

**UNITED STATES PATENT AND TRADEMARK OFFICE**

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**BEFORE THE PATENT TRIAL AND APPEAL BOARD**

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**AMAZON.COM, INC. AND AMAZON.COM SERVICES LLC,**  
**Petitioners**

**vs.**

**LIGHTGUIDE, INC.,**  
**Patent Owner**

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**Case IPR2024-00141**

**U.S. Patent No. 7,515,981**  
**Title: LIGHT GUIDED ASSEMBLY SYSTEM**  
**Issue Date: April 7, 2009**

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**PETITION FOR *INTER PARTES* REVIEW**

Mail Stop Patent Board  
Patent Trial and Appeal Board  
U.S. Patent and Trademark Office  
P.O. Box 1450  
Alexandria, VA 22313-1450

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## **PETITIONER’S EXHIBIT LIST**

| <b>Petitioner Exhibit No.</b> | <b>DESCRIPTION</b>  |
|-------------------------------|---|
| 1001                          | U.S. Patent No. 7,515,981 (cited as “’981 patent”)  |
| 1002                          | File History of U.S. Patent No. 7,515,981   |
| 1003                          | Declaration of Dr. William Singhose   |
| 1004                          | <i>Curriculum Vitae</i> of Dr. William Singhose   |
| 1005                          | European Patent Application Publication No. 0,470,901   |
| 1006                          | English Translation of European Patent Application Publication No. 0,470,901A1 (cited as “Poggi”)   |
| 1007                          | Declaration of Danelle Shaw (Translator of European Patent Application Publication No. 0,470,901)   |
| 1008                          | U.S. Patent No. 6,547,397 (cited as “Kaufman”)  |
| 1009                          | Claudio Pinhanez et al., <i>Applications of Steerable Projector-Camera Systems</i> , in Proceedings of the IEEE International Workshop on Projector-Camera Systems at ICCV (2003) (cited as “Pinhanez”)   |
| 1010                          | Siemens SIMATIC VS 72X / SIMATIC Spectation Manual (cited as “SIMATIC”)   |
| 1011                          | U.S. Patent No. 2,682,117   |
| 1012                          | Scott Blake, <i>Improving Manual Manufacturing with a Computer Based Laser Projection System</i> , 102-5 SAE Transactions: J. Materials & Manufacturing (1993)  |
| 1013                          | Karen Mason, <i>Laser projection systems improve composite ply placement</i> , CompositeWorld (Mar. 1, 2004), <a href="https://www.compositesworld.com/articles/laser-projection-systems-improve-composite-ply-placement">https://www.compositesworld.com/articles/laser-projection-systems-improve-composite-ply-placement</a> |
| 1014                          | Hiroshi Ishii et al., <i>Tangible bits: towards seamless interfaces between people, bits and atoms</i> , in Proceedings of ACM SIGCHI Conference on Human factors in computing systems 234-241 (Mar. 1997)  |

|      |   |
|------|---|
| 1015 | Rodney A. Brooks, <i>The Intelligent Room Project</i> , in Proceedings 2nd Int'l Conference on Cognitive Technology Humanizing the Information Age 271-278 (Aug. 1997)  |
| 1016 | Ramesh Raskar et al., <i>The Office of the Future: A Unified Approach to Image-Based Modeling and Spatially Immersive Displays</i> , in Proceedings of SIGGRAPH Annual Conference on Graphics 179-188 (1998)              |
| 1017 | John Underkoffler et al., <i>Emancipated pixels: real-world graphics in the luminous room</i> , in Proceedings of the 26th Conference on Computer Graphics and Interactive Techniques 385-392 (Jul. 1999)                 |
| 1018 | Excerpt entitled "Chapter 10, Manual, light-guided, semiautomatic and robotic assembly" from P.J.W. Noble, Printed Circuit Board Assembly 117-126 (1989)  |
| 1019 | U.S. Patent No. 5,506,641   |
| 1020 | Michael Robertson & William Singhose, <i>Evaluation of Analytic Deflection-Limiting Commands</i> , in Proceedings of 16th IFAC World Congress 598-603 (Jul. 2005)   |
| 1021 | Khalid Sorensen, William Singhose, & Stephen Dickerson, <i>A Controller Enabling Precise Positioning and Sway Reduction in Cranes with On-off Actuation</i> , in Proceedings of 16th IFAC World Congress (Jul. 2005)      |
| 1022 | Jason Lawrence & William Singhose, <i>Design of a Minicrane for Education and Research</i> , in Proceedings of 6 <sup>th</sup> International Workshop on Research and Education in Mechatronics (2005)                    |
| 1023 | Khalid Lief Sorensen, <i>A Combined Feedback and Command Shaping Controller for Improving Positioning and Reducing Cable Sway in Cranes</i> , Master Thesis in Dept. Mechanical Eng'g, Georgia Inst. of Tech. (Feb. 2005) |
| 1024 | U.S. Patent Application Publication No. 2007/0236354 (cited as "Green")   |
| 1025 | Declaration of Rick Kjeldsen (former IBM researcher)  |
| 1026 | Declaration of James L. Mullins (library practices and public availability expert)  |

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| 1027 | USPTO Record of patents assigned to Laser Projection Technologies |
|------|---|

All citations to specific pages of exhibits follow the pagination added to those exhibits per 37 C.F.R. § 42.63(d)(2)(i).

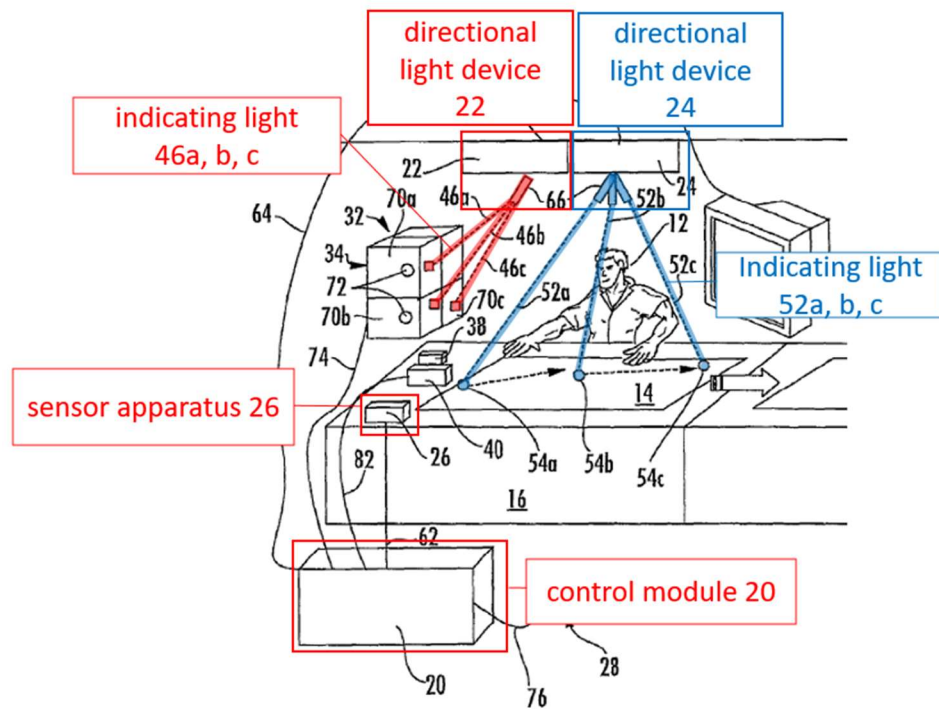


## I. INTRODUCTION

Petitioners Amazon.com, Inc. and Amazon.com Services LLC (collectively, “Amazon” or “Petitioner”) request *inter partes* review and cancellation of Claims 1-25 (“challenged claims”) of U.S. Patent No. 7,515,981 (EX1001, “’981 patent”), assigned to LightGuide, Inc. (“LightGuide”). The ’981 patent claims an earliest effective filing date of October 7, 2005. ’981 patent, (60).

The '981 patent is titled “Light Guided Assembly System” and concerns the long-known technique (dating back to at least the 1950s, when it was used for manufacturing) of using light to project instructions. EX1011 (U.S. Patent No. 2,682,117), 9:46-51 (describing “projecting light beams ... to indicate to an operator the sequence in which the parts are to be assembled.”)

The '981 patent purports to improve this established technique by combining it with a sensor, a “controller,” and input and command signaling. The base embodiment of the '981 patent, directed to an assembly workstation, is shown below:

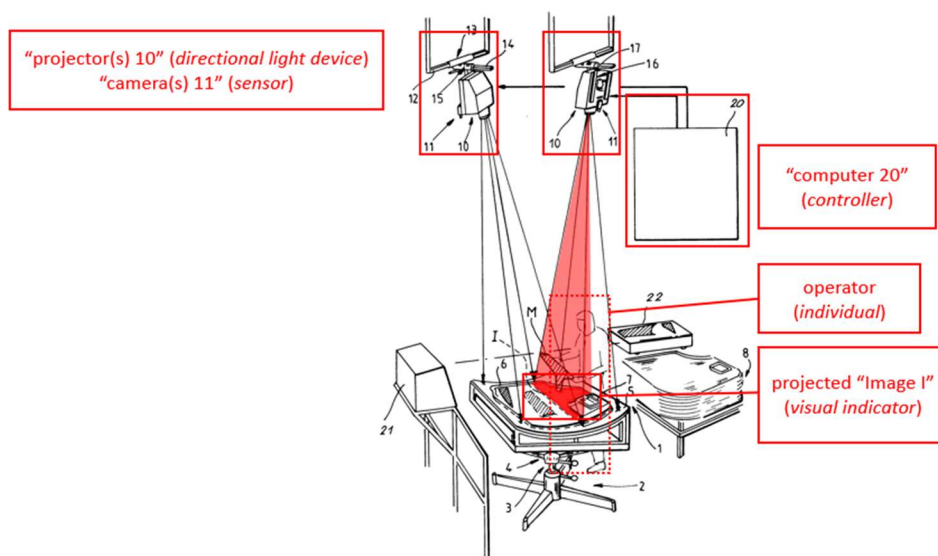


**'981 patent, FIG. 1 (annotated).**

Figure 1 shows two projectors to guide actions of an operator at an assembly workstation. Device 22 projects light, identifying which components to select, and device 24 projects light, showing where to put those components. '981 patent, 4:38-56. Sensor 26 detects “operation information” at the workstation, and sends

signals to the “control module 20,” which controls the projectors based on the inputs. *Id.*

The claimed combination of light-guided manufacturing and sensor/controller technology was not patentable in October 2005. Specifically, Poggi (EX1006), which was not cited or considered by the Examiner during prosecution of the '981 patent, uses two projectors, a controller, and camera sensors to guide an operator, step-by-step, to assemble parts:



**Poggi, FIG. 1 (annotated).**

Poggi combined with SIMATIC (EX2010), a machine vision camera reference which was also not considered during prosecution, renders most of the '981 patent claims obvious. Adding another light-guided assembly reference (either Kaufman, EX1008, or Pinhanez, EX1009) renders obvious the remaining claims.

This petition also presents grounds based on Green (EX1024, U.S. Patent Application Publication No. 2007/0236354), a Boeing reference with sensors, a controller, and a projector to instruct workers how to assemble aircraft parts. Green anticipates or, in combination with Kaufman or Pinhanez, renders the claims obvious, and was not cited during prosecution.

Accordingly, Amazon requests that the Board institute *inter partes* review and find the challenged claims unpatentable.

## II. IDENTIFICATION OF CHALLENGES

Petitioner requests *inter partes* review and cancellation of the challenged claims.

**Challenge 1A:** Claims 1-2, 4-7, 11-17, 19-21, 23, and 25 are obvious under (pre-AIA) 35 U.S.C. §103 based on the combination of Poggi (certified original EX1005, English translation EX1006) and SIMATIC (EX1010). Poggi was published February 12, 1992, more than a decade before the '981 patent's earliest filing date (October 7, 2005). Thus, it is thus prior art under (pre-AIA) 35 U.S.C. §102(b). SIMATIC is a product manual for Siemens' SIMATIC VS 720 series of vision sensors and is prior art under pre-AIA 35 U.S.C. § 102(a) because it was publicly available prior to October 7, 2005, as stated in the Declaration of Dr. William Singhose, Amazon's technical expert, who also has personal knowledge of its publication. Singhose ¶ 67.

**Challenge 1B:** Claims 9-10, 18, 22, and 24 are obvious under (pre-AIA) 35 U.S.C. §103 based on the combination of Poggi, SIMATIC, and Kaufman (EX1008). Kaufman issued April 15, 2003, more than a year before '981 patent's earliest filing date, and is thus prior art under (pre-AIA) 35 U.S.C. §102(b).

**Challenge 1C:** Claims 3 and 8 are obvious under (pre-AIA) 35 U.S.C. §103 based on the combination of Poggi, SIMATIC, and Pinhanez (EX1009). Pinhanez was publicly available in 2003, as explained by Pinhanez co-author Rick Kjeldsen (EX1025) and library expert Jim Mullins (EX1026). Thus, Pinhanez is prior art under (pre-AIA) 35 U.S.C. §102(b).

**Challenge 2A:** Claims 1-2, 4-6, 8, and 11-12 are anticipated by Green (EX1024). Green was filed on August 3, 2005, before the '981 patent's earliest filing date. Thus, Green is prior art under (pre-AIA) 35 U.S.C. §102(e).

**Challenge 2B:** Claims 7, 9-10, and 13-25 are obvious under (pre-AIA) 35 U.S.C. §103 based on the combination of Green and Kaufman.

**Challenge 2C:** Claim 3 is obvious under (pre-AIA) 35 U.S.C. §103 based on the combination of Green and Pinhanez.

### **III. CLAIM CONSTRUCTION**

This petition does not raise any issues requiring claim construction. Although LightGuide has misapplied the claims in ways that require construction in other

proceedings, this petition can be resolved based on the claim terms' ordinary and customary meanings. 37 C.F.R. § 42.100(b).

#### **IV. LEVEL OF ORDINARY SKILL IN THE ART**

A person of ordinary skill in the art (“POSITA”) pertinent to the ’981 patent would have had at least a four-year degree in electrical engineering, mechanical engineering, computer science, or a closely related field, and a year of experience working in interactive computer applications. Additional education could substitute for professional experience, and significant work experience—such as designing or implementing interactive computer applications—could substitute for formal education. Specific experience with projected light is not required because, by 2005, projecting light was a routine step that used essentially the same tools as any other display output (e.g., HDMI connections). However, experience with laser projection would be a plus, as many prior art light-guided assembly tools used laser projection. Singhose ¶¶ 53-56.

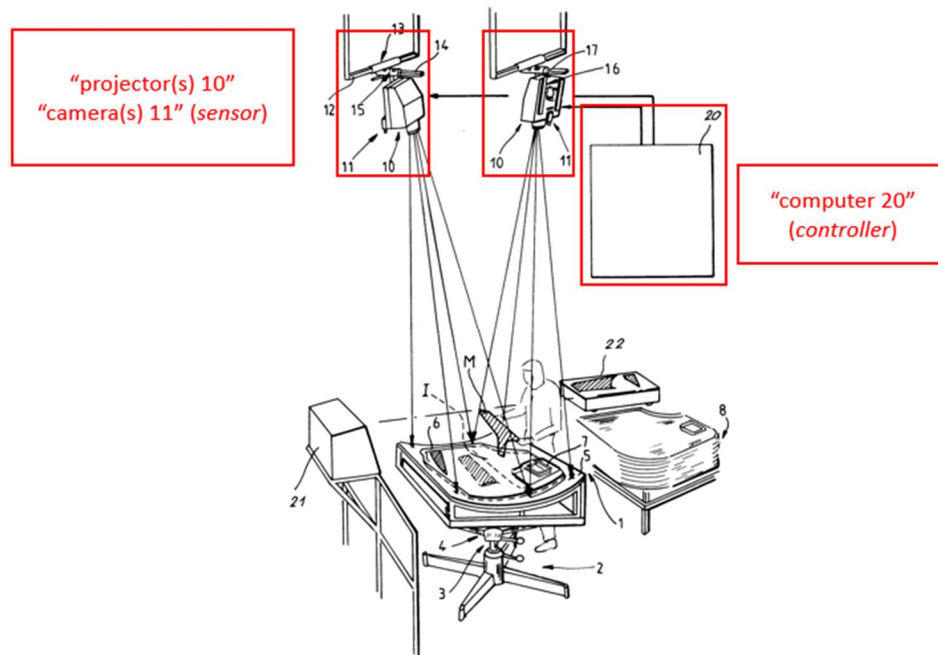
#### **V. IDENTIFICATION OF HOW THE CLAIMS ARE UNPATENTABLE**

##### **A. Challenge 1A: Claims 1-2, 4-7, 11-17, 19-21, 23 and 25 are rendered obvious by Poggi-SIMATIC**

## 1. Claim 1

**[1.0] An operational guide system adapted to provide visual indicators to an individual to guide sequential actions, said operational guide system comprising:**

Poggi discloses [1.0]. As illustrated below, Poggi discloses an *operational guide system*, including a projector, camera sensors, and a computer, that is *adapted to provide visual indicators* (projected light):



**Poggi, FIG. 1 (annotated).**

Singhose ¶¶ 89-92.

Poggi teaches “hand lay-up of composite material parts,” *i.e.*, assembling high-strength fabrics, infused with curable resin, into larger parts with complicated shapes. Poggi, 1:2-15. In Poggi, “an image (I in Figure 1) of the layer to be placed ... is projected on the correct location.” *Id.*, 3:31-35. “The appropriate layer (M)

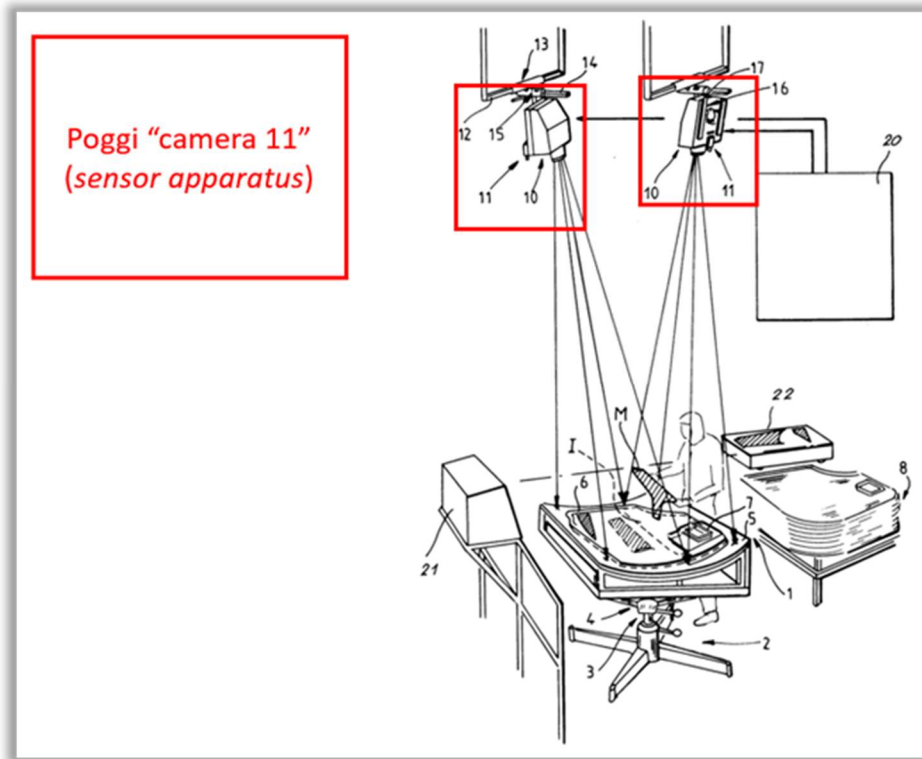
is then placed by the operator so that it overlaps with the projected image.” *Id.*, 3:38-39. Poggi then uses camera sensors to “verify the proper execution of [manual placement of layers].” *Id.*, 3:39-41, 2:13-17.

Poggi’s system is *adapted to provide visual indicators ... to guide sequential actions* because it includes “a video image projection system ... project[ing] the images that indicate the exact locations where the [composite] layers must be *successively deposited ... to facilitate their placement by the operator.*” *Id.*, 1:50-57 (emphasis added); Singhose ¶ 90. Poggi therefore discloses [1.0]. Singhose ¶¶ 88-93.

**[1.1] at least one sensor apparatus, said at least one sensor apparatus operable to detect operation information and generate an output indicative of said operation information;**

Poggi-SIMATIC renders obvious [1.1]. Poggi’s camera(s) 11 is a *sensor apparatus*:





**Poggi, FIG. 1 (annotated).**

Poggi's camera(s) are "able to discern the texture, the shape and position of the layers actually placed on the tooling." Poggi, 2:5-8. Poggi also discloses that computer 20 is "able to compare the images from the camera with the reference images of the layers." *Id.*, 2:11-12. Computer 20 then prevents the display of a new image until any problems are addressed. *Id.*, 4:7-12 (explaining if an error is found, "operation of the projectors 10 is blocked until the error is corrected.") Poggi thus discloses a *sensor apparatus operable to detect operation information and generate an output indicative of said operation information*. Singhose ¶¶ 95, 97.

However, Poggi's arrangement of camera and computer 20 arguably does not satisfy later claim limitations requiring the controller *receiving* a signal from the *sensor apparatus*. See [1.2], *infra*.

SIMATIC (a product manual for Siemens' SIMATIC VS 720 Vision Sensors) describes an off-the-shelf camera that can capture a series of images, and use machine vision to evaluate those images. SIMATIC, 11; Singhose ¶¶ 64, 96. A SIMATIC camera appears below.



Figure 1-1: Member of the VS 720 Series: the SIMATIC VS 724 Vision Sensor

**SIMATIC, FIG. 1-1.**

SIMATIC's camera implements built-in computer vision techniques that "tell the camera ... how to evaluate changes in contrast and in what direction to evaluate

them. The camera then collects this information from the image and evaluates it following the user-defined rules.” *Id.*, 11. This allows SIMATIC’s cameras to be used in part inspection systems, such as Poggi’s, to determine whether a part is present or placed properly. *Id.*, 14 (using SIMATIC cameras for “inspections on part presence/absence, positioning, defect detection, [etc.].”); Singhose ¶¶ 64-66.

SIMATIC’s camera is *operable to detect operation information*. Dependent claim 4 defines *operation information* as including *identification of a presence of a work piece*, which is exactly what the vision sensors in SIMATIC detect. *Id.*, 12 (“Vision Sensors inspect images to provide the user with feedback regarding the presence or absence of a part”), 115 (“Presence/Absence inspections involve inspecting a part for specific features.”) Other ways SIMATIC *detect[s] operation information* include “detect and count features that make the part being inspected different from the background,” and recognizing “connected pixels of similar intensity,” i.e. “blobs.” *Id.*, 64, 91; Singhose ¶ 98. SIMATIC also discloses detecting the *type* of a part, which is also *operation information*. SIMATIC, 121 (describing “part identification.”); Singhose ¶¶ 99-101. The ’981 patent acknowledges machine vision sensors may detect *operation information*. ’981 patent, 5:35-62 (esp. 5:53-56).

SIMATIC’s camera is also *operable to ... generate an output indicative of said operation information*. For example, SIMATIC discloses sending inspection

results to other computers. SIMATIC, 13 (describing “inspection values being sent to a PLC [programmable logic controller]” and that such “information might be as generalized as a PASS or FAIL signal or as specific as position feedback”), 31 (“when the Vision Sensor is inspecting the images, it sends out the user defined outputs indicating the result of the inspection.”), 123 (“Synchronous transfers of data happen after every inspection.”) SIMATIC also describes information output in configurable strings. *Id.*, 125 (“Depending on the output from every SoftSensor, one of the selected messages (Strings) will be sent out ... The fact that every string is fully configurable gives the user the flexibility needed.”). Singhose ¶¶ 103-105.

It would have been obvious to use SIMATIC’s camera to implement Poggi’s system. Poggi’s camera “collect(s) square images of 512 pixels per side and are capable of discerning 250 gray levels or, more generally, different shades of color.” Poggi, 3:46-49. SIMATIC provides the same or better functionality. SIMATIC, 12 (describing image sensors with up to 1280x1024 pixels and 256 gray levels). Thus, it would have been a simple substitution to use SIMATIC’s camera to take the images described in Poggi. Singhose ¶ 81.

It also would have been obvious that SIMATIC’s camera was suitable to implement Poggi’s image evaluation functionality for comparing the shape, location, and “overall gray level” of a recently deposited layer to what is expected for a given assembly step. Poggi, 3:54-4:6. SIMATIC’s camera includes multiple

software tools (called “SoftSensors”) for performing shape comparison and position identification, including “Template Match,” “ObjectFind,” “Presence/Absence,” and “Part Identification.” SIMATIC, 94, 97, 99, 115, 121. These functions all *detect operation information* because they determine whether or not a particular part is present (i.e., they determine both the *presence* and the *type* of the part/workpiece based on whether or not its shape or other defining characteristics are located in the image). ’981 patent, 5:35-42; Singhose ¶¶ 98-101. In one example, SIMATIC’s “ObjectFind” SoftSensor determines both the presence and location of a desired shape. *Id.*, 97 (ObjectFind works “to learn the characteristics of an object and find occurrences of that object in subsequent images.”); 99 (ObjectFind is used for “position feedback.”)

It would have been obvious to implement Poggi’s image processing function using SIMATIC’s camera (*sensor apparatus*) instead of Poggi’s computer 20 (*controller*). Moving computation function from Poggi’s computer 20 to another device (SIMATIC’s camera) is nothing more than a simple substitution. Singhose ¶ 81. Moreover, a POSITA would have a design incentive to make the change because using off-the-shelf image processing functionality would save time, effort, and expense associated with manually implementing Poggi’s image evaluation functionality. Singhose ¶ 87. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 415 (2005) (“[D]esign incentives and other market forces can prompt variations ... If a

person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability.”)

Moreover, the prior art shows only two locations where such image evaluation can take place—on the camera (as in SIMATIC) or on a separate computer (as in Poggi). Thus, there are a finite number of variations and implementing Poggi’s image evaluation on the camera would at least have been obvious to try. *KSR*, 550 U.S. at 421. Singhose ¶ 82. Notably, the Federal Circuit has found combinations such as this obvious (i.e., combinations that reassign calculations from one computing resource to another). *Uber Tech’s v. X One, Inc.*, 957 F.3d 1334, 1340 (Fed. Cir. 2020) (reversing nonobviousness finding and holding instead that “because Okubo’s terminal-side plotting and Konishi’s server-side plotting were both well known in the art, and were the only two identified, predictable solutions for transmitting a map and plotting locations, it would have been obvious to substitute server-side plotting for terminal-side plotting”).

Finally, it would have been obvious that once the SIMATIC camera completed its processing, it would *generate an output indicative of said operation information* and send it to Poggi’s computer 20. As discussed, SIMATIC outputs image evaluations results, either as simple pass/fail or with image-specific information. After the image processing functionality is reassigned to SIMATIC’s camera, Poggi would still need computer 20 to control what is projected. Poggi,

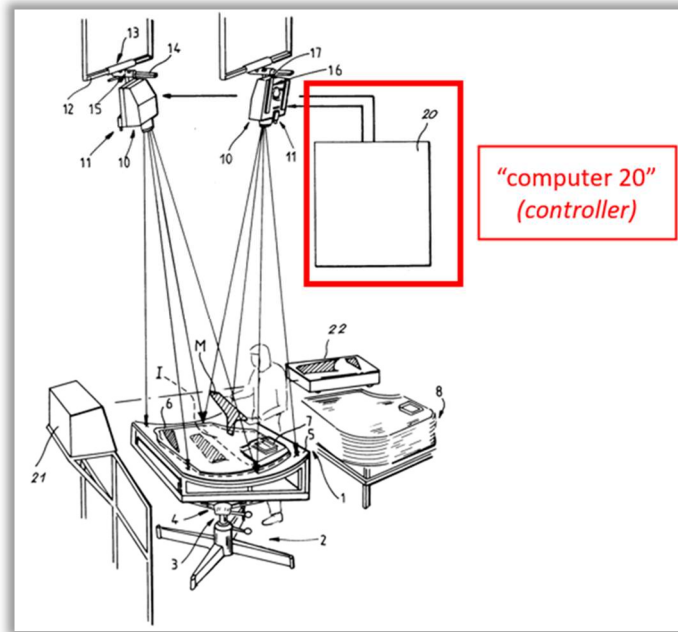
4:7-12. For example, Poggi’s computer 20 will not permit a new projection “until [an] error is corrected.” *Id.* It would be obvious from this teaching that, in Poggi-SIMATIC, the camera would still *generate* and send an output that would permit computer 20 to perform this function, which would be an *output indicative of said operation information*. Singhose ¶¶ 102-105.

Poggi and SIMATIC are both analogous to the ’981 patent. Poggi is concerned with the same problem as the ’981 patent: using projected light to guide operational or assembly actions. SIMATIC is reasonably pertinent to the ’981 patent because it is in the class of “vision system[s],” which the ’981 patent describes as relevant to this claimed *sensor system* limitation. A POSITA would have had a reasonable expectation of success with the combination because Poggi requires a camera and image processing capabilities, and SIMATIC provides both functions in a single device. Singhose ¶ 87.

Thus, Poggi-SIMATIC renders obvious [1.1]. Singhose ¶¶ 94-106.

***[1.2] a controller, said controller receiving at least a first input signal indicative of said operation information and selectively providing at least one command signal in response to said first input signal; and***

Poggi’s computer 20 is *a controller*. Poggi, 3:24-27, 1:50-57.



**Poggi, FIG. 1 (annotated).**

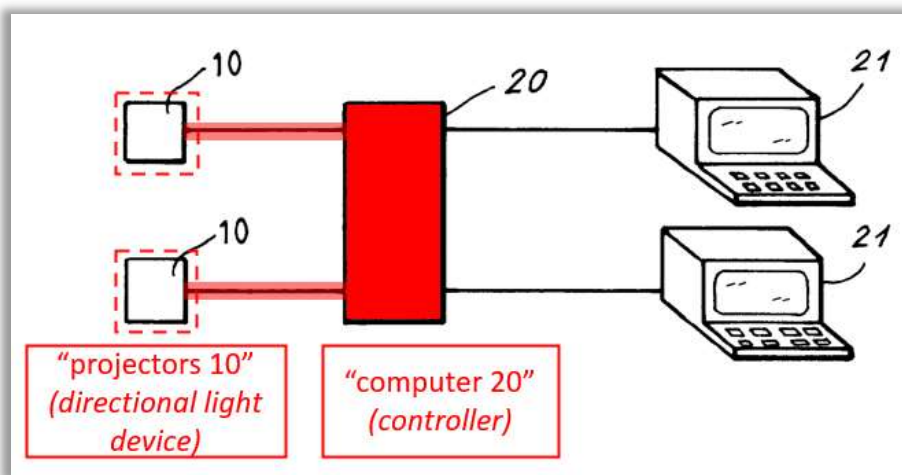
As discussed in [1.1], in Poggi-SIMATIC, the camera detects *operation information* and generates an output indicative of said operation information. Poggi's computer 20 is connected to the camera (*id.*, 3:24-27) and receives *input signals* in the form of camera images. *Id.*, 3:40-44 ("when the computer 20 is told that we will move on to the next step, the image collected by the cameras 11 is examined by the computer 20"), 2:11-15. In the combination, as discussed above, Poggi's computer 20 (*controller*) receives image evaluation output information generated by the SIMATIC camera as *a first input signal indicative of said operation information*.

Poggi discloses said controller *selectively providing at least one command signal* instructing the projector to display an image *in response to said first input*



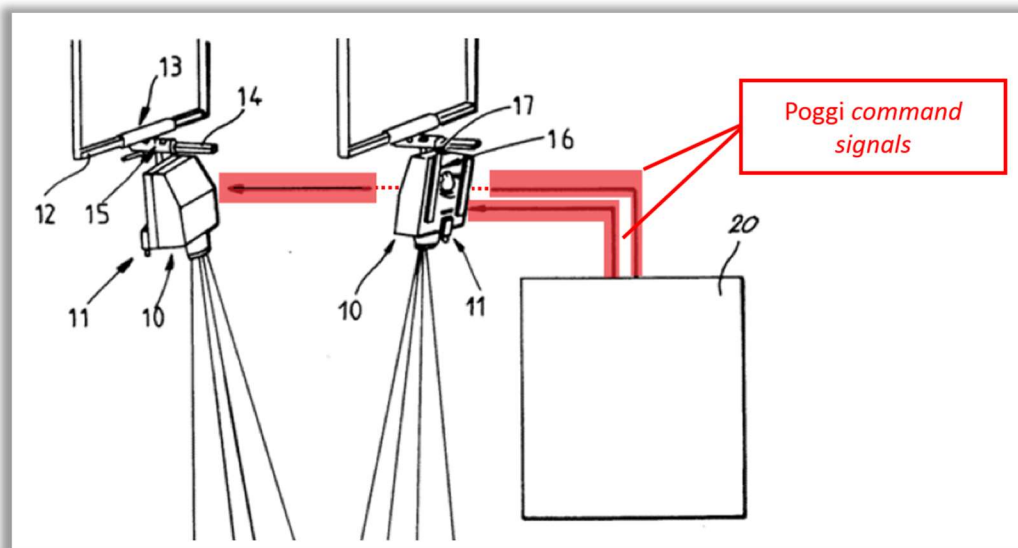
*signal*. In Poggi, “[i]f no errors are found, the computer 20 projects the image of the next layer when the operator requests it.” *Id.*, 4:7-8. Thus, computer 20 sends a *command signal* to the projector *selectively*—that is, a *command signal* is sent to a projector only if no errors are found. If Poggi detects errors, then “operation of the projectors 10 is blocked until the error is corrected.” *Id.*, 4:11-12, 5:52-58; Singhose ¶ 111. Notably, the ’981 patent teaches “command signals 44, 50 being communicated based on, at least in part, the first input signal 42.” ’981 patent, 6:62-63. Similarly, Poggi discloses that a *command signal* to project a new image is provided in part based on the operator request and in part on the outcome of the image analysis (i.e., *in response to said first input signal*). Singhose ¶ 111.

Notably, computer 20 and projector 10 are electrically connected:



**Poggi, FIG. 2 (annotated).**

Because of this connection, Poggi’s computer 20 sends command signals telling the projectors what to display, as illustrated below:



**Poggi, FIG. 1 (annotated).**

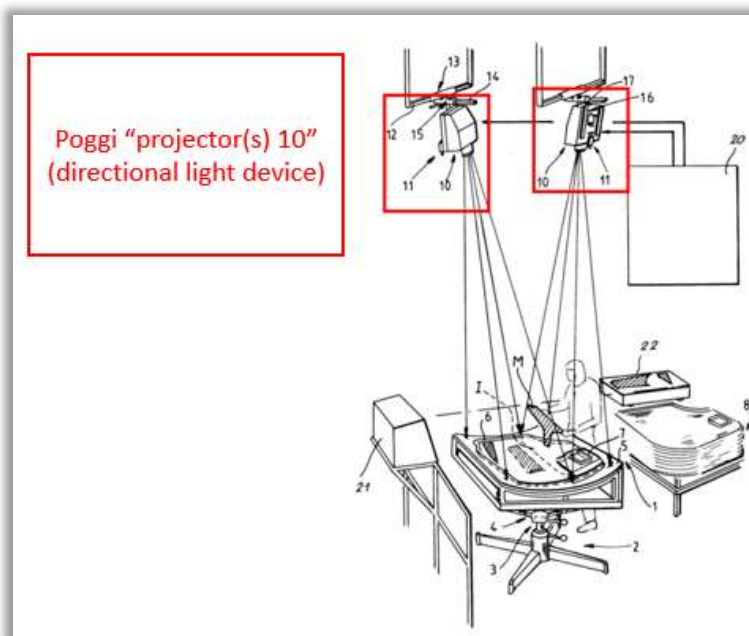
A POSITA considering the electrical connection between computer 20 and the projectors would understand the *controller* (computer 20) sends *at least one command signal* to the projector because “computer 20 projects the image of the next layer when the operator requests it.” Poggi, 4:7-8, 1:53-57, 3:31-34, 5:40-44; Singhose ¶¶ 112-114.

Even if Poggi does not expressly disclose computer 20 *providing at least one command signal*, it still would have been obvious. Sending a command signal from computer 20 to projector 10 through their shared electrical connection would have been a top design option out of a discrete set of such options, and well within a POSITA’s knowledge/skill. Singhose ¶ 114.

Thus, Poggi-SIMATIC renders obvious [1.2]. Singhose ¶¶ 107-116.

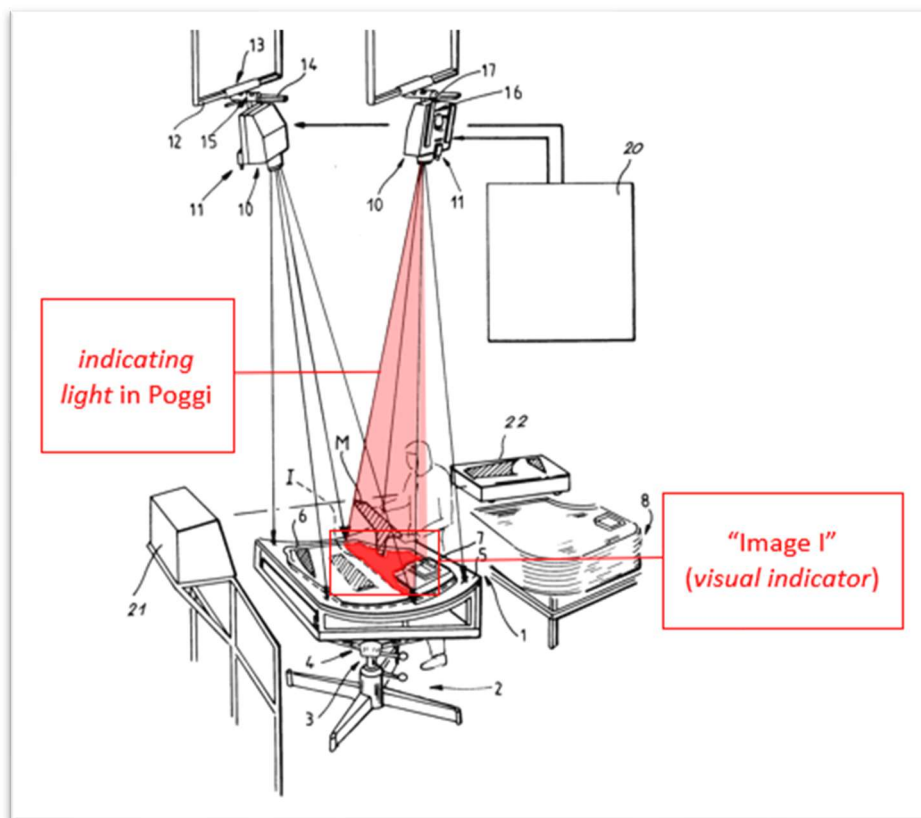
***[1.3] at least one directional light device, said at least one directional light device selectively operable to project and target at least one indicating light in response to said at least one command signal from said controller.***

Poggi teaches [1.3]. Poggi includes a “projector 10 of video images,” which is a *directional light device*. Poggi, 3:4-5; *see also id.*, 1:50-57, 3:4-18, 3:24-35, 5:39-44. Projector(s) 10 are illustrated in Figure 1:



**Poggi, FIG. 1 (annotated).**

Poggi also teaches that projector(s) 10 are *selectively operable to project and target at least one indicating light*. Poggi’s projected images “indicate to the operator the nature and location of the cutouts to be successively placed.” *Id.*, Abstract; *see also* 1:50-57, 3:31-39, 5:39-44. Poggi Fig. 1 shows an image projected and targeted from projector 10:



**Poggi, FIG. 1 (annotated).**

Projector(s) 10 are *selectively operable to project and target* images at “the exact locations where the layers must be successively deposited.” *Id.*, 1:53-56, 3:31-39.

Poggi further teaches that projector(s) 10 operate *in response to said at least one command signal from said controller*. Poggi describes “a control system capable of having the image projection system project the images that indicate the exact locations where the layers must be successively deposited.” Poggi, 1:49-56, 3:31-35, 5:39-44. Poggi also discloses that its projector(s) 10 *project and target an indicating light in response to the command signal from [the] controller* (computer

20) when it states that “[t]he computer 20 then controls the projectors 10 so that an image (I in Figure 1) of the layer to be placed at that time is projected on the correct location on the tooling 1.” *Id.*, 3:30-35; Singhose ¶ 120.

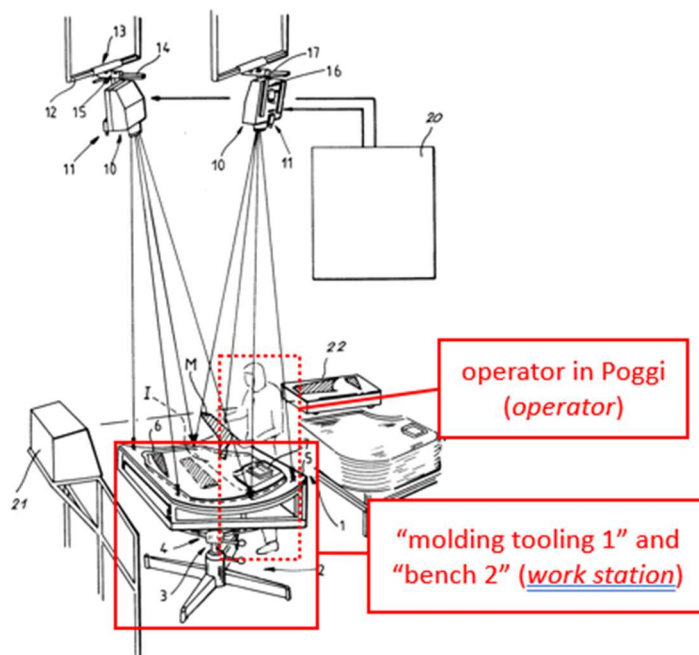
Thus, because Poggi’s projectors project images in response to instructions from computer 20, Poggi discloses [1.3], and Poggi-SIMATIC renders obvious claim 1. Singhose ¶¶ 117-121.

## **2. Claim 2**

***The operational guide system of claim 1, wherein said at least one indicating light is provided to an operator performing an assembly action at a work station.***

Poggi discloses *said at least one indicating light is provided to an operator*. Poggi, Abstract (“projections of images ... ***indicate to the operator*** the nature and location of the cutouts to be successively placed,” replacing a “written list of instructions describing the manufacturing steps.”), 1:50-57, 3:31-39, 5:39-44; Singhose ¶ 124; *see* [1.0], [1.3], *supra*.

Poggi also teaches *said operator perform[s] an assembly action at a work station*. Poggi’s operator is at a workstation (including molding tooling 1 and bench 2), as shown below:



**Poggi, FIG. 1 (annotated).**

The operator performs *an assembly action* of “hand lay-up of composite parts” (or “manual placement of fabric layers and strips” to form larger parts) at *said work station*. Poggi, Abstract, 1:29-30, 1:1-15, 1:56-57, 3:30-39, 5:39-44, FIG.1. Singhose ¶¶ 125-126.

Therefore, Poggi-SIMATIC renders obvious claim 2. Singhose ¶¶ 122-127.

### 3. Claim 4

***The operational guide system of claim 2, wherein said operation information comprises identification of a presence of a work piece at said work station.***

Poggi discloses *work piece(s)*, which are “composite material parts” composed of “fabric cutouts or high strength fiber strips” (i.e., “layers”) assembled “on the surface of a molding tooling.” Poggi, Abstract, 1:4-9.

SIMATIC teaches *said operation information compris[ing] identification of a presence of a work piece at said work station*. As discussed, SIMATIC's Vision Sensor is *operable to detect operation information*, among other reasons, because it detects the presence of a workpiece, a form of *operation information* ('981 patent, 4:38-43). See [1.1], *supra*; SIMATIC, 115 ("Presence/Absence inspections involve inspecting a part for specific features to make sure the feature is present or absent ..."), 61 ("Presence/Absence SoftSensors perform basic checks for detection of features"), 61-66, 91-105; Singhose ¶ 98.

Thus, Poggi-SIMATIC renders obvious claim 4. Singhose ¶¶ 129-132.

#### 4. Claim 5

***The operational guide system of claim 4, wherein said operation information comprises identification of a type of the work piece at said work station, and wherein said at least one command signal is selectively provided depending on the type of the work piece identified.***

As discussed for [1.1]-[1.2] and claim 4, in Poggi-SIMATIC, a vision sensor and related software evaluate, after each step, whether a collection of fabric layers have been properly placed. Thus, as discussed above, Poggi-SIMATIC renders obvious that the *operation information compris[ing] identification of a type of the work piece at said work station* (i.e., whether the workpiece (collection of layers) is of the *type* that is expected).

SIMATIC's *software* tools identify *a type of the work piece*, for example, "ObjectFind" determines both the presence and location of a desired shape. *Id.*, 97

(ObjectFind works “to learn the characteristics of an object and find occurrences of that object in subsequent images.”), 99 (explaining ObjectFind is used for “position feedback.”) As discussed for [1.1], this function *detect[s] operation information* because it determines whether or not a particular part is present (i.e., they determine both the *presence* of a part/workpiece and the *type* of the part/workpiece based on whether or not its shape or other defining characteristics are located in the image). ’981 patent, 5:35-42; Singhose ¶ 98. As also discussed in [1.1], other SIMATIC functions such as Template Match, Presence/Absence, and Part Identification also *detect operation information* including the *type* of a workpiece because they determine whether a particular type of workpiece is present. Singhose ¶ 99.

Poggi-SIMATIC also renders obvious that its *controller* (computer 20) *selectively provides command signals depending on the type of the work piece identified* because it permits projection of a new image only if the camera image includes the expected shape, position, and gray level (i.e., only if the expected *type* of part is present). Poggi, 4:9-12; Singhose ¶ 137.

Thus, Poggi-SIMATIC renders obvious claim 5. Singhose ¶¶ 133-138.

## 5. Claim 6

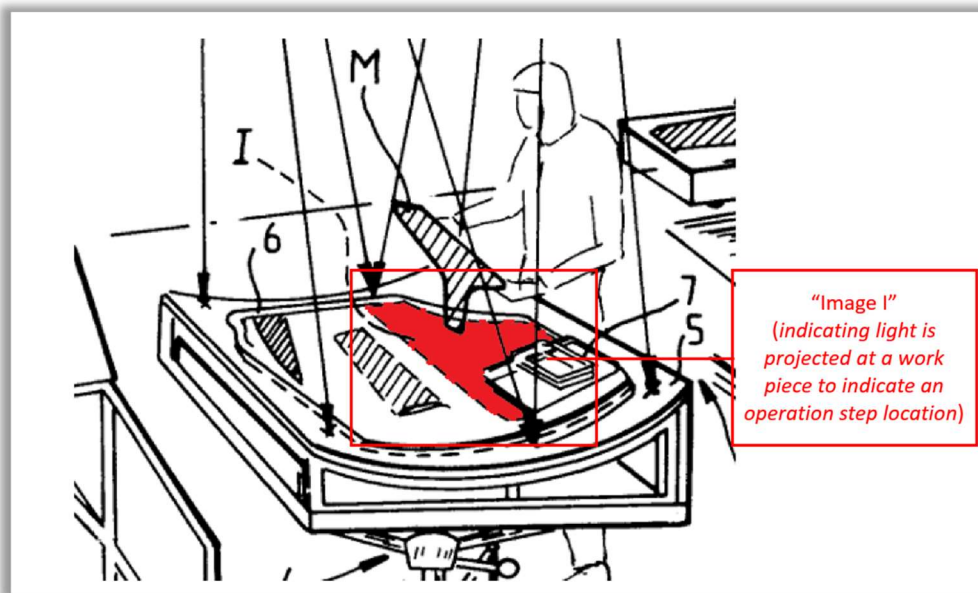
***The operational guide system of claim 2, wherein said at least one indicating light is projected at a work piece to indicate an operation step location.***

Poggi teaches projecting *at least one indicating light ... to indicate an operation step location* because its “image projection system projects the images



that indicate the exact locations where the layers must be successively deposited.”

Poggi, 1:52-56, Abstract, 3:31-39, 5:39-44. Figure 1 further illustrates a projected image (image I) as follows:



**Poggi, FIG. 1 (annotated).**

When Poggi shines a light at “the exact locations where the layers must be successively deposited,” Poggi, 1:53-56, an *indicating light is projected at a work piece* (as illustrated in FIG. 1). Notably, in Poggi, the layers forming the work piece at least “partially overlap,” confirming that the light is projected towards the *work piece* and not just toward an individual layer. *Id.*, 1:6-11 (describing “bind[ing] the composite layers” in a manner that requires overlapping regions); Singhose ¶ 141.

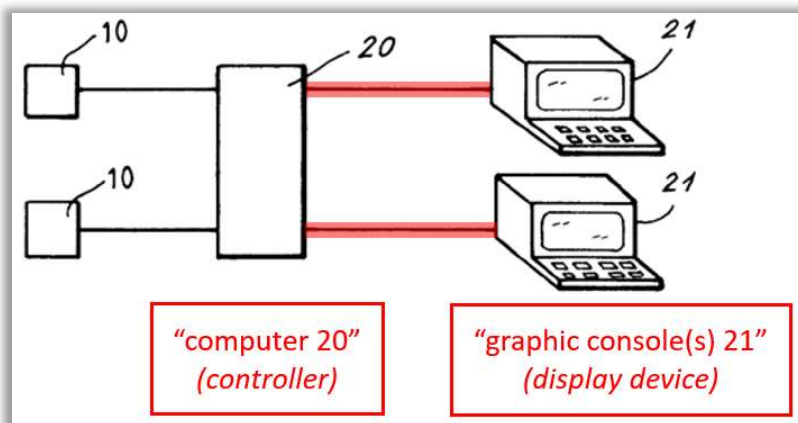
Thus, Poggi-SIMATIC renders obvious claim 6. Singhose ¶¶ 139-141.

## 6. Claim 7

***The operational guide system of claim 1, wherein said controller is adapted to receive at least one confirmation signal indicative of a completion of an assembly action, said at least one confirmation signal comprising at least one signal selected from the group consisting of a manually input signal and an automated input signal.***

In Poggi, an *assembly action* is complete when an “appropriate layer (M) is ... placed by the operator so that it overlaps with the projected image.” Poggi, 3:37-39. Then, “computer 20 is told that we will move on to the next step.” *Id.*, 3:40-42. This is an example of a *controller* (computer 20) receiving a *confirmation signal indicative of a completion of an assembly action* (i.e., an instruction to “move on to the next step” following placement of the “appropriate layer (M).”). *Id.*, 3:37-42; Singhose ¶ 144. Poggi teaches that this *confirmation signal* is a *manually input signal* because “[b]efore placing a layer, the operator signals it by typing an instruction on a graphic console 21.” Poggi, 3:29-31.

Poggi Figure 2 (shown below) illustrates console 21 and its connection to computer 20, showing that *said controller* (computer 20) *is adapted to receive at least one confirmation signal* (from graphic console 21, as manually entered by the operator). Singhose ¶ 145.



**Poggi, FIG. 2 (annotated).**

Thus, Poggi-SIMATIC renders obvious claim 7. Singhose ¶¶ 143-145.

## 7. Claims 11 and 12

**11. The operational guide system of claim 1, wherein said controller is configured to monitor operational information<sup>1</sup> associated with sequential actions.**

**12. The operational guide system of claim 11, said operational information including at least one selected from the group consisting of a cycle time, an incorrectly performed action, a time between sequential actions, and an operator identification.**

In Claim 11, the *controller is configured to monitor operational information associated with sequential actions*. Claim 12 (which depends from claim 11) explains that *operational information* includes information regarding *an incorrectly*

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<sup>1</sup> The term *operational information* is not used in the specification, and Amazon has argued it is indefinite in related litigation. However, claim 12 shows that *operational information* includes at least “an incorrectly performed action.”

*performed action*. As explained below, Poggi discloses claim 12 and thus discloses claim 11 too.

In Poggi, computer 20 verifies that “successive layers are correctly deposited.” Poggi, 1:58-59, Abstract, 3:39-4:12. “If no errors are found, the computer 20 projects the image of the *next layer* when the operator requests it. Otherwise, an error message is displayed on the graphic consoles 21 based on the results of the various comparisons, and the operation of the projectors 10 is blocked until the error is corrected.” *Id.*, 4:7-12 (emphasis added). Thus, Poggi’s *controller* (computer 20) *is configured to monitor operational information associated with sequential actions* because it monitors for incorrectly placed layers (which is *operational information* in the form of an *incorrectly performed action* per claim 12). Singhose ¶¶ 148-149.

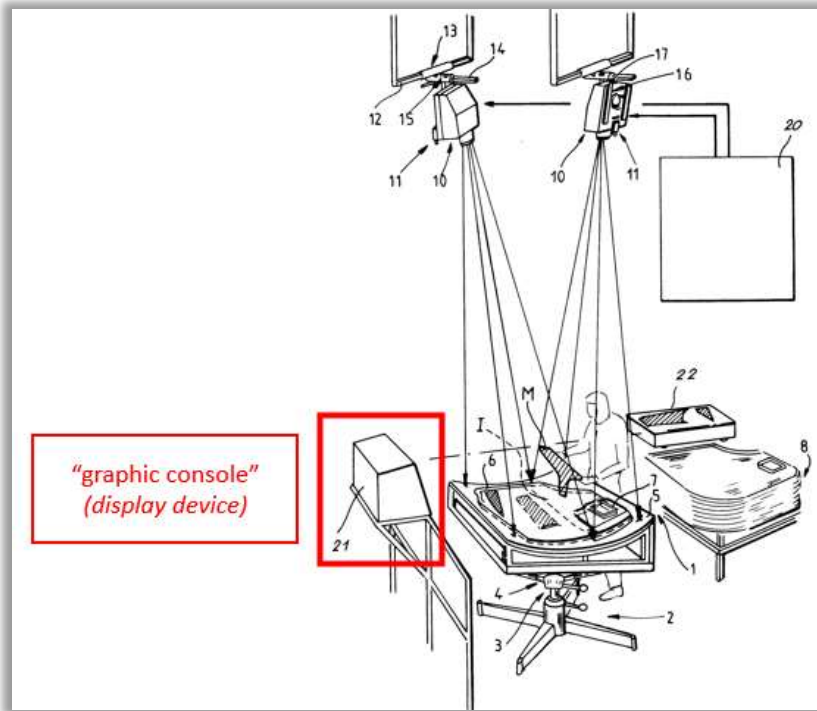
Thus, Poggi-SIMATIC renders obvious claims 11-12. Singhose ¶¶ 146-154.

## 8. Claims 13 and 25

***The operational guide system of claim [1 or 2], further including a display device, said display device being operable to display information regarding sequential actions.***

Claims 13 and 25 are the same, except they depend from claim 1 and 2, respectively. Poggi discloses this limitation for both claims. Singhose ¶¶ 156-160, 207-208.

Poggi discloses *a display device* (“graphic console 21”):



**Poggi, FIG. 1 (annotated).**

Poggi, 3:24-27, 3:30-31, 4:7-21, FIG. 2.

Regarding “graphic console 21,” “it is possible to view the image on the screen of the tooling and the theoretical locations of the layers of the part. The image collected by the cameras 11 of the lay-up actually carried out can also be viewed, superimposed on the previous one or on another screen.” *Id.*, 4:13-20; *see also* 4:9-12. Thus, Poggi’s *display device* (graphic console 21) is *operable to display information regarding sequential actions*.

Thus, Poggi-SIMATIC renders obvious claims 13 and 25. Singhose ¶¶ 155-160, 206-208.

## 9. Claim 14

***[14.0] A method for guiding assembly actions by providing visual indicators, said method comprising:***

*See [1.0], supra.*

***[14.1] identifying a characteristic of a work piece requiring assembly actions;***

As discussed in [1.1], Poggi-SIMATIC renders obvious using a vision sensor to evaluate placement of each fabric layer. As with claim 2, the combined layers in Poggi (i.e., the *work piece*) *require[s] assembly actions*, namely continued “hand lay-up of composite [] parts.” Poggi, Abstract, 1:1-9, 1:29-30, 1:55-56, 3:30-39, 5:39-44, Fig.1. The ’981 patent says *characteristic[s] of a work piece* include the presence and/or type of the work piece. ’981 patent, 5:35-43. Thus, SIMATIC teaches *identifying [] characteristic[s] of the work piece* including its presence and type for the reasons discussed above for [1.1] and claims 4/5.

Thus, Poggi-SIMATIC discloses [14.1]. Singhose ¶¶ 164-167.

***[14.2] communicating identification information to a controller in response to the identifying of a characteristic of the work piece;***

The ’981 patent states “the presence and/or type of [a] work piece” are examples of *identification information*. ’981 patent, 5:35-43 (“As noted, sensor apparatus 26 functions to detect ... identification information associated with work

piece 14, such as the presence and/or type of work piece 14.”).<sup>2</sup> As discussed above for [1.1], claims 4/5, and [14.1], SIMATIC teaches *identifying [] a characteristic of the work piece* including presence and type. Further, as discussed in [1.1], SIMATIC teaches that such information (*identification information*) can be included in an output signal from SIMATIC’s camera to a connected computer, such as Poggi’s computer 20. SIMATIC, 31, 123-125; Singhose ¶ 171. Thus, as discussed above for claims 4/5, it would have been obvious for Poggi-SIMATIC’s machine vision camera to detect presence information or type identification information and communicate that information to Poggi’s computer 20 (*controller*) *in response to the identifying of a characteristic of the work piece*.

As discussed for [1.1], because Poggi discloses computer 20 (*a controller*) is connected to a camera and receives input signals from the camera (*see* [1.2], *supra*), it would have been obvious to a POSITA that, in a combined Poggi-SIMATIC system, the output signals from SIMATIC are communicated to Poggi’s computer 20. Thus, Poggi-SIMATIC discloses [14.2]. Singhose ¶ 173.

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<sup>2</sup> As discussed above for [1.1], the presence and type of a workpiece are also operation information.

***[14.3] communicating a first command signal to at least one directional light device in response to the identifying of a characteristic;***

As discussed for [1.2], Poggi's computer 20 *communicates a first command signal to at least one directional light device* (projectors 10) by "having the projectors (10) project images." Poggi, 5:39-44, 3:31-35, 1:52-57; 4:7-8 ("If no errors are found, the computer 20 projects the image of the next layer when the operator requests it."). If LightGuide argues Poggi does not expressly disclose *communicating said first command signal to projectors 10 (at least one directional light device)*, it would have been obvious to a POSITA. See [1.2], *supra*.

Said first command signal is further provided *in response to the identifying of a characteristic*, because it depends on at least the shape and location of a layer. *Id.*, 3:54-4:12; Singhose ¶ 174.

Thus, Poggi discloses [14.3]. Singhose ¶¶ 174-175.

***[14.4] selectively projecting at least one indicating light via the directional light device in response to the first command signal; and***

See [1.3], *supra*; Singhose ¶ 176.

***[14.5] communicating a confirmation signal to the controller upon completion of a first operation step.***

As in claim 7, Poggi's computer 20 receives a confirmation signal indicative of the completion of an assembly action (i.e., after placement of an appropriate layer). Because the *assembly action* of claim 7 is an *operation step*, '981 patent,



2:20-24, the analysis from claim 7 applies here and Poggi discloses this limitation. Singhose ¶ 177.

Therefore, Poggi-SIMATIC renders obvious claim 14. Singhose ¶¶ 161-178.

## **10. Claims 15 and 16**

***15. The method of claim 14, wherein identifying a characteristic of a work piece comprises identifying the presence of a work piece with a sensor apparatus.***

***16. The method of claim 15, including identifying the type of work piece requiring assembly actions.***

As discussed for [14.1], Poggi-SIMATIC renders obvious *identifying a characteristic of a work piece*, which includes detecting the presence and type of the work piece. The discussion above for [1.1] and claims 4/5 shows that Poggi-SIMATIC renders obvious *identifying the [presence or type] of a work piece with a sensor apparatus* (such as a SIMATIC camera), including any *work piece requiring assembly actions* (such as a partially made composite part as in Poggi). Singhose ¶¶ 179-182.

Thus, Poggi-SIMATIC renders obvious claims 15-16. Singhose ¶¶ 179-184.

## **11.Claim 17**

***The method of claim 14, wherein projecting at least one indicating light comprises projecting at least one indicating light toward at least one of a component location and an operation step location.***

The discussion for claim 6, *supra*, shows that Poggi-SIMATIC *projects at least one indicating light* toward the location where each fabric layer is placed (i.e.,

*an operation step location*). Thus, Poggi-SIMATIC renders obvious claim 17. Singhose ¶¶ 185-187.

## **12.Claim 19**

***The method of claim 14, wherein communicating a confirmation signal comprises communicating a confirmation signal from at least one selected from the group consisting of a manual input signal and an automated input signal.***

*See claim 7, supra.* Singhose ¶¶ 188-190.

## **13.Claim 20**

***[20.0] The method of claim 14, including: communicating a second command signal from the controller to the at least one directional light device in response to the confirmation signal;***

As discussed for claim 7 and [14.5], Poggi discloses a *confirmation signal* that is input by the operator after a layer is put in place. Poggi, 3:29-31 (“Before placing a layer, the operator signals it by typing an instruction on a graphic console 21”); Singhose ¶ 193.

*In response to the confirmation signal*, Poggi’s computer 20 (*controller*) begins a process to determine whether the previous layer was properly placed:

The cameras 11 verify the proper execution of this operation. To do this, when the computer 20 is told that we will move on to the next step, the image collected by the cameras 11 is examined by the computer 20 and compared to the image that should be found.

Poggi, 3:38-44.

If the layer was properly placed, then Poggi's controller sends a message (*second command signal*) to the projector (*directional light device*) to display the next image:

If no errors are found, the computer 20 projects the image of the next layer when the operator requests it. Otherwise, an error message is displayed on the graphic[s] consoles 21 based on the results of the various comparisons, and the operation of the projectors 10 is blocked until the error is corrected.

*Id.*, 4:7-12; [1.2], *supra*. Singhose ¶ 194.

To the extent LightGuide argues Poggi does not expressly disclose *communicating said second command signal* to projectors 10 (*the at least one directional light device*), it would have been obvious to a POSITA. *See* [1.2], *supra*; Singhose ¶ 193.

***[20.1] projecting at least one indicating light from the directional light device in response to the second command signal; and***

*See* [1.3], *supra*. Poggi's projector displays images in response to the *second command signal* of [20.0] to the same extent as the command signal of [1.3]. Singhose ¶¶ 196-197.

***[20.2] communicating a confirmation signal to the controller upon completion of a second operation step.***

*See* claim 7 and [14.5], *supra*. The same confirmation signal discussed in claim 7 (i.e., the signal made when the operator indicates a layer is complete) is used

after each layer is added. Poggi, 3:29-31 (“Before placing a layer, the operator signals it by typing an instruction on a graphic console 21.”); Singhose ¶ 198.

Therefore, Poggi-SIMATIC renders obvious claim 20. Singhose ¶¶ 191-199.

#### **14.Claim 21**

***The method of claim 20, including: repeating said communicating a command signal; projecting at least one indicating light in response to said command signal; and communicating a confirmation signal until assembly actions for the work piece have been completed.***

Poggi discloses this claim limitation. Poggi provides “a lay-up control device that verifies that *the successive layers* are correctly deposited on the tooling.” Poggi, 1:57-60 (emphasis added). Poggi also discloses that in response to putting down a layer, “[i]f no errors are found, the computer 20 projects the image of the next layer when the operator requests it.” *Id.*, 4:7-8. A POSITA reading this would understand that the process in claim 20 is repeated for each layer of the composite material part until the lay-up is complete, resulting in *repeating said communicating a command signal; projecting at least one indicating light in response to said command signal; and communicating a confirmation signal until assembly actions for the work piece have been completed.* Singhose ¶ 202.

Thus, Poggi-SIMATIC renders obvious claim 21. Singhose ¶¶ 200-203.

### 15.Claim 23

***The method of claim 14, including: monitoring operational information associated with sequential actions via the controller.***

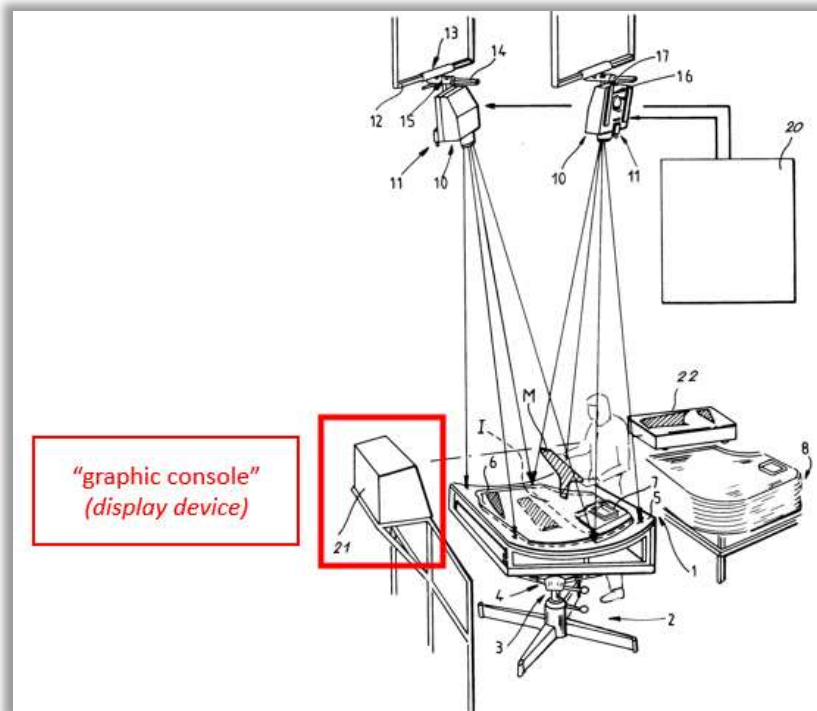
See claim 11, *supra*. Singhose ¶¶ 204-206.

**B. Challenge 1B: Claims 9-10, 18, 22, and 24 are obvious over Poggi-SIMATIC in view of Kaufman**

### 1. Claim 9

*[9.0] The operational guide system of claim 1, further including a display device,*

Poggi *includ[es] a display device* in graphic console 21. Poggi, 3:24-27, 3:30-31, 4:7-21, Figs. 1-2; Singhose ¶ 218.



**Poggi, FIG. 1 (annotated).**

Thus, Poggi discloses [9.0]. Kaufman also discloses a *display device* (display 10) and discloses [9.0]. Kaufman, Fig. 1, 7:32-44; Singhose ¶ 219.

***[9.1] and wherein said controller is programmable via at least one program screen displayable on said display device, said at least one program screen configured to include at least one input field for entering and/or selecting indicia regarding sequential actions;***

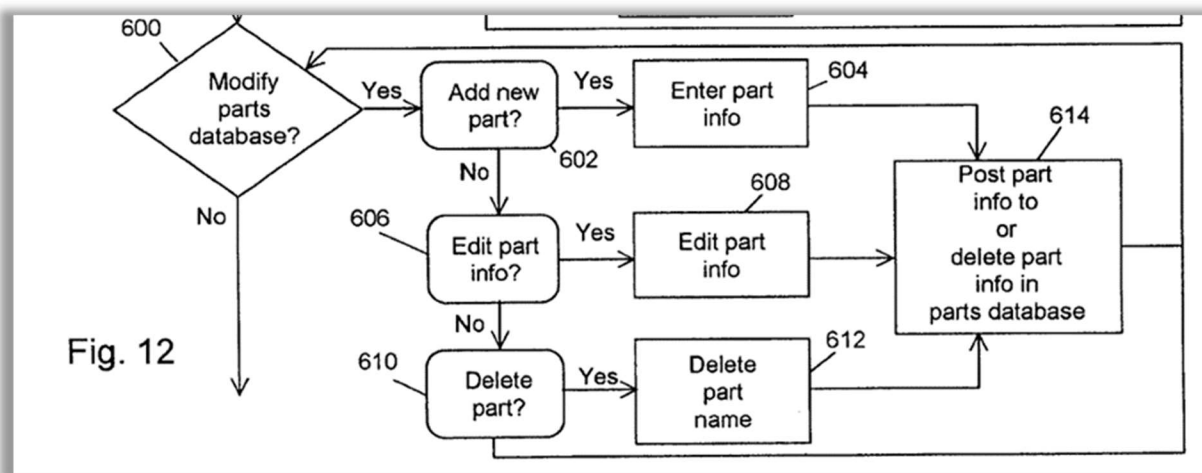
Poggi-SIMATIC-Kaufman renders this limitation obvious. Singhose ¶¶ 220-231.

Poggi discloses that its computer 20 (*controller*) “was programmed to teach it the shape of each tooling 1 as well as the location and shape of the various layers that must be placed on this tooling 1.” Poggi, 3:27-30. A POSITA would understand this disclosure necessarily implies the presence of a *program screen* with *at least one input field for entering and/or selecting indicia regarding sequential actions*. Singhose ¶ 223. However, because such a *program screen* is not expressly disclosed in Poggi, this challenge combines Poggi with teachings of Kaufman (EX1008, U.S. Patent No. 6,547,397).

Kaufman describes a “laser projector for projecting a 3-D image onto an object,” which, like in Poggi, uses light to show operators where to put layers (or “plies”) used in making composite material parts. Kaufman, Abstract, 1:20-26, 1:43-48, 8:17-18. Kaufman’s system includes an “Administrator program” which “provides for the administration of the various databases used in operating the 3-D projection system.” *Id.*, 9:46-50. This program includes an “administrator interface

318,” *id.*, 9:61-63, that has a variety of *program screen[s] displayable on said display device*. Singhose ¶¶ 223-226. Specifically, Kaufman’s administrator software provides, among other things, screens for “modifying parts information.” Kaufman, 10:6-11.

In Kaufman, modifying parts information means modifying its parts database 340, for example by “adding a new part[], editing existing parts information or deleting current parts information.” *Id.*, 11:43-47. Kaufman also explains that “[i]f the administrator selects to add a new part at Step 602, the administrator is then prompted to enter the new part’s name and properties at Step 604.” *Id.*, 11:47-49. The various parts-related input processes are shown below in Figure 12 as described in Kaufman, 11:47-59.



**Kaufman Fig. 12.**

A POSITA would understand Kaufman’s “[e]nter part info” (604) and “[e]dit part info” (608) describe *at least one input field for entering and/or selecting* information. See Kaufman, 11:47-59; Singhose ¶¶ 226-228.

Kaufman’s part information includes information about each “layer” that makes up the part. Kaufman, 8:17-18 (“Parts database 340 contains each part name and the various layers that are incorporated into each part.”). Kaufman’s operating software (which is not the administrator software) uses this layer information to determine sequence information. *Id.*, 15:8-11 (“[T]he operator may also view the next layer at step 1252 or the previous layer at step 1256 and the proper layer is displayed at steps 1254 and 1258, respectively.”). Thus, because entering or editing a part requires layer information, Kaufman’s parts database provides *indicia regarding sequential actions*. Singhose ¶¶ 228-229.

Putting it all together, Poggi-SIMATIC-Kaufman discloses [9.1] as follows. Poggi discloses computer 20 (*controller*) that is *programmable* relative to projected layers (Poggi, 3:27-30) and a *display device* (graphics display 21). Kaufman discloses *at least one program screen* (as part of administrator software interface 318) *configured to include at least one input field* (as shown above relative to parts database 340) *for entering and/or selecting indicia regarding sequential actions* (relative to the layer information in parts database 340). Thus, Poggi and Kaufman disclose all elements of [9.1]. Singhose ¶¶ 220-231.



It would have been obvious to a POSITA to combine Poggi-SIMATIC and Kaufman so that Poggi-SIMATIC incorporated features from Kaufman and displayed Kaufman's administrator software using graphics console 21 (*display device*). As discussed, Poggi's computer 20 (*controller*) "was programmed to teach it the ... shape of the various layers that must be placed." Poggi, 3:27-30. As discussed above, Kaufman discloses a parts database 340 for storing such layer information and an administrator software interface for adding or editing parts information (including layer information, Kaufman, 8:18-33). Thus, the Poggi-SIMATIC-Kaufman combination is nothing more than combining prior art elements (Poggi-SIMATIC and Kaufman's parts database and administrator interface) according to known methods to yield predictable results. Singhose ¶ 212. The combination is also taking concepts from one reference (Kaufman) and using it to improve a similar system (Poggi-SIMATIC) in the same way. Singhose ¶ 213. Additionally, design incentives regarding the need to improve and control manufacturing would have lead a POSITA to implement Poggi-SIMATIC with the types of interfaces described in Kaufman, because Poggi and Kaufman are both directed to the same type of light-guided assembly system. Singhose ¶ 214.

A POSITA would have a reasonable expectation of success with this combination. Singhose ¶¶ 215-216. As discussed above, both Poggi-SIMATIC and Kaufman use a projector and a computer system to identify where to place

layers when building a layered part. Although the two systems use different types of projectors, the fundamental principle of using lasers to display layers to an operator is the same. A POSITA would also regard Poggi-SIMATIC and Kaufman as analogous to the '981 patent because both systems concern interactive computer applications—particularly those that project instructions to aid operators in completing a task. Poggi, Abstract, 1:50-57; Kaufman, 1:20-26; Singhose ¶ 210.

Thus, Poggi-SIMATIC-Kaufman discloses [9.1]. Singhose ¶¶ 220-231.

***[9.2] said controller being further configured to display at least one display screen on said display device during operation of said operational guide system, said display screen being adapted to display indicia regarding sequential actions to be performed.***

Poggi discloses that “indications may [] appear on the ***graphic consoles 21*** ... [i]n particular, it is possible to ***view the image on the screen of the tooling and the theoretical locations of the layers of the part.***” Poggi, 4:13-17 (emphasis added). Poggi further teaches these “schematic indications” are used “to facilitate [layer] placement by the operator,” *id.*, 1:56-57, 4:9-11.<sup>3</sup> Thus, Poggi teaches *displaying at*

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<sup>3</sup> Displaying this information would have further been obvious based on the combined teachings with Kaufman, which also discloses an “operator interface” that displays each layer on screen before “project[ing] the layer or layers with projector 100 onto object 30.” Kaufman, 15:16-18, 9:43-57, 14:53-15:21, Figs. 19-22; Singhose ¶ 235.

*least one display screen on said display device (graphics console 21) during operation of said operational guide system, where said display screen [is] adapted to display indicia regarding sequential actions to be performed (as described in Poggi, 4:13-17). Singhose ¶¶ 233-234.*

Additionally, Kaufman discloses operator software that is shown on “display 10.” Kaufman, Fig. 1, 12:60-13:2. This operator software *display[s] at least one display screen on said display device (graphics console 21) during operation of said operational guide system. Id.*, 12:28-32 (“FIG. 14-22 describe the process of how the operator interfaces with the laser system.... The operator begins by logging onto the system using operator interface 320.”) Kaufman’s operator software includes features that *display indicia regarding sequential actions to be performed*, including displaying job details (*Id.*, 13:16-18) and allowing the operator to mark layers as complete (*Id.*, 15:36-38). Kaufman thus further discloses or renders obvious the concepts recited in [9.2]. Singhose ¶ 235.

Therefore, Poggi-SIMATIC-Kaufman renders obvious claim 9. Singhose ¶¶ 217-236.

## 2. Claim 10

***[10.0] The operational guide system of claim 9, wherein said at least one input field comprises at least one selected from the group consisting of a description field, a graphic field, and a location field, and***

As discussed above for [9.1], Kaufman discloses *input field[s]* for entering and/or editing different information, such as parts information in the administrator interface. These input fields, including part names and part properties, are *description field[s]* for entering and editing descriptive text. *See, e.g.,* Kaufman, 11:47-55 (“If the administrator selects to add a new part at step 602, the administrator is then prompted to enter the new part’s name and properties at step 604.... If the administrator selects to edit existing parts information at step 606, the administrator then selects the part name to edit and is allowed to edit the part properties at step 608.”).

Thus, Kaufman discloses [10.0]. Singhose ¶¶ 238-242.

***[10.1] wherein said description field is configured to enable programming of descriptive text associated with sequential actions, said graphic selection field is configured to enable programming of an image formed by said at least one indicating light, and said location field is configured to enable programming of the location at which said at least one directional light device projects said at least one indicating light.***

As discussed for [10.0], Kaufman discloses the ability to enter or edit a part name via a *description field*. Kaufman, 11:47-49 (editing *descriptive text* for part information). This *description field* is configured to enable programming of *descriptive text* (for example, the part name). The part name is *associated with*

*sequential actions* because it describes the set of layers that make up a part. Those layers are themselves *associated with sequential actions* as stated in [9.1]. Singhose ¶¶ 243-244.

Thus, Kaufman discloses [10.1] and Poggi-SIMATIC-Kaufman renders obvious claim 10. Singhose ¶ 245.

### 3. Claim 18

***The method of claim 14, wherein projecting at least one indicating light comprises projecting at least one indicating light in a selectively configurable pattern.***

Poggi discloses *projecting at least one indicating light* as discussed for [1.3] and [14.4]. Moreover, Poggi discloses *projecting at least one indicating light in a selectively configurable pattern* because Poggi’s computer 20 “was programmed to teach it the ... shape of the various layers that must be placed.” Poggi, 3:27-30. Singhose ¶ 248.

Additionally, as discussed above with regards to [9.1], Kaufman teaches allowing an administrator to configure layers in a part, including the “series of points” that make up the layer. *See* Kaufman, 8:17-31 (Kaufman’s parts information includes layers made up of a “series of points”); *id.*, 11:43-57 (Kaufman’s parts information can be edited). The patterns that Kaufman projects are based on these layers. *Id.*, 15:10-21. Because Kaufman discloses editable parts, it discloses editable layers having *selectively configurable patterns*. Singhose ¶ 219. Thus, Kaufman also discloses *projecting at least one indicating light in a selectively*

*configurable pattern* because its layer information is *selectively configurable* based on administrator inputs, as described for [9.1]. *Id.* Thus, Poggi-SIMATIC-Kaufman renders obvious claim 18, based on the teaching in both Poggi and Kaufman of *projecting at least one indicating light in a selectively configurable pattern*. Singhose ¶¶ 246-250.

#### 4. Claim 22

***[22.0] The method of claim 14, including: programming the controller via at least one program screen displayable on the display device, the at least one program screen configured to include at least one input field for entering and/or selecting indicia regarding sequential actions; and***

*See* [9.1], *supra*. Singhose ¶¶ 251-252.

***[22.1] displaying indicia regarding sequential actions to be performed on at least one display screen displayable on the display device.***

*See* [9.2], *supra*. Singhose ¶ 253. Therefore, Poggi-SIMATIC-Kaufman renders obvious claim 22. Singhose ¶ 254.

#### 5. Claim 24

***[24.0] The operational guide system of claim 2, further including a display device, and wherein said controller is programmable via at least one program screen displayable on said display device, said at least one program screen configured to include at least one input field for entering and/or selecting indicia regarding sequential actions;***

*See* [9.0]-[9.1], *supra*. That claim 24 depends from claim 2 makes no difference to the Poggi-SIMATIC-Kaufman combination, since both Poggi and Kaufman describe the use of projected light to aid in assembly actions. Singhose ¶¶ 255-256.

***[24.1] said controller being further configured to display at least one display screen on said display device during operation of said operational guide system, said display screen being adapted to display indicia regarding sequential actions to be performed.***

See [9.2], *supra*. Singhose ¶ 257. Therefore, Poggi-SIMATIC-Kaufman renders obvious claim 24. Singhose ¶ 258.

**C. Challenge 1C: Claims 3 and 8 are obvious over Poggi-SIMATIC in view of Pinhanez**

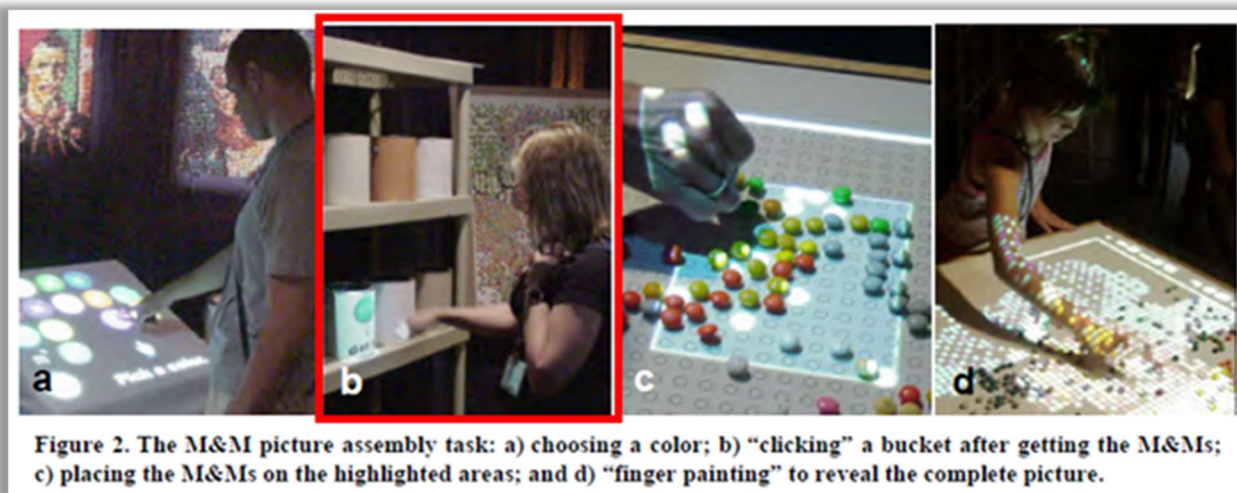
**1. Claim 3**

***The operational guide system of claim 2, wherein said at least one indicating light is projected at a component location, said component location retaining a part required for assembly at said work station.***

As discussed above for [1.3], Poggi discloses *at least one indicating light*. However, Poggi does not specifically disclose its *indicating light is projected at a component location*.

Pinhanez describes using an “Everywhere Displays projector” to guide humans in a variety of activities, including “a collaborative assembly task in a factory.” Pinhanez, 2-3. As a “whimsical demonstration” of that application, Pinhanez used a projector to direct users in the placement of multi-colored M&M’s to create “a picture made of 3,000 M&M’s ... where each M&M is regarded as a pixel of the picture.” *Id.*, 3. As part of this task, the projector was also used to “highlight[] the bucket that contains the M&M’s.” *Id.*, 3, Figure 2b. This is an example of *at least one indicating light [being] projected at a component location*

(the bucket of M&M's), *said component location retaining a part required for assembly at said work station* (because the M&Ms were to be used to create the artwork). Singhose ¶¶ 269-271. This is illustrated below:

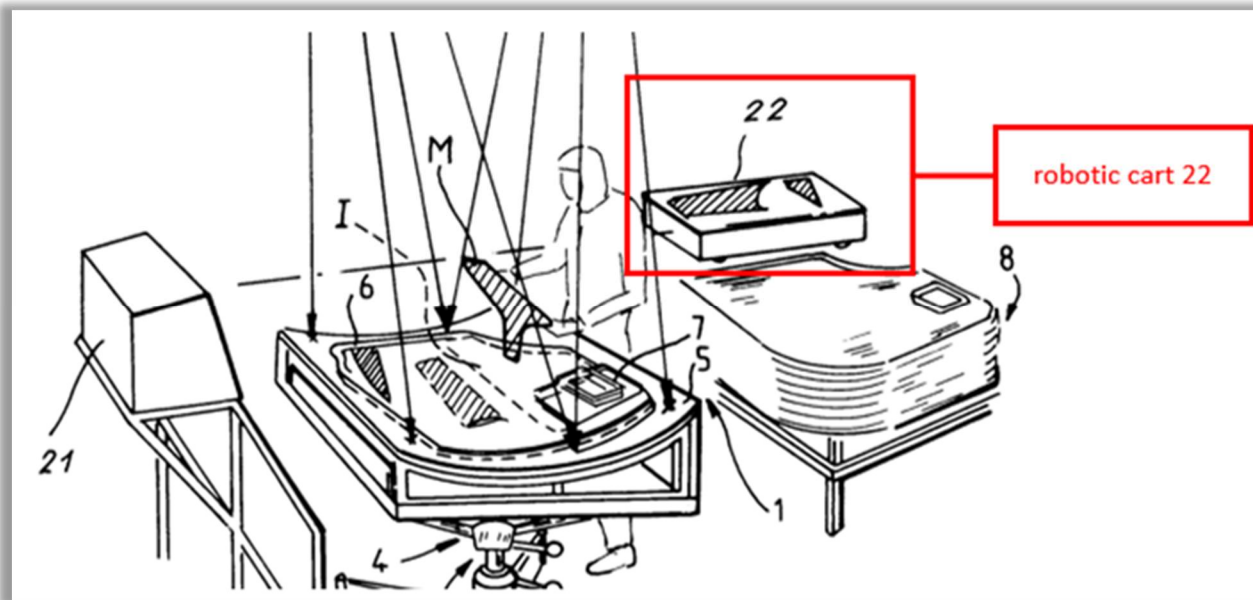


**Pinhanez, FIG. 2 (annotated).**

It would have been obvious to a POSITA to use the teachings in Pinhanez regarding highlighting a component location (i.e. Poggi’s part-carrying robotic cart 22) to improve the similar projection-for-assembly system in Poggi-SIMATIC in the same way as Pinhanez. Singhose ¶¶ 259-266. A POSITA would consider Poggi-SIMATIC and Pinhanez analogous to the ’981 patent, because both systems involve interactive computer applications (especially those that project instructions to aid operators in completing a task). Poggi, Abstract, 1:50-57; Pinhanez, 2-3; Singhose ¶ 259. Both systems also involve assembling different components. *See, e.g.*, Poggi, 1:4-9; Pinhanez, 3. Poggi further discloses “us[ing] a robotic cart 22 that provides



the operator with all the pieces necessary to lay up the part,” where different layers are organized at different locations on the cart. Poggi, 4:22-24, Fig. 1.



**Poggi, FIG. 1 (annotated).**

The overall work environment in Poggi Figure 1 is a *work station* because it is where the operator gathers materials from and assembles them into a composite part (although the table where the parts are laid would also be considered a *work station* by itself). Singhose ¶ 261.

In light of the robotic cart in Poggi, it would have been obvious to highlight the locations on that cart where each component is stored to assist the operator in finding such components more quickly, in the same way that highlighting the correct M&M bucket in Pinhanez assists the user. Singhose ¶ 263. A POSITA would have had a reasonable expectation of success in this combination because it would be

nothing more than using the already-developed technology of Pinhanez in a similar system (Poggi-SIMATIC). Singhose ¶¶ 260-266. Similarly, Poggi-SIMATIC-Pinhanez is the use of a known technique (Pinhanez) in a known device (Poggi-SIMATIC) ready for improvement to yield predictable results of faster and more accurate retrieval of components. Singhose ¶ 265. Market forces, including the need to decrease assembly time, would also have led a POSITA to combine Poggi-SIMATIC with the teachings in Pinhanez. Singhose ¶ 266. Notably, Poggi’s image projection system is consistent with Pinhanez’s aiming capability because Poggi’s “ball joint allows the projector and the camera to turn in all directions” and it is “possible to adjust the position of the projector and the camera in all directions.” Poggi, 3:11-16; Singhose ¶ 262.

Thus, Poggi-SIMATIC-Pinhanez renders obvious claim 3. Singhose ¶¶ 267-272.

## 2. Claim 8

***The operational guide system of claim 1, wherein said at least one indicating light is produced by at least one high intensity light emitting device selected from the group consisting of a laser projector, a digital light projector, and a liquid-crystal display.***

Poggi discloses a “video image projection system” to display images. Poggi, 1:51-52. Poggi does not state what type of projection system this is. However, Pinhanez discloses using an “LCD projector.” Thus, to the extent the phrase “liquid

crystal display” encompasses a *liquid-crystal display* projector, Pinhanez discloses it. Pinhanez, 1, 3; Singhose ¶ 273-277.

It would have been obvious to a POSITA to implement Poggi’s projection system using an LCD projector as taught in Pinhanez. This is nothing more than a simple substitution of a generic “video image projection system” (Poggi) for a more specific “LCD projector” (Pinhanez). There are no barriers to the combination and a POSITA would have considered it a routine implementation/design choice. Singhose ¶ 276.

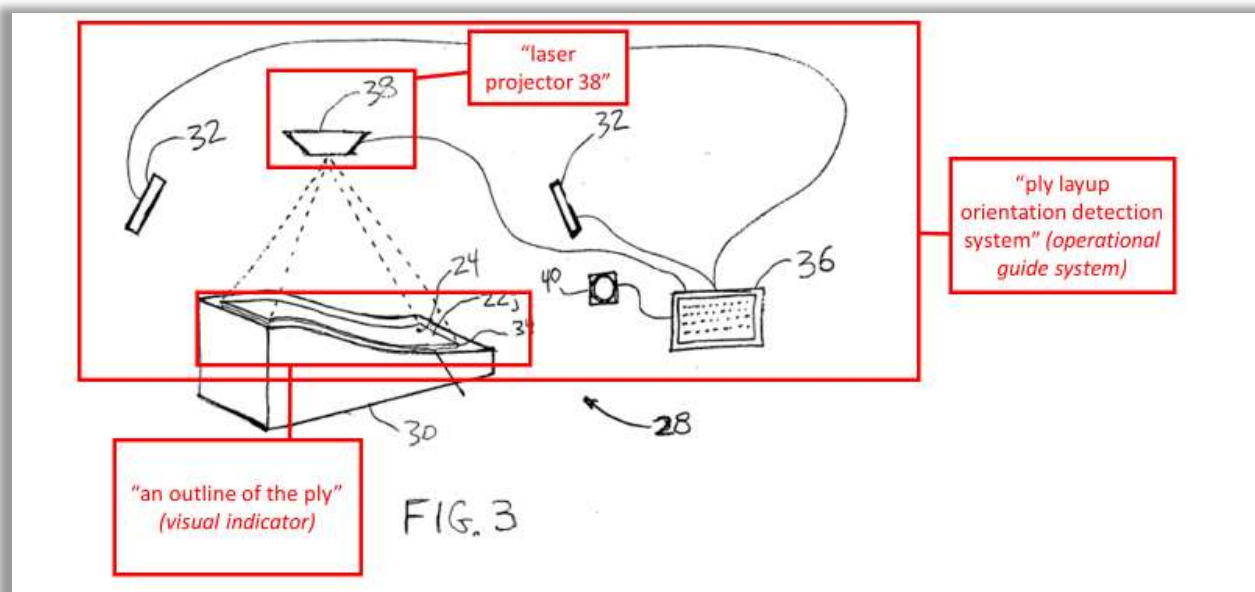
Thus, Poggi-SIMATIC-Pinhanez renders obvious claim 8. Singhose ¶ 277.

#### **D. Challenge 2A: Claims 1-2, 4-6, 8, and 11-12 are anticipated by Green**

##### **1. Claim 1**

***[1.0] An operational guide system adapted to provide visual indicators to an individual to guide sequential actions, said operational guide system comprising:***

Green discloses a “ply layup orientation detection system” for “identifying composite plies and [e]nsuring a correct layup sequence, as well as a correct location and orientation are used during panel fabrication.” Green ¶¶ [0021], [0018]. Green’s system may be “connected to a laser projector 38” that “project[s] an outline of the ply”—a *visual indicator*—to “display a proper orientation for the ply” to the system’s operator. *Id.* ¶ [0023].



**Green, FIG. 3 (annotated).**

Green’s “ply layup orientation detection system” is *an operational guide system* because it provides visual indicators on where an individual should place objects. Singhose ¶ 278. Additionally, each ply is one of a “sequence.” Green ¶¶ [0020], [0023]. Accordingly, Green’s system is *adapted to provide visual indicators to an individual to guide sequential actions*.

Thus, Green discloses [1.0]. Singhose ¶¶ 278-279.

**[1.1] at least one sensor apparatus, said at least one sensor apparatus operable to detect operation information and generate an output indicative of said operation information;**

Green discloses *at least one sensor apparatus* as “tag sensors 32.” Green ¶¶ [0023], [0025]. Each tag sensor 32 is a reader for “electronically identifiable tags 24.” *Id.* ¶ [0023] (“Each tag sensor 32 ... may scan/read each electronically

identifiable tag 24 in ... each ply ....”); Singhose ¶ 280. Green’s tags may include “marks or dots painted or affixed on one or more of the plies 22a-22e, that may be detected by a vision system/optical sensor; a radio frequency identification (RFID) tag; another passive electronic tag device; and/or an active electronic tag device.” Green ¶ [0019].

Green teaches that as each ply is created, computer system 36 “associate[s] each electronically identifiable tag 24 with a part number and a ply number.” *Id.* ¶ [0024]. Thus, when tag sensor 32 reads an electronically identifiable tag on a ply, it *detect[s] operation information* about that ply. The ’981 patent explains that *operation information* includes information about the presence or type of a work piece. *See* ’981 patent, 5:35-38 (“[S]ensor apparatus 26 functions to detect an operation information or characteristic or identification information associated with work piece 14, such as the presence and/or type of work piece 14 located at the work station 16.”); *see also id.*, claims 4/5 (claiming same). Thus, when Green’s tag sensor 32 “scan[s]/read[s] each electronically identifiable tag 24 in ... each ply,” Green ¶ [0023], it *detect[s] operation information*, i.e., it detects information regarding the presence of a ply at a work station, as well as identification information

associated with the ply (*i.e.*, identification of a tag that has been associated with a particular ply).<sup>4</sup> Singhose ¶ 281.

After Green's tag sensor 32 reads an electronically identifiable tag, it "transmit[s] appropriate data to the computer system 36 to confirm that each ply is being placed in a proper layup sequence and orientation." Green ¶ [0023]. Then, "the computer system 36 and the tag sensors 32 may be used to detect the identification and position of the ply ...." *Id.* ¶ [0025]; *see also id.*, Fig. 5 ("System Detects Tag on Ply for Identification and Position"). In other words, the tag sensor sends to the computer system information about electronically identifiable tag 24 that the computer system transforms into an identification and position determination. Thus, the tag sensor *generate[s]* and sends to the computer system *an output indicative of the operation information* that the tag sensor detected from the electronically identifiable tag. Singhose ¶ 282.

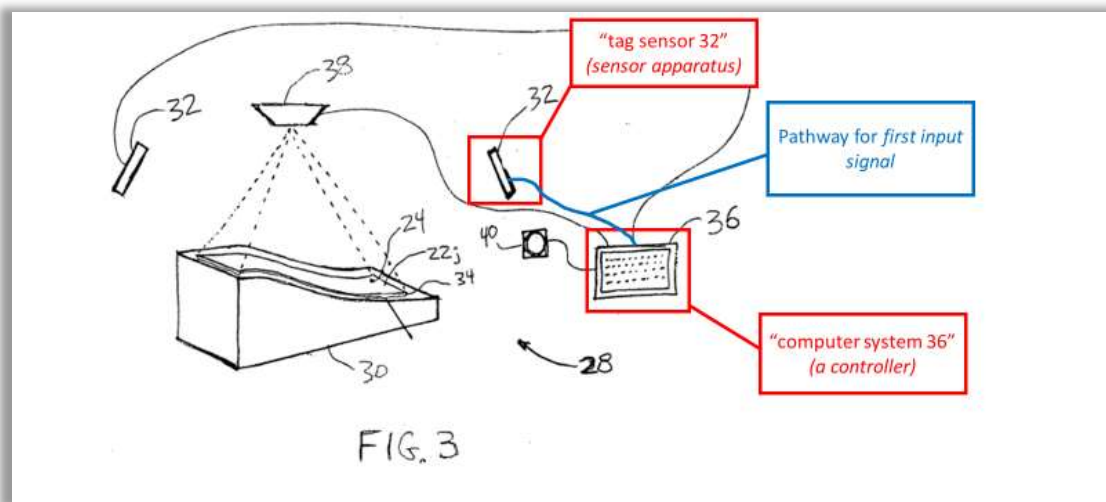
Thus, Green discloses [1.1]. Singhose ¶¶ 280-284.

***[1.2] a controller, said controller receiving at least a first input signal indicative of said operation information and selectively providing at least one command signal in response to said first input signal; and***

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<sup>4</sup> Notably, the '981 patent, 5:35-53 describes using a tag identification sensor to *detect operation information*.

As discussed for [1.1], Green's computer system 36 receives "appropriate data" regarding electronically identifiable tags from tag sensor 32 that is indicative of *operation information* that the tag sensor 32 sensed from those tags. Green ¶ [0023]; Singhose ¶ 285.

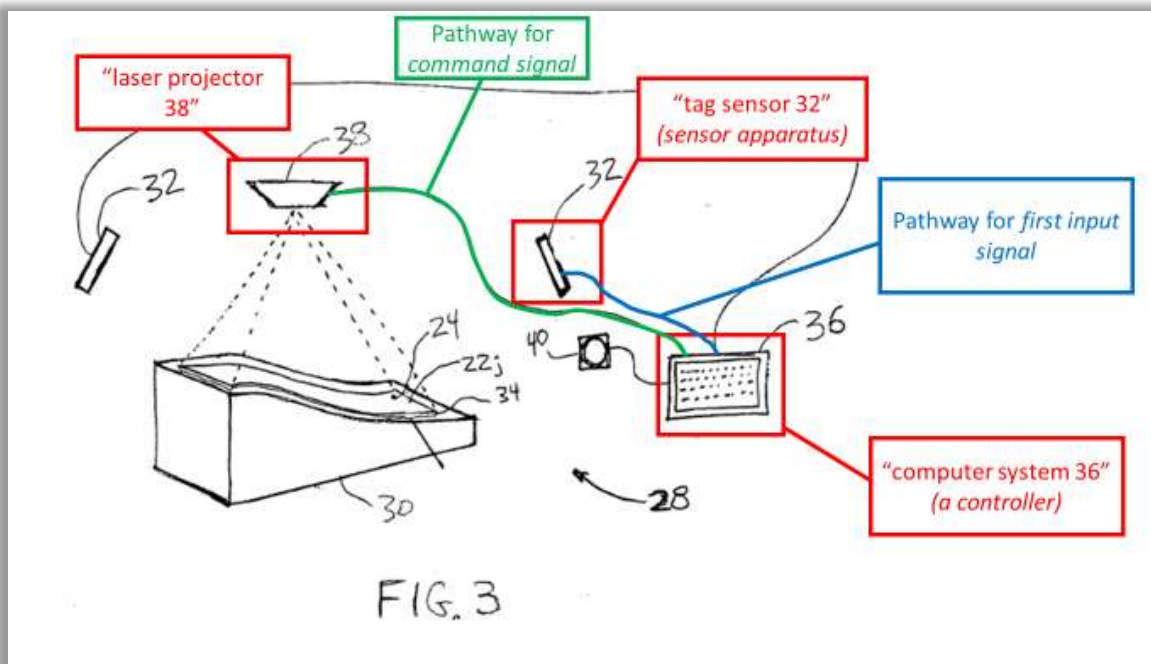


**Green, FIG. 3 (annotated).**

Green's computer system 36 is *a controller* because it is "operatively connected to a laser projector 38" to control "display [of] a laser projected outline." Green ¶¶ [0023], [0025]; Singhose ¶ 285. The "appropriate data" it receives from "tag sensor 32" is *a first input signal*. Singhose ¶ 285.

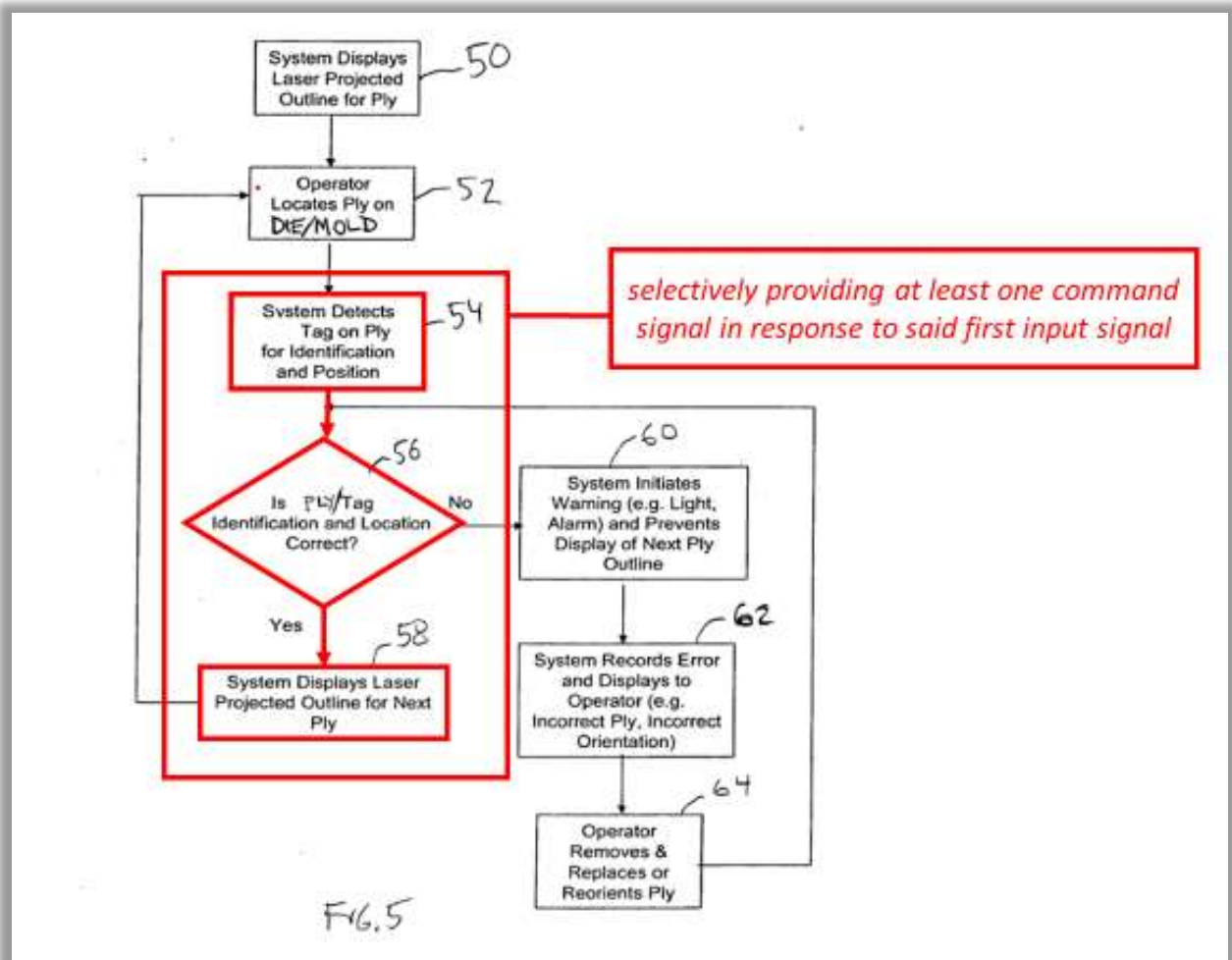
As discussed above for [1.1], computer system 36 uses the *input signal* from tag sensor 32 to determine the identification and position of the ply. Green ¶ [0025], Fig. 5. Then, "[i]f the identification and location of the ply detected ... is correct, the computer system 36 and laser projector 38 display a laser projected outline for

the next ply.” *Id.* ¶ [0025]. Thus, Green’s computer system 36 *selectively provid[es]* *at least one command signal* to laser projector 38. The *command signal* (instruction to display an outline) is sent *in response to said first input signal* because it depends on whether the “identification and location of the ply detected ... is correct.” *Id.* ¶ [0025]; Singhose ¶¶ 286-287. Figures 3 and 5 provide additional disclosure of this element:



**Green, FIG. 3 (annotated).**



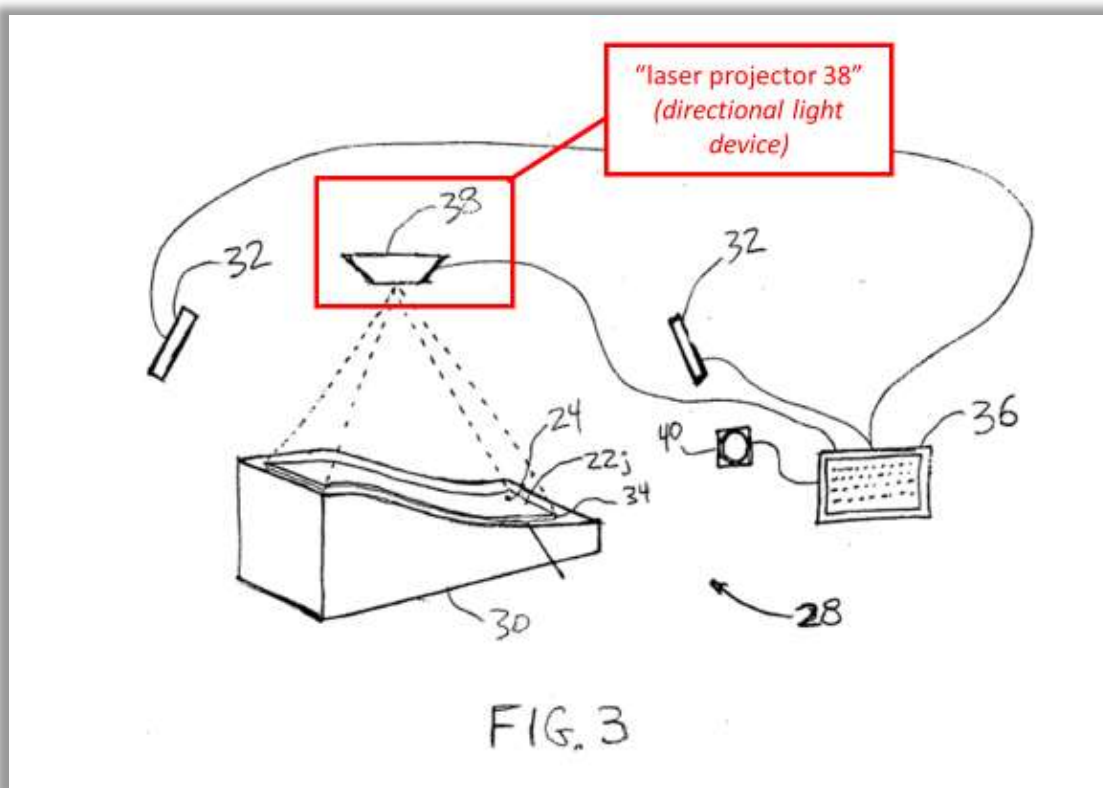


Green, FIG. 5 (annotated).

Thus, Green discloses [1.2]. Singhose ¶¶ 285-288.

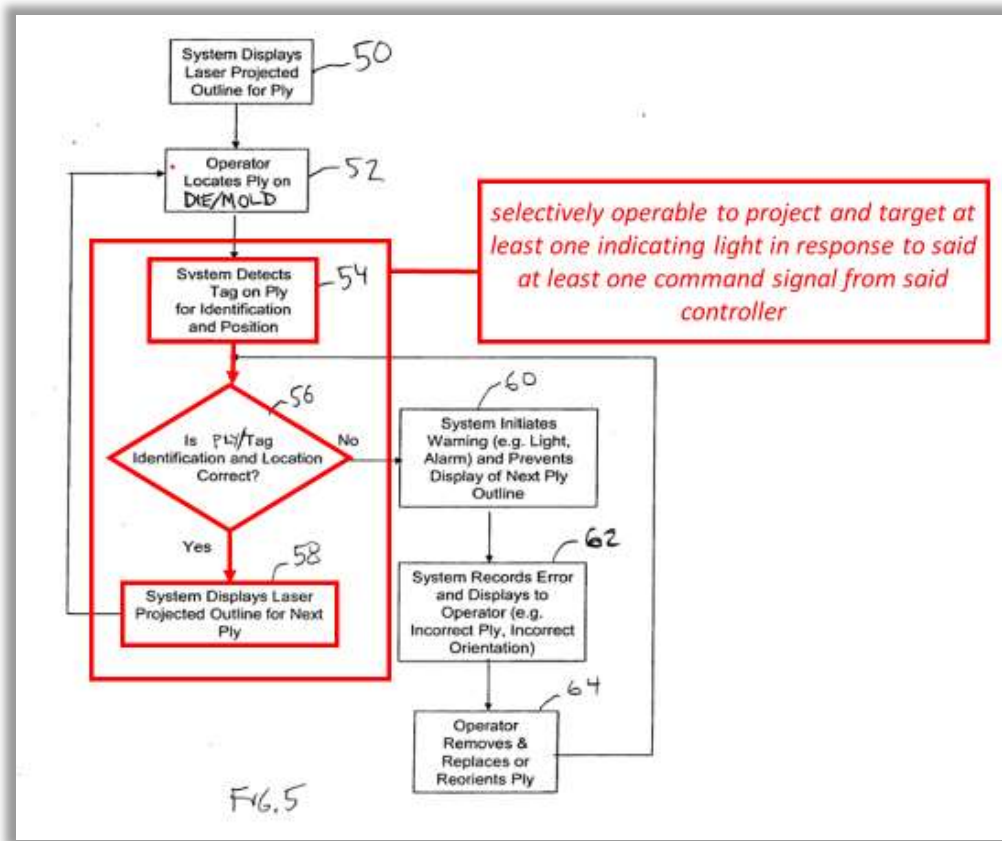
*[1.3] at least one directional light device, said at least one directional light device selectively operable to project and target at least one indicating light in response to said at least one command signal from said controller.*

Green discloses laser projector 38 (*at least one directional light device*):



**Green, FIG. 3 (annotated).**

As discussed for [1.2], in Green, “[i]f the identification and location of the ply detected ... is correct, the computer system 36 and laser projector 38 display a laser projected outline for the next ply.” Green ¶ [0025]. Thus, in Green, the *directional light device* (projector 38) is *selectively operable to project and target at least one indicating light in response to said at least one command signal from said controller* (i.e., in response to a command signal from computer system 36 as discussed for [1.2]). Singhose ¶ 290. Notably, laser projectors *target* their indicating light because they must aim it at specific locations. Singhose ¶ 290. This is also illustrated in Green:



Green, FIG. 5 (annotated).

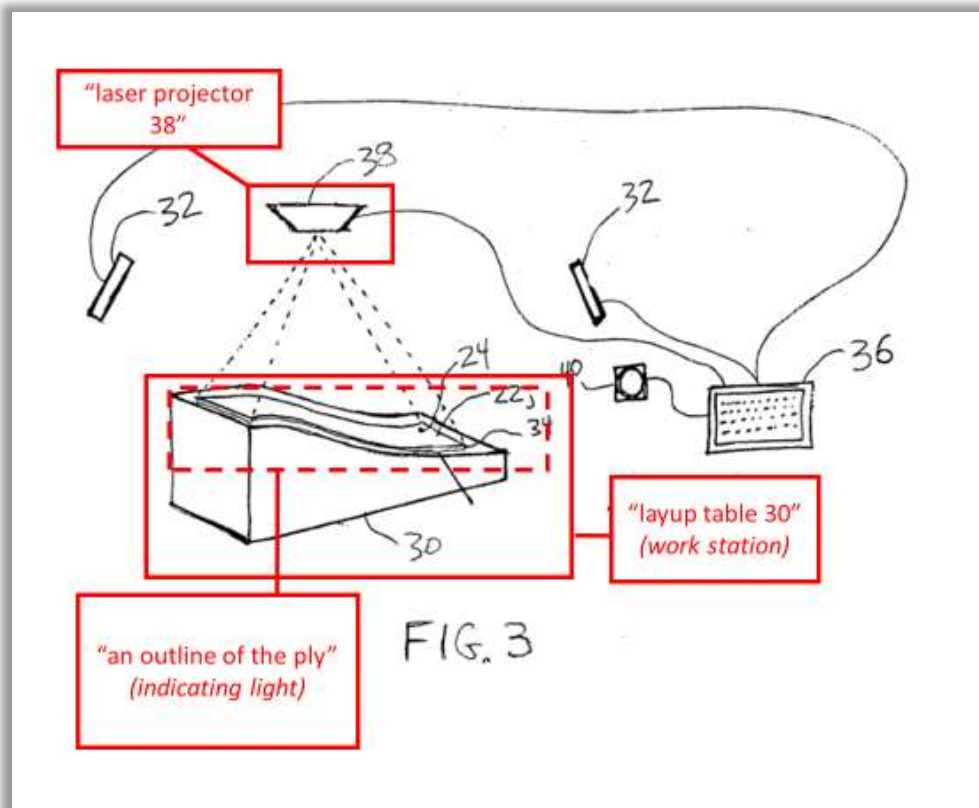
Thus, Green discloses [1.3] and anticipates claim 1. Singhose ¶¶ 289-291.

## 2. Claim 2

*The operational guide system of claim 1, wherein said at least one indicating light is provided to an operator performing an assembly action at a work station.*

Green’s “laser projector 38 may be used to project an outline showing the proper positioning of a ply” (*at least one indicating light*). Green ¶ [0025]. The outline is projected “on the layup table 30” (*at a workstation*). *Id.* The operator then places “the ply on the layup table 30 in accordance with the projected outline”

and repeats these steps with multiple layers of ply to form a “composite panel” *Id.* ¶¶ [0025], [0010], Fig. 5. Placing layers for “manufacturing composite structures” is an *assembly action*. *Id.* ¶ [0002]; Singhose ¶ 294. Thus, the *indicating light* in Green is *provided to an operator performing an assembly action at a work station*, as illustrated below:



**Green, FIG. 3 (annotated).**

Thus, Green anticipates claim 2. Singhose ¶¶ 293-295.

### 3. Claim 4

***The operational guide system of claim 2, wherein said operation information comprises identification of a presence of a work piece at said work station.***

At each step in Green’s assembly process, an operator places a “ply” onto the layup table 30 (*work station*). Green ¶ [0025]. As discussed for [1.1], Green’s tag sensor 32 detects *operation information* by detecting which electronically identifiable tags, located on plies and associated by the system with part numbers, are present. *See id.* ¶¶ [0020], [0023-0025]. Green’s *operation information*, conveying the presence and placement of electronically identifiable tags on plies, thus *comprises identification of a presence of a work piece at said work station*. Singhose ¶ 298.

Thus, Green anticipates claim 4. Singhose ¶¶ 296-299.

### 4. Claim 5

***The operational guide system of claim 4, wherein said operation information comprises identification of a type of the work piece at said work station, and wherein said at least one command signal is selectively provided depending on the type of the work piece identified.***

As discussed for [1.1] and claim 4, Green’s tag sensor 32 detects *operation information* because it detects which electronically identifiable tags—each associated with specific plies—are present at the workstation. *See, e.g.*, Green ¶ [0024] (“[A]t 48 the computer system 36 may associate each electronically identifiable tag 24 with a part number and a ply number.”); Singhose ¶ 302. Green’s

*operation information thus comprises identification of a type of a work piece at said work station, because each tag is assigned to a specific part number (type of the work piece).*

Green teaches that if, based on the information from tag sensor 32, “the identification and location of the ply detected ... is correct,” then “computer system 36 may further be operatively connected to a laser projector 38” to provide a signal (*command signal*) to “display a laser projected outline for the next ply.” Green ¶¶ [0023], [0025], Fig. 5 (56-58). If the current ply is not in the proper “sequence” and “orientation,” the computer system does not provide the signal to laser projector 38. *Id.*; see also Fig. 5 (56-64). Thus, *depending on the identification (type) of the ply (work piece)*, computer system 36 *selectively provide[s]* a signal (*command signal*) to laser projector 38. Singhose ¶¶ 302-303. Thus, Green anticipates claim 5. Singhose ¶¶ 300-304.

## 5. Claim 6

***The operational guide system of claim 2, wherein said at least one indicating light is projected at a work piece to indicate an operation step location.***

Green’s “laser projector 38 may be used to project an outline showing the proper positioning of a ply on the layup table 30.” Green ¶ [0025]. “If the identification and location of the ply detected at 54 is correct, the computer system 36 and laser projector 38 display a laser projected outline for the next ply.” *Id.* Thus, Green discloses *at least one indicating light (laser outline) that is projected at a*

*workpiece* (the set of already-placed plies) *to indicate an operation step location* (“proper positioning of a ply”). *Id.*; Singhose ¶ 307. Thus, Green anticipates claim

6. Singhose ¶¶ 305-308.

## 6. Claim 8

***The operational guide system of claim 1, wherein said at least one indicating light is produced by at least one high intensity light emitting device selected from the group consisting of a laser projector, a digital light projector, and a liquid-crystal display.***

Green’s laser projector 38 (a *high intensity light emitting device* that is a *laser projector*) “display[s] a laser projected outline for the next ply” (an *indicating light*).

Green ¶ [0025]. Thus, Green anticipates claim 8. Singhose ¶¶ 309-312.

## 7. Claims 11 and 12

***11. The operational guide system of claim 1, wherein said controller is configured to monitor operational information<sup>5</sup> associated with sequential actions.***

***12. The operational guide system of claim 11, said operational information including at least one selected from the group consisting of a cycle time, an incorrectly performed action, a time between sequential actions, and an operator identification.***

Green includes a tag sensor 32 that “may scan/read each electronically identifiable tag 24” embedded in “each ply” “to detect the identification and position of the ply.” Green ¶¶ [0023], [0025]; *see also id.* ¶ [0018]. “Tag sensor 32” transmits the identification and position data “to the computer system 36 to confirm

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<sup>5</sup> *See supra*, n.1.

that each ply is being placed in a proper layup sequence and orientation.” *Id.* ¶ [0023]. “If an incorrect one of the plies is selected or the ply that was placed on the layup table 30 is in an improper location and/or orientation, the computer system” is configured to react by flashing lights, sounding an alarm, and/or preventing further displays by the laser projector. *Id.*, Fig. 5 (56-60). Green thus discloses that the computer system (controller) is configured to monitor for *an incorrectly performed action*, and thus monitor *operational information*. Singhose ¶ 316. Moreover, the information monitored includes whether the “ply is being placed in a proper layup sequence,” and thus is *associated with sequential actions*. Green ¶ 316.

Thus, Green anticipates claims 11-12. Singhose ¶¶ 313-321.

**E. Challenge 2B: Claims 7, 9-10, and 13-25 are rendered obvious by the combination of Green and Kaufman**

**1. Claim 7**

*The operational guide system of claim 1, wherein said controller is adapted to receive at least one confirmation signal indicative of a completion of an assembly action, said at least one confirmation signal comprising at least one signal selected from the group consisting of a manually input signal and an automated input signal.*

Green uses its tag sensor 23 (*sensor apparatus*) and computer system 36 (*controller*) to determine when a ply has been placed on a layup table (i.e., to determine whether an assembly action has been completed). Green ¶ [0023]. Kaufman teaches that its operator manually marks layers “as complete” by “clicking



on a particular layer.” Kaufman, 15:36-38. When an operator “click[s] on a particular layer” to mark it “complete,” Kaufman’s operator program receives a *manually input confirmation signal indicative of a completion of an assembly action*. *Id.*, 15:36-38; Singhose ¶ 332.

It would have been obvious to combine Green with Kaufman, such that Green’s computer 36 would receive the *confirmation signal* manually input by the operator as disclosed in Kaufman. Singhose ¶ 330. A POSITA would have recognized Green and Kaufman are analogous to the ’981 patent because they disclose interactive computer applications (that project instructions to aid operators in completing an assembly task). Singhose ¶ 323; Green ¶ [0025]; Kaufman, 1:20-26. Further, both are reasonably pertinent to the same problem as the ’981 patent of guiding human operators in assembly tasks, including by projected light. A POSITA would have understood that enabling Green’s computer system 36 to receive manual confirmation of the completion of a ply layer placement would have benefited that system by helping it know *when* to read the electronically identifiable tags to determine whether the plies had been placed correctly. Without Kaufman’s manual signal, the system disclosed in Green might have monitored at all times, potentially creating irritating error signals while the operator was still working to place the ply correctly. Singhose ¶ 330. The combination is further obvious because Kaufman discloses functionality by which “layers are marked or unmarked as complete at Step

1276 by the operator simply clicking on a particular layer.” Kaufman, 15:36-38. Using this version of Kaufman’s manual *confirmation signal* would also render obvious adding Kaufman’s *display device* (to the extent Green does not already disclose it). Adding Kaufman to Green in this way would be nothing more than applying a known technique to a system ready for the improvement to achieve a predictable result. Singhose ¶ 330.

More generally, the Green-Kaufman combination is obvious because Green expressly references an “overhead laser projection system” that is “commercially available from Laser Projection Technologies.” Green ¶ [0006]. According to the USPTO patent database, when Green was filed (August 3, 2005), Kaufman was the only issued U.S. Patent assigned to Laser Projection Technologies. EX1027. Thus, a POSITA considering Green would have looked to Kaufman for information regarding how to implement Green using the off-the-shelf commercial laser projector technologies expressly referenced in Green. This combination rationale applies to all of the claims described below. Moreover, based on the Laser Projection Technologies reference in Green, a POSITA would also have had a reasonable expectation of success in the combination. Singhose ¶ 324.

In the Green-Kaufman combination, Green’s *controller [would be] adapted to receive at least one confirmation signal indicative of a completion of an assembly action* when the operator confirmed the placement of a ply (i.e., generating a

*manually input signal*). Singhose ¶ 333. Thus, Green-Kaufman renders obvious claim 7. Singhose ¶ 331-334.

## **2. Claims 9-10, 24**

As described in Challenge 1B, *supra*, Kaufman discloses the limitations of claims 9-10 and 24. As described for claim 7, it would have been obvious to combine Green with the laser projection management techniques of Kaufman. A POSITA would have further been motivated to combine Green with the software interfaces in Kaufman to specify part information. Singhose ¶ 325. That claim 24 depends from claim 2 makes no difference to the combination of Green-Kaufman (both of which concern using a laser projector to perform an assembly action). Singhose ¶ 389. Thus, Green-Kaufman renders claims 9-10 and 24 obvious. Singhose ¶¶ 335-340, 388-390.

## **8. Claims 13 and 25**

***The operational guide system of claim [1 or 2], further including a display device, said display device being operable to display information regarding sequential actions.***

These claims are identical except that claim 13 depends from claim 1 and claim 25 depends from claim 2.

As discussed above for [9.0] and [9.2] (for both challenges 1B and 2B), Kaufman discloses a *display device*, namely “display 10.” Kaufman, Fig. 1, 12:60-13:2. As also discussed, Kaufman’s display is *operable to display information*

*regarding sequential actions.* Kaufman’s operator software includes features that *display indicia regarding sequential actions to be performed*, including displaying job details (*id.*, 13:16-18) and allowing the operator to mark particular layers as complete (*id.*, 15:36-38). Singhose ¶¶ 343, 235.

Green also discloses *display[ing] information regarding sequential actions*. For example, Green teaches that “computer system 36 may be programmed to **display** a warning to the operator to correct the position and/or orientation of the ply.” Green ¶ [0023] (emphasis added). It may also “display an error message to the operator” when “the identification and location of the [current] ply ... is not correct.” *Id.* ¶ [0025]. The computer system also “direct[s]” an operator “to select a first ply, such as the ply 22j, and to place it on the layup table 30.” *Id.* ¶ [0023]. To the extent Green’s “computer system 36” does not include a *display screen*, it would be obvious to include one based on the teachings of Kaufman. Kaufman, 7:32-44 (explaining that the computer controlling the laser projector may be a “conventional personal computer or computer workstation” or it may be integrated with the laser projector “except for the keyboard and display.”) Singhose ¶ 327-328. The messages displayed by the computer are *regarding sequential actions* because, for example, they address whether “each ply is being placed in a proper layup sequence and orientation.” *Id.* ¶ [0023].

Thus, Green-Kaufman renders obvious claims 13 and 25. Singhose ¶¶ 342-344, 391-393.

### 3. Claim 14

***[14.0] A method for guiding assembly actions by providing visual indicators, said method comprising:***

*See* Challenge 2A at [1.0]. Singhose ¶ 345.

***[14.1] identifying a characteristic of a work piece requiring assembly actions;***

As discussed in Challenge 2A, Green’s “tag sensor 32 ... may scan/read each electronically identifiable tag 24 in ... each ply.” Green ¶ [0023]. This is *identifying a characteristic of a work piece requiring assembly actions*. Notably, each tag is associated “with a part number and a ply number.” *Id.* ¶ [0024].

Thus, Green discloses [14.1]. Singhose ¶¶ 346-347.

***[14.2] communicating identification information to a controller in response to the identifying of a characteristic of the work piece;***

As discussed for [1.1]-[1.2] in Challenge 2A, after “tag sensor 32 ... scan[s]/read[s] each electronically identifiable tag 24 in ... each ply” it “transmit[s] appropriate data” to computer system 36 (*controller*). Green ¶ [0023]. The computer system then uses that “appropriate data” to determine “the identification and position of the ply.” *Id.* ¶ [0025]. Thus, Green teaches *communicating identification information* (from the identifiable tag 24) to a *controller* (computer system 36). This is *communic[ated] in response to the identifying of a characteristic*

*of the work piece* because it occurs in response to tag sensor 32 detecting a tag. Thus, Green discloses [14.2]. Singhose ¶¶ 348-349.

***[14.3] communicating a first command signal to at least one directional light device in response to the identifying of a characteristic;***

Green discloses [14.3] for the reasons stated above for [1.2] in Challenge 2A. The *operation information* used to determine whether to send a *command signal* in [1.2] (i.e., the presence and identity of a tag) is also the *characteristic* identified in [14.1]-[14.3]. Thus, Green discloses *communicating a first command signal to at least one directional light device in response to the identifying of a characteristic* for the reasons discussed for [1.2]. Thus, Green discloses [14.3]. Singhose ¶¶ 350-351.

***[14.4] selectively projecting at least one indicating light via the directional light device in response to the first command signal; and***

See Challenge 2A at [1.3]. Singhose ¶ 352.

***[14.5] communicating a confirmation signal to the controller upon completion of a first operation step.***

The Green-Kaufman combination renders this element obvious for the reasons stated for claim 7. The *operation step* of [14.5] corresponds to the *assembly action* of claim 7. Singhose ¶ 353.

Thus, Green-Kaufman discloses [14.5] and renders claim 14 obvious. Singhose ¶¶ 345-354.

#### **4. Claims 15-17, 23**

Green discloses the additional requirements of claims 15-16 for the reasons above for claims 4-5 (which also concern identifying the presence or type of a workpiece). Green discloses claim 17 for the reasons stated for claim 6 (concerning projecting an indicating light at an operation step location). Green discloses claim 23 for the reasons stated for claim 11 (concerning monitoring operational information). Thus, Green-Kaufman renders obvious claims 15-17, and 23. Singhose ¶¶ 355-364, 385-387.

#### **5. Claims 18, 22**

As described in Challenge 1B, *supra*, Kaufman discloses the limitations of claims 18 and 22. As described for claim 7, it would have been obvious to combine Green with the laser projection management techniques of Kaufman. Thus, Green-Kaufman renders claims 18 and 22 obvious. Singhose ¶¶ 365-367, 382-384.

#### **6. Claim 19**

Green-Kaufman renders obvious the limitations of claim 19 for the reasons stated above for claim 7. Singhose ¶¶ 369-370.

#### **7. Claim 20**

***[20.1] The method of claim 14, including: communicating a second command signal from the controller to the at least one directional light device in response to the confirmation signal;***

As discussed for claim 7 and [14.5], Green-Kaufman renders obvious a *confirmation signal* that is input by the operator after a ply is placed. Singhose ¶ 372.

In the combination, this *confirmation signal* leads Green's tag sensor 32 and computer system 36 to (1) read the tags on the plies; and (2) determine if the plies are properly placed. Green ¶¶ [0024], [0025]; Singhose ¶ 372. Then, "[i]f the identification and location of the ply detected at 54 is correct, the computer system 36 and laser projector 38 display a laser projected outline for the next ply, as indicated at 58." Green ¶ [0025], Fig. 5. As discussed in Challenge 2A at [1.2], Green's computer system 36 *controller* sends a *command signal* to laser projector 36 (*directional light device*). Thus, when Green discloses that "computer system 36 and laser projector 38 display a laser projected outline for the next ply," Green ¶ [0025], it is the claimed *second command signal* sent *in response to the confirmation signal* (i.e., the manual signal from the operator as disclosed in Kaufman). Thus, Green-Kaufman renders obvious [20.1]. Singhose ¶¶ 372-373.

***[20.2] projecting at least one indicating light from the directional light device in response to the second command signal; and***

Green's laser projector 38 displays an outline of the next ply in response to the *second command signal* of [20.1] to the same extent as the command signal of [1.3]. Singhose ¶¶ 374-375.

***[20.3] communicating a confirmation signal to the controller upon completion of a second operation step.***

See claim 7 and [14.5] above. In the Green-Kaufman combination, the same confirmation signal discussed in claim 7 (i.e., the signal made when the operator



indicates that a ply layer is complete) is used after each ply is added. Green ¶¶ [0023], [0025], FIG. 5; Singhose ¶ 376. Therefore, Green-Kaufman renders obvious claim 20. Singhose ¶¶ 371-377.

## **8. Claim 21**

***The method of claim 20, including: repeating said communicating a command signal; projecting at least one indicating light in response to said command signal; and communicating a confirmation signal until assembly actions for the work piece have been completed.***

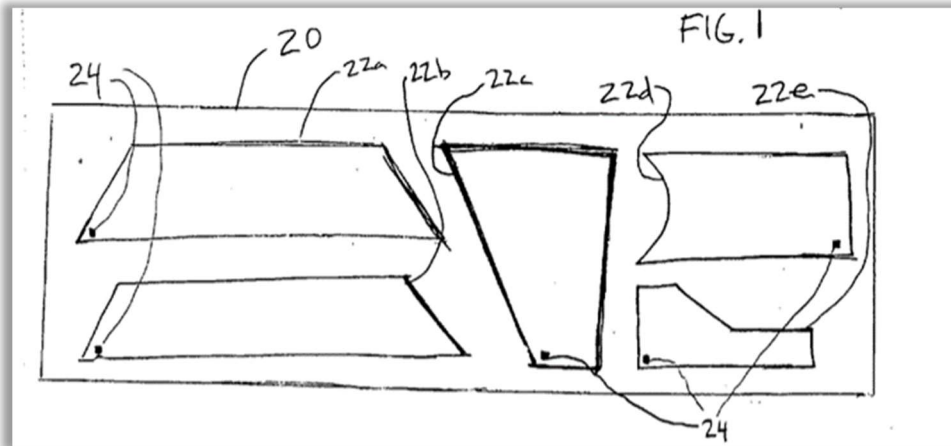
As discussed in Challenge 2B at [20.3], using a laser projector to display ply outlines and sending a confirmation signal once the ply has been placed is repeated for each ply. Singhose ¶ 380. Green does not expressly mention repeating this process until *assembly actions for the work piece have been completed*, but it would have been obvious to a POSITA that Green's process continues until that point. Singhose ¶ 380. Thus, the process described above for claims 1, 7, 14, 19, and 20 renders obvious the requirement of *repeating* [the claimed method] *until assembly actions for the work piece have been completed*. Thus, Green-Kaufman renders claim 21 obvious. Singhose ¶¶ 378-381.

## **F. Challenge 2C: Claim 3 is obvious over Green in view of Pinhanetz**

### **3. Claim 3**

As described in Challenge 1C above, Pinhanetz discloses *projecting at least one indicating light at a component location, said component location retaining a part required for assembly at said work station*. See Challenge 2C at [3], *supra*.

Green further discloses “a ply cutter bed” that contains “cut plies” for use in the ply layup operation. Green ¶ [0013], FIG. 1.



**Green, FIG. 1.**

Green also discloses that the system instructs an operator to “select a first ply, such as the ply 22j.” *Id.* ¶ [0023]; Singhose ¶ 399.

A POSITA would have modified Green based on the teachings of Pinhanez to include light projection that would indicate to the operator which ply (*part[s] required for assembly at said work station*) on the ply cutter bed (*component location*) is needed next. Singhose ¶ 400.

It would have been obvious to a POSITA to use the teachings in Pinhanez on highlighting a component location to improve the similar projection system in Green in the same way as Pinhanez. Singhose ¶ 394. Both Green and Pinhanez disclose analogous systems of interactive computer applications to that of the '981 patent,

particularly applications that project instructions to operators to aid them in completing a task. Green ¶ [0025]; Pinhanez, 2-3; Singhose ¶ 394.

It would have been obvious and helpful to highlight the locations where each ply is stored to assist the operator to find the correct ply more quickly, in the same way that highlighting the bucket with M&M's of the selected color in Pinhanez assists the user in their retrieval. Singhose ¶ 395. A POSITA would have had a reasonable expectation of success in this combination because it would be nothing more than applying the concept that Pinhanez had already developed to Green, a similar system. Singhose ¶ 395. Similarly, combining Green and Pinhanez is using a known technique (Pinhanez) with a known device (Green) ready for improvement to yield predictable results of faster and more accurate retrieval of components. Singhose ¶ 395. Market forces, including the benefits from decreasing assembly time or increasing accuracy, would also have led a POSITA to combine Green with the teachings in Pinhanez. Singhose ¶ 395.

Thus, Green-Pinhanez renders obvious claim 3. Singhose ¶¶ 394-401.

## **VI. DISCRETIONARY DENIAL IS INAPPROPRIATE**

Amazon stipulates that, if review is instituted, it will not argue at trial that any claim of the '981 patent is invalid on any ground that Amazon raised or reasonably could have raised during this IPR. Accordingly, applying Director Vidal's

Memorandum, there is no basis to deny institution under *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019 (PTAB Mar. 20, 2020) (precedential).

This Petition also presents materially different references from those in the file history; none of the references relied on were considered during prosecution. If any reference in this Petition is cumulative of prior art considered during prosecution, the examiner materially erred by failing to reject the challenged claims on the grounds of this Petition that establish unpatentability of the challenged claims. Accordingly, there is no basis to decline institution under Section 325(d).

## **VII. MANDATORY NOTICES**

### **A. Real Party-in-Interest**

The Petitioner is Amazon.com, Inc. and Amazon.com Services LLC, both of whom are the real parties-in-interest.

### **B. Judicial Matters**

As of the filing date of this petition and to the best knowledge of the Petitioner, the '981 patent is or has been involved in the following litigations:

- *LightGuide, Inc. v. Amazon.com, Inc. and Amazon.com Services LLC*, 2:22-cv-00433 (E.D. Tex. 2022);
- *Amazon.com, Inc. and Amazon.com Services LLC v. LightGuide, Inc.*, 2:23-cv-00053 (W.D. Wash. 2023); and

- *OPS Solutions LLC v. Delta Sigma, LLC, et al.*, 2:14-cv-14389 (E.D. Mich. 2014).

### **C. Administrative Matters**

Petitioner has filed petitions for *inter partes* review against two patents that are also assigned to LightGuide: U.S. Patent No. 9,658,614 and U.S. Patent No. 10,528,036. While neither of these patents are related to the '981 patent, they recite similar technology and incorporate significant content from the '981 into their disclosures. As such, those proceedings may affect or be affected by this proceeding. Further, LightGuide has asserted those two other patents against Petitioner in the above-recited litigation in the Eastern District of Texas, and Petitioner has requested declaratory judgment of non-infringement as to those two other patents in the above-recited litigation in the Western District of Washington.

### **D. Designation of Lead and Back-up Counsel and Service Information**

With this petition, Petitioner is filing a power of attorney appointing the lead and back-up counsel designated herein. Petitioner designates the following lead and back-up counsel:

#### **Lead Counsel:**

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Please direct all correspondence to lead and back-up counsel at the addresses listed above. Amazon consents to electronic service at the email addresses listed above.

**VIII. FEES**

Petitioner is concurrently electronically submitting the required fees for this Petition. The Board is authorized to charge Hueston Hennigan LLP's deposit account for any fee deficiency.

**IX. GROUNDS FOR STANDING**

Petitioner certifies that the '981 patent is available for *inter partes* review and that neither Petitioner nor any real party-in-interest or privy is barred or estopped from requesting review challenging the claims on the grounds identified herein.


**X. CONCLUSION**

Petitioner has established a reasonable likelihood of prevailing and asks that the Board institute *inter partes* review, hold the challenged claims unpatentable, and cancel the challenged claims.

Respectfully submitted,

Dated: November 4, 2023

HUESTON HENNIGAN LLP

By:   
\_\_\_\_\_  
Christina V. Rayburn  
Registration No. 78,166  
Lead Counsel for Petitioner

**CERTIFICATE OF WORD COUNT**

Pursuant to 37 C.F.R. § 42.24, the undersigned attorney for the Petitioner, declares that the argument section of this Petition (Section II-IX) has a total of 13,722 words, according to the word count tool in Microsoft Word™.



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Christina V. Rayburn  
Registration No. 78,166  
Lead Counsel for Petitioner




IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

**CERTIFICATE OF SERVICE**

The undersigned certifies, in accordance with 37 C.F.R. § 42.205, that service was made on the Patent Owner as detailed below.

|                   |   |
|-------------------|---|
| Date of service   | November 4, 2023  |
| Manner of service | Priority Express Mail   |
| Documents served  | Petition for <i>Inter Partes</i> Review; Exhibits 1001-1027   |
| Persons served    | Karl Ondersma<br>Gardner, Linn, Burkhardt & Ondersma LLP<br>2900 Charlevoix Dr., SE, Suite 300<br>Grand Rapids, MI 49546<br><br>LightGuide, Inc.<br>48443 Alpha Drive, Suite 175<br>Wixom, MI USA 48393 |

  
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