1. *Id.* Stratasys did not mention this in their briefing, and instead chose to cherry pick my statements to fit its narrative.

69. Boyer’s purge tower is a component that is distinct from the three-dimensional part and support structure described in that reference. Just because two components are distinct does not mean that the components cannot have any physical contact. Indeed, the “three-dimensional part” and “support structure” of claim 1 are recited independently yet Dr. Osswald testified that these different components would generally be in contact. EX1025, 35:18-36:2; 36:21-37:6; 106:9-13 (admitting that claim 1 does “allow for physical contact between the three-dimensional part and the support structure”). Boyer’s disclosure that the transition segments (purge towers) are “*sacrificial material deposited outside the exterior of the object*” reveals that they are separate components that may or may not contact the object itself. EX1008, [0043].

IX. CONCLUSION

70. I hereby declare that all statements made of my own knowledge are true and that all statements made on information and belief are believed to be true. I further declare that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of the Title 18 of the United States Code.

Dated: December 12, 2025

By: 
Dr. Michael A. Hickner