

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ALIGN TECHNOLOGY, INC.
Petitioner,

v.

3SHAPE A/S,
Patent Owner.

Case IPR2018-00197
Patent 9,329,675 B2

Before ELENI MANTIS MERCADER, MICHELLE N. WORMMEESTER,
and JESSICA C. KAISER, *Administrative Patent Judges*.

MANTIS MERCADER, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a)

I. INTRODUCTION

A. *Background*

Align Technology, Inc. (“Petitioner”) filed a Petition requesting an *inter partes* review of claims 1–19 of U.S. Patent No. 9,329,675 B2 (Ex. 1001, “the ’675 patent”). Paper 2 (“Pet.”). 3Shape A/S (“Patent Owner”) filed a Preliminary Response. Paper 5 (“Prelim. Resp.”).

Upon consideration of the Petition, the Preliminary Response, and the associated evidence, we instituted trial to determine whether claims 1, 2, 9–11, and 18 are anticipated under 35 U.S.C. § 102 by Kriveshko,¹ whether claims 1–5, 8–11, and 14–19 would have been obvious under 35 U.S.C. § 103 over Kriveshko in combination with Serra,² and whether claims 6, 7, 12, and 13 would have been obvious under 35 U.S.C. § 103 over Kriveshko in combination with Serra and Brennan.³ See Paper 7, 6, 31 (“Institution Decision” or “Inst. Dec.”). After institution of trial, Patent Owner filed a Patent Owner Response. Paper 11 (“PO Resp.”). Petitioner replied. Paper 14 (“Pet. Reply”).

An oral hearing was conducted on February 4, 2019. A transcript of that hearing is entered in the record. See Paper 21 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This decision is a Final Written Decision under 35 U.S.C. § 318(a) as to the patentability of claims 1–19 of the ’675 patent. For the reasons discussed below, we hold that Petitioner has demonstrated by a preponderance of the evidence that claims 1–19 of the ’675 patent are unpatentable.

¹ US 2007/0171220 A1 (July 26, 2007) (“Kriveshko”; Ex. 1005).

² US 2006/0020204 A1 (Jan. 26, 2006) (“Serra”; Ex. 1006).

³ US 8,903,476 B2 (Dec. 2, 2014) (“Brennan”; Ex. 1007).

B. Related Matters

The parties identify *inter partes* review proceeding IPR2018-00198 that also challenges the '675 patent. Pet. 55, Paper 4, 1. Patent Owner further submits that the following is a list of judicial and administrative matters that would affect, or be affected by, a decision in this proceeding: *Align Technology, Inc. v. 3Shape A/S*, Petition for *Inter Partes* Review of U.S. Patent No. 9,329,675 B2, filed on November 22, 2017; U.S. Provisional Application No. 61/420,138, filed on December 6, 2010; and PCT International Application No. PCT/DK2011/050461, filed on December 5, 2011. Paper 4, 1.

Petitioner states that the '675 patent has not been involved in any litigation proceedings. Pet. 55.

C. The '675 Patent

The '675 patent relates to handheld intraoral scanner device 100 and computer screen 101. Ex. 1001, Fig. 1, 11:29–31. Operator 102 uses the intraoral scanner 100 to record some intraoral 3D geometry and the user interface functionality to rotate, pan, and zoom displayed 3D model 105 of the scanned data on computer screen 101. *Id.* at 11:31–37. The integration of the user interface functionality in device 100 is provided by motion sensors (not visible), which can be accelerometers inside scanner 100, whose readings determine the orientation of 3D model 105 of the teeth acquired by scanner 100 on computer screen 101. *Id.* at 11:37–42. Figure 1 of the '675 patent is reproduced below.

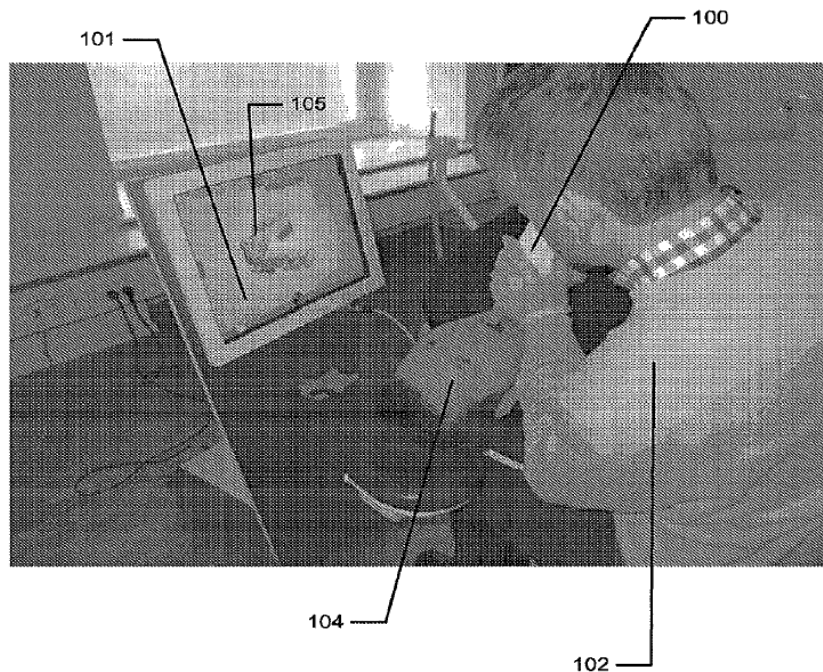


Figure 1 above shows operator 102 using intraoral scanner 100 to record some intraoral 3D geometry and displayed 3D model 105 of the scanned data on computer screen 101. *Id.* at Fig. 1, 11:31–37.

The 3D user interface functionality is provided by at least one motion sensor built into or on the device. *Id.* at 6:46–56. Two different types of motion sensors are described. *Id.* at 6:48–59. One type of motion sensor includes accelerometers, gyros, and magnetometers, which can sense rotations, lateral motion, and/or combinations thereof. *Id.* at 6:48–51. Another type of motion sensor uses infrared sensing. *Id.* at 6:51. At least one infrared sensor is mounted on the device, and at least one infrared emitter can be mounted in the surroundings of the device. *Id.* at 6:51–54. Conversely, the at least one emitter can be mounted on the device, and the at least one sensor in the surroundings. *Id.* at 6:54–56. Another possibility is to use infrared reflector(s) on the device, and both sensor(s) and emitter(s) on the surroundings. *Id.* at 6:56–58.

An example of user interface functionality in the form of remote controlling using the handheld device to determine the view to be displayed is provided by Figures 2a and 2b and respective descriptive disclosure. *Id.* at 11:9–42. The motion sensors (not shown) in handheld device 100, i.e. scanner, allow user 102 to determine the view shown on the display 101, i.e. screen, by moving handheld device 100. *Id.* at 11:10–14.

The operation functionality of device 100 is to record some intraoral 3D geometry, and the user interface functionality is to rotate, pan, and zoom 3D model 105 of the scanned data on computer screen 101. *Id.* at 11:32–37. The integration of the user interface functionality in device 100 is provided by motion sensors (not visible), which can be accelerometers inside scanner 100, whose readings determine the orientation of 3D model 105 of the teeth acquired by scanner 100 on computer screen 101. *Id.* at 11:37–42.

The user interface functionality is illustrated in Figure 2a, reproduced below. Figure 2a shows that pointing device 100 down can provide 3D model 105 of the scanned teeth shown from a downward viewing angle. *Id.* at 11:15–17.

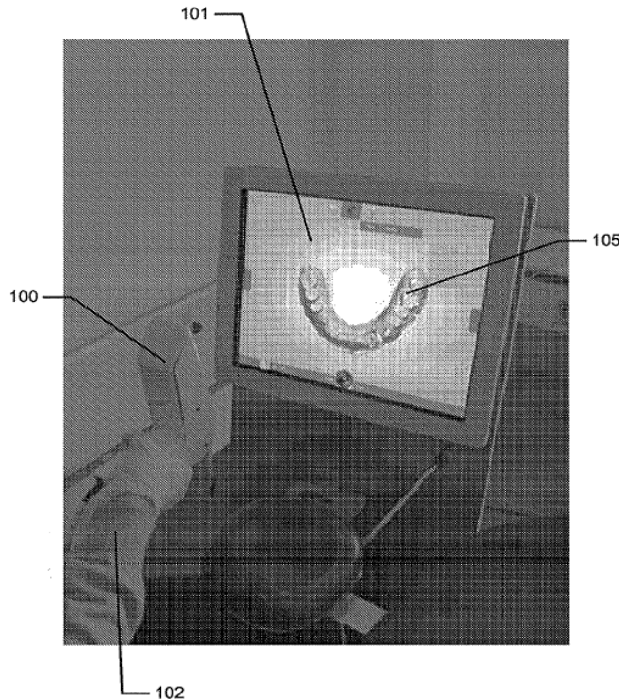


Fig. 2a)

Figure 2a above shows operator 102 using intraoral scanner 100 pointed downwards to provide 3D model 105 of the scanned teeth shown from a downward viewing angle. *Id.* at Fig. 2a, 11:15–17.

Figure 2b reproduced below shows that holding the scanner in a horizontal position can provide that the viewing angle is likewise horizontal from the front, such that 3D model 105 of the scanned teeth is shown from the front. *Id.* at 11:18–21.

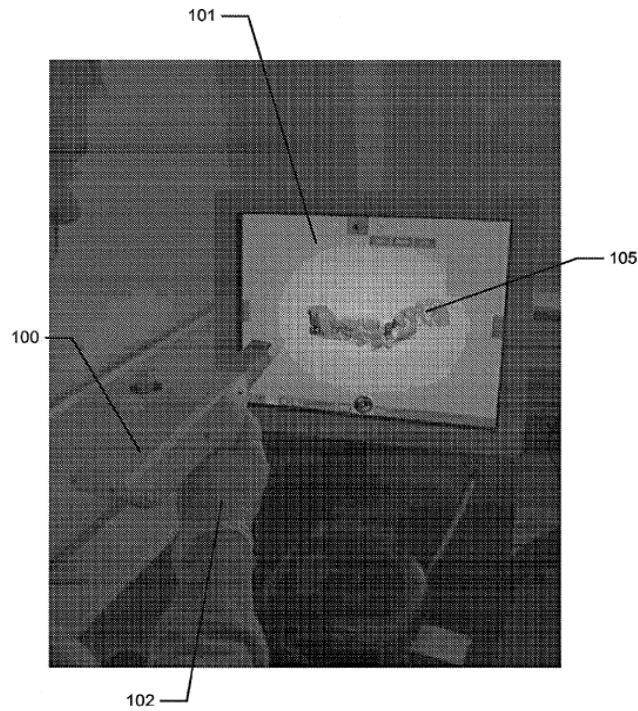


Fig. 2b)

Figure 2b above shows operator 102 using intraoral scanner 100 pointed horizontally to provide 3D model 105 of the scanned teeth shown from a horizontal frontal viewing angle. *Id.* at Fig. 2b, 11:18–21.

Additional functionality to start/stop scanning is provided by button 103 as seen in Figure 3. *Id.* at Fig. 3, 11:42–45. Figure 3 of the '675 patent is reproduced below.

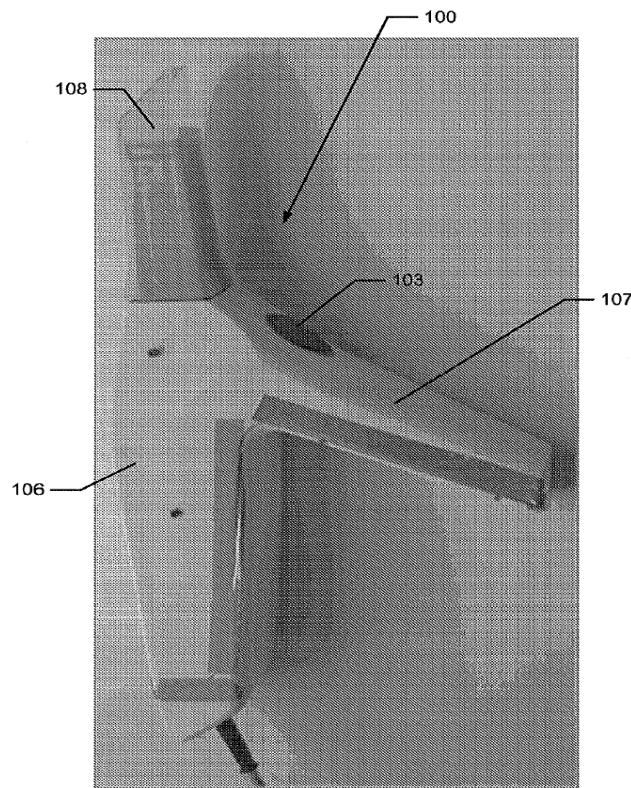


Figure 3 above shows button 103 being located where the user's index finger can reach it conveniently. *Id.* at 11:44–46. When the button is pressed quickly the handheld device is prepared for scanning, e.g., it is set for performing at least one action, the scanning procedure, in the physical 3D environment. *Id.* at 3:58–61. The scanning is stopped when the button is pressed quickly a second time. *Id.* at 3:61–63. While the scanning is performed, a virtual 3D representation is visually built on the display and the user can press and hold the button. *Id.* at 3:61–66. This action puts the handheld device in a controller mode, where the handheld device is adapted for remotely controlling the view with which the 3D environment, such as scanned teeth, is represented on the display. *Id.* at 3:66–4:3. While the button is pressed, the system will use signals from a motion sensor in the

handheld device to determine how to present the view of the virtual 3D environment on computer screen 101. *Id.* at 4:3–5.

D. The Challenged Claims

Petitioner challenges claims 1–19 of the '675 patent. Claims 1 and 19 are independent and are reproduced below:

1. A scanning system for scanning a 3D environment, the scanning system comprising:

a handheld device including an optical scanner, wherein the 3D environment to be scanned is selected by pointing the optical scanner at the 3D environment; and

at least one display remotely connected to the handheld device,

wherein the handheld device is adapted for performing at least one scanning action in a physical 3D environment, and the at least one display is adapted for visually representing the physical 3D environment; and

the handheld device includes a user interface for remotely controlling the display to adjust the view with which the 3D environment is represented on the display.

Ex. 1001, 15:29–42.

19. A system comprising:

a handheld device and at least one display;

wherein the handheld device is adapted for switching between

performing at least one action in a physical 3D environment, wherein the at least one display is adapted for visually representing the physical 3D environment; and remotely controlling the display to adjust the view with which the 3D environment is represented on the display;

wherein the handheld device is an intra-oral 3D scanner and the at least one action performed in the physical 3D environment is scanning and that the view is remotely controlled by at least one motion sensor arranged in the handheld device, and wherein an actuator provided on the handheld device switches between performing the at least one action and remotely controlling the view.

Id. at 16:35–50.

E. Instituted Grounds of Unpatentability

On April 24, 2018, the Supreme Court issued its decision in *SAS Institute Inc. v. Iancu*, 138 S. Ct. 1348 (2018). Consistent with the Supreme Court’s decision in *SAS Institute Inc.*, as well as *PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018), we instituted a trial on all the asserted grounds of unpatentability, which are set forth in the table below.

Reference(s)	Basis	Challenged Claims
Kriveshko	§ 102	1, 2, 9–11, and 18
Kriveshko and Serra	§ 103	1–5, 8–11, and 14–19
Kriveshko, Serra, and Brennan	§ 103	6, 7, 12, and 13

Inst. Dec. 6. Petitioner relies on the declaration of Chandrajit L. Bajaj, Ph.D. for support (Ex. 1003). With its Response, Patent Owner submits the declaration of Ravin Balakrishnan, Ph.D. (Ex. 2011). The transcripts of the depositions of Dr. Bajaj and Dr. Balakrishnan are entered in the record as Exhibits 2008 and 1037, respectively.

F. Level of Ordinary Skill in the Art

In determining whether an invention would have been obvious to an ordinarily skilled artisan at the time it was made, we consider the level of ordinary skill in the pertinent art at the time of the invention. *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17 (1966). “The importance of resolving the level of ordinary skill in the art lies in the necessity of maintaining objectivity in the obviousness inquiry.” *Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 718 (Fed. Cir. 1991). The person of ordinary skill in the art is a hypothetical person who is presumed to have known the relevant art at the time of the invention. *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). The level of ordinary skill in the art may be reflected by the prior art of record. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). Factors that may be considered in determining the level of ordinary skill in the art include, but are not limited to, the types of problems encountered in the art, the sophistication of the technology, and educational level of active workers in the field. *GPAC*, 57 F.3d at 1579. In a given case, one or more factors may predominate. *Id.* Generally, it is easier to establish obviousness under a higher level of ordinary skill in the art. *Innovation Toys, LLC v. MGA Entm’t, Inc.*, 637 F.3d 1314, 1323 (Fed. Cir. 2011) (“A less sophisticated level of skill generally favors a determination of nonobviousness . . . while a higher level of skill favors the reverse.”).

Relying on the declaration testimony of Dr. Bajaj, Petitioner contends that a person of ordinary skill (“POSITA”) at the relevant time would have had a bachelor’s degree in computer engineering, computer science, computer vision or an equivalent field, as well as at least one or two years of industry experience in three-dimensional imaging systems, or at least five

years of comparable industry experience in three-dimensional imaging systems. Pet. 13 (citing Ex. 1003 ¶¶ 19–22). In particular, according to Petitioner, a POSITA would have had experience with, and knowledge of, three-dimensional imaging systems. *Id.*

Patent Owner responds that Petitioner’s definition of an ordinarily skilled artisan is inadequate at least because Petitioner’s definition does not take into account that the ’675 Patent relates to user interfaces. PO Resp. 7–8 (citing Ex. 1001’s title (“System with 3D User Interface Integration”); Ex. 2011 ¶¶ 40–43).

The parties’ dispute regarding the level of ordinary skill is based on the type of relevant experience. Patent Owner’s declarant agrees a POSITA would have had “a bachelor’s degree in computer engineering, computer science, computer vision or an equivalent field, as well as at least one or two years of industry or research experience,” but Patent Owner’s declarant testifies that experience would have been “with user interfaces used in three-dimensional imaging systems” rather than three-dimensional imaging systems generally. Ex. 2011 ¶ 41. Patent Owner’s declarant also notes that his opinions would not change under either formulation. *Id.* ¶ 43.

Based on the evidence of record, including the testimony of the parties’ declarants as cited above, the subject matter at issue, and the prior art of record, we determine that Patent Owner’s proposed skill level is appropriate, and we adopt Patent Owner’s articulation of the level of ordinary skill in the art. Our analysis, however, would not differ under either party’s definition, and this is consistent with Patent Owner’s declarant’s statement noting that his opinions would not change under either formulation of the level of the ordinary skilled artisan. *See* Ex. 2011 ¶ 43.

II. DISCUSSION

A. Claim Construction

Claims in an unexpired patent subject to *inter partes* review are given their broadest reasonable interpretation in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b) (2017)⁴; *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131 (2016). Consistent with the broadest reasonable construction, claim terms are presumed to have their ordinary and customary meaning as understood by a person of ordinary skill in the art in the context of the entire patent disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007).

The breadth of a claim term can be limited in two instances: (1) where the Specification reveals a special definition given to a claim term by the patentee acting as a lexicographer that differs from the meaning it would otherwise possess (see *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002)); or (2), where the Specification reveals an intentional disclaimer, or disavowal, of claim scope by the inventor (see *SciMed Life Sys., Inc. v. Advanced Cardiovascular Sys., Inc.*, 242 F.3d 1337, 1343–44 (Fed. Cir. 2001)). An inventor may provide a meaning for a term that is different from its ordinary meaning by defining the term in the specification with reasonable clarity, deliberateness, and precision. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994).

⁴ A recent amendment to this rule does not apply here because the Petition was filed before November 13, 2018. See “Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board,” 83 Fed. Reg. 51,340, 51,340 (Oct. 11, 2018) (to be codified at 37 C.F.R. pt. 42).

Intrinsic evidence “is the most significant source of the legally operative meaning of disputed claim language.” *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996). When the specification is clear about the scope and content of a claim term, there is no need to turn to extrinsic evidence for claim interpretation. *3M Innovative Props. Co. v. Tredegar Corp.*, 725 F.3d 1315, 1326–28 (Fed. Cir. 2013).

The parties separately argue proposed constructions for various limitations of the claims. See Pet. 9–12; PO Resp. 5–7; Pet. Reply 2–4, 17–25. In light of the parties’ arguments and evidence developed during trial, we address two claim terms: (1) “motion sensor”; and (2) “user interface.” See *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“only those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy”).

1. “motion sensor”

Claims 4, 5, 7, 8, and 19 of the ’675 patent recite a “motion sensor.” Ex. 1001, 15:50–16:9, 16:35–50. Petitioner and Patent Owner agree that the term “motion sensor” requires “[a] sensor detecting motion.” Pet. 11; PO Resp. 6; Pet. Reply 16 (all citing Ex. 1001, 10:35). Petitioner contends that “[w]here the parties diverge is in regard as to what sensors qualify as motion sensors.” Pet. Reply 16. Petitioner alleges that Patent Owner “seeks to limit the scope of the claimed ‘motion sensor’ to exclude sensors that collect position and orientation data.” *Id.* at 17.

Petitioner contends that the ’675 patent specification defines a motion sensor as

[a] sensor detecting motion. Motion can be detected by: sound (acoustic sensors), opacity (optical and infrared sensors and video image processors), geomagnetism (magnetic sensors,

magnetometers), reflection of transmitted energy (infrared laser radar, ultrasonic sensors, and microwave radar sensors), electromagnetic induction (inductive-loop detectors), and vibration (triboelectric, seismic, and inertia-switch sensors). MEMS accelerometers, gyros, and magnetometers are examples of motions sensors.

Pet. 11 (citing Ex. 1001, 10:35–39).

Petitioner further references the '675 patent specification for the teaching of infrared sensors mounted on the device to track the probe in the surroundings. Pet. Reply 18 (citing Ex. 1001, 6:46–59). Petitioner contends that Patent Owner's own extrinsic evidence (Ex. 2013) explains that infrared sensors, such as the '675 patent's infrared sensors, function as motion sensors by tracking position and orientation. *Id.* at 19. Petitioner further points us to the deposition testimony of Patent Owner's declarant Dr. Balakrishnan that infrared ("IR") trackers can track position and orientation. *Id.* (citing Ex. 1037, 44:15–17). Petitioner contends that Dr. Balakrishnan acknowledged that the '675 patent does not provide any "particular way to sense motion." *Id.* Petitioner contends that the '675 patent recitation of "motion sensors" is sufficiently broad to include sensors that sense motion by tracking position and orientation. *Id.* at 20.

Patent Owner asserts that a 3D tracking system that detects 3D position and orientation and records time does not constitute a motion sensor because it detects 3D position data and not 3D motion data. PO Resp. 19 (citing Ex. 1006 ¶ 74, Fig. 7; Ex. 2011 ¶ 59). Patent Owner asserts a distinction exists between a 3D sensor that detects "absolute values" of position as opposed to a motion sensor that detects "relative values" equated with motion of "how far they move rather than where they are." *Id.* at 26 (quoting Ex. 2013, 92). During the hearing, Patent Owner's counsel stated

“you can use many different technologies to detect motion, but the fact of the matter is a motion sensor detects motion. It’s different than detecting position. It’s different than tracking position. It’s different than sensing orientation and it’s different from tracking orientation.” Tr. 28:5–8. Patent Owner’s counsel acknowledged, however, that “[m]otion can be a change in orientation and position.” *Id.* at 30:1–2.

We agree with Petitioner that the ’675 patent specification teaches a non-exclusive extensive list of motion sensors including acoustic, optical, and infrared sensors. Pet. 11 (citing Ex. 1001, 10:35–43). The non-exhaustive list of motion sensors includes accelerometers. *Id.*

According to the ’675 patent specification, the system uses signals from a motion sensor in or on the handheld device to determine how to present the view of the virtual 3D environment on computer screen 101. Ex. 1001, 4:3–5. The function of the motion sensor used in the ’675 patent is described in pertinent part as follows:

The integration of the user interface functionality in the device 100 is provided by motion sensors (not visible), which can be accelerometers inside the scanner 100, whose readings determine the orientation, as seen in FIGS. 2a and 2b, of the display on the screen of the 3D model 105 of the teeth acquired by the scanner 100.

Ex. 1001, 11:37–42 (emphasis added).

The particular descriptions of Figures 2a and 2b show that the viewing angle changes based on holding or pointing the scanner downwards or horizontally. Ex. 1001, 11:15–21. Thus, the ’675 patent specification contradicts Patent Owner’s assertion that the motion sensor excludes sensors that detect position and orientation. See PO Resp. 19 (citing Ex. 1006 ¶ 74, Fig. 7; Ex. 2011 ¶ 59). In fact, the ’675 patent specification discloses the

reading of the orientation of the motion sensor at a downward angle of the scanner shows a downward viewing angle displayed in Figure 2a (see Ex. 1001, 11:15–17, Fig. 2a) compared to the reading of the orientation of the motion sensor at a horizontal direction which shows a horizontal viewing angle displayed in Figure 2b (see *id.* at 11:18–21, Fig. 2b).

Thus, we agree with Petitioner that the '675 patent's "motion sensors" do not exclude sensors that track position and orientation. See Pet. Reply 17–20.

Patent Owner further contends the '675 patent specification discloses that position and orientation data is from the 3D image data recorded by the handheld device, not from the motion sensor. PO Resp. 22 (citing Ex. 1001, 9:1–3 ("The 3D data recorded by the handheld device can be registered in real time with the a-priori data, such that the position and orientation of the device can be detected."), 1:24–25, 1:32–35 (disclosing that "3D data" refers to displayed image data)). Patent Owner concludes that the '675 patent distinguishes position and orientation data, from motion data detected by a motion sensor. *Id.* (citing Ex. 2011 ¶ 63).

We do not agree with Patent Owner's contention. The context for the cited embodiment is provided below:

In some embodiments the handheld device is a mechanical tool. In some embodiments, the tool has at least one motion sensor built in. In other embodiments, other user-interface elements are built in as well, for example buttons, scroll wheels, touch-sensitive fields, or proximity sensors.

In some embodiment[s] the 3D geometry of the 3D environment is known a-priori or a 3D representation of the environment is known a priori, i.e. before the actions (s) are performed. For example in surgery, a CT scan may have been taken before the surgical procedure. The handheld device in

this example could be a surgical instrument that a physician needs to apply in the proper 3D position. To make sure this proper position is reached, it could be beneficial to view the 3D environment from multiple perspectives interactively, i.e. without having to release the surgical instrument.

An advantage of the system, also in the above surgery example, is the ability of the handheld device to record the 3D environment at least partially, typically in a 3D field-of-view that is smaller than the volume represented in the a-priori data. The 3D data recorded by the handheld device can be registered in real time with the a-priori data, such that the position and orientation of the device can be detected.

Ex. 1001, 8:49–9:3 (emphases added). Furthermore, the '675 patent specification discloses that the system uses signals from a motion sensor in the handheld device to determine how to present the view of the virtual 3D environment on computer screen 101. *Id.* at 4:3–5. These disclosures in the '675 patent demonstrate the handheld device (i.e., surgical instrument) includes a built in motion sensor that allows the physician to place the surgical instrument in the *proper 3D position* by allowing viewing of the previously acquired 3D environment (i.e., CT scan used to create an a priori 3D representation) from multiple perspectives. *See* Ex. 1001, 8:49–63. The system uses signals from a motion sensor in the handheld device (i.e., in this instance a surgical instrument) to determine how to present the view of the virtual 3D environment on the computer screen. *See* Ex. 1001, 4:3–5. Accordingly, the reading of the *position and orientation signals of the motion sensor* located in the handheld surgical instrument allows viewing the respective view of the 3D environment in order to guide the surgical instrument at the right position.

The citation by Patent Owner (Ex. 1001, 9:1–3) refers to the additional embodiment where a handheld device is performing a scanning procedure *in real time* creating a smaller 3D field-of-view than the 3D image produced a-priori and the two sets of images can be co-registered so that *the position and orientation of the device can be detected*. See *id.* at 8:64–9:3. In other words, the co-registration of the images allows for determination of the position and orientation of the surgical instrument in real time by reading the signals from the motion sensor. Although the excerpt cited by Patent Owner does not reference the motion sensor, the earlier paragraph, when read in context, reveals the use of a motion sensor so that the position and orientation of the surgical instrument can be determined. See Ex. 1001, 8:49–9:3. Thus, in the embodiment cited by Patent Owner, the signals of position and orientation read from the motion sensor of the handheld device (whether the handheld device is a surgical instrument and/or a scanner) are still what determine the view to present on the display.

Nowhere in the '675 patent specification do we see a special definition or disavowal of a particular type of motion sensor to exclude those sensors that can only detect position and orientation information to detect motion. On the contrary, the specification describes examples of motion sensors that detect position and orientation as described above.

Furthermore, we see no disavowal of a particular type of motion sensor to exclude those sensors that only detect position and orientation information. In particular, we see no distinction between using a motion sensor that is delineated as a “position” versus a “motion” sensor.

Thus, the breadth of a claimed term is not limited because (1) the specification does not reveal a special definition given to “motion sensor” by

the patentee acting as a lexicographer that differs from the meaning it would otherwise possess (*see CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d at 1366); and (2) the specification does not reveal an intentional disclaimer, or disavowal, of claim scope by the inventor (*see SciMed Life Sys.*, 242 F.3d at 1343–44).

Accordingly, we determine that, under a broadest reasonable interpretation in light of the specification of the '675 patent, the term “motion sensor” does not exclude motion sensors that track position and orientation.

When the specification is clear about the scope and content of a claim term, there is no need to turn to extrinsic evidence for claim interpretation. *3M Innovative Props. Co.*, 725 F.3d at 1326–28. However, for completeness we also address the extrinsic evidence of record.

Patent Owner’s expert testified that “tracking 3D position over time provides 3D position over time . . . simply sensing position over time does not give me motion.” Ex. 1037, 79:19–80:12. Furthermore, Patent Owner provides the extrinsic evidence of the “Buxton table” to indicate that motion and position are fundamentally different properties and that one ordinarily skilled in the art would have understood that motion sensed at particular times is different than position sensed at particular times. PO Resp. 21–22 (citing Ex. 2009, 149). The Buxton Table is reproduced below.

		Number of Dimensions								
		1		2		3				
Property sensed	Position	Rotary Pot	Sliding Pot	Tablet	Light Pen	Joystick	3D Joystick	M	Sensing type	
		-----		Touch Tablet	Touch Screen			T		
	Motion	Continuous Rotary Pod	Treadmill Thumbwheel			Trackball	Trackball	M		
		-----		Tasa Ferinstat	Tasa X-Y Pad			T		
	Pressure	Torque Sensing	Pressure Pad			Isometric Joystick				T

The Buxton Table

The Buxton Table reproduced above shows “Motion” and “Position” as different properties sensed. Ex. 2009, 149.

Petitioner asserts that Patent Owner tries to exclude sensors that derive motion from position and orientation from the scope of the ’675 patent’s claimed “motion sensor,” by turning to studies on the taxonomy of input devices that show certain devices categorized based on whether they sense motion (e.g., trackball, treadmill) or position (e.g., joystick, light pen, etc.). Pet. Reply 23 (citing PO Resp. 21 (citing Ex. 2013, 130)).

Petitioner cites to a different section of the reference provided by Patent Owner showing a table as reproduced below to emphasize that trackers that sense “position” do so by tracking position and orientation. Pet. Reply 23–24 (citing to Ex. 2013, 130).

		Number of Dimensions					
		1		2		6	
Property Sensed	Position	Bend Sensor	Linear Slider	Tablet and Stylus	Isotonic Joystick	Trackers (Position & Orientation)	M
				Touch Tablet			T
	Motion		Treadmill	Mouse	TrackBall		M
	Pressure	Torque Sensor			Isometric Joystick	SpaceBall & SpaceMouse	T

Figure 4.30 of Exhibit 2013 shows the “position” property being sensed by trackers (depicted under numeral 6 of the table) sensing position and orientation. Pet. Reply 24; *also see* Ex. 2013, 130.

Petitioner contends that Patent Owner misreads the Buxton table to mean that something listed as a position sensing device cannot detect motion. Pet. Reply 24. According to Petitioner, “a motion sensor can be formed from a position and orientation tracker.” *Id.* Petitioner contends that other extrinsic evidence, namely, a book titled “3D User Interfaces Theory and Practice” (i.e., “Bowman” which cites to the Buxton Table),⁵ clarifies that “there are a number of different *motion-tracking* technologies in use, which include . . . optical tracking” and that infrared emitters can be used in optical tracking for position and orientation tracking. See Pet. Reply 24 (citing Ex. 1038, 97), 19–20 (citing Ex. 1038, 97, 101).

⁵ Different portions of Bowman are reproduced by Patent Owner and Petitioner. Patent Owner’s Exhibit 1038 and Petitioner’s Exhibit 2013 are Bowman excerpts.

Petitioner further points us to Patent Owner's U.S. Patent Application Publication No. 2014/0022352, which discloses that "[i]n some embodiments the motion is determined by determining the position and orientation of one or more of the sensors" (Ex. 1039 ¶ 49) and that "[i]n some embodiments the motion is determined by means of 3D position sensors." (*Id.* ¶ 51; Ex. 1040, WO 2013/010910, 28:1–2; Ex. 1037, 38:22–39:7.)" Pet. Reply 20.

Petitioner during the hearing pointed us to the disclosure of the '675 patent specification including infrared emitters or reflectors mounted on the device whereby their detection can be used to track the probe in its surroundings to determine "the position and the orientation of this device: its lateral movement, its rotation, and you can track that movement of this device and use that for this virtual interface that allows you to control the display of the scanned 3D data that's being rendered on the display panel." Tr. 13:8–15:4 (citing Ex. 1001, 6:46–59, 10:35–43). As pointed out by Petitioner, Patent Owner's declarant, Dr. Balakrishnan, stated that "[a]n IR receiver [and] detector, if configured in a particular way, could be a position and orientation tracker." Pet. Reply 19 (citing Ex. 1037, 44:15–17).

Based on the evidence discussed above, we are persuaded by Petitioner that the Buxton Table does not, contrary to Patent Owner's contentions, distinguish motion sensors from position sensors, especially since trackers including IR emitters or sensors identified as "position" sensing in Buxton Figure 4.30 are identified as motion sensors in the '675 patent. *See* Ex. 1001, 6:46–59; Ex. 1037, 44:15–17.

Patent Owner further argues that the motion sensor of the '675 patent detects *relative* values, because the property sensed is the motion of the

sensor (“how far they move rather than where they are”), not the absolute position. PO Resp. 26 (citing Ex. 2013, 92). Petitioner responds that Patent Owner’s attempt to distinguish sensors based on detection of absolute or relative values (PO Resp. 25–26) fails because the exact same sensors (i.e., tracking sensors) are in the ’675 patent’s contemplation of infrared emitter/sensor-based motion sensors. Pet. Reply 24 (citing Ex. 1040, 16:9–14; Ex. 1037, 40:9–41:19).

We agree with Petitioner’s contentions for the reasons stated by Petitioner. We further note that Patent Owner’s assertion that a “motion sensor” must detect relative values equated with motion of “how far they move rather than where they are” (PO Resp. 26), is not supported by the ’675 patent specification. On the contrary, the ’675 patent specification, as discussed above, teaches reading of the motion sensor’s position and orientation to display the respective previously acquired image/3D model (i.e., top view versus horizontal view, as shown in Figs. 2a and 2b of the ’675 patent specification).

On this record, we agree with Petitioner and determine that the extrinsic evidence is consistent with the ’675 patent specification, and that it does not support Patent Owner’s contentions that the recited “motion sensor” excludes sensors that detect position and orientation data to detect motion.

Accordingly, under the broadest reasonable interpretation in light of the ’675 patent specification as well as the extrinsic evidence presented, the term “motion sensor” is properly construed as a motion sensor that detects motion and does not exclude sensors that collect position and orientation data.

2. “*user interface*”

Claim 1 of the ’675 patent recites that “the handheld device includes *a user interface* for remotely controlling the display to adjust the view with which the 3D environment is represented on the display.” Ex. 1001, 15:40–42 (emphasis added). We address the claim construction of the term “user interface” in our discussion of Petitioner’s challenge to claim 1 as anticipated by Kriveshko.

B. Anticipation by Kriveshko

Petitioner argues that Kriveshko anticipates claims 1, 2, 9–11, and 18. Pet. 15–24. For the reasons explained below, we are persuaded that Petitioner has demonstrated by a preponderance of the evidence that these claims are unpatentable on this ground.

1. *Overview of Kriveshko (Ex. 1005)*

Kriveshko’s Figure 1, reproduced below, shows system 100 including scanning device 102 with input device 116. Ex. 1005 ¶¶ 51, 72.

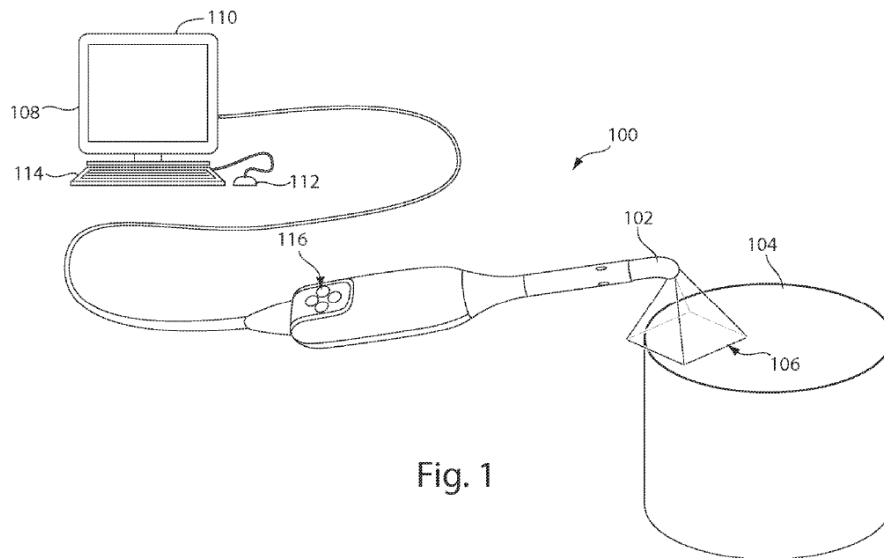


Fig. 1

Figure 1 shows handheld scanner 102 having input device 116 located on scanner 102 wherein scanner 102 is remotely connected to display 110.

Ex. 1005, Fig. 1.

Kriveshko discloses “scanner 102 is a *handheld, freely positionable probe having at least one user input device, such as a button, lever, dial, thumb wheel, switch, or the like*, for user control of the image capture system 100 such as starting and stopping scans.” *Id.* ¶ 52 (emphasis added). The scanning device 102 acquires three-dimensional data. *Id.* Kriveshko’s scanning system 100 includes computer 108 having display 110. *Id.* ¶ 51.

Kriveshko's Figure 4 is reproduced below:

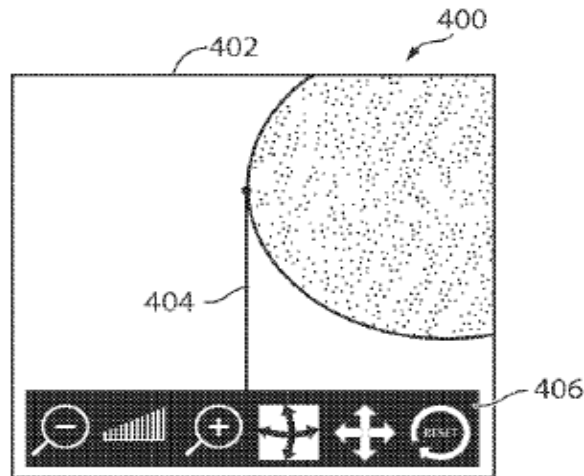


Fig. 4

Figure 4 shows user controls 406 which can be manipulated by any of the user input devices. *Id.* ¶¶ 90–91.

Kriveshko's Figure 4 shows that,

[w]ithin the window 402, a video image may be displayed including a field of view of a scanner, such as the scanner 102 of FIG. 1. Within the field of view, a subject 404, such as the subject 104 of Figure 1 may be displayed, along with one or more user controls 406.

Id. ¶ 90. Kriveshko discloses that

user controls 406 may generally include one or more controls for manipulating the three-dimensional model (e.g., rotating, scaling, panning, and the like), selecting a landing target, controlling operation of the image capture system (e.g., starting or stopping an acquisition), and so forth. The one or more controls may be manipulated, for example, using any of the user input devices described above with reference to FIG. 1.

Id. ¶ 91.

2. Analysis

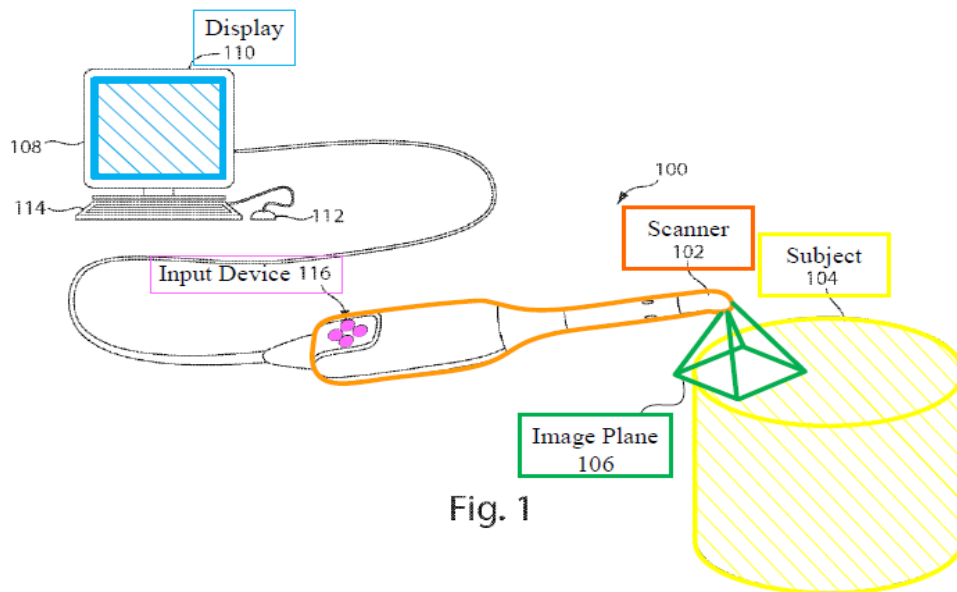
To establish anticipation, each and every element in a claim, arranged as recited in the claim, must be found in a single prior art reference. See *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008); *Karsten Mfg. Corp. v. Cleveland Golf Co.*, 242 F.3d 1376, 1383 (Fed. Cir. 2001). Although the elements must be arranged or combined in the same way as in the claim, “the reference need not satisfy an *ipsissimis verbis* test,” i.e., identity of terminology is not required. *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009); accord *In re Bond*, 910 F.2d 831, 832 (Fed. Cir. 1990).

Claim 1

Petitioner relies on Kriveshko as disclosing the limitations of independent claim 1. Pet. 15–20. In particular, Petitioner provides mappings of Kriveshko’s disclosure to claim 1 as further supported by Dr. Bajaj’s declaration. *Id.*

For example, for the preamble (e.g., “[a] scanning system for scanning a 3D environment”), Petitioner relies on Kriveshko’s disclosure of system 100 (e.g., the scanning system) for “scan[ning] complex surfaces . . . by maintaining a continuous three-dimensional scan across separated subsections of the surface.” Pet. 15 (citing Ex. 1005 ¶ 8). Scanning device 102 is passed over a surface of subject 104. *Id.* at 15–16 (citing Ex. 1005 ¶ 58). Scanning device 102 captures images of subject 104 within image plane 106. *Id.* at 16 (citing Ex. 1005 ¶ 51). Based on Kriveshko’s disclosures as discussed above, we are persuaded that Kriveshko discloses claim 1’s recited “scanning system.”

Claim 1 further recites “a handheld device including an optical scanner, wherein the 3D environment to be scanned is selected by pointing the optical scanner at the 3D environment.” For this limitation, Petitioner points us to Kriveshko’s scanning device 102, which is disclosed as a “handheld, freely positionable probe” and includes an “optical scanner” optically acquiring three-dimensional data. Pet. 16 (citing Ex. 1005 ¶¶ 51–52; Ex. 1003 ¶ 95). Petitioner explains that, in Kriveshko, the 3D environment to be scanned is selected by freely positioning (e.g., pointing) scanning device 102 over the surface of subject 104 (e.g., the 3D environment) and capturing images of the subject within image plane 106. *Id.* at 17 (citing Ex. 1003 ¶¶ 94–96). Petitioner provides an annotated version of Kriveshko’s Figure 1, reproduced below, to further support its contentions:



Annotated Figure 1 (reproduced above) shows pointing freely positionable handheld optical scanner 102 over 3D environment 104 to be scanned. See Pet. 16–17. Based on the record before us, we are persuaded that Kriveshko

discloses claim 1's recited "handheld device including an optical scanner, wherein the 3D environment to be scanned is selected by pointing the optical scanner at the 3D environment."

Claim 1 further recites "at least one display remotely connected to the handheld device." Regarding this limitation, Petitioner points us to Kriveshko's Figure 1 (annotated version reproduced above) showing scanning system 100 with computer 108 that includes display 110 (e.g., the at least one display). Pet. 17 (citing Ex. 1005 ¶ 51, Fig. 1; Ex. 1003 ¶ 98). In Kriveshko, display 110 is remotely connected to handheld optical scanning device 102. Ex. 1005 ¶ 51, Fig. 1. Petitioner explains that similar to the '675 patent's wired scanning device 100 remotely connecting to display 101 (Ex. 1001, Fig. 3), Kriveshko's scanner 102 is remotely connected to display 110 by a wire. *Id.* at 17–18 (citing Ex. 1005, Fig. 1; Ex. 1003 ¶¶ 98–99). Petitioner contends that Kriveshko's display 110 is remotely connected to its handheld scanner 102 in the same way that the '675 patent's display 101 is remotely connected to scanning device 100. *Id.* at 18 (citing Ex. 1003 ¶¶ 97–100). Petitioner adds that when handheld scanning device 102 performs a scan of subject 104, computer 108 presents images of the scan on display 110 for viewing by an operator of scanning device 102. *Id.* (citing Ex. 1005 ¶¶ 60, 90, Fig. 1; Ex. 1003 ¶¶ 97–100).

Based on the record before us, we are persuaded that Kriveshko discloses claim 1's recited "at least one display remotely connected to the handheld device."

Claim 1 further recites "wherein the handheld device is adapted for performing at least one scanning action in a physical 3D environment." For this limitation, Petitioner relies on Kriveshko's handheld scanning device

102 capturing images of subject 104 in an image plane 106 while the handheld scanning device 102 is passed over subject 104. Pet. 18 (citing Ex. 1005 ¶¶ 51, 56, 58). Based on the record before us, we are persuaded that Kriveshko discloses that its “handheld device” performs a scanning action in a physical 3D environment.

Claim 1 also recites “the at least one display is adapted for visually representing the physical 3D environment.” Petitioner relies on Kriveshko as disclosing that display 110 presents a virtual representation of subject 104 in its environment, which Petitioner asserts is an example of “visually representing the physical 3D environment,” as claimed. Pet. 19 (citing Ex. 1005 ¶¶ 60, 90, Fig. 4; Ex. 1003 ¶¶ 76, 105–108). Petitioner points us to an annotated version of Kriveshko’s Figure 4 wherein the visual representation of subject 104 is being rendered within window 402 of user interface 400 on display 110. *Id.* (citing Ex. 1005 ¶¶ 60, 90).

The annotated version of Kriveshko’s Figure 4 provided by Petitioner is reproduced below:

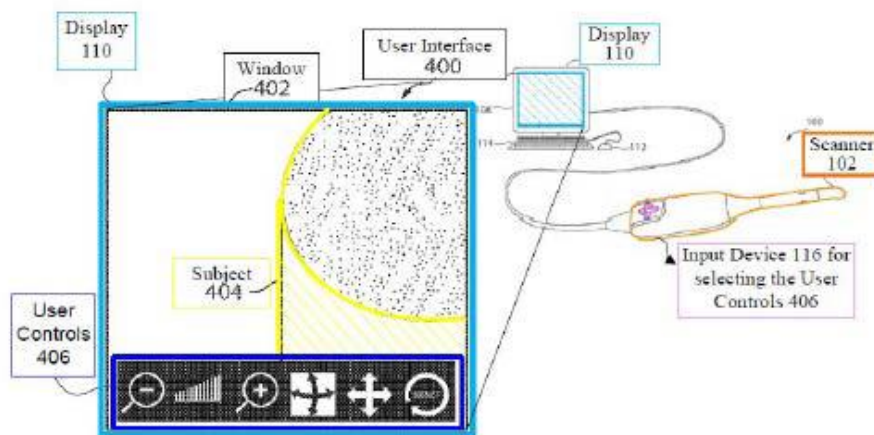


Fig. 4

The annotated Figure 4 includes display 110 visually representing subject 404. Based on the record before us, we are persuaded that Kriveshko discloses that its “display” visually represents a physical 3D environment.

Finally, claim 1 recites “the handheld device includes a user interface for remotely controlling the display to adjust the view with which the 3D environment is represented on the display.” For this limitation, Petitioner relies on Kriveshko’s handheld scanning device 102 including user input device 116 (e.g., a button, lever, dial, thumb wheel, or switch) for user control of image capture system 100. Pet. 20 (citing Ex. 1005 ¶ 52). Petitioner explains that Kriveshko’s user interface of user input device 116 is used to select one or more controls that are presented on display 110, resulting in the manipulation of a three-dimensional model from a scan of the 3D environment. *Id.* (citing Ex. 1005 ¶¶ 90–91; Ex. 1003 ¶¶ 76, 109–111). According to Petitioner, such manipulation includes adjusting the view, which in the 3D environment is represented on the display by rotating, scaling, or panning the view of the three-dimensional model. *Id.*

Petitioner’s contentions are further supported by Dr. Bajaj’s testimony that Kriveshko’s user controls for manipulating the three-dimensional model are selected via a user input element of the scanning device. Ex. 1003 ¶ 76. Dr. Bajaj explains that as illustrated in Figure 1, Kriveshko discloses that scanner 102 includes user input device 116, such as a button, lever, dial, thumb wheel, or switch, for user control of image capture system 100. *Id.* ¶ 110 (citing Ex. 1005 ¶ 52). Furthermore, Dr. Bajaj, referring to Figures 4–9, testifies that Kriveshko discloses presenting one or more user controls 406 on display 110 for manipulating a three-dimensional model, e.g., rotating, scaling, and panning. *Id.* ¶¶ 76, 110 (citing Ex. 1005 ¶¶ 90, 91).

Additionally, Dr. Bajaj explains that in Kriveshko, user controls may be selected using user input devices. *Id.* ¶ 111 (citing Ex. 1005 ¶¶ 90, 91). Dr. Bajaj concludes that a person of ordinary skill in the art would have understood that in Kriveshko, the user input device of scanner 102 would have been used to manipulate the user controls to adjust the view of the display as illustrated in Petitioner’s combined annotated version of Figures 1 and 4 as reproduced below. *See id.*

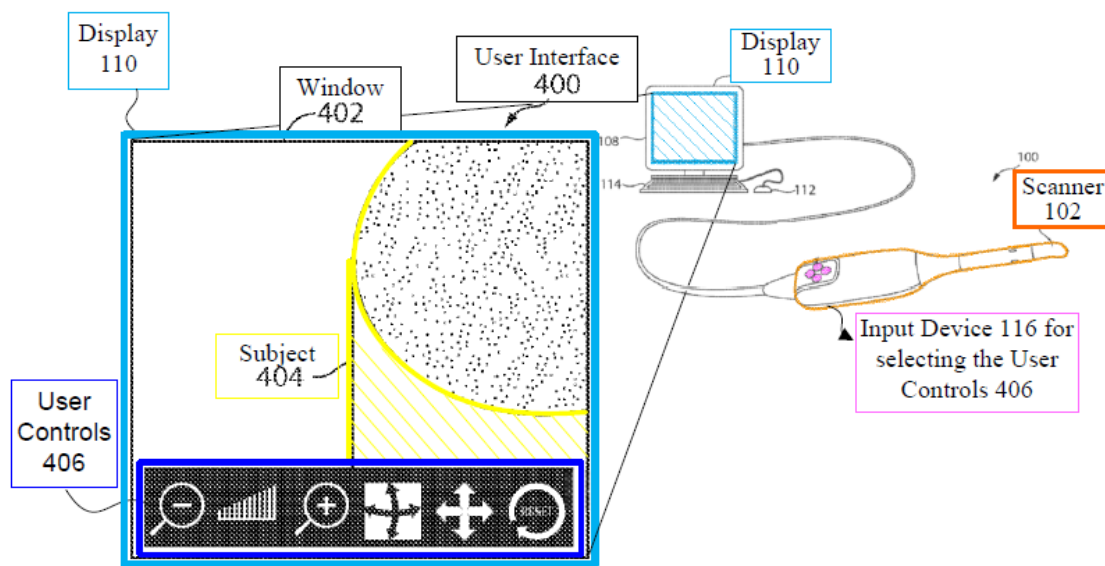


Fig. 4

The combined annotated Figures 1 and 4 of Kriveshko show user input device 116 for remotely selecting user controls 406. *See* Ex. 1003 ¶ 111.

Based on the record before us, we are persuaded that Kriveshko discloses “the handheld device includes a user interface for remotely controlling the display to adjust the view with which the 3D environment is represented on the display,” as recited in claim 1.

As detailed above, we have reviewed Petitioner's explanations and supporting evidence as to how Kriveshko discloses the limitations of claim 1, and we agree with and adopt Petitioner's analysis. *See* Pet. 15–20.

For this challenge to claim 1, Patent Owner argues only that Kriveshko does not disclose the recited “user interface.” *See* PO Resp. 33. Claim 1 of the '675 patent recites that “the handheld device includes *a user interface* for remotely controlling the display to adjust the view with which the 3D environment is represented on the display.” Ex. 1001, 15:40–42 (emphasis added). Patent Owner argues that the '675 patent disclaims 2D user interfaces from the claim term “user interface.” PO Resp. 7, 33–35.

Patent Owner asserts that when read in light of the specification, the claim term “user interface” should be construed as “not encompassing a mere 2D user interface.” *Id.* at 7 (citing Ex. 2011 ¶¶ 47–48). Patent Owner asserts that the specification clearly disavows 2D user interfaces from the claim term “user interface” because the specification criticizes the use of such 2D user interfaces. *Id.* at 33–34. According to Patent Owner, the specification states that “prior art user interface devices can be inconvenient, awkward and difficult to use, and they can be labor-intensive, and thus costly to sterilize or disinfect.” *Id.* at 34 (citing Ex. 1001, 4:39–42). Patent Owner explains that the specification discloses that prior art user interfaces include “‘intraoral scanners [that] use a touch screen, a trackball, or a mouse to determine the view in the display’—all examples of 2D user interfaces.” *Id.* at 34 (citing Ex. 1001, 4:38–39). Further, according to Patent Owner, the title of the '675 patent explicitly discloses that the '675 patent relates to a system having an integrated “3D user interface.” *Id.* (citing Ex. 1001, entitled “System with 3D user interface integration”). Patent Owner

concludes that the '675 patent specification specifically identifies and criticizes 2D user interfaces, and distinguishes the same from the 3D user interfaces. *Id.*

Petitioner responds that contrary to the supposed disavowal of 2D input devices, the '675 patent explicitly lists 2D user interface elements, such as buttons and scroll-wheels, in describing embodiments of the claimed invention. Pet. Reply 3 (citing Ex. 1001, 7:9–17). Furthermore, Petitioner asserts that Patent Owner ignores that the '675 patent makes similar statements in its specification about 2D and 3D user interfaces. *Id.* at 7. According to Petitioner, if Patent Owner's relied-upon language disavows 2D user interfaces, then the '675 patent also disavows 3D user interfaces. *Id.* In particular, Petitioner cites the following disclosure from the '675 patent:

Various user interaction devices are in use for software that displays 3D data; these devices are: *3D mice, space balls*, and touch screens. The operation of these current interaction devices *requires physically touching them*.

Physically touching a user-interaction device *can be a disadvantage* in medical applications due to risks of cross-contamination between patients or between patient and operator, or in industrial applications in dirty environments.

Id. (citing Ex. 1001, 1:24–31).

Petitioner further points us to Patent Owner's declarant's deposition testimony wherein Dr. Balakrishnan acknowledged that the '675 patent's discussion of the disadvantages applied to any device that needed to be physically touched, whether it is a 2D or 3D interface. Pet. Reply 7–8. Petitioner's excerpt quotes the pertinent deposition section as follows:

Q Thank you for clarifying. The space balls, are those typically 2D or 3D input devices?

A A *space ball* is -- one skilled in the art -- typically, those *would be considered 3D input devices*.

Q Okay. And a touch screen?

A A touch screen would typically be considered a 2D input device.

Q Okay. And what does it say about those devices on lines 28 through 30?

A It says ‘Physically touching a user interaction device can be a disadvantage in medical applications due to risks of cross-contamination between patients or between patient and operator, or in industrial applications in dirty environments.’

Q Would you understand that to mean that this *3D mice and space balls have a disadvantage*?

A I think -- I understand this to mean that *physically touching some device can be a disadvantage* for the reasons provided here that can be ameliorated -- I believe it talks further in the patent -- by appropriate sanitization measures.

Id. (quoting Ex. 1037, 55:4–56:5 (emphasis added)).

We are persuaded by Petitioner’s argument and evidence. The specification may “disavow [a prior art] embodiment,” even if it “would otherwise be covered by the plain language of the claims,” by criticizing such an embodiment in the specification. *In re Abbott Diabetes Care Inc.*, 696 F.3d 1142, 1149–50 (Fed. Cir. 2004). We are mindful that “the claims

must ‘not be read restrictively unless the patentee has demonstrated a clear intention to limit the claim scope using words or expressions of manifest exclusion or restriction.’” *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1347 (Fed. Cir. 2015).

We agree with Petitioner to the extent that the ’675 patent disparages 2D user interfaces, because of the need for sterilization or disinfection, the ’675 patent similarly disparages 3D user interfaces (i.e., 3D mice and space balls). *See* Pet. Reply 7 (citing Ex. 1001, 1:24–31). Furthermore, Patent Owner’s own declarant acknowledges that the ’675 patent disparages 3D user interfaces such as 3D mice and space balls in the same way as it disparages 2D user interfaces. *Id.* at 7–8 (citing Ex. 1037, 55:4–56:5). In other words, the problem identified in the specification of the ’675 patent relates to interfaces that require physical touch, rather than whether those interfaces are 2D or 3D.

Accordingly, we determine that “user interface” as recited in the challenged claims is not limited to 3D user interfaces. *See Williamson*, 792 F.3d at 1347.

Patent Owner further argues that the 2D user interfaces disclosed by Kriveshko are disclaimed from the term “user interface” recited in claim 1. PO Resp. 35–37. Patent Owner points us to Kriveshko’s disclosure stating that the user input can be received through input device 116 on scanner 102, mouse 112, keyboard 114, or display 110. *Id.* at 35 (citing Ex. 1005 ¶ 72). However, according to Patent Owner, input device 116, mouse 112, keyboard 114, and display 110 are not 3D user interfaces. *Id.* at 36 (citing Pet. 26). Patent Owner points to Petitioner’s concession and its declarant’s declaration testimony that input device 116 disclosed by Kriveshko is a 2D

input device and not a 3D user interface. *Id.* at 36–37 (citing Pet. 26; Ex. 1003 ¶ 241; *see also* Ex. 2001 ¶ 3; Ex. 2011 ¶ 81).

Patent Owner’s argument is based on its proposed construction of the term “user interface” as excluding 2D user interfaces. As we stated previously, we are persuaded the term “user interface” does not exclude 2D user interfaces, and thus, we disagree with Patent Owner’s argument that Kriveshko’s 2D input devices cannot meet the “user interface” limitation.

For the reasons discussed above, we determine that Petitioner has shown, by a preponderance of the evidence, that claim 1 is anticipated under 35 U.S.C. § 102 by Kriveshko.

Claims 2, 9–11, and 18

We have reviewed Petitioner’s explanations and supporting evidence for this ground regarding claims 2, 9–11, and 18. In particular, Petitioner contends Kriveshko discloses the additionally recited limitations of claims 2, 9–11, and 18. Pet. 20–24. Petitioner provides detailed explanations and specific citations to Kriveshko indicating where in the reference the claimed features are disclosed. *Id.* (citing Ex. 1005 ¶¶ 52, 54, 60–61, 76, 90–91, 103).

Patent Owner does not offer specific and separate arguments regarding claims 2, 9–11, and 18. PO Resp. 37–38. We determine that Petitioner, for reasons set forth in its analysis which we adopt as our own, has shown by a preponderance of the evidence that dependent claims 2, 9–11, and 18 are unpatentable under 35 U.S.C. § 102 as anticipated by Kriveshko.

C. Obviousness over Kriveshko and Serra

Petitioner argues that claims 1–5, 8–11, and 14–19 would have been obvious over Kriveshko and Serra. Pet. 24–46. For the reasons explained below, we are persuaded that Petitioner has demonstrated by a preponderance of the evidence that these claims are unpatentable on this ground.

1. Overview of Serra (*Ex. 1006*)

Serra teaches switches or manual actuators on a handheld probe to allow user control of display parameters by actuating one or more buttons on a probe. *Ex. 1006* ¶ 53. Serra further teaches that a button can be used to use the probe to scan an image or to use it to rotate the entire virtual scene, which is a common 3D data set interactive visualization operation. *Id.* The handheld scanning device collects tracking information corresponding to the movement of the scanning device and the user interface of the scanning device “rotate[s] the entire scene (effectively changing the viewpoint of the user over the entire 3D scene).” *Id.* ¶ 54.

2. Independent Claim 1

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *See KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when in the record, objective

evidence of nonobviousness. *See Graham*, 383 U.S. at 17–18. In that regard, an obviousness analysis “need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” *KSR*, 550 U.S. at 418.

As discussed above with respect to anticipation by Kriveshko, Petitioner argues that Kriveshko teaches all the limitations recited in claim 1. Regarding the limitation “the handheld device includes a user interface for remotely controlling the display to adjust the view with which the 3D environment is represented on the display,” however, Petitioner relies alternatively on Serra. Pet. 24–25. Specifically, Petitioner directs us to where Serra teaches a handheld scanning device that includes a button that can be used to rotate the entire visual scene. *Id.* at 25 (citing Ex. 1006 ¶ 54).

Petitioner further asserts that incorporating Serra’s 3D user interface into a scanning device provides *ergonomic advantages* over other scanning systems by permitting the user to both perform a scanning process and examination process with the same device. Pet. 26 (citing Ex. 1006 ¶ 53). Petitioner explains that a person of ordinary skill would have been motivated and would have found it obvious to incorporate Serra’s 3D user interface into Kriveshko’s optical handheld device in order to provide an ergonomic handheld scanning device with a user interface that is adapted to control the display of three-dimensional imaging data displayed from an optical scan of the 3D environment. *Id.* at 27 (citing Ex. 1006 ¶¶ 11, 53; Ex. 1003 ¶¶ 153–164, 239–244).

In particular, Petitioner contends that Serra “provides an improvement over 2D input devices, such as the input device 116 of Kriveshko.” Pet. 26.

Petitioner asserts that in Serra, such improvement over 2D input devices is provided by the use of a *single* “handheld scanning device including a user interface consisting of a 3D sensor, one or more switches, or other manual actuators.” *Id.* at 25–26.

Patent Owner argues that Serra does not attribute the improvement over 2D input devices to the use of a single handheld device. Rather, according to Patent Owner, Serra attributes the improvement over 2D input devices to the use of a system including *two* handheld devices. PO Resp. 39–40.

We disagree with Patent Owner’s argument. We agree with Petitioner’s contention that Serra teaches ergonomic advantages by permitting a scanning process and an examination process with the same device. Pet. Reply 11–12 (citing Ex. 1006 ¶¶ 53, 54). In particular, Serra’s paragraph 53 reads in part:

Because a user is generally always holding the ultrasound (or other substantially real-time image acquisition) probe, it is ergonomically convenient to allow him to control display parameters by actuating one or more buttons on the probe. For example, a button can be used to indicate when to use the probe to scan real-time or when to use it to rotate the entire virtual scene, which is a common a [sic] 3D data set interactive visualization operation. . . .

Ex. 1006 ¶ 53.

Thus, Serra teaches a single device with two alternative modes of scanning and 3D data set interactive visualization actuated by one or more buttons. We further agree with Petitioner that “Serra’s scanning device includes a 3D user interface that rotates a visual representation of 3D data

based on movement of the scanning device determined by a motion sensor.”
See Pet. 26 (citing Ex. 1006 ¶¶ 53–54).

Accordingly, we agree with Petitioner that a POSITA would have been motivated and found it obvious to incorporate Serra’s 3D user interface into Kriveshko’s optical handheld device “[g]iven Serra’s explicit acknowledgement of the ergonomic benefits of modifying a scanning device to include the ability to adjust display parameters.” Pet. 27.

Based on the record before us, we are persuaded that the combination of Kriveshko and Serra teaches the recited “user interface.” We also are persuaded that Petitioner’s proffered reasoning for modifying Kriveshko’s handheld device to include Serra’s user interface, namely, to provide an ergonomic handheld scanning device, is sufficient to support the conclusion of obviousness. See *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (“[T]here must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.”).

We also note that the test for obviousness is not whether a secondary reference’s feature (e.g., 3D sensor) can be bodily incorporated into the structure of the primary reference. *In re Keller*, 642 F.2d 413, 425 (CCPA 1981). Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. *Id.* Petitioner’s analysis is supported by its declarant’s testimony, and we find that testimony persuasive. Pet. 27 (citing Ex. 1003 ¶¶ 153–164, 239–244).

Thus, we are persuaded by Petitioner that claim 1 would have been obvious over the Kriveshko and Serra combination.

2. Dependent Claims 2, 3, 9–11, 14–18

We discuss Petitioner’s contentions that dependent claims 2, 3, 9–11, and 14–18 would have been obvious over the combination of Kriveshko and Serra below. Patent Owner does not present specific arguments for these dependent claims, other than the argument for claim 1 discussed above. *See* PO Resp. 41–42. We determine Petitioner has shown, by a preponderance of the evidence, that claims 2, 3, 9–11, and 14–18 would have been obvious over the combination of Kriveshko and Serra based on the analysis below, which we adopt as our own.

Claim 2

Petitioner contends that Kriveshko teaches or suggests “wherein the handheld device is adapted to record the 3D geometry of the 3D environment,” as required by dependent claim 2. Pet. 30. Petitioner explains that modified handheld scanning device 102 records 3D geometry of the 3D environment by using its cameras to capture (i.e., record) images of the 3D environment from which “a three-dimensional point cloud may be recovered.” *Id.* (citing Ex. 1005 ¶¶ 52, 60–61; Ex. 1003 ¶¶ 165–167).

We are persuaded by Petitioner that claim 2 would have been obvious over the Kriveshko and Serra combination.

Claim 3

Petitioner contends that Kriveshko as modified by Serra teaches or suggests, “wherein the user interface includes means for manually switching between performing the at least one scanning action and remotely controlling the view,” as required by dependent claim 3. Pet. 30.

Petitioner contends that Serra teaches that its handheld optical scanning device includes means for manually switching between performing the at least one scanning action and remotely controlling the view by virtue of the button on Serra's handheld device. *Id.* at 31 (citing Ex. 1006 ¶ 53). Petitioner states that Serra teaches that the "button can be used to indicate when to use the probe to scan real-time or when to use it to rotate the entire virtual scene, which is a common a 3D data set interactive visualization operation." *Id.* Additionally, Petitioner states that the button in Serra can be used to activate two modes of operation: (i) a scanning mode (where the button switch is ON) and (ii) an interactive mode (where the button switch is OFF). *Id.* (citing Ex. 1006 ¶ 54; Ex. 1003 ¶¶ 168–172).

According to Petitioner, a POSITA would have understood how and why to modify Kriveshko to include this teaching of Serra because doing so would have been nothing more than the use of known technique to improve similar devices in the same way. *Id.* (citing *KSR Int'l Co.*, 550 U.S. at 416; Ex. 1003 ¶¶ 153–164, 168–173, 239–244).

We are persuaded by Petitioner that claim 3 would have been obvious over the Kriveshko and Serra combination.

Claim 9

Petitioner contends that Kriveshko in view of Serra teaches or suggests, "wherein the handheld device is adapted to change a viewing angle with which the 3D environment is represented on the at least one display," as required by dependent claim 9. Pet. 35.

Petitioner asserts that the modified handheld scanning device 102 in Kriveshko rotates the three-dimensional environment represented on the

display 110 via the user controls 406. *Id.* (citing Ex. 1005 ¶¶ 90–91; Ex. 1003 ¶¶ 195–196). *Id.*

Petitioner further points us to where Serra teaches rotating a visual presentation of a 3D scene using the movement of a scanning device. *Id.* at 36 (citing Ex. 1006 ¶¶ 53, 54; Ex. 1003 ¶¶ 197–198). Petitioner asserts that Serra further teaches that the scanning device is used to rotate a virtual scene presented on a display—effectively changing the viewpoint of the user over the entire 3D scene. *Id.* (citing Ex. 1006 ¶¶ 53, 54; Ex. 1003 ¶¶ 197–198.)

According to Petitioner, a POSITA would have understood how and why to modify Kriveshko to include this teaching of Serra to meet this claim because doing so would have been nothing more than the use of known techniques to improve similar devices in the same way. *Id.* (citing *KSR Int'l Co.*, 550 U.S. at 416; Ex. 1003 ¶ 199).

We are persuaded by Petitioner that claim 9 would have been obvious over the Kriveshko and Serra combination.

Claim 10

Petitioner argues that Kriveshko teaches or suggests, “wherein the handheld device is adapted to change a magnification factor with which the 3D environment is represented on the at least one display,” as required by dependent claim 10. Pet. 36.

According to Petitioner, the modified handheld scanning device 102 in Kriveshko is adapted to scale the three dimensional environment represented on display 110 via the user controls 406, which can be manipulated by the handheld device. *Id.* (Ex. 1003 ¶¶ 200–204). Petitioner

points us to annotated Figures 1 and 4 of Kriveshko to illustrate that user controls 406 include a first graphical user interface icon that includes a magnifying glass and plus sign, and a second graphical user icon that includes a magnifying glass and a minus sign. *Id.* at 37 (citing Ex. 1003 ¶¶ 200–204).

Petitioner further points us to Serra’s teaching that its handheld scanning device performs three-dimensional volumetric operations to modify a magnification factor of a viewpoint of scanned objects. *Id.* at 37–38 (citing Ex. 1006 ¶ 57 (“Once such a selection is made, the clinician can, for example, use the pen or other tracked handheld tool to control the way in which to see the objects by performing various 3D volumetric operations upon them, such as, for example, described in detail in *Zoom Slider*, *Zoom Context* and *3D Matching . . .*”) (emphasis added); Ex. 1003 ¶¶ 205–207).

Petitioner further points us to Serra’s zoom operation wherein as illustrated in annotated Figure 5 of Serra, the size of a scanned subject displayed on a monitor is magnified in response to a zoom effect operation (performed by the handheld device) in order to realize an optimal viewpoint for viewing the objects present within the 3D environment. *Id.* at 38 (citing Ex. 1003 ¶¶ 205–206; Ex. 1006, Fig. 5, ¶¶ 57–58).

Petitioner asserts that a POSITA would have understood how and why to modify Kriveshko to include this teaching of Serra to meet this claim because doing so would have been nothing more than the use of known techniques to improve similar devices in the same way. *Id.* (citing *KSR*, 550 U.S. at 416; Ex. 1003 ¶¶ 200–207, 239–246).

We are persuaded by Petitioner that claim 10 would have been obvious over the Kriveshko and Serra combination.

Claim 11

Petitioner asserts that Kriveshko teaches or suggests, “wherein the handheld device is an intra-oral 3D scanner,” as required by dependent claim 11. Pet. 39. We agree with Petitioner that Kriveshko teaches a dental imaging application wherein subject 104 scanned using scanning device 102 includes a tooth, a quadrant of teeth, or a full collection of teeth. *Id.* (citing Ex. 1005 ¶ 54; Ex. 1003 ¶¶ 208–211). Furthermore, Petitioner points us to Kriveshko’s Figure 10 description stating that

A scan of the arch using the image capture system 100 described above may include a continuous scan of exposed tooth surfaces from within a dental patient's mouth

Id. (citing Ex. 1005 ¶ 103; Ex. 1003 ¶¶ 209–210).

We are persuaded by Petitioner that claim 11 would have been obvious over the Kriveshko and Serra combination.

Claim 14

Petitioner asserts that Kriveshko teaches or suggests, “wherein the handheld device is an in-ear 3D scanner,” as required by dependent claim 14. Pet. 39. We agree with Petitioner that Kriveshko teaches an imaging application wherein the subject 104 includes “a human head, or a portion thereof, from which a three-dimensional model is desired for custom fitting of a hearing aid” *See id.* (citing Ex. 1005 ¶ 54.)

Additionally, we agree with Petitioner that a POSITA would have understood that the fitting of a hearing aid requires the handheld device to be an in ear 3D scanner allowing for collection of three-dimensional data used

to fit the hearing aid inside the hearing canal of a human. *Id.* at 39–40 (citing Ex. 1003 ¶¶ 212–215).

We are persuaded by Petitioner that claim 14 would have been obvious over the Kriveshko and Serra combination.

Claim 15

Petitioner asserts that Kriveshko as modified by Serra teaches or suggests, “wherein the at least one display is defined as a first display, and where the system further comprises a second display,” as required by dependent claim 15. Pet. 40.

Petitioner relies on Serra’s Figure 8 (as annotated in the Petition) that shows an ultrasound scanner system comprising a first computer and a main monitor, and an external box system comprising a second computer with 3D graphics capabilities and a second monitor. *Id.* (citing Ex. 1006, Fig. 8 ¶¶ 75–76; Ex. 1003 ¶¶ 216–220). Petitioner asserts that Serra further teaches that the second monitor receives “as an input the ultrasound image (either as a standard video signal or as a digital image), and provides as an output a 3D display.” *Id.* (citing Ex. 1006 ¶ 75, Fig. 8). As an example, Serra provides that the three dimensional display output by the second monitor includes an autostereoscopic display or a polarized display. *Id.* (citing Ex. 1006 ¶ 76; Ex. 1003 ¶¶ 216–220).

Petitioner asserts that a POSITA would have understood why and how to modify Kriveshko to include this teaching of Serra to meet this claim because doing so would have been nothing more than the use of known technique to improve similar devices in the same way. *Id.* at 40–41 (citing *KSR Int’l Co.*, 550 U.S. at 416; Ex. 1003 ¶¶ 221–224, 245–246).

We are persuaded by Petitioner that claim 15 would have been obvious over the Kriveshko and Serra combination.

Claim 16

Petitioner asserts that Kriveshko as modified by Serra teaches or suggests, “wherein the second display indicates where the handheld device is positioned relative to the 3D environment,” as required by dependent claim 16. Pet. 42.

Petitioner contends that Kriveshko teaches displaying images and visual cues that indicate the position of a scanning device relative to the three-dimensional environment during an acquisition mode. *Id.* (citing Ex. 1003 ¶¶ 225–228). Petitioner further provides an example wherein Kriveshko teaches,

During this phase of the process 200, a video image such as a video image of the subject from a position or point of view of the scanning device, may be rendered on the display 110. ... In other embodiments, the subject 104 may be displayed in a static, nonmoving orientation within the display 110, while a visual cue may be provided within the user interface as to a position and orientation of the scanner.

Id. (emphasis added) (citing Ex. 1005 ¶ 60; Ex. 1003 ¶ 226).

Petitioner further contends that Serra also teaches an ultrasound scanner system comprising a first computer and a main monitor, and an external box system comprising a second computer with 3D graphics capabilities and a second monitor. *Id.* at 43 (citing Ex. 1006, Fig. 8, ¶¶ 75–76). Petitioner explains that in the combination, the position indication relative to the 3D environment provided by Kriveshko would be displayed on the second monitor of Serra (which is used specifically “as an input the

ultrasound image (either as a standard video signal or as a digital image), and provides as an output a 3D display”). *Id.* (citing Ex. 1006 ¶ 75; *see also id.* at Fig. 8; Ex. 1003 ¶¶ 225–228).

Petitioner asserts that a POSITA would have understood how and why to modify Kriveshko to include this teaching of Serra to meet this claim because doing so would have been nothing more than the use of known techniques to improve similar devices in the same way. *Id.* (citing *KSR Int'l Co.*, 550 U.S. at 416; Ex. 1003 ¶¶ 228, 245–246).

We are persuaded by Petitioner that claim 16 would have been obvious over the Kriveshko and Serra combination.

Claim 17

Petitioner contends that Kriveshko teaches or suggests, “wherein the first display and/or the second display provides instructions for the operator,” as required by dependent claim 17. Pet. 43.

Petitioner contends that Kriveshko teaches that the display 110 is configured to provide guidance (i.e. the instructions) to an operator of the handheld scanning device 102 during a recovery mode. *Id.* at 43–44 (citing Ex. 1005 ¶ 14; Ex. 1003 ¶¶ 229–233). For example, Petitioner states that Kriveshko teaches that

In the recover mode, the system 100 may seek to reacquire the previous scan by test fitting new scan data to previously acquired data, and *providing visual feedback to a user to assist in navigating back to a scan location on the subject where the re-acquisition is being attempted.*

Id. at 44 (emphasis added) (quoting Ex. 1005 ¶ 59) (citing Ex. 1003 ¶ 231).

We are persuaded by Petitioner that claim 17 would have been obvious over the Kriveshko and Serra combination.

Claim 18

Petitioner asserts that Kriveshko teaches or suggests, “wherein audible information is provided to the operator,” as required by dependent claim 18. Pet 44. We agree that Kriveshko teaches providing verbal cues (i.e., the audible information) to the user while the user re-acquires three-dimensional data for an existing three-dimensional model. *Id.* (citing Ex. 1005 ¶ 76 (“It will be appreciated that other techniques may be employed, such as directional arrows or verbal cues, to coach a user back to an appropriate location relative to the subject 104.”); Ex. 1003 ¶¶ 234–236).

Additionally, Petitioner contends Kriveshko’s image capture system 100 provides audible indicators to a user communicating “whether the image capture system 100 is in a recover mode or a normal acquisition mode.” *Id.* (citing Ex. 1005 ¶ 76; Ex. 1003 ¶ 235). Petitioner contends that, as such, Kriveshko’s system provides audible information to a user that will assist the user in re-centering the scanning device 102 at the desired position on the subject 104. *Id.* (citing Ex. 1003 ¶¶ 234–236).

We are persuaded by Petitioner that claim 18 would have been obvious over the Kriveshko and Serra combination.

3. Claims 4, 5, 8, and 19

Petitioner states that claim 19 merely recites a system that includes all the limitations of claims 1, 3–5, and 11. Pet. 45–46. We were persuaded by Petitioner’s evidence and arguments regarding claims 1, 3, and 11 as addressed above, so we address whether the combination, and in particular whether Serra teaches or suggests a “motion sensor” as recited in claims 4, 5, 8, and 19.

Claim 4 depends from claim 1 and recites “wherein the handheld devices comprises at least one motion sensor.” Ex. 1001, 15:50–51. Claim 5 further depends from claim 4 and recites “the view of the 3D environment represented in the at least one display is at least partly determined by the at least one motion sensor.” *Id.* at 16:1–3. Claim 8 further depends from claim 4 and recites “wherein the user interface is other than the at least one motion sensor.” *Id.* at 16:8–9. Claim 19 is independent and recites the limitation, “the view is remotely controlled by at least one motion sensor arranged in the handheld device.” *Id.* at 16:35–50. We have reviewed Petitioner’s arguments and evidence regarding these limitations, and we find them persuasive and adopt Petitioner’s analysis as our own. Pet. 32–34, *see also id.* at 45–46. We address Patent Owner’s arguments regarding the recited “motion sensor” below.

a. Does Serra’s “3D sensor” constitute a “motion sensor” meeting the limitation of claim 4?

Patent Owner asserts that the combination of Kriveshko and Serra does not teach or suggest a “motion sensor.” PO Resp. 15–31. In particular, Patent Owner asserts three reasons for its assertion that Serra does not teach a “motion sensor”:

1. Serra teaches a 3D sensor detecting position—not motion.
2. Petitioner and its expert do not provide evidence that Serra’s 3D sensor is a motion sensor.
3. Position and motion are fundamentally distinct properties and thus, a person of ordinary skill in the art would understand the 3D sensor of Serra as being a position sensor and thus different from the ’675 patent claimed motion sensor.

PO Resp. 15–20 (citing Ex. 2011 ¶ 53).

Patent Owner also asserts that Petitioner wrongly relies on Serra's 3D sensor to meet the claimed motion sensor because Serra's tracking of three-dimensional position and orientation does not constitute detection of motion. PO Resp. 16 (citing Pet. 32, 34, 46). Patent Owner contends that Serra teaches that the 3D sensor detects *position*. *Id.* at 16–17 (citing Ex. 1006, Fig. 7 (“3D Sensor attached to Ultrasound Probe or any other way of determining the *position* of the plane of scan” (emphasis added)), ¶ 74 (“the 3D *position* of the ultrasound probe 715 can be tracked by 3D tracker 703, by, for example, 3D sensor 720 which is attached to ultrasound probe 715” (emphasis added))). Patent Owner asserts that there is no disclosure or suggestion in Serra of detecting “motion” or “movement” of the ultrasound probe. *Id.* (citing Ex. 2011 ¶ 56). According to Patent Owner, this distinction is because Serra's objective is to provide “a system [which] can record both the 3D position and the time of acquisition for each image,” so that each image can be correlated with corresponding position data at a given time. *Id.* at 17 (citing Ex. 1006 ¶¶ 36–37; *see also id.* ¶¶ 11–12).

Patent Owner further asserts that Petitioner's declarant Dr. Bajaj, in support of his assertion that Serra's 3D sensor suggests a motion sensor, relies on the teachings of Kerr (Ex. 1011), Touma (Ex. 1028), and Brennan (Ex. 1007). PO Resp. 19–20 (citing Ex. 1003 ¶ 178 (“Kerr, Touma, and Brennan provide additional evidence that a [person of ordinary skill in the art] would have considered Serra's 3D sensor to at least suggest a motion sensor.”)). According to Patent Owner none of these references even mention the term “3D sensor,” much less explain how tracking position (or tracking position, orientation, and time) constitutes detecting motion. *Id.* at 20.

We are not persuaded by Patent Owner’s argument. As we determined above, the claim construction of the term “motion sensor,” under the broadest reasonable interpretation in light of the ’675 patent specification as well as extrinsic evidence, is properly construed as a motion sensor that detects motion and does not exclude sensors that collect position and orientation data. We further note that there is no *ipsissimis verbis* test for determining whether a reference discloses a claim element, i.e., identity of terminology is not required. *Bond*, 910 F.2d at 832. Thus, it is of no moment that Serra refers to a “3D sensor” rather than a “motion sensor” as long as Serra’s “3D sensor” teaches detecting motion by tracking position and orientation.

Here, we find that Petitioner has shown Serra’s “3D sensor” senses motion through tracking position and orientation. Pet. Reply 20–21. Specifically, we credit Dr. Bajaj’s declaration testimony that Serra teaches “rotating the 3D data presented on the display using tracking information corresponding to the movement of the scanning device.” Ex. 1003 ¶ 177 (citing Ex. 1006 ¶ 54); *see also* Pet. 34 (citing Ex. 1003 ¶¶ 185–86; Ex. 1006 ¶¶ 57, 60, Fig. 5).

We further credit Dr. Bajaj’s declaration testimony that Serra provides that the tracking information is collected by the 3D sensor attached to scanning device. Ex. 1003 ¶ 177 (citing Ex. 1006 ¶¶ 42, 49; *see also id.* at Fig. 7). In addition, we are persuaded by Dr. Bajaj’s testimony that a POSITA would have understood that Serra’s 3D sensor at least suggests a motion sensor given that Serra’s 3D sensor is used to determine the three-dimensional movement of the scanning device. *Id.*

Furthermore, we do not agree with Patent Owner's argument that Serra's 3D sensor does not track position and orientation. PO Resp. 23–25. Although we do not disagree with Dr. Bajaj's additional declaration testimony that Serra's 3D sensor reads a "change of position" or a "change of orientation" and derivatives, Dr. Bajaj's testimony in paragraphs 175–180 of his declaration already adequately supports that Serra's "3D sensor" tracks position and orientation and thus teaches a "motion sensor." Ex. 1003 ¶¶ 175–180.

Accordingly, based on Petitioner's contentions and evidence under the claim construction of the term "motion sensor," as we discussed above, we find that Serra teaches this limitation.

b. Does Serra teach the limitation of "the view is remotely controlled by at least one motion sensor," as recited in claim 19?

Patent Owner further argues that Petitioner fails to explain how Serra discloses or suggests that the view is remotely controlled by Serra's 3D sensor attached to the ultrasound probe (which Petitioner alleges corresponds to the claimed "motion sensor"). PO Resp. 29 (citing Ex. 2011 ¶¶ 71–72). Patent Owner asserts that Petitioner's annotated version of Figure 5 of Serra "illustrates changing the viewpoint of the user over the entire three-dimensional scene based on the 3D sensor" using a "zoom operation" and a "rotation operation." *Id.* (citing Pet. 34). Patent Owner explains that although Figure 5 of Serra discloses the words "rotation" and "zoom," Figure 5 does not describe the manner in which the rotation and zoom operations are controlled, much less disclose that a 3D sensor arranged in an ultrasound probe is used to control the rotation and zoom operations. *Id.* at 30. Patent Owner argues that Petitioner cites paragraphs 57 and 60 of Serra, but such disclosures make no mention of a 3D sensor nor do they

describe the manner in which the rotation and zoom functions are operated, or that the 3D sensor is used to operate the rotate or zoom functions. *Id.* Patent Owner further asserts that paragraph 57 of Serra discusses the use of a second device (“use the pen or other tracked handheld tool to control the way in which to see the objects”), not the ultrasound probe, and similarly, paragraph 58 of Serra does not disclose that the rotation and zoom operations are done by the handheld scanning device. *Id.* Patent Owner asserts that Petitioner failed to demonstrate where Serra discloses that the view (the way a 3D environment is represented on a display) is remotely controlled by at least one motion sensor as required by claim 19. *Id.* at 31 (citing Ex. 2011 ¶¶ 73–74).

Patent Owner further asserts that paragraph 53 of Serra, cited by Petitioner, does not describe any element of the probe that remotely controls the display to adjust the way in which the 3D environment is represented on the display, much less a motion sensor. *Id.* (citing Pet. 33). That paragraph states: “[A] button can be used to indicate when to use the probe to scan real-time or when to use it to rotate the entire virtual scene.” Ex. 1006 ¶ 53. Patent Owner contends this paragraph of Serra does not even mention the 3D sensor, i.e., the element which Petitioner alleges corresponds to the claimed “motion sensor.” PO Resp. 31. Patent Owner also asserts that Petitioner cites paragraph 54 of Serra, which discloses using “tracking information in the ultrasound probe” to rotate the scene, but this disclosure does not explain how the tracking information is acquired. *Id.* (citing Pet. 33; Ex. 1006 ¶ 54). Patent Owner also states that this disclosure does not explain how the tracking information is used to rotate the scene. *Id.* Patent Owner repeats that tracking information, which constitutes 3D *positional*

information, is not the same as *motion* information, and thus the positional sensor of Serra (Serra's 3D sensor) is not the same as a motion sensor. *Id.* (citing Ex. 2011 ¶ 75).

Petitioner responds that Patent Owner ignores Petitioner's argument that "Serra further discloses that incorporating the 3D user interface into a scanning device provides ergonomic advantages over other scanning systems by permitting the user to both perform a scanning process and examination process *with the same device*." Pet. Reply 11–12 (citing Pet. 26). Petitioner cites to Serra's paragraph 53 for support, which reads in part:

Because a user is generally always holding the ultrasound (or other substantially real-time image acquisition) probe, it is ergonomically convenient to allow him to control display parameters by actuating one or more buttons on the probe. For example, a button can be used to indicate when to use the probe to scan real time or when to use it to rotate the entire virtual scene, which is a common a [sic] 3D data set interactive visualization operation. . . .

Id. at 12 (quoting Ex. 1006 ¶ 53).

Petitioner argues that Patent Owner ignores that "Serra's scanning device includes a 3D user interface that rotates a visual representation of 3D data *based on movement of the scanning device determined by a motion sensor*." *Id.* (citing Pet. 26; Ex. 1006 ¶¶ 53–54). Petitioner asserts that Patent Owner focuses on a different Serra embodiment that optionally uses two devices: an acquisition device and a separate handheld tracker. *Id.* (citing PO Resp. 39–40). Petitioner argues that "regardless of the embodiment, as the Petition notes and [Patent Owner] again fails to address, a POSITA would have been motivated and found it obvious to incorporate Serra's 3D user interface into Kriveshko's optical handheld device '[g]iven

Serra's explicit acknowledgement of the ergonomic benefits of modifying a scanning device to include the ability to adjust display parameters.”

Pet. Reply 12–13 (quoting Pet. 27).

Serra teaches that “*one or more switches, or other manual actuators, can be provided on or for a handheld probe to enhance 3D interactions.*” Ex. 1006 ¶ 53 (emphasis added). Serra further teaches that a button on the probe can be used to switch between scanning in real-time and a 3D data set interactive visualization operation rotating the entire virtual scene. *See id.* Importantly, Serra elaborates “*the user can release the button on the probe, and use the tracking information in the ultrasound probe to rotate the entire scene (effectively changing the viewpoint of the user over the entire 3D scene).*” *Id.* ¶ 54 (emphasis added). Serra teaches that “*the 3D position of the ultrasound probe 715 can be tracked by 3D tracker 703, by for example, 3D sensor 720 which is attached to ultrasound probe 715.*” *Id.* ¶ 74. (emphasis added). Serra further teaches that the tracking system can track *position and orientation.* *Id.* ¶ 42. We credit Dr. Bajaj's testimony pointing to these findings and explaining the tracking information in relation to the 3D interactions. Ex. 1003 ¶ 177 (citing Ex. 1006 ¶¶ 12, 42, 74, Fig. 7).

Thus, based on the disclosures above, we determine Serra teaches the limitation of “the view is remotely controlled by at least one motion sensor,” as recited in claim 19, because Serra teaches tracking a 3D sensor in a device to allow rotation of the entire scene of view based on the position and orientation of the sensor.

Other than its arguments regarding whether Serra teaches a “motion sensor,” Patent Owner does not present arguments specific to the additional

limitations of claims 4, 5, and 8. *See generally* PO Resp. We find Petitioner has shown Serra teaches those limitations. Pet. 32–35.

For the reasons discussed above, we are persuaded that Petitioner has shown by a preponderance of the evidence that claims 4, 5, 8, and 19 would have been obvious over the Kriveshko and Serra combination.

D. Obviousness over Kriveshko, Serra, and Brennan

Petitioner argues that claims 6, 7, 12, and 13 would have been obvious over Kriveshko, Serra, and Brennan. Pet. 46–54. For the reasons explained below, we are persuaded that Petitioner has demonstrated by a preponderance of the evidence that these claims are unpatentable on this ground.

Petitioner contends that the combination of Kriveshko, Serra, and Brennan teaches or suggests the limitation of “wherein functionality of the user interface comprises a use of gestures,” as required by dependent claim 6 and the limitation of “wherein the gestures are detected by the at least one motion sensor,” as required by dependent claim 7. Pet. 51–53. Petitioner further contends that the combination teaches the limitations of claims 12 and 13 specifying the handheld instrument as a surgical instrument and a mechanical tool respectively. *Id.* at 53–54. Petitioner provides reasoning why a person of ordinary skill in the art would have combined the teachings of these references. *Id.* at 46–50.

Petitioner asserts that “Brennan describes controlling the functionality of the scanning device via the gestures” and that “Figure 19 depicts exemplary gesture-based alphanumeric input strokes that may be utilized to control various functions of the scanning device.” Pet. 51 (citing Ex. 1007,

5:25–36, 17:40–42, 22:31–23:65). Petitioner asserts that Patent Owner does not dispute that Brennan teaches gestures, but rather counters that Brennan’s gestures are not for the purpose of claim 1’s “controlling the display to adjust the view with which the 3D environment is represented on the display.” Pet. Reply 27. In doing so, Petitioner argues that Patent Owner fails to respond to or consider the Petition’s arguments as to how these features are taught or suggested by the combination of all three references, again improperly addressing Brennan alone. *Id.*

Patent Owner argues with respect to claims 6 and 7 that Brennan fails to disclose remotely controlling the display to adjust the view by any means. PO Resp. 43–44. Patent Owner further argues that Petitioner’s declarant admits that “Kriveshko/Serra does not explicitly teach gestures detected by a motion sensor as recited in claim 7.” *Id.* at 45 (citing Ex. 1003 ¶ 256).

It is well settled that “a determination of obviousness based on teachings from multiple references does not require an actual, physical substitution of elements.” *In re Mouttet*, 686 F.3d 1322, 1332 (Fed. Cir. 2012) (citations omitted). Nor is the test for obviousness whether a secondary reference’s features can be bodily incorporated into the structure of the primary reference. *Keller*, 642 F.2d at 425. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. *Id.*

Here, we agree with Petitioner that one ordinarily skilled in the art would have had reason to combine the teachings of Brennan disclosing handheld scanning devices with well-known user input techniques using gestures for user control of an image capture system, Kriveshko disclosing a scanning device 102 that includes a user input device 116 (e.g., a button,

lever, dial, thumb wheel, or switch) for user control of the image capture system 100, and Serra disclosing a scanning device that includes a motion sensor that collects tracking information corresponding to the movement of the scanning device using the motion sensor. Pet. 47 (citing Ex. 1003 ¶¶ 74–85, 248–254, 277–279; Ex. 1005 ¶ 52; Ex. 1006 ¶¶ 49, 53–54, Fig. 7; Ex. 1007, 5:25–36, 22:49–23:21); *see also* Inst. Dec. 28–29.

As we previously stated in the Institution Decision, Petitioner explained that an ordinarily skilled artisan would have been motivated to incorporate the gesture based input techniques of Brennan into the combination of Kriveshko’s and Serra’s scanning device in order to provide an intuitive means of user input via a motion sensor. Inst. Dec. 29 (citing Pet. 47–48); *see also* Inst. Dec. 27–29. We found that Petitioner’s cited section of Brennan refers to making the gesture “R” with the probe to trigger the function of recording, and thus, making the gesture “R” is an intuitive way of triggering the function that starts with the letter “R.” *Id.* at 29 (citing Ex. 1007, 22:49–22:59).

We further agree with Petitioner’s additional motivation to combine based on Brennan’s teaching of combining a scanning device with a surgical instrument to avoid having to constantly swap out surgical instruments within a surgical site. Pet. 48 (citing Ex. 1007, 2:4–8); *see also* Inst. Dec. 29–30. Petitioner explains that Brennan identifies “[t]he need to constantly swap out instruments because of limited access to the surgical site is frequently a problematic and time-consuming distraction to the surgeon.” Pet. 48 (citing Ex. 1007, 1:46–49).

Petitioner states that Kriveshko teaches that its scanner has applications in the medical space, such as use by a dentist who often

performs different surgical procedures, including tooth extractions, tooth implants, wisdom teeth removal, that require the use of surgical tools. *Id.* at 49 (citing Ex. 1003 ¶ 282). Petitioner contends that one ordinarily skilled in the art would have recognized that incorporating a surgical instrument into Kriveshko's scanning device would have permitted a dentist to perform a scanning process and a surgical process at a surgical site without having to use multiple devices. *Id.* (citing Ex. 1003 ¶¶ 281–283). Additionally, Petitioner explains that a person of ordinary skill in the art would have recognized the importance of reducing distractions for a medical practitioner performing a dental procedure on a patient, like that disclosed by Kriveshko. *Id.* (citing Ex. 1003 ¶¶ 281–283).

We agree with Petitioner that a person of ordinary skill in the art would have been motivated and found it obvious to enhance the combination of Kriveshko-Serra by incorporating a surgical instrument, given that Brennan explicitly teaches the efficiency benefits of combining a scanning device with other devices having diagnostic and/or therapeutic functions. *Id.*

Patent Owner's arguments to the contrary are not persuasive because it is of no moment that Brennan fails alone to disclose remotely controlling the display to adjust the view by any means and the Kriveshko/Serra combination does not explicitly teach gestures detected by a motion sensor. Instead, it is the Petitioner's proposed combination of Kriveshko, Serra, and Brennan that teaches the limitations of claims 6, 7, 12, and 13 as discussed *supra*.

For the reasons discussed above, we determine that Petitioner has shown by a preponderance of the evidence that claims 6, 7, 12, and 13 are unpatentable as obvious over Kriveshko, Serra, and Brennan.

III. CONCLUSION

On this record, Petitioner has shown by a preponderance of the evidence that claims 1–19 of the '675 patent are unpatentable.

IV. ORDER

Accordingly, it is

ORDERED that

1. Claims 1–2, 9–11, and 18 of the '675 patent are unpatentable on the ground of anticipation by Kriveshko;
2. Claims 1–5, 8–11, and 14–19 of the '675 patent are unpatentable on the ground of obviousness over Kriveshko and Serra; and
3. Claims 6, 7, 12, and 13 of the '675 patent are unpatentable on the ground of obviousness over Kriveshko, Serra, and Brennan; and

FURTHER ORDERED that because this Final Written Decision is final, a party to the proceeding seeking judicial review of the Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2018-00197
Patent 9,329,675 B2

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