

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 IPR2025-00311
U.S. Patent No. 8,562,324

**SECOND DECLARATION OF ANDREW WOLFE, PH.D.
ON BEHALF OF PETITIONER**

Second Declaration of Andrew Wolfe, Ph.D.
IPR Proceeding IPR2025-00311

I, Andrew Wolfe, Ph.D., declare as follows:

1. I have been retained on behalf of Shenzhen Tuozhu Technology Co., Ltd. (“Petitioner” or “Tuozhu Tech”) as an independent expert consultant in *inter partes* review (“IPR”) proceeding IPR2025-00311 regarding U.S. Patent No. 8,562,324 (“the ’324 Patent”). I understand that this declaration will be submitted in support of the Petitioner’s Reply to Patent Owner’s Responses to the Petition for IPR proceeding IPR2025-00311.

2. This declaration supplements, and is intended to be read in conjunction with, my first declaration in this proceeding. In my first declaration, I address many topics, including (but not limited to) my background and qualifications, the level of skill in art, an overview of the ’324 Patent, claim construction, certain legal standards explained to me by Petitioner’s counsel, and a detailed analysis of the prior art with respect to the ’324 Patent’s claims. The opinions and explanations expressed in my first declarations apply equally here.

3. I have no financial interest in either party or in the outcome of this proceeding. I am being compensated for my work as an expert on an hourly basis, for all tasks involved. My compensation is not dependent on the outcome of these proceedings or on the content of my opinions.

4. All of the opinions contained in this declaration are based on the documents I reviewed and my knowledge and professional judgment. My opinions have also been guided by my appreciation of how a person of ordinary skill in the art would have understood the claims and the specification of the '324 patent at the time of the alleged invention, which I have been asked to initially assume is August 18, 2010.

5. Based on my experience and expertise, it is my opinion that certain references disclose and/or suggest, alone or in combination, all the features recited in the Challenged Claims of the '324 patent, as I explain in detail below.

1. Claim Construction

6. Based on my review of the '324 patent and the relevant prosecution history, along with my knowledge and experience in the relevant field, and as I explain below, there is no requirement in the claims of the '324 patent that claimed “image of the build volume from the video camera” and the claimed “two-dimensional projection of the three-dimensional model from the point of view of the video camera” be presented simultaneously. Element [1.d] of claim 1 recites in part:

the processor further configured to provide a user interface to a remote user accessing the device through the network interface, and to

present in the user interface an image of the build volume from the video camera and a two-dimensional projection of the three-dimensional model from the point of view of the video camera.

'324 Patent, Element [1.d].

7. The Patent Owner and Dr. Cormier are now attempting to read a simultaneous presentation requirement into the claims that is not part of the actual claim language, effectively rewriting the claim to recite:

the processor further configured ... to simultaneously present in the user interface an image of the build volume from the video camera and a two-dimensional projection of the three-dimensional model from the point of view of the video camera.

See EX2009, ¶118 (Dr. Cormier asserting that the claims require “a user interface that presents an image and projection from the same point of view at the same time.”), ¶119 (Dr. Cormier asserting that “the plain meaning of the claim terms in claims 1 and 19 is that the image and projection are presented at the same time.”), ¶120 (“...the plain meaning of the claims in which the image and projection are presented in the user interface at the same time.”), ¶125 (“...the plain meaning of the claims that require the presentation of the image and projection at the same time.”), ¶126 (“...require presenting the image and projection at the same time instead of presenting the image and projection at different times.”).

8. However, contrary to the assertions of Patent Owner and Dr. Cormier, the claims neither recite, nor require, that the presentation of the image of the build volume and the presentation of the two-dimensional projection of the three-dimensional model be at the same time, only that both are presented by the same user interface. As Dr. Cormier confirmed during his deposition, changing the display of a user interface to include updated/changed information or adding new information to a user interface does not create a new, different user interface. EX1027, 19:1-20:3, 33:16-34:2. I agree with this assessment from Dr. Cormier. Presenting an image of the build volume in a user interface, followed by presenting a two-dimensional projection of the three-dimensional model in the user interface does not create a new user interface. In this example, both the image and the two-dimensional projection are presented by the same user interface. This is all that the claims require.

9. In addition to what a POSITA would have understood from the claim language itself, the specification of the '324 patent confirms that there is no requirement that the image of the build volume and the presentation of the two-dimensional projection of the three-dimensional model be presented simultaneously. Rather, the specification indicates that numerous different types of information and configurations of the presentation of such information in the

user interface falls within the scope of the claims. For example, the '324 patent describes that “a visualization area 510” of the user interface shown in Figure 5 “displays a visual representation of the print job.” EX1001, 22:41-42.

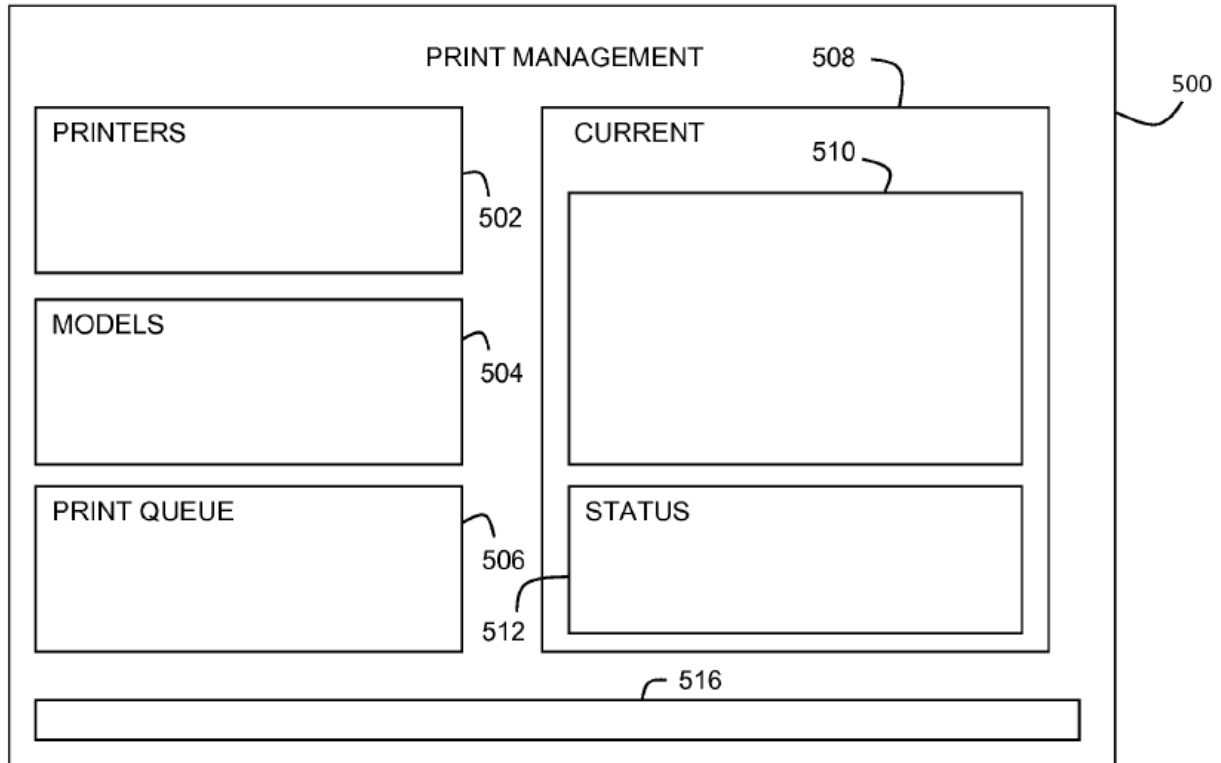


Fig. 5

EX1001, FIG. 5.

10. The '324 patent goes on to describe that the information displayed in the visualization area can take many forms, stating:

For example, the visualization area 510 may display a current tool path of the printer that is executing the print job, such as a two-

dimensional layer of the object showing a path of a print head as it traverses that layer. The visualization area 510 may also *or instead* show a simulated print object, such as a rendering of a three-dimensional model depicting a current state of the completion of an object being fabricated according to a print job. The visualization area 510 may also *or instead* show an image of a working volume of a three-dimensional printer or other fabrication resource captured during execution of the print job. This may, for example, include a digital still image (which may be updated periodically) or a video image captured from a video camera at the three-dimensional printer.

EX1001, 22:41-55 (emphasis added).

11. Figure 5 (reproduced above) does not show the three-dimensional model and the image of the working volume displayed simultaneously. Similarly, while the above quote from the '324 patent describes that various different types of information can be shown in the visualization area, it does not ever expressly describe these different types of information as being displayed at the same time, only that these various types of information, including the tool path, rendering of a three-dimensional model, and image of the working volume could also be presented by the same user interface.

12. Later on in the specification, the '324 patent describes that the user interface “may be any of the user interfaces described above, or any other suitable

interface for conveying visual information such as a video image and/or model projection.” EX1001, 24:47-55. This example once again describes that the video image and model projection can both be presented by the user interface but does not describe the image and model projection as being presented at the same time. A POSITA reading these examples in the ’324 patent specification would have recognized that these preferred embodiments cover displaying the image and model projection at the same time or at different times, so long as they are both presented by the same user interface. This is especially true given that the ’324 patent expressly states that “the methods and systems described above are set forth by way of example and not of limitation.” *Id.*, 27:1-8.

13. The ’324 patent specification gives additional examples of the user interface being dynamically updated with new information, thus changing the user interface, yet continues to refer to this dynamically changing user interface as the same user interface. For example, step 708 of FIG. 7 “include[s] providing a user interface” and then after this step, at step 710, the method “include[s] transmitting status information...includ[ing] data presented through the user interface.” EX1001, FIG. 7, 24:47-52, 25:6-10. As such, “status information” that is provided after initial presentation of the user interface (e.g., later information presented “upon completion of the object”) is still described as being “presented through the

user interface”, indicating that the later presented information shown “upon completion of the objection” and the earlier presented information are all considered to be presented in the user interface. *Id.*, 25:6-10, *see also* cls. 20-21. Claims 20-21 include similar recitations indicating that different information is presented in the user interface at different times, yet all of this information still constitutes information presented by the same user interface. For example, claim 20 states “transmitting status information over the data network upon completion of the object” and claim 21 states “wherein the status information includes data presented through the user interface.” *Id.*, cls. 19-21. The user interface identified in claims 20 and 21 is the same user interface that presents the image of the build volume as recited in claim 19. In other words, the status information that is transmitted “upon completion of the object” (aka, after the fabrication process has ended) as described in claims 20-21 is presented in the same “user interface” same user interface as information displayed during fabrication.

14. I also disagree with Dr. Cormier’s assessment that the prosecution history indicates that the claims “require presenting the image and projection at the same time instead of presenting the image and projection at different times.” EX2009, ¶126. Inspection of the statements made by the applicant during prosecution indicate that the applicant never made an assertion that simultaneous

display of the image of the build volume and the two-dimensional projection is required by the claims. Dr. Cormier focuses on a particular statement made by the applicant during prosecution that presenting “both video and model views from the same point of view” would “permit side-by-side comparison of model and results by a remote user.” *Id.* (citing EX1002, 161). In my reading of this statement, along with the surrounding context of statements made by the application on pages 160-162 of Exhibit EX1002, it appears that the applicant was emphasizing that it was the presentation of the image and the two-dimensional projection “from the same point of view” that provided such comparison, not a requirement to display them simultaneously. And indeed, simultaneous display of the image and the two-dimensional projection would fall within the scope of the claims as written, facilitating such side-by-side comparison. But the claims themselves do not *require* side-by-side comparison and the applicant never asserted that they did, only presentation of the image and two-dimensional projection “from the same point of view” would “*permit*” such a comparison. EX1002, 160-161.

15. The examiner similarly stated that it was the feature of “presenting the user interface an image of the build volume from the video camera and a two-dimensional projection of the three-dimensional model from the point of view of the video camera” that distinguished over the Taminger reference. EX1002, 174.

The Examiner notably did not identify or suggest a requirement for simultaneous presentation of the image and two-dimensional model was indicated by the claim language or that simultaneous display of the image and two-dimensional model is the feature the distinguished the claims from Taminger and other known prior art. For these reasons, I do not believe that the prosecution history indicates that a simultaneous presentation requirement should be imported into the claims.

2. The Mori Reference (EX1005) is in the Same Field of Endeavor as the '324 Patent and is Reasonably Pertinent to the Problem Addressed by the '324 Patent

16. The '324 patent describes its relevant field of endeavor broadly, stating that “[t]he invention relates to three-dimensional fabrication using networked resources.” EX1001, 1:14-15. The '324 patent specification makes clear that the invention is not limited to three-dimensional printing but rather that the disclosure is relevant to “[a] variety of three-dimensional fabrication techniques... [that] support rapid prototyping from computer models.” *Id.*, 1:16-18. The '324 patent goes on to state that “[i]t will be understood that while the exemplary embodiments below emphasize fabrication techniques using extrusion, the principles of the invention may be adapted to *a wide variety of three-dimensional fabrication processes.*” *Id.*, 1:65-2:6. The '324 patent makes clear that “[a]ll such variations that can be adapted to use with a networked fabrication

resource as described herein are intended to fall within the scope of this disclosure.” *Id.*, 2:6-8. Dr. Cormier’s assertion that the field of endeavor of the ’324 patent is narrowly limited to only “three-dimensional printing” thus runs exactly counter to the statements made in the ’324 patent itself. The field of endeavor is not determined by the scope of the issued claims. Based on the descriptions in the ’324 patent, I believe that the field of endeavor of the ’324 Patent would properly be classified as rapid prototyping or three-dimensional fabrication.

17. Mori’s machining tool, which fabricates an object by removing material rather than adding material based on a model of the object to be fabricated, falls squarely within the field of endeavor of the ’324 patent of rapid prototyping or three-dimensional fabrication. Dr. Cormier agreed that Mori discloses a machining tool and that machining or destructive fabrication is a type of automated, rapid fabrication. EX2009, ¶111; EX1027, 22:19-23:12, 26:10-16. Dr. Cormier also confirmed that there is a great deal of overlap between students who study additive manufacturing and students who study machining or destructive manufacturing. EX1027, 26:12-23.

18. Mori describes a system to “monitor the machining status of a workpiece” within a “machine tool” where “workpieces are machined in an

internal area” of the machine tool. EX1005, [0005], [0044], [0002]. Mori also describes that the object created from the “workpiece” is based on a “three-dimensional model.” *Id.*, Abstract. As I discussed in my first declaration, Mori describes that the tool and workpiece of three-dimensional model are imaged by the virtual CCD cameras from each point and virtual two-dimensional image data thereof are generated, and a display control section for selecting one virtual CCD camera corresponding to the virtual two-dimensional image data in which the distal end of the tool is not hidden by the workpiece among the generated two-dimensional image data, and displaying the actual two-dimensional image data generated by the actual CCD camera corresponding to the selected virtual CCD camera on a display device.” *Id.*; EX1003, ¶¶52-57. As I mentioned in my first declaration, Mori’s system is a rapid fabrication system. EX1003, ¶88. Mori is also a rapid prototyping system and a three-dimensional fabrication system. Mori is thus in the same field of endeavor as the ’324 patent.

19. Based on my review of the ’324 patent and Mori, it is also clear that Mori is also reasonably pertinent to the problems addressed by the ’324 Patent. One of the primary problems addressed by the ’324 patent is monitoring and control of an automated fabrication process. For example, the client devices discussed in the ’324 patent are described as “devices within the environment 300

operated by users to initiate and monitor print jobs at the three-dimensional printers 304.” EX1001, 8:49-51. The ’324 patent goes on to describe that such client devices can include mobile devices used “to submit objects for printing, to monitor a personally owned printer and/or to monitor a pending print job.” *Id.*, 12:47-51. In yet another example, the ’324 patent describes that a “web-based user interface may permit video monitoring of each one of the plurality of three-dimensional printers, or otherwise provide information useful to a remote user.” *Id.*, 14:63-15:5. The user interface described in the ’324 patent allows users to “visually monitor progress or status of a remote print job through the user interface.” *Id.*, 22:56-60.

20. Mori is directly applicable to this monitoring functionality with which the ’324 patent is concerned. For example, Mori describes a “machining status monitoring apparatus” that provides images of “the tool and workpiece” and “virtual two-dimensional image data” of the tool and workpiece. EX1005, Abstract, [0043], [0049]-[0050], [0059]-[0065]. For example, “[a] machine status monitoring apparatus is provided on a machine tool, and has a plurality of actual CCD cameras for imaging the tool and workpiece from different view points and generating actual two-dimensional image data thereof, a virtual image generating section having a plurality of virtual CCD cameras corresponding to the actual CCD

cameras, in which the tool and workpiece of three-dimensional model are imaged by the virtual CCD cameras from each point and virtual two-dimensional image data thereof are generated, and a display control section for selecting one virtual CCD camera corresponding to the virtual two-dimensional image data.” *Id.*, Abstract. Mori is therefore reasonably pertinent to the problem of monitoring an automated fabrication process toward which the ’324 patent is directed.

3. The Henke Reference (EX1014) is in the Same Field of Endeavor as the ’324 Patent and is Reasonably Pertinent to the Problem Addressed by the ’324 Patent

21. As I discussed above, the ’324 patent describes its relevant field of endeavor broadly. The ’324 patent specification makes clear that the invention is not limited to three-dimensional printing but rather that the disclosure is relevant to “[a] variety of three-dimensional fabrication techniques... [that] support rapid prototyping from computer models.” *Id.*, 1:16-18, 1:65-2:8 (“All such variations that can be adapted to use with a networked fabrication resource as described herein are intended to fall within the scope of this disclosure.”). In another example, the ’324 patent describes that it is directed toward “three-dimensional printers *or other fabrication or prototyping devices.*” *Id.*, 8:28-31.

22. Henke is directed toward the same field of endeavor of rapid prototyping. Indeed, the title of the Henke paper is “Rapid prototyping modules

for remote engineering applications.” EX1014, 2. Henke “describes concept for an integration of microcontroller- and FPGA- based Rapid Prototyping modules into a Remote Lab system and its implementation. The implementation enables a Web-based access to control electro-mechanical models.” *Id.* Henke describes that “[s]imulation and visual prototyping help to find functional errors.” *Id.*, 3. As with the ’324 patent, Henke describes using models which are tested using the rapid prototyping system. *Id.*

23. Based on my review of the ’324 patent and Henke, it is also clear that Henke is also reasonably pertinent to the problems addressed by the ’324 Patent. One of the primary problems addressed by the ’324 patent is monitoring and control of a remote automated process. For example, the client devices discussed in the ’324 patent are described as “devices within the environment 300 operated by users to initiate and monitor print jobs at the three-dimensional printers 304.” EX1001, 8:49-51. This includes the ability to “host remote users and/or activity through the network interface.” *Id.*, 5:35-37. In one example a “video camera may provide a remote video feed through the network interface 136, which feed may be available to remote users through a user interface maintained by, e.g., remote hardware such as the print servers...or within a web page provided by a web server hosted by the three-dimensional printer.” *Id.*, 6:19-33. The ’324

patent goes on to describe that client devices can include mobile devices used “to submit objects for printing, to monitor a personally owned printer and/or to monitor a pending print job.” *Id.*, 12:47-51. In yet another example, the ’324 patent describes that a “web-based user interface may permit video monitoring of each one of the plurality of three-dimensional printers, or otherwise provide information useful to a remote user.” *Id.*, 14:63-15:5. The user interface described in the ’324 patent allows users to “visually monitor progress or status of a remote print job through the user interface.” *Id.*, 22:56-60.

24. Henke is directly applicable to this remote monitoring and control functionality with which the ’324 patent is concerned. For example, Henke’s system provides “Web-based access to control electro-mechanical models.” EX1014, 2. Henke is directly relevant to the problem of remote monitoring and control of an automated process, describing that a user interface is provided at a remote computer to allow the remote user to “handle laboratory procedure (start, stop, reset), change environmental variables if necessary and watch the laboratory procedure by supervising the model and environmental variables inside an I/O monitor or by observing the hardware model directly via a Web-Cam.” EX1014, 5. These disclosures of Henke regarding control and monitoring of an automated process at a remote computer are reasonably pertinent to the problem addressed by

the '324 Patent. POSITA's working in the area of networked 3D printers during the relevant time frame would have also had knowledge relating to remote control and monitoring of other networked automated systems and would have known to look to such systems (such as the system described in Henke) to provide useful guidance on how to implement such systems. Henke's teachings regarding remote monitoring and control of automated processes are therefore reasonably pertinent to the problems of remote control and monitoring of an automated process toward which the '324 patent is directed.

4. Claims 1, 3, 5-7, 9-10, and 19-22 are rendered obvious by the combination of Mazumder and Mori

4.1. The combination of Mazumder and Mori provides all elements of independent claims 1 and 19

25. Dr. Cormier argues that the proposed combination of Mazumder and Mori that I discussed in my first declaration fails to provide all elements of independent claims 1 and 19 because "Mori as used in the combination does not teach or disclose a user interface that presents an image and projection at the same time." EX2009, ¶128. However, this assertion from Dr. Cormier is incorrect for at least two reasons: (1) as I discussed above in Section 1, the claims of the '324 patent do not require that the image of the build volume from the video camera and the two-dimensional projection of the three-dimensional model be presented in the

user interface at the same time; and (2) Dr. Cormier's arguments focus on the Mori reference alone rather than the proposed combination of Mazumder with Mori that I discussed in my first declaration.

26. In his declaration, Dr. Cormier accurately identifies that in a first embodiment of Mori, "[t]he first apparatus/method in Mori displays either actual images or section images" of the workpiece (the object being fabricated). EX2009, ¶129. The sectional information images described in Mori are an example of the "two-dimensional projection of the three-dimensional model" recited in claims 1 and 19 because the sectional images show a virtual cross section of the workpiece based on the model. EX1005, [0070], [0074]-[0076], FIGs. 4, 7, 10. Mori describes that the "sectional image data" is virtual two-dimensional image data depicting a "sectional shape appearing when at least the workpiece W is cut along a predetermined cutting plane, and the shape of the workpiece W which is located behind the predetermined cutting plane." *Id.*, [0074]. The sectional images are therefore a two-dimensional projection of the three-dimensional model. Mori is also clear that the sectional image data is displayed in the user interface, describing that the system "transmits a sectional image display signal to the display-image switching section 25" and that the system "displays on the display device 65 the actual image data output from any one of the actual CCD cameras 11, 12, 13 and

14, the virtual image data transmitted from the camera selection section 24, or the sectional image data transmitted from the sectional image generating section 26, and Switches the image to be displayed between the actual image data, the virtual image data and the sectional image data.” *Id.*, [0070]. Mori thus discloses displaying the actual image data, the virtual image data, and the sectional image data. Mori is also clear that “the virtual CCD cameras 19, 20, 21 and 22 are respectively arranged at the same positions and in the same orientations as the actual CCD cameras 11, 12, 13 and 14” such that “the view points of the virtual CCD cameras 19, 20, 21 and 22 match the view points of the actual CCD cameras 11, 12, 13 and 14, respectively.” *Id.*, [0062]. Because there is no requirement in the claims that the image of the build volume from the video camera and the two-dimensional projection of the three-dimensional model, Mori, when predictably applied to Mazumder, discloses that the user interface presents both the image of the build volume from the video camera and the two-dimensional projection of the three-dimensional model from the same point of view.

27. However, even if the claims did include such an unrecited requirement that the image of the build volume from the video camera and the two-dimensional projection need to be displayed simultaneously, the predictable combination of Mazumder with Mori that I described in my first declaration

renders such an arrangement obvious. For example, Mazumder describes presenting an image of the build volume in a user interface. Specifically, Mazumder describes that the system includes a “video or television camera 65” and that “video or TV camera 65 records the laser-aided DMD process and transmits the images to the local computer 70, which then sends the images together with the associated temperature, strain and stress data to the remote computer 95 to be displayed preferably on a TV screen or shown on the remote computer monitor as streaming video.” EX1004, 3:26-31, 6:36-43. Mazumder also discloses use of “web browsers” for viewing text, “video, graphics and audio files” at the remote user’s station. EX1004, 1:24-29, 2:14-17 (“a design team or an individual designer is located at the ‘remote’ site and operates, through a user interface, their ‘remote’ host computer.”), 7:36-38 (“a user interfaces to the communications link through an Internet browser”). Mazumder therefore discloses a user interface that presents an image of the build volume from the video camera.

28. In applying the teachings of Mori to Mazumder, which already has a user interface that displays an image of the build volume from the video camera, I proposed a straight forward modification in which the virtual images disclosed by Mori (including both the full virtual images of the object being fabricated and/or the sectional images) would be added to Mazumder’s user interface. Specifically,

in my first declaration, I identified that a POSITA would have recognized multiple benefits that would have predictably been provided by *modifying Mazumder's system based on Mori's teachings* to include actual images of the object being fabricated as captured by one or more cameras (as described by both Mazumder and Mori) *in the user interface displayed at Mazumder's remote computer 95 along with virtual images of the object generated* from stored model data shown from the perspective of one or more virtual cameras (as suggested by Mori)."

EX1003, ¶84. I then identified a number of benefits that would have arisen from such a combination of Mazumder and Mori as would have been readily recognized by a POSITA. *Id.*, ¶¶85-88. Neither the Patent Owner nor Dr. Cormier has identified any flaws in the benefits that I identified in my first declaration, nor have they argued that such benefits would not have occurred from the predictable combination of Mazumder and Mori that I described in my first declaration. As such, Dr. Cormier's arguments, which focus on the disclosures of Mori alone, rather than the combination of Mazumder with Mori that I previously described, miss the point. The predictable combination of Mazumder and Mori would have included simply adding virtual and/or sectional images (as taught by Mori) to the user interface already disclosed by Mazumder (which already includes images of the build volume taken using actual cameras). *Id.*, ¶¶84-88. This proposed combination thus would have resulted in a system in which the image of the build

volume from the video camera and the two-dimensional projection are displayed simultaneously in the user interface.

29. As I previously described “the presentation of the actual images captured by the camera and the virtual images simultaneously within the user interface would have beneficially aided the remote user to more easily visually compare the actual image and virtual image to quickly identify any defects or problems with the fabrication process.” EX1003, ¶113. Dr. Cormier has not disputed this benefit. Such an implementation would have complimented the goal of Mazumder, which was to allow a user to detect faults or defects in the model and/or build process. For example, Mazumder expressly describes “image and video observation of the laser-aided direct material deposition process” including “*detailed and accurate view[s]*” that allows “the designer [to] *perceive[] a defect, an abnormality or some other undesirable characteristic*” of the fabrication process. EX1004, 2:27-42. As I described in my first declaration, modifying Mazumder’s user interface to include display of Mori’s virtual images and/or sectional images (in addition to the actual camera images already displayed in Mazumder’s user interface) would have increased the ability of users to perceive defects or other undesirable characteristics in the model or build process and

therefore such a modification would have furthered the express goals that Mazumder was attempting to achieve.

4.2. The combination of Mazumder and Mori provides the additional recitations of dependent claim 5

30. Claim 5 of the '324 patent recites “[t]he device of claim 1 wherein the two-dimensional projection is dynamically updated to correspond to a state of physical completion of the object.” Mori demonstrates that the predictable combination of Mazumder with Mori provides this additional claim recitation.

31. Dr. Cormier argues that Mori’s “teachings are very specific to a destructive machine tool.” EX2009, ¶145. However, as I explained in Section 2, above, a POSITA would have recognized that the teachings of Mori are broadly applicable to all types of rapid fabrication systems, including three-dimensional printing type rapid fabrication systems. While it is true, as Dr. Cormier states, that Mori includes specific teachings regarding determining a cutting area that overlaps between the tool and workpiece and updating the model based on removing a cutting area from the model (EX1005, [0056]; EX2009, ¶145), the broader teaching of Mori to update the virtual images as the fabrication process progresses is directly applicable to the three-dimensional fabrication system of Mazumder.

32. Mori includes clear disclosure that “the model data of the entire machine tool 50 in the model data storage section 16 is updated by the model data updating section 17 synchronically with the actual operations of the first saddle 52, second saddle 53 and spindle head 54, based on the operation command obtained from the control device 62.” EX1005, [0078]. This “model data” that is updated includes “model data of the tool T, workpiece W and a part of the table 56 among the model data of the entire machine tool 50.” *Id.*, [0061]. In this context, the “workpiece W” is the object being fabricated (in a destructive manner, rather than an additive manner). A POSITA would have recognized that these disclosures are more broadly applicable to automated fabrication systems in general and not limited to machining tools. As such, a POSITA would have recognized the broader teaching of these disclosures that the virtual image data is updated based on the progress of fabricating the object. In the case of Mori’s machining tool, this would include updating the virtual image as material is removed from the object being fabricated as the fabrication process progresses but a POSITA would have recognized that in an additive manufacturing system, this would have included updating the virtual image based on the progress of the additive fabrication process.

33. To be clear, a POSITA would have known how to dynamically update the virtual images to correspond to a state of physical completion of the object because such processes were known in the prior art. For example, Anderson demonstrates that a POSITA had the ability to apply Mori's teachings to Mazumder in such a manner. For example, Anderson discloses the user interface includes "progress information" that is updated as the three-dimensional printer operates such that "[a]fter each pass of the printheads, the printer updates a status register" to accurately track "the number of passes completed by the printhead." EX1012, [0018]. Anderson teaches that "the server polls the printer for the pass number" and updates the displayed model "to show the completed portion as a filled-in (e.g., solid colored) area." *Id.*

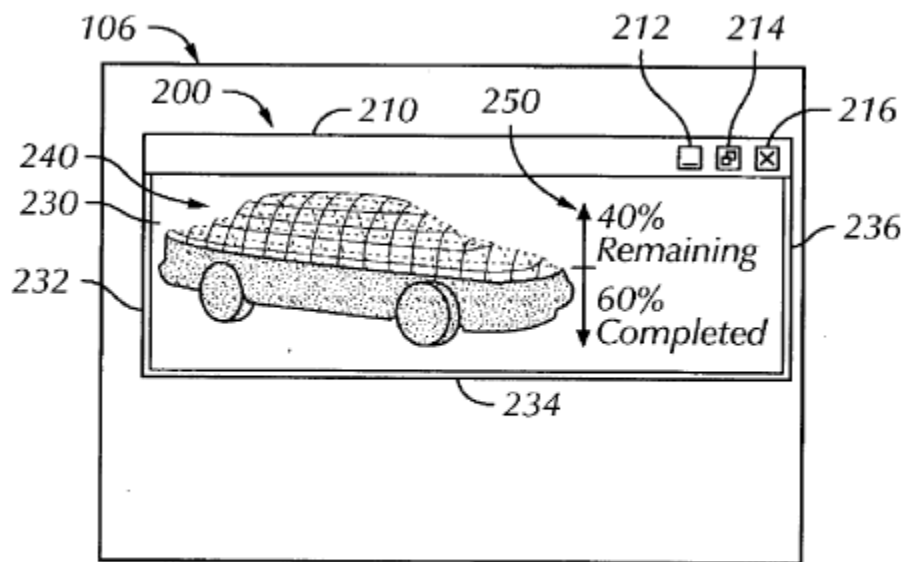


FIG. 2A

EX1012, FIG. 2A, [0018]-[0020]. In another example, Anderson discloses that “status includes...data pertaining to three-dimensional object(s) fabrication progress.” *Id.*, [0026].

34. These examples in Anderson are just one example demonstrating that a POSITA would have had the skill to apply Mori’s straight forward teaching (to update the virtual image of the model as the fabrication process progresses) to an additive manufacturing system, such as that described in Mazumder.

5. Claim 8 is rendered obvious by the combination of Mazumder, Mori, and Hull

35. In asserting that the combination of Mazumder, Mori, and Hull does not provide claim 8, Dr. Cormier addresses the Hull reference alone rather than the proposed combination of Mazumder, Mori, and Hull that I described in my first declaration. In my first declaration, I proposed applying the teachings of Hull to the previously described combination of Mazumder and Mori “to further include functionality to require a user to provide credentials to access the user interface.” EX1003, ¶149. I then presented a number of benefits that would have arisen from such a modification based on Hull that a POSITA would have readily recognized. *Id.*, ¶¶119-153.

36. Rather than addressing the combination that I proposed in my first declaration, Dr. Cormier makes arguments about the specific computers in Hull. For example, in describing Hull's system, Dr. Cormier asserts that "[a]fter entering the address of the slice computer, a POSITA would have understood that Hull's 'remote user' that is local at the process/control computer then provides a password to access the slice computer in order to 'get' the sliced files from the slice computer to the process/control computer." EX2009, ¶162. However, the precise nature of the computer where the user is located and the computer that the user is remotely accessing in Hull's system (rather than the Mazumder-Mori-Hull system) is irrelevant. Hull has a clear teaching that it is useful to require credentialed access to a remote computer in a networked rapid fabrication environment. EX1008, [0157]. Specifically, Hull discloses a "remote user" feature that requires a user to "type your password and press ENTER" *Id.* to access a computer that is remotely located from the computer at which the user is located. This disclosure of requiring credential-based access to access a remotely located computer is broadly applicable to networked computing systems in general and directly applicable to Mazumder's networked fabrication system, regardless of the specific names/locations of the computers in Hull's system. Application of Hull's suggestion to the Mazumder-Mori combination therefore would have led to a system in which the remote user was required to enter access credentials to access

Mazumder's local computer 70 at the local fabrication site 205 which provided the user interface and therefore the user interface would have required credential-based access in the resulting combination.

37. Indeed, requiring credentials to access a remotely located computer over a network was hardly new by the August 2010, priority date of the '324 patent and a POSITA would have been well aware of such functionality. *See e.g.* EX1028, 1:25-30 (“provide remote access to their computer networks.”), 1:62-2:5 (describing “an optional authentication phase by providing two authentication protocols, the Password Authentication Protocol (PAP and the Challenge Handshake Authentication Protocol (CHAP)” that includes using “a set of fixed passwords to authenticate a remote node that is requesting to make a dial-in connection with a network access server.”); EX1029, Abstract (describing a “remote login manager” that retrieves “authentication information from the service management server and authenticates them based on the obtained information”), [0058] (“The remote login manager 251 requests authentication information from the user 801.”), [0072] (“The login manager 151 displays a dialog to prompt the user 801 to input a user name and a password.”); EX1030, Abstract (describing “secure access control of an intelligent electronic device (‘IED’)” and that “The security key may take the form of a password inputted into the IED, an access

device incorporated within the IED, and/or a remote access device.”), [0016] (“The system may further comprise a network, and a remote computer coupled to the IED via the network. The remote computer may be configured to transmit an IED security file to the IED. The IED security file may comprise a unique security code/password that is associated with a role comprised of one or more permissions.”); EX1031, Abstract (“...provide a tri-mode security network having remote connectivity and access”), [0236] (“Authentication as a security requirement means that stream clients must present credentials in order to obtain a stream. Furthermore, this presentation of credentials should be done in a way that is secure from network snooping and replays. An example of secure authentication is Basic Authentication over HTTPS. Here a username and password are presented over an encrypted HTTPS channel so snooping and replays are prevented.”); EX1032, Abstract (describing “remote access to devices in a private subscriber network” where “device access information includes login information for the device web server, such as a user ID and password, or SSO token.”).

38. As such, a POSITA would have been well aware of credential based access for remotely accessing a computing system in a networked computer system and therefore would have known how to apply the teachings of Hull to the

Mazumder-Mori system to require credential based access for remotely accessing Mazumder's local computer 70. In any case, since the elements of claim 1 are taught in the prior art, merely adding the limitation that a user should log into a computer before using it in 2010 would not be novel.

6. Claims 1, 3, 5-7, 9-10, and 19-22 are rendered obvious by the combination of Kritchman, Tay, and Henke

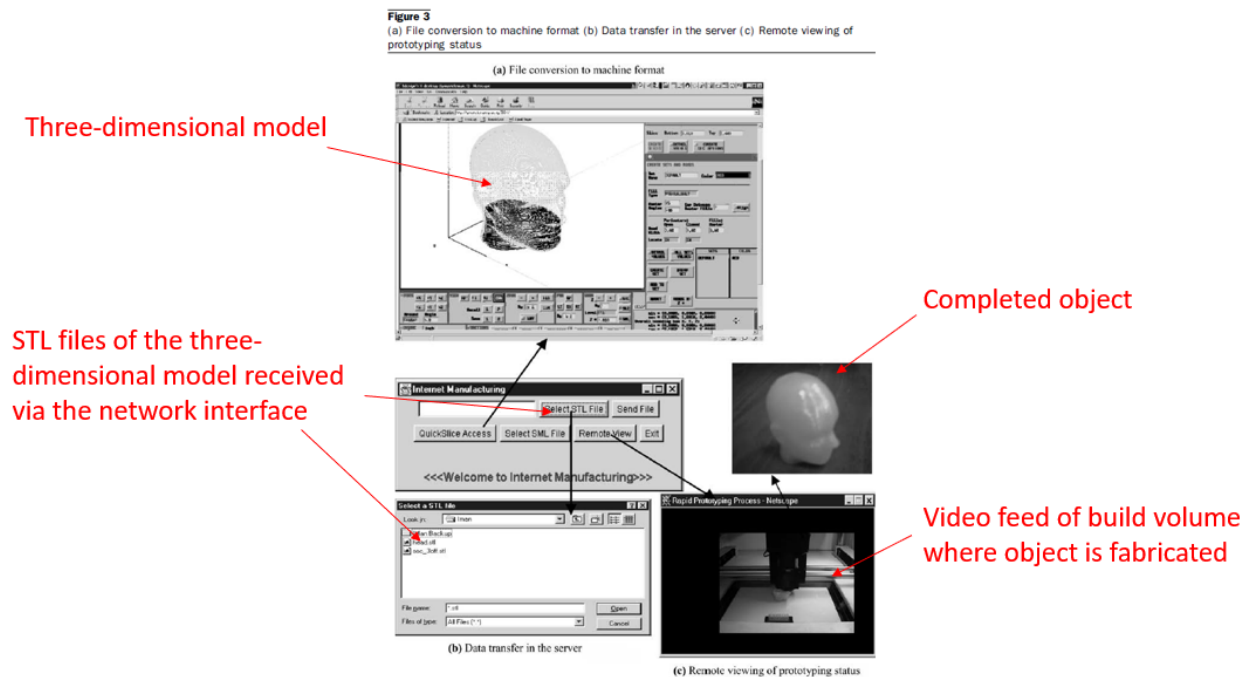
6.1. The combination of Kritchman, Tay, and Henke provides all elements of independent claims 1 and 19

39. With respect to Ground 2A, the Patent Owner and Dr. Cormier again assert that the combination that I described in my first declaration fails to provide Elements [1.d] and [19.d]. However, as addressed in my first declaration, the combination of Kritchman, Tay, and Henke provides “an image of the build volume from the video camera and a two-dimensional projection of the three-dimensional model from the point of view of the video camera” in at least two ways.

40. First, such a feature is disclosed by the Tay reference (when properly applied to Kritchman). Tay describes a networked three-dimensional printer system in which “the server applications...have a direct link with the front-end terminals controlling the rapid prototyping hardware.” EX1013, 1. Tay's rapid prototyping center includes a web cam and video conferencing software to provide

images of the fabrication process in progress to the user at the client device.

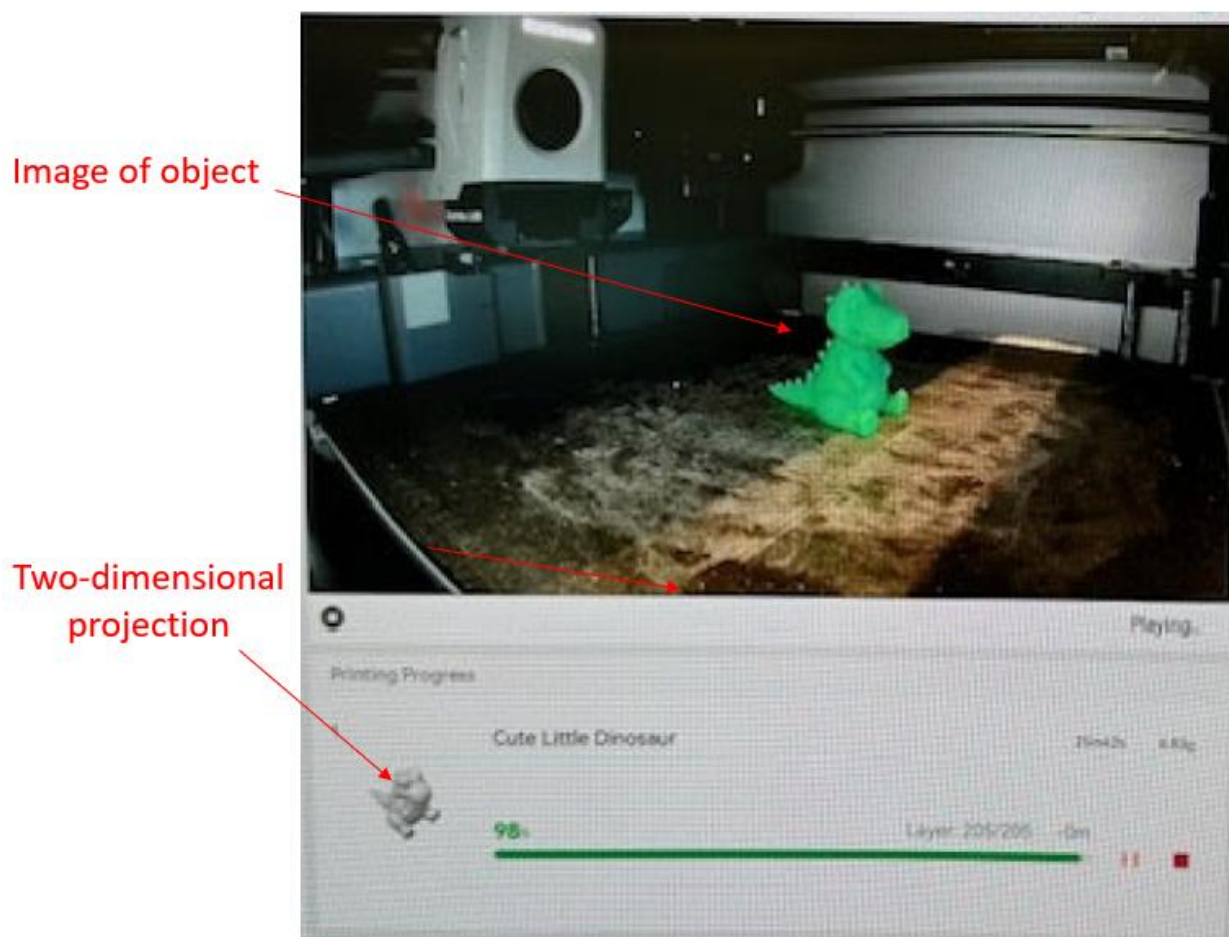
EX1013, 3. Figure 3 shows the user interface of Tay which includes displays of the model of the object to be fabricated and actual images of the build process captured by cameras located at the rapid prototyping center:



EX1013, 4-5.

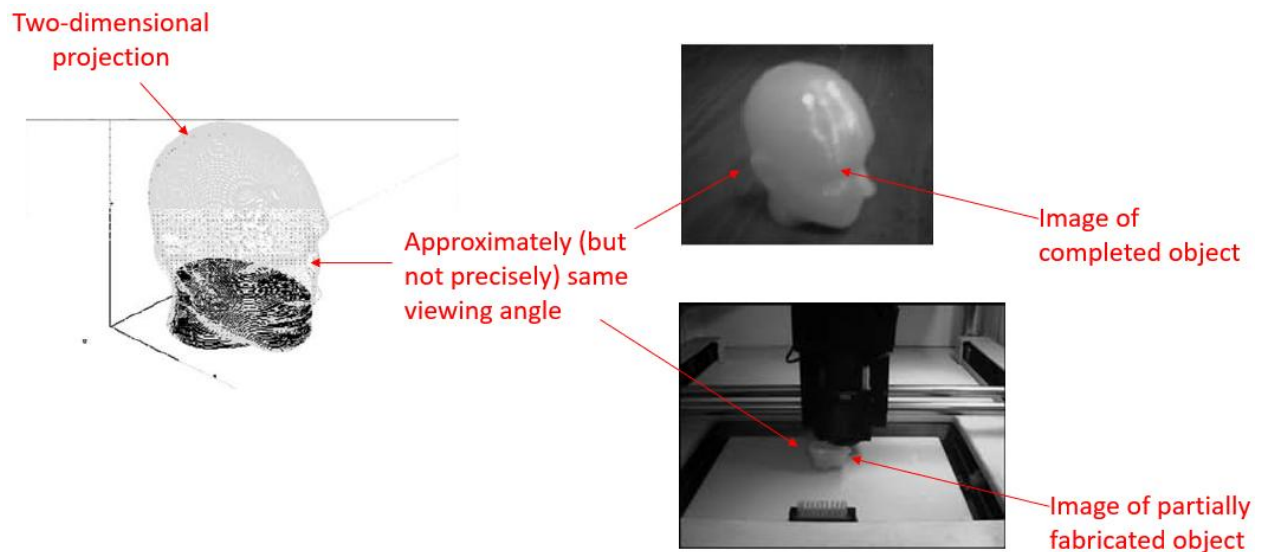
41. In the example shown in Figure 3 of Tay, the displayed image of the completed object, the display of the build process in progress, and the displayed two-dimensional projection of the three-dimensional model appear to be from the same point of view included in Tay's user interface. I have reviewed Patent Owner's infringement contentions and in those contentions, the Patent

Owner appears to make arguments that presenting the two-dimensional projection of the three-dimensional model from the point of view of the video camera does not require that the image of the build volume from the video camera and the two-dimensional projection of the three-dimensional model have the exact same angle with respect to the object being fabricated. For example, Patent Owner's infringement contentions identify following projection and image are from the same point of view:



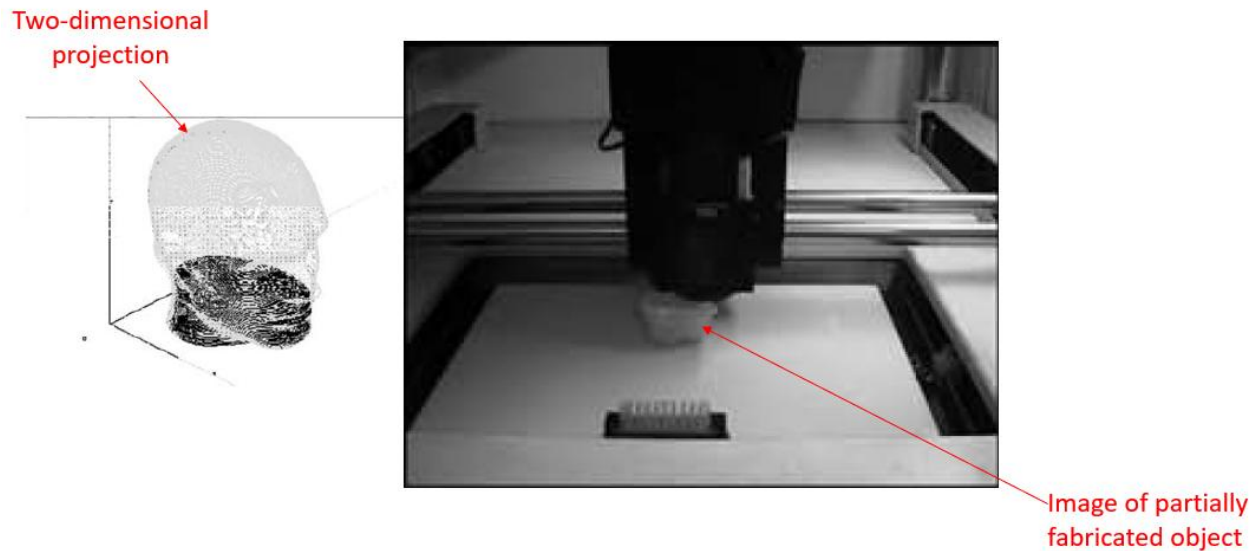
EX1016, 43, 39. The Patent Owner identifies this screen shot as allegedly satisfying element [1.d] even though the object identified in the image of the build volume is depicted at a different angle than the image that the Patent Owner identifies as a two-dimensional projection of the three-dimensional model. In the above example, the actual image of the object shows substantially a side-view of the object and the projection shows more of a top down angle of the object.

42. The angle of observation of the two-dimensional projection of the three-dimensional model and the image of the object shown in Tay are depicted from a much closer angle than the images Patent Owner identified in its infringement contentions (above). This is shown in Figure 3 of Tay:



EX1013, 5.

43. This is shown even more clearly when the image of the partially fabricated object is zoomed-in, with both the actual image of the object and the two-dimensional projection showing an angled side view:



44. As I explained in Section 1, above, the claims do not require that the image of the build volume from the video camera and the two-dimensional projection of the three-dimensional model from the point of view of the video camera need to be displayed simultaneously. So, the above disclosures of Tay provide this claim feature alone as well as in combination with the other references.

45. However, even if the claims were interpreted to read in a requirement that the image and the two-dimensional projection need to be

displayed simultaneously, and/or to require that the image and the two-dimensional projection need to be from the exact same angle, application of Henke to Kritchman and Tay provides such features. For example, Figure 8 of Henke shows a user interface for accessing a remotely located rapid prototyping environment in which in which camera images of the real-world device and the simulation of the model being executed by the device are both shown at the same time in the user interface and shown from the same angle (a direct front-on perspective).

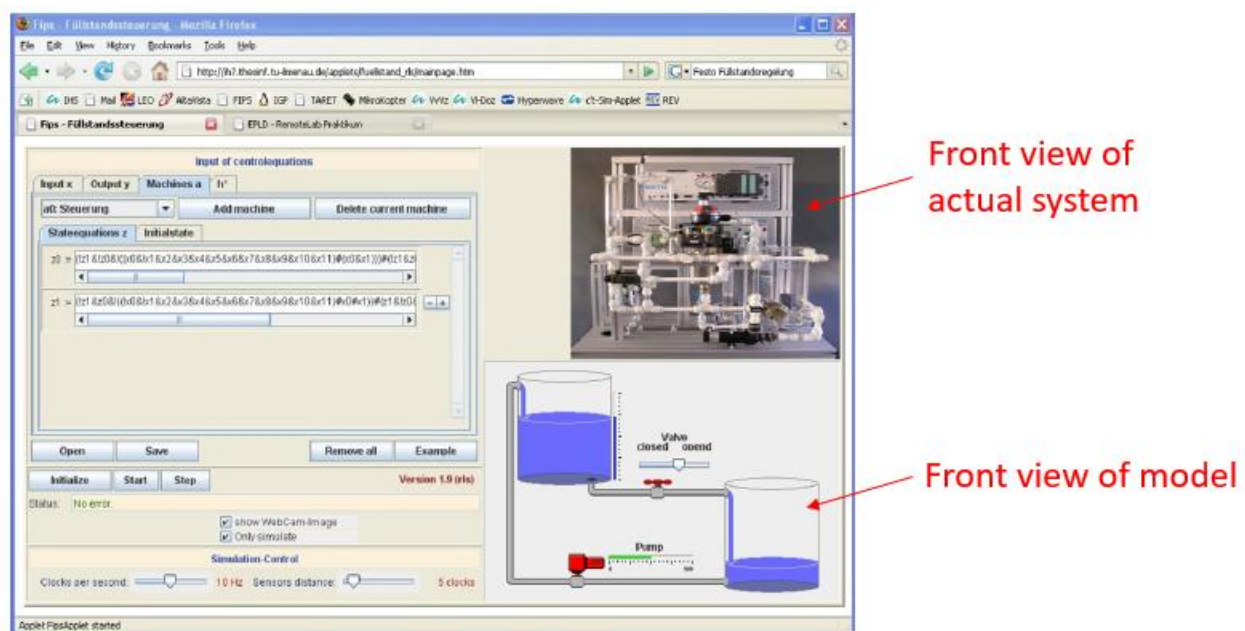


Figure 8. Online control of the Water level control - with Internet connectivity to the Remote Lab

EX1014, 5. Applying these teachings to a networked three-dimensional printing system (resulting from applying Tay to Kritchman) would have resulted in the images of the build volume and image of the model (both already disclosed by

Tay) being displayed from the exact same angle at the same time. In my first declaration, I identified a number of benefits that would have arisen from such a predictable application of Tay and Henke to Kritchman and neither the Patent Owner nor Dr. Cormier has disputed these benefits. EX1003, ¶¶197-208.

46. Dr. Cormier asserts that “Henke only visualizes an underlying simulation of water-level control.” EX2009, ¶182. This is not the case. Henke shows video of an operating apparatus as well. In any case, this assertion focuses on a narrow, single example in Henke rather than the broader disclosures of Henke as a whole. Henke makes clear that its teachings are relevant to “various electro-mechanical models” to allow for “Rapid Prototyping” without requiring designers to travel. EX1014, 2, 7 (“...we present here exemplarily.”). These teachings are thus directly applicable to other networked rapid prototyping systems in which a user controls and monitors execution of an electro-mechanical device from a remote work station, such as the system described by Tay (and the resulting system of applying Tay to Kritchman). The predictable application of Henke’s teachings to the Kritchman-Tay combination would have provided a system in which Tay’s image of the build volume from the video camera and Tay’s two-dimensional projection of the three-dimensional model from the point of view of the video camera are displayed simultaneously and from the same viewing angle.

6.2. The combination of Kritchman, Tay, and Henke provides dependent claims 3 and 5

47. Claim 3 recites: “wherein the two-dimensional projection is simulated based upon operation of the three-dimensional printer.” Claim 5 recites: “The device of claim 1 wherein the two-dimensional projection is dynamically updated to correspond to a state of physical completion of the object.” The Kritchman-Tay-Henke combination provides these additional claim recitations. For example, Henke describes that “[t]he physical behaviour of the actual model, and its environment as well, will be emulated (e. g. as simulation model)” and the “[d]ynamic activities will be animated.” EX1014, 3. Henke further describes that “[s]imulation and visual prototyping help to find functional errors.” *Id.* The model is both simulated and “tested on real electro-mechanical models.” *Id.* Additionally, Henke discloses displaying the simulation of the model and the actual real-world implementation of the model using the electro-mechanical station:

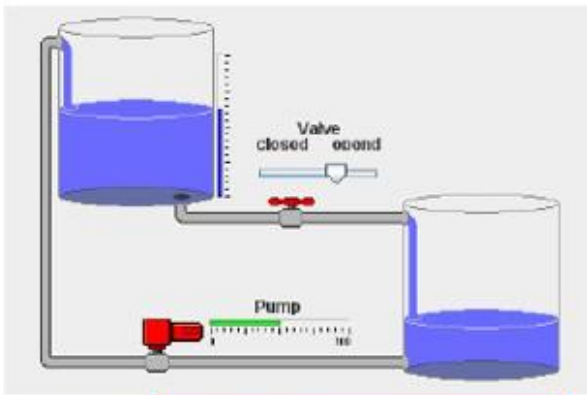


Figure 2. Visual model of the Water level control task



Figure 3. Hardware model of the Water level control unit

EX1014, 3.

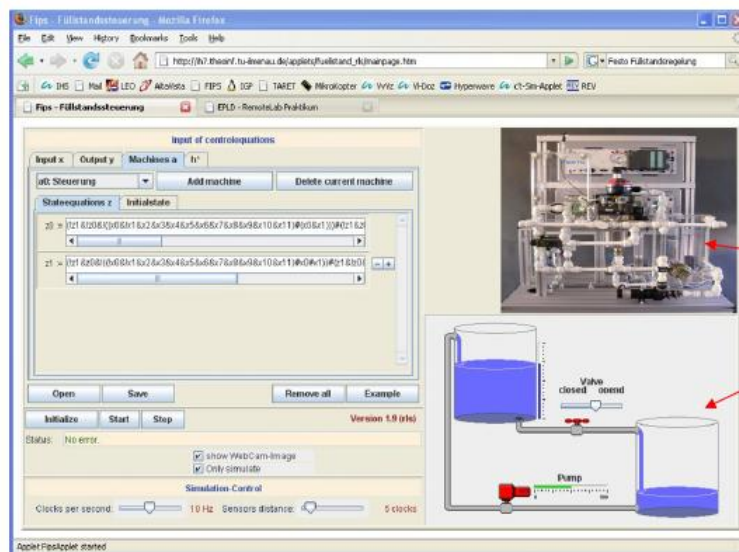


Figure 8. Online control of the Water level control - with Internet connectivity to the Remote Lab

EX1014, 5.

48. As Henke describes, the rapid prototyping system provides both a “visual prototype” as a virtual display and as an actual “Hardware model” to allow

users to “test their design under real environmental conditions in the Remote Lab.”

EX1014, 5, 3. Additionally, Henke discloses that the displayed simulation of execution of the model is conducted in parallel with the real-world execution of the model such that the virtual representation of the execution of the model is simulated based upon operation of the real-world implementation of the model and corresponds to a state of execution of the model. Specifically, Henke discloses “step by step and *parallel execution* of these prototypes” to allow the user to “*watch* the laboratory procedure by *supervising the model* and environmental variables inside an I/O monitor or by *observing the hardware model directly via a Web-Cam*.” *Id.*, 5-6 (“supervising the hardware equipment via Web-cam”). Based on these descriptions in Henke, a POSITA would have recognized that when Henke is applied to the networked three-dimensional system of Kritchan and Tay, the model is updated based on operation of the real-world device to correspond to the state of physical completion of the object being fabricated.

7. The combination of Kritchman, Tay, Henke, and Anderson provides dependent claim 5

49. Claim 5 recites: “The device of claim 1 wherein the two-dimensional projection is dynamically updated to correspond to a state of physical completion of the object.” Dr. Cormier asserts that “Anderson only teaches updating the amount of fill in a fixed wireframe representation of a model that is

updated periodically based on the pass number” and that this means that the updates to the model are not “dynamic updates.” EX2009, ¶193. I believe that Dr. Cormier’s analysis of claim 5 with respect to the Kritchman-Tay-Henke-Anderson combination is based on an overly narrow interpretation of the claim language.

50. As I discussed in my first declaration, Anderson discloses the user interface includes provides “progress information” that is updated as the three-dimensional printer operates such that “[a]fter each pass of the printheads, the printer updates a status register” to accurately track “the number of passes completed by the printhead.” EX1012, [0018]. Anderson teaches that “the server polls the printer for the pass number” and updates the displayed model “to show the completed portion as a filled-in (e.g., solid colored) area.” *Id.*

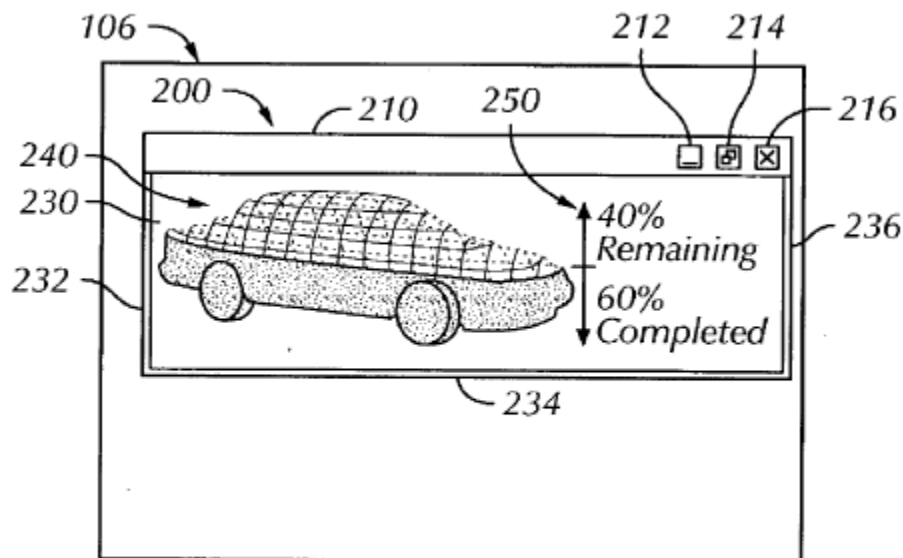


FIG. 2A

EX1012, FIG. 2A, [0018]-[0020]. Anderson describes that these depictions in the user interface provide “a visual representation of progress of the three-dimensional object(s) fabrication task” to provide “monitoring of the build progress.” EX1012, [0027]-[0028]. A POSITA would have understood that this “visual representation of the progress” of fabrication of the object indicates that the model is updated dynamically to correspond to a state of the physical completion of the object. *Id.* Anderson also describes the updating as “a real time indication of job progress.” *Id.*, [0005], [0018]. This updating of the model displayed in the user interface based on the “number of passes completed by the printhead” that provides “a real time indication of job progress” satisfies the requirement of claim 5 that “the two-dimensional projection is dynamically updated to correspond to a state of physical completion of the object.” *Id.*

51. A POSITA would not have read claim 5 so narrowly as to require instantaneous or near instantaneous updating of the model and exclude updating the model based on the number of passes performed. I have reviewed the '324 patent specification and I do not find any description in the '324 patent that would indicate such a narrow reading for the claims in the specification or in the claim language itself. The term “dynamic” does not appear on the '324 patent specification and the term “dynamically” appears only once. EX1001, 24:64-25:5.

The statement in the '324 patent that “[t]he two-dimensional projection may be dynamically updated to correspond to a state of physical completion of the object in order to provide real time, or quasi-real time visual status information” does not indicate the narrow claim interpretation advanced by Patent Owner and Dr. Cormier. Rather, this statement mirrors the disclosure of Anderson of providing a “a real time indication of job progress” in the form of the updated model. *Id.*, [0005], [0018].

52. Dictionary definitions for the term “dynamic” similarly indicate that the claim interpretation advanced by Patent Owner and Dr. Cormier is improperly narrow. The plain and ordinary meaning of the word “dynamic” only requires that the two-dimensional projection be “changing or capable of being changed over a period of time” while the “program is running.” EX1024; see also EX1025 (“dynamic” means “referring to data which can change with time.”); EX1026 (“dynamic” in the area of “computing” means “needing its contents refreshed periodically.”).

8. The combination of Kritchman, Tay, Henke, and Hull provides dependent claim 8

53. The combination of Kritchman, Tay, Henke, and Hull provides claim 8 for reasons similar to those that I discussed above in paragraphs 35-38.

Similar to his arguments regarding the application of Ground 1C to claim 8, Dr. Cormier's arguments with respect to the application of Ground 2C to claim 8 address the Hull reference alone rather than the proposed combination of Kritchman, Tay, Henke, and Hull that I described in my first declaration. In my first declaration, I proposed applying the teachings of Hull to the previously described combination of Krtichman, Tay, and Henke "to further include functionality to require a user to provide credentials to access the user interface." EX1003, ¶260. I then presented a number of benefits that would have arisen from such a modification based on Hull that a POSITA would have readily recognized. *Id.*, ¶¶260-264.

54. In addressing the application of Ground 2C to claim 8, Dr. Cormier retreads his arguments from Ground 1C and provides discussion of the specific arrangement of computers and the location of the user in Hull's system itself, rather than addressing the application of Hull's suggestion to the previously described combination of Krtichman, Tay, and Henke. For example, Dr. Cormier argues that "a POSITA would have understood that the 'remote user' that is local to the fabrication system and three-dimensional printer already has access to the local fabrication system and three-dimensional printer and thus there would be no reason for credentials to access the local fabrication system and three-dimensional

printer in the combination of Ground 2C.” EX2009. ¶199. However, this argument addresses the Hull system, not the application of Hull to the Kritchman-Tay-Henke combination. It is also not true. Users regularly used credentials to access a local system ranging from a shared computer at a student computer lab to an ATM machine at a bank.

55. Hull has a clear teaching that it is useful to require credentialed access to a remote computer in a networked rapid fabrication environment. EX1008, [0157]. Specifically, Hull discloses a “remote user” feature that requires a user to “type your password and press ENTER” to access a computer that is remotely located from the computer at which the user is located. *Id.* This disclosure of requiring credential-based access to access a remotely located computer is broadly applicable to networked computing systems in general and directly applicable to the networked fabrication system resulting from applying Tay and Henke to Kritchman, regardless of the specific names/locations of the computers in Hull’s system. Application of Hull’s suggestion to the Kritchman-Tay-Henke combination therefore would have led to a system in which the remote user was required to enter access credentials to remotely access Kritchman’s controller 105 via the network (as taught by Tay) which provided the user interface

and therefore the user interface would have required credential-based access in the resulting combination.

56. Indeed, requiring credentials to access a remotely located computer over a network was hardly new by the August, 2010 priority date of the '324 patent and a POSITA would have been well aware of such functionality. *See e.g.* EX1028, 1:25-30 (“provide remote access to their computer networks.”), 1:62-2:5 (describing “an optional authentication phase by providing two authentication protocols, the Password Authentication Protocol (PAP and the Challenge Handshake Authentication Protocol (CHAP)” that includes using “a set of fixed passwords to authenticate a remote node that is requesting to make a dial-in connection with a network access server.”); EX1029, Abstract (describing a “remote login manager” that retrieves “authentication information from the service management server and authenticates them based on the obtained information”), [0058] (“The remote login manager 251 requests authentication information from the user 801.”), [0072] (“The login manager 151 displays a dialog to prompt the user 801 to input a user name and a password.”); EX1030, Abstract (describing “secure access control of an intelligent electronic device (‘IED’)” and that “The security key may take the form of a password inputted into the IED, an access device incorporated within the IED, and/or a remote access device.”), [0016] (“The

system may further comprise a network, and a remote computer coupled to the IED via the network. The remote computer may be configured to transmit an IED security file to the IED. The IED security file may comprise a unique security code/password that is associated with a role comprised of one or more permissions.”); EX1031, Abstract (“...provide a tri-mode security network having remote connectivity and access”), [0236] (“Authentication as a security requirement means that stream clients must present credentials in order to obtain a stream. Furthermore, this presentation of credentials should be done in a way that is secure from network snooping and replays. An example of secure authentication is Basic Authentication over HTTPS. Here a username and password are presented over an encrypted HTTPS channel so snooping and replays are prevented.”); EX1032, Abstract (describing “remote access to devices in a private subscriber network” where “device access information includes login information for the device web server, such as a user ID and password, or SSO token.”).

57. As such, a POSITA would have been well aware of credential based access for remotely accessing a computing system in a networked computer system and therefore would have known how to apply the teachings of Hull to the Kritchman-Tay-Henke system to require credential based access for remotely accessing Kritchman’s controller 105.

9. Right to Supplement

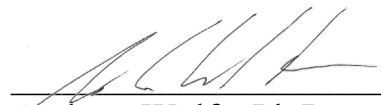
58. I reserve the right to supplement my opinions in the future to respond to any arguments that the Patent Owner may raise. This declaration represents only those opinions that I have formed to date. I reserve the right to revise, supplement, and/or amend my opinions stated herein based on new information that becomes available to me and on my continuing analysis of the materials already provided.

10. Jurat

59. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further 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 Title 18 of the United States Code.

12/12/25

Date



Andrew Wolfe, Ph.D.