

**UNITED STATES PATENT AND TRADEMARK OFFICE**

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**BEFORE THE PATENT TRIAL AND APPEAL BOARD**

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DENTAL IMAGING TECHNOLOGIES CORPORATION,  
Petitioner

v.

3SHAPE A/S,  
Patent Owner

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U.S. Patent No. RE48,221 to Öjelund *et al.*  
Issue Date: September 22, 2020  
Title: SYSTEM WITH 3D USER INTERFACE INTEGRATION

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**Petition for *Inter Partes* Review of U.S. Patent No. RE48,221  
under 35 U.S.C. §§ 311-319 and 37 C.F.R. § 42.100 *et seq.***

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| <b>1001</b>        | U.S. Patent No. RE48,221 to Öjelund <i>et al.</i>                                                                                                                                                                                           |
| <b>1002</b>        | File History of U.S. Patent No. RE48,221 (“Prosecution History”)                                                                                                                                                                            |
| <b>1003</b>        | Declaration of Kurtis Keller (“Keller Decl.”) in support of Petition for <i>Inter Partes</i> Review of U.S. Patent No. RE48,221                                                                                                             |
| <b>1004</b>        | <i>Curriculum Vitae</i> of Kurtis Keller                                                                                                                                                                                                    |
| <b>1005</b>        | Öjelund Provisional, U.S. Provisional Application No. 61/420,138 (filed December 6, 2010)                                                                                                                                                   |
| <b>1006</b>        | Logozzo <i>et al.</i> , “A Comparative Analysis of Intraoral 3D Digital Scanners For Restorative Dentistry” (“Logozzo”), published January, 2011                                                                                            |
| <b>1007</b>        | Ireland <i>et al.</i> , “3D surface imaging in dentistry – what we are looking at” British Dental Journal, Vol. 205, No. 7, October 11, 2008                                                                                                |
| <b>1008</b>        | U.S. Patent No. 6,485,413 to Boppart <i>et al.</i>                                                                                                                                                                                          |
| <b>1009</b>        | Johnny Chung Lee, “Hacking the Nintendo Wii Remote” IEEE CS, 2008                                                                                                                                                                           |
| <b>1010</b>        | Hajeer <i>et al.</i> , “Current Products and Practices Applications of 3D imaging in orthodontics: Part II” Journal of Orthodontics, Vol. 31, No. 2, June 2004                                                                              |
| <b>1011</b>        | U.S. Patent No. 6,592,371 to Durbin <i>et al.</i>                                                                                                                                                                                           |
| <b>1012</b>        | U.S. Patent No. 5,722,412 to Pflugrath <i>et al.</i>                                                                                                                                                                                        |
| <b>1013</b>        | U.S. Patent No. 6,645,148 to Nguyen-Dinh <i>et al.</i>                                                                                                                                                                                      |
| <b>1014</b>        | Brad A. Myers, <i>CRC Handbook of Computer Science and Engineering</i> , 2d. Ed., Allen B. Tucker, January 27, 2003, “Graphical User Interface Programming”                                                                                 |
| <b>1015</b>        | Foley <i>et al.</i> , <i>Introduction to Computer Graphics</i> , Addison-Wesley, 1994, “Chapter 2.2: Basic Interaction Handling”, “Chapter 6: Viewing in 3D”, and “Chapter 8: Input Devices, Interaction Techniques, and Interaction Tasks” |

| <b>Exhibit No.</b> | <b>Description</b>                                                                                                                                                                                                                                       |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1016</b>        | Donald Hearn and M. Pauline Baker, <i>Computer Graphics</i> , 2d. Ed., Prentice Hall, 1994, “Chapter 2: Overview of Graphics Systems”, “Chapter 8: Graphical User Interfaces and Interactive Input Methods”, and “Chapter 9: Three-Dimensional Concepts” |
| <b>1017</b>        | U.S. Patent No. 5,181,181 to Glynn                                                                                                                                                                                                                       |
| <b>1018</b>        | U.S. Patent Publication No. 2006/0092133 to Touma <i>et al.</i>                                                                                                                                                                                          |
| <b>1019</b>        | Bornik <i>et al.</i> , “A Hybrid User Interface for Manipulation of Volumetric Medical Data” 3DUI '06: IEEE Symposium on 3D User Interfaces, March 2006                                                                                                  |
| <b>1020</b>        | U.S. Patent Publication No. 2010/0009308 to Wen <i>et al.</i>                                                                                                                                                                                            |
| <b>1021</b>        | Greg Welch and Eric Foxlin, “Motion Tracking: No Silver Bullet, but a Respectable Arsenal” IEEE Computer Graphics and Applications, Vol. 22, No. 6, December 10, 2002                                                                                    |
| <b>1022</b>        | Hannes Kaufmann, “Applications of Mixed Reality” Thesis, Vienna University of Technology, May 27, 2009                                                                                                                                                   |
| <b>1023</b>        | Ferreira, Joao Filipe, Jorge Lobo, and Jorge Dias. “Tele-3D-Developing a Handheld Scanner Using Structured Light Projection” 3DPVT, 2002                                                                                                                 |
| <b>1024</b>        | Ueda, Tatsuro, <i>et al.</i> “Visual information assist system using 3D SOKUIKI sensor for blind people, system concept and object detecting experiments.” IECON 2006-32nd Annual Conference on IEEE Industrial Electronics, IEEE, 2006                  |
| <b>1025</b>        | U.S. Patent No. 4,342,227 to Petersen <i>et al.</i>                                                                                                                                                                                                      |
| <b>1026</b>        | U.S. Patent No. 5,563,343 to Shaw <i>et al.</i>                                                                                                                                                                                                          |
| <b>1027</b>        | Steven Nasiri, “A Critical Review of MEMS Gyroscopes Technology and Commercialization Status” InvenSense, 2005                                                                                                                                           |
| <b>1028</b>        | U.S. Patent Publication No. 2008/0070684 to Haigh-Hutchinson                                                                                                                                                                                             |
| <b>1029</b>        | U.S. Patent Publication No. 2013/0110469 to Kopelman                                                                                                                                                                                                     |
| <b>1030</b>        | U.S. Patent Publication No. 2012/0062557 to Dillon <i>et al.</i>                                                                                                                                                                                         |
| <b>1031</b>        | U.S. Patent Publication No. 2007/0031774 to Cinader, Jr. <i>et al.</i>                                                                                                                                                                                   |

Petition for *Inter Partes* Review  
of U.S. Patent No. RE48,221

| <b>Exhibit No.</b> | <b>Description</b>                                                                                                                                                                                             |
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| <b>1032</b>        | U.S. Patent No. 9,329,675 to Öjelund <i>et al.</i>                                                                                                                                                             |
| <b>1033</b>        | <i>Inter Partes</i> Review Certificate, U.S. Patent No. 9,329,675 K1 to Öjelund <i>et al.</i>                                                                                                                  |
| <b>1034</b>        | Final Written Decision for <i>Inter Partes</i> Review of U.S. Patent No. 9,329,675 in IPR2018-00197, May 29, 2019                                                                                              |
| <b>1035</b>        | Giammanco <i>et al.</i> , “Using 3D Laser Scanning Technology to Create Digital Models of Hailstones,” American Meteorological Society, July 2017.                                                             |
| <b>1036</b>        | Orhan H. Karatas and Ebubekir Toy, “Three-dimensional imaging techniques: A literature review,” European Journal of Dentistry, Vol. 8, No. 1, March 2014.                                                      |
| <b>1037</b>        | B. H. Broadbent, “A New X-Ray Technique and Its Application to Orthodontia,” The Angle Orthodontist, Vol. I, No. 2, February 4, 1931.                                                                          |
| <b>1038</b>        | ’221 Patent Notice of Allowance                                                                                                                                                                                |
| <b>1039</b>        | Nathan S. Birnbaum and Heidi B. Aaronson, “Dental impressions using 3D digital scanners: virtual becomes reality,” Compend. Contin. Educ. Dent., Vol. 29, No. 8, October 2008.                                 |
| <b>1040</b>        | U.S. Patent No. 6,227,850 to Chishti <i>et al.</i>                                                                                                                                                             |
| <b>1041</b>        | Steele <i>et al.</i> , “Bodies in motion: Monitoring daily activity and exercise with motion sensors in people with chronic pulmonary disease,” J. Rehabil. Res. Dev., Vol. 40, No. 5, Suppl. 2, October 2003. |
| <b>1042</b>        | Hale <i>et al.</i> , “Measuring free-living physical activity in adults with and without neurologic dysfunction with a triaxial accelerometer,” Arch. Phys. Med. Rehabil., Vol. 89, No. 9, September 2008.     |
| <b>1043</b>        | Daniel Turner, “Hack: The Nintendo Wii,” MIT Technology Review, July 1, 2007.                                                                                                                                  |
| <b>1044</b>        | File History of U.S. Patent No. 9,329,675                                                                                                                                                                      |
| <b>1105</b>        | U.S. Patent Publication No. 2008/0071143 (“Gattani”)                                                                                                                                                           |
| <b>1106</b>        | U.S. Patent Publication No. 2007/0171220 (“Kriveshko”)                                                                                                                                                         |
| <b>1107</b>        | U.S. Patent Publication No. 2006/0020204 (“Serra”)                                                                                                                                                             |

Petition for *Inter Partes* Review  
of U.S. Patent No. RE48,221

| <b>Exhibit No.</b> | <b>Description</b>                                    |
|--------------------|-------------------------------------------------------|
| <b>1108</b>        | U.S Patent No. 8,914,245 (“Hopkins”)                  |
| <b>1109</b>        | U.S. Patent Publication No. 2005/0212756 (“Marvit”)   |
| <b>1110</b>        | U.S. Patent Publication No. 2005/0110751A1 (“Wilson”) |
| <b>1111</b>        | U.S. Patent Publication No. 2006/0142657 (“Quaid”)    |
| <b>1112</b>        | Hopkins Provisional Application No. 61/161,910        |

**LIST OF CHALLENGED CLAIMS** 1-3, 5-7, 9-11, 15, 18-28, 30-34, and 40-44

| <b>Claim</b> | <b>Limitation</b>                                                                                                                                                                                                             |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.0          | A scanning system for scanning a 3D environment, the scanning system comprising:                                                                                                                                              |
| 1.1          | 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                                                               |
| 1.2          | at least one display remotely connected to the handheld device,                                                                                                                                                               |
| 1.3          | 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           |
| 1.4          | the handheld device includes a 3D user interface for remotely controlling the display to adjust the view with which the 3D environment is represented on the display,                                                         |
| 1.5          | wherein the handheld device comprises at least one motion sensor, and                                                                                                                                                         |
| 1.6          | wherein the at least one motion sensor is a sensor that directly detects motion.                                                                                                                                              |
| 2            | The scanning system according to claim 1, wherein the handheld device is adapted to record the 3D geometry of the 3D environment.                                                                                             |
| 3            | The scanning system according to claim 1, wherein the user interface handheld device includes means an actuator for manually switching between performing the at least one scanning action and remotely controlling the view. |
| 5            | The scanning system according to claim 4 1, wherein 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.                                   |

| Claim | Limitation                                                                                                                                                                                  |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6     | The scanning system according to claim 4 1, wherein functionality of the 3D user interface comprises a use of gestures.                                                                     |
| 7     | The scanning system according to claim 6, wherein the gestures are detected by the at least one motion sensor.                                                                              |
| 9     | The scanning system according to claim 1, wherein the handheld device is adapted to change a viewing angle with which the 3D environment is represented on the at least one display.        |
| 10    | The scanning system according to claim 1, wherein the handheld device is adapted to change a magnification factor with which the 3D environment is represented on the at least one display. |
| 11    | The scanning system according to claim 1, wherein the handheld device is an intra-oral 3D scanner.                                                                                          |
| 15    | The scanning system according to claim 1, wherein the at least one display is defined as a first display, and where the system further comprises a second display.                          |
| 18    | The scanning system according to claim 1, wherein audible information is provided to the operator.                                                                                          |
| 19.0  | A system comprising:                                                                                                                                                                        |
| 19.1  | a handheld device and at least one display;                                                                                                                                                 |
| 19.2  | wherein the handheld device is adapted for switching between performing at least one action in a physical 3D environment,                                                                   |
| 19.3  | wherein the at least one display is adapted for visually representing the physical 3D environment; and                                                                                      |
| 19.4  | remotely controlling the display to adjust the view with which the 3D environment is represented on the display;                                                                            |
| 19.5  | wherein the handheld device is an intra-oral 3D scanner and the at least one action performed in the physical 3D environment is                                                             |

| Claim | Limitation                                                                                                                                                                                                                    |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | scanning and that the view is remotely controlled by at least one motion sensor arranged in the handheld device, and                                                                                                          |
| 19.6  | wherein an actuator provided on the handheld device switches between performing the at least one action and remotely controlling the view, and                                                                                |
| 19.7  | wherein the at least one motion sensor is a sensor that directly detects motion.                                                                                                                                              |
| 20    | The scanning system according to claim 1, wherein the at least one motion sensor is an accelerometer, gyro, or magnetometer.                                                                                                  |
| 21    | The scanning system according to claim 1, wherein the at least one motion sensor is adapted for taking the movement of the scanner into account while performing the scanning.                                                |
| 22    | The scanning system according to claim 1, wherein the system comprises at least two motion sensors and wherein the at least two motion sensors provide sensor fusion.                                                         |
| 23    | The scanning system according to claim 1, wherein the at least one motion sensor is the 3D user interface for remotely controlling the display, wherein the view on the display is determined by moving the handheld scanner. |
| 24    | The scanning system according to claim 23, wherein moving the handheld scanner to point down causes the view on the display to be a downward viewing angle.                                                                   |
| 25    | The scanning system according to claim 1, wherein the handheld device further comprises a user-interface element.                                                                                                             |
| 26    | The scanning system according to claim 25, wherein the user-interface element comprises a touch-sensitive element, a button, a scroll-wheel, or a proximity sensor.                                                           |
| 27    | The scanning system according to claim 25, wherein the user-interface element provides more than one user input.                                                                                                              |

| <b>Claim</b> | <b>Limitation</b>                                                                                                                                                                                                                                |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 28           | The scanning system according to claim 25, wherein the at least one motion sensor and/or the user-interface element are utilized in a workflow.                                                                                                  |
| 30           | The scanning system according to claim 1, wherein the at least one display is arranged on a cart.                                                                                                                                                |
| 31           | The scanning system according to claim 1, wherein the at least one display is divided into multiple regions.                                                                                                                                     |
| 32.0         | The system according to claim 19, wherein the handheld device further comprises a user interface element,                                                                                                                                        |
| 32.1         | wherein switching to remotely controlling the view puts the handheld device into a controller mode,                                                                                                                                              |
| 32.2         | wherein holding the user interface element and/or the actuator on the handheld device in conjunction with moving the handheld device determines the view of the 3D environment on the display in accordance with signals from the motion sensor. |
| 33.0         | A scanning system for scanning a 3D environment, the scanning system comprising:                                                                                                                                                                 |
| 33.1         | a handheld device including an optical scanner,                                                                                                                                                                                                  |
| 33.2         | wherein the 3D environment to be scanned is selected by pointing the optical scanner at the 3D environment; and                                                                                                                                  |
| 33.3         | at least one display remotely connected to the handheld device,                                                                                                                                                                                  |
| 33.4         | wherein the handheld device is adapted for performing at least one scanning action in a physical 3D environment, and                                                                                                                             |
| 33.5         | the at least one display is adapted for visually representing the physical 3D environment; and                                                                                                                                                   |
| 33.6         | wherein the handheld device includes at least one motion sensor for remotely controlling the display to adjust the view with which the 3D environment is represented on the display; and                                                         |

| <b>Claim</b> | <b>Limitation</b>                                                                                                                                                                                                                                                                                                                                                      |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 33.7         | wherein the at least one motion sensor is an accelerometer, gyro, or magnetometer.                                                                                                                                                                                                                                                                                     |
| 34           | The scanning system according to claim 33, wherein the handheld device further comprises at least two user interface elements.                                                                                                                                                                                                                                         |
| 40           | The scanning system according to claim 1, wherein the at least one display is a 3D display, whereby a 3D representation of the 3D environment is displayed on the 3D display; and wherein the handheld device is an intra-oral 3D scanner or an in-ear 3D scanner.                                                                                                     |
| 41           | The scanning system according to claim 40, wherein the 3D display is configured to project stereoscopic image pairs of the 3D representation.                                                                                                                                                                                                                          |
| 42           | The scanning system according to claim 40, wherein the 3D display is volumetric display configured to create a 3D effect of the 3D representation.                                                                                                                                                                                                                     |
| 43           | The system according to claim 19, wherein the at least one display is a 3D display, whereby a 3D representation of the 3D environment is displayed on the 3D display; and wherein the 3D display is configured to project stereoscopic image pairs of the 3D representation.                                                                                           |
| 44           | The scanning system according to claim 33, wherein the at least one display is a 3D display, whereby a 3D representation of the 3D environment is displayed on the 3D display; wherein the handheld device is an intra-oral 3D scanner or an in-ear 3D scanner; and wherein the 3D display is configured to project stereoscopic image pairs of the 3D representation. |

## **I. INTRODUCTION**

Petitioner Dental Imaging Technologies Corporation (“Petitioner” or “DITC”), in accordance with 35 U.S.C. §§ 311-19 and 37 C.F.R. § 42.100 *et seq.*, respectfully requests IPR of claims 1-3, 5-7, 9-11, 15, 18-28, 30-34, and 40-44 (the “Challenged Claims”) of U.S. Patent No. RE48,221 (“the RE’221”) (Ex. 1001), which according to USPTO records is assigned to 3Shape A/S (“3Shape”).

## **II. STATEMENT OF PRECISE RELIEF REQUESTED**

Petitioner respectfully requests that claims 1-3, 5-7, 9-11, 15, 18-28, 30-34, and 40-44 be cancelled based on the following grounds (collectively, “Grounds”):

**Ground 1:** Claims 1-3, 5-7, 9-11, 15, 18-21, 23-28, 30-34, and 40-44 are unpatentable under pre-AIA 35 U.S.C. § 103 as obvious in view of the combination of U.S. Patent Publication No. 2007/0171220 (“Kriveshko”) (Ex. 1106) in view of U.S. Patent Publication No. 2006/0020204 (“Serra”) (Ex. 1107) and U.S. Patent No. 8,914,245 (“Hopkins”) (Ex. 1108).

**Ground 2:** Claim 22 is unpatentable under pre-AIA 35 U.S.C. § 103 as obvious in view of the combination of Kriveshko in view of Serra, Hopkins, and U.S. Patent Publication No. 2005/0110751A1 (“Wilson”) (Ex. 1110).

**Ground 3:** Claim 30 is unpatentable under pre-AIA 35 U.S.C. § 103 as obvious in view of the combination of Kriveshko in view of Serra, Hopkins, and U.S. Patent Publication No. 2006/0142657 (“Quaid”) (Ex. 1111).

**Ground 4:** Claims 1-3, 5-7, 9-11, 15, 19-28, 30-34, and 40-44 are unpatentable under pre-AIA 35 U.S.C. § 103 as obvious in view of the combination of Kriveshko, Serra, and U.S. Patent Publication No. 2005/0212756 (“Marvit”) (Ex. 1109).

**Ground 5:** Claim 30 is unpatentable under pre-AIA 35 U.S.C. § 103 as obvious in view of the combination of Kriveshko, Serra, Marvit, and Quaid.

**Ground 6:** Claims 1, 5, 9, 18, 22-26, 28, 31, and 33 are anticipated by U.S. Patent Publication No. 2008/0071143 (“Gattani”) (Ex. 1105).

The '221 patent was filed on July 30, 2019, and claims priority to U.S. Provisional Patent Application No. 61/420,138, filed on December 6, 2010. For purposes of this IPR, December 6, 2010 is assumed to be the “effective date,” although Petitioner reserves the right to challenge that date in other proceedings.

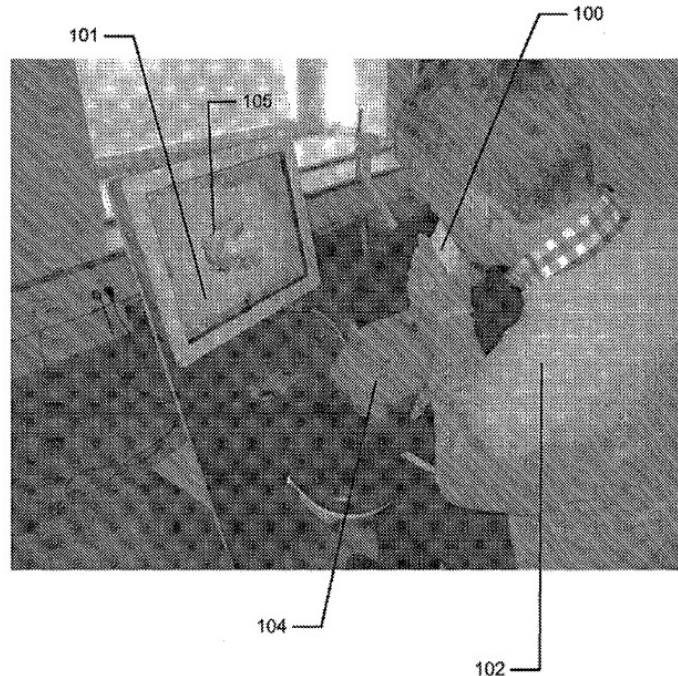
Kriveshko published on July 26, 2007. Ex. 1106, Cover. Serra published on January 26, 2006. Ex. 1107, Cover. Wilson published on May 26, 2005. Ex. 1110, Cover. Quaid published on June 29, 2006. Ex. 1111, Cover. Marvit published on September 29, 2005. Ex. 1109, Cover. Gattani published on March 20, 2008. Ex. 1105, Cover. Therefore, Kriveshko, Serra, Wilson, Quaid, Marvit, and Gattani are prior art under pre-AIA 35 U.S.C. § 102(b). Hopkins claims priority to Provisional Patent Application No. 61/161910, filed on March 20, 2009. Ex. 1108, Cover. Hopkins is prior art under pre-AIA 35 U.S.C. § 102(e).

**Grounds 1-3** establish invalidity based on Kriveshko, Serra, and Hopkins. To the extent the Board finds Hopkins is not entitled to its provisional date, **Grounds 4-5** establish invalidity of the same claims based on Kriveshko, Serra, and Marvit. **Ground 6** is an anticipation ground based on Gattani.

### **III. OVERVIEW OF RE'221 AND FILE HISTORY**

#### **A. The '221 Patent**

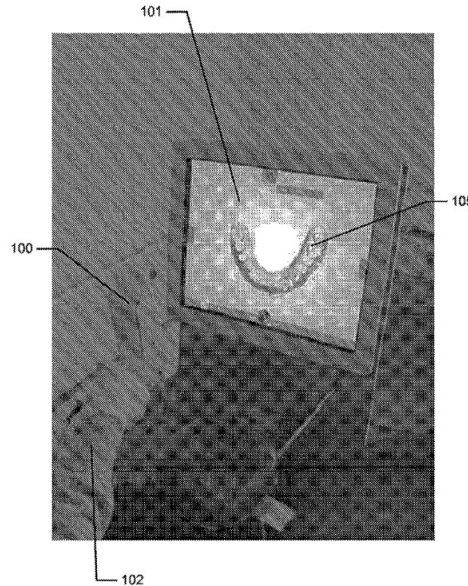
RE'221 relates to a handheld intraoral scanner device 100 and computer screen 101. EX 1001, FIG. 1, 11:24-36. Operator 102 uses the intraoral scanner 100 to record intraoral 3D geometry, and the user interface functionality to rotate, pan, and zoom displayed 3D model 105 of the scanned data on computer screen 101. *Id.*, 11:60-67. The user interface functionality in device 100 is provided by motion sensors, 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 as shown in Figure 1 below. *Id.*, 11:29-42.



An operator 102 uses intraoral scanner 100 to record intraoral 3D geometry and displays 3D model 105 of the scanned data on computer screen 101. *Id.*, FIG. 1; 11:26-36.

The handheld device 100 determines the view to be displayed. *Id.*, FIG. 2a, 2b; 11:37-49. The motion sensors 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.*, 11:37-42. The user interface functionality allows the user to rotate, pan, and zoom 3D model 105 on computer screen 101. *Id.* The 3D user interface functionality in device 100 is accomplished by motion sensors, including inside scanner 100, whose readings dictate the orientation of 3D model 105 of the teeth acquired by scanner 100 on computer screen 101. *Id.* For example, the user

interface functionality of Figure 2a below shows that pointing device 100 down provides a downward viewing angle of 3D model 105. *Id.*, 11:43-45.



RE'221 patent describes two types of motion sensors. *Id.*, 4:48-59. One type includes accelerometers, gyros, and magnetometers, which can sense rotations, lateral motion, and/or combined rotation/motion. *Id.*, 6:64-7:10. Another type uses infrared sensing. *Id.* The '221 patent does not exclude motion sensors that track position and orientation.

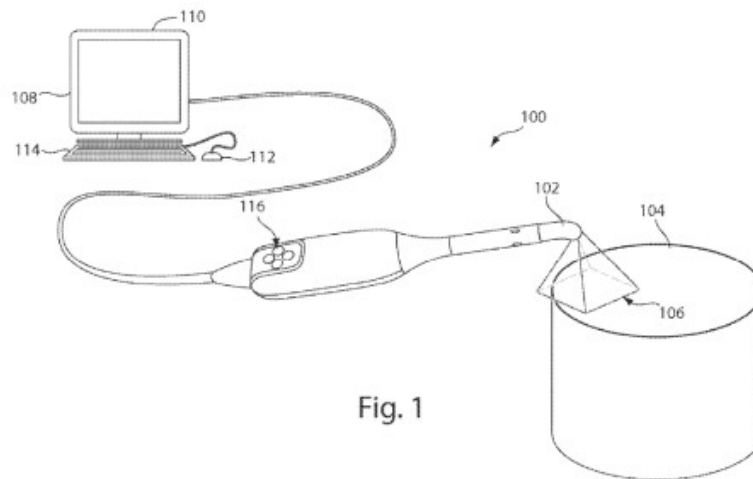
## **B. IPR2018-00197**

3Shape filed this reissue application (Ex. 1020) after the Board cancelled claims 1-19 of the '675 patent in IPR2018-00197. Ex. 1034, 25-59.

### **1. Anticipation**

The Board found that Kriveshko anticipates claims 1, 2, 9-11, and 18 of the '675 patent. Ex. 1034, 25-38. Kriveshko's Figure 1 shows system 100 including

scanning device 102 with input device 116:



Ex. 1106, ¶¶0051, 0072. Figure 1 shows handheld scanner 102 having input device 116 located on a scanner 102 remotely connected to display 110.

Figure 4 shows user controls 406 which can be manipulated by any of the user input devices. *Id.*, ¶¶0090-91. Kriveshko's Figure 4 shows that a subject and control may be displayed and that those controls include, for example, "(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)." *Id.*

The Board found in view of Figure 4, that the display 110 of Kriveshko visually represents a physical 3D environment. Ex. 1034, 32.

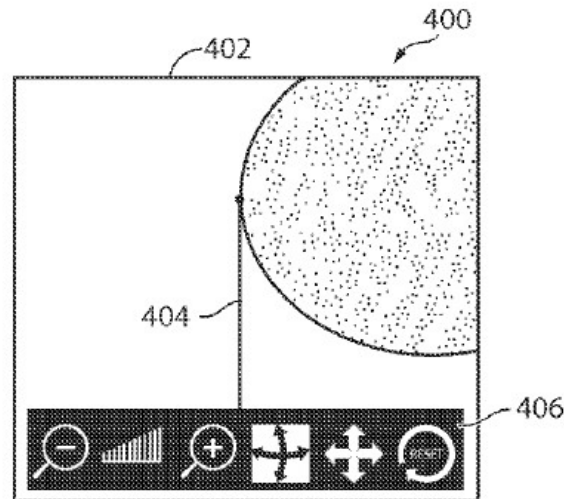


Fig. 4

## 2. Obviousness

The Board found that Kriveshko and Serra render claims 1-5, 8-11, and 14-19 of the '675 patent obvious. Ex. 1034, 39-59. 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. 1034, 39 (citing Ex. 1107, ¶0053). 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.* (citing Ex. 1107, ¶0054).

The Board found that Serra satisfied '675 patent claim 19's “at least one

motion sensor limitation” because “Serra’s ‘3D sensor’ senses motion through tracking position and orientation.” *Id.*, 54. The view is controlled by the 3D sensor of Serra because “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.*, 39, 51-59. The Board concluded that it would have been obvious to incorporate the 3D user interface of Serra into the optical handheld device of Kriveshko, “[g]iven Serra’s explicit acknowledgement of the ergonomic benefits of modifying a scanning device to include the ability to adjust display parameters.” *Id.*, 42. The Board further concluded that Kriveshko, Serra, and Brennan render claims 6, 7, 12, and 13 of the ’695 patent obvious. The Board recognized that it would have been obvious to incorporate gesture-based control in the combination of Kriveshko and Serra. Ex. 1034, 61.

### **C. Reissue Prosecution History**

3Shape then filed Reissue Application 16/526,281 seeking substantively the same claims as invalidated claims 1 and 19, adding only that the user interface is “3D”, the motion sensor “directly detects motion,” and “wherein the at least one motion sensor is an accelerometer, gyro, or magnetometer.” *Compare, e.g.*, ’675 patent claim 1 (Ex. 1032), *with* RE’221 claim 33 (Ex. 1001). 3Shape did not disclose the IPR certificate or notify the Patent Office that the subject matter of claims 1-19 had been invalidated. 3Shape also did not file a Rule 1.183 Petition. Lastly, 3Shape

did not “call to the attention” of the Examiner the outcome of the IPR, as required by Rule 1.178(b). *As a result, the Examiner’s reasons for allowance were identical to those given in the ’675 patent claims during original prosecution and refer only to the invalidated features. Compare* Ex. 1044, at 0112, *with* Ex. 1002, 0013.

3Shape should have been precluded from seeking claims that are not patentably distinct from claims that were canceled during an administrative trial under the doctrine of *res judicata*. MPEP §2190.

#### **IV. OVERVIEW OF ADDITIONAL PRIOR ART**

##### **A. Hopkins**

Hopkins is titled, “Ultrasound Probe with Accelerometer.” Ex. 1108. Hopkins explains, “[t]he accelerometer (32) is configured to detect the movement of the probe (10) in from two to three axes when the probe (10) is rotated or moved in a linear direction to allow the probe (10) to detect images from more than one plane.” *Id.* at Abstract. Hopkins explains that the use of a 3D accelerometer allows for new and improved image capture techniques to be implemented. *Id.*, 3:56-63, 4:53-57; 4:66-5:5; 5:50-6:39. For example, an “abdominal probe scan of the bladder the prostate is usually scanned in the anteroposterior and sagittal planes and as described before for the abdominal probe, the 90° turn can be automatically detected using the MEMS32 accelerometer sensor and the image automatically saved.” *Id.*, 6:18-23.

Hopkins has a provisional filing date of March 20, 2009, and Petitioner is

entitled to rely on that date because claim 1 and the relied upon disclosures have written description support in the provisional. *Dynamic Drinkware, LLC, v. National Graphics, Inc.*, 800 F.3d 1375 (Fed. Cir. 2015).

| <b>Hopkins, Claim 1</b>                                                                                                                                                                                                                                 | <b>Provisional Support, Ex. 1112</b>               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| An ultrasonic probe which scans a subject with beams of sound waves comprising:                                                                                                                                                                         | Claim 1                                            |
| a transducer to produce sound waves;                                                                                                                                                                                                                    | Claim 1                                            |
| a means to steer the sound waves in the direction of a subject;                                                                                                                                                                                         | Claim 1                                            |
| a printed circuit board with a non-volatile memory;                                                                                                                                                                                                     | Claim 1                                            |
| a micro electrico-mechanical accelerometer integrated circuit;                                                                                                                                                                                          | Claim 1                                            |
| an outlet connector; and                                                                                                                                                                                                                                | Claim 1                                            |
| a logic device that is electrically coupled to the accelerometer and transducer,                                                                                                                                                                        | Attachment A, pgs. 1-4.                            |
| wherein said micro electrico-mechanical accelerometer integrated circuit detects the movement of the probe in two to three axes when the probe is rotated or moved in a linear direction to allow the probe to detect images from more than one plane,  | Claim 1                                            |
| wherein the logic device instructs the transducer to produce the sound waves for scanning the subject and saves a first image from a first position based on the movement detection of the micro electrico-mechanical accelerometer integrated circuit, | Attachment A, pgs. 1, 5-7. Claims 1, 4, 9, and 10. |
| wherein the logic determines that the ultrasonic probe is rotated to a second predetermined position relative to the first position based on the movement                                                                                               | Attachment A, pgs. 1, 5-7. Claims 1, 4, 9, and 10. |

|                                                                                                                                                                                                                                                                                                                                                          |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <p>detection of the micro electrico-mechanical accelerometer integrated circuit, and responsive to determining that the ultrasonic probe is rotated the second predetermined position, the logic device instruct the transducer to produce the sound waves for scanning the subject and saves a second image from the second predetermined position.</p> |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

| <b>Hopkins, Ex. 1108</b> | <b>Provisional Support, Ex. 1112</b> |
|--------------------------|--------------------------------------|
| Title                    | Title                                |
| Abstract                 | Claims 1, 4, 9, and 10.              |
| 1:25-55                  | [0003]-[0006]                        |
| 1:49-50                  | [0005]-[0006]                        |
| 3:56-61                  | Attachment A, pp. 1, 5-7.            |
| 4:52-57                  | Attachment A, pp. 1, 5-7.            |
| FIG. 4                   | Attachment A, pp. 4                  |
| FIG. 6                   | Attachment A, pp. 5                  |

## **B. Wilson**

Wilson discloses a hand-held device that uses multiple sensors and sensor fusion techniques to determine the orientation of the handheld device. Ex. 1110, ¶¶0046 (handheld), 0076 (“sensor fusion”).

## **C. Quaid**

Quaid discloses placing displays and other hardware on carts, and the benefits of having a medical device on a cart. Ex. 1111, ¶¶0093 (display on cart), 0096 (benefits of carts in the medical context).

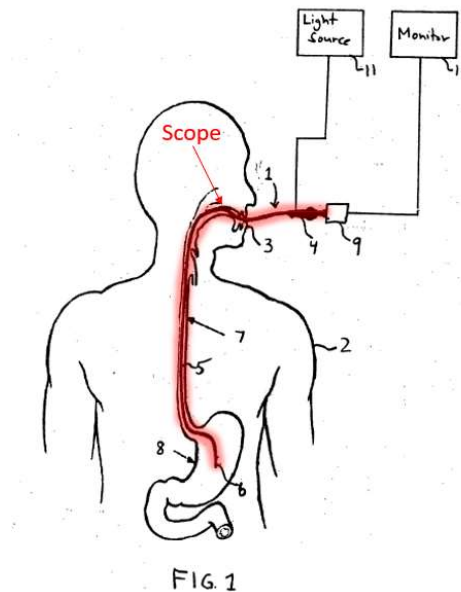
**D. Marvit**

Marvit, titled “Gesture Based Navigation of a Handheld User Interface,” discloses a handheld device that uses accelerometers to measure movement for the purpose of device control and gesture recognition. Ex. 1109, Marvit, Abstract, ¶¶0042, 0043. Marvit explains that the described “handheld device” is application agnostic. *Id.*, ¶0034. The handheld device can include a display, an input, and a motion detector to provide “an interface for a user to communicate input to the device.” *Id.* The motion detector can track movement of the handheld device and that movement can “be used as a form of input to perform certain functions.” *Id.*, ¶¶0038-0040. For example, “input movement may be in the form of translation and/or gestures” of the handheld device and “translation-based input...may change the display during the movement.” *Id.*, ¶0040; *see also* ¶¶0122, 0125, 0167.

Marvit discloses, “there may be value in having the position of a virtual display, or the information displayed at display 12 of handheld device 10, linked to the position of the device,” and further describes manipulating the display based on the position of the handheld device 10. *Id.*, ¶¶0063-0066. For example, Marvit discloses navigating across a virtual desktop by movement (*e.g.*, gestures) of the handheld device for panning, zooming, and rotating a display. *Id.*, ¶¶0080-0086, 0165-0167.

**E. Gattani**

Gattani discloses “an endoscopic surgical navigation system” for scanning a human body. Ex. 1105, Abstract. Gattani uses motion sensors such as electromagnetic sensors or optical sensors on the distal tip of a scope inserted inside a patient to capture position/orientation. *Id.* at ¶¶0047, 0058, 0064, 0073, 0088, 0094, 0099-111.



Ex. 1105, FIG. 1 (annotated).

Gattani uses the position/orientation information to determine the view on a display: “At 502 the VNS 30 determines the current position and orientation of the scope’s distal tip. At 503 the VNS 30 generates real-time 3-D (volumetric) scan images, based on the intra-operative scan data and the current position and orientation of the scope’s distal tip. The VNS 30 then co-registers the real-time 3-D scan images with the live video from the endoscopic video camera at 504. The co-

registered scan images and live video are then sent to a monitor . . . for display. . . .”

*Id.*, ¶0064.

## V. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art (“POSA”) as of the effective filing date of RE’221 would have at least bachelor’s degree in Computer Engineering, Computer Science, Computer Vision, or an equivalent field, as well as at one or two years of design experience, or alternatively, at least five years of comparable industry experience. In particular, a POSA would have had experience with and knowledge of 3D imaging systems and 3D modeling techniques. Ex. 1003, ¶30.

## VI. CLAIM CONSTRUCTION

None of the challenged claims have been construed in any civil action. Petitioner submits that, for purposes of this proceeding, all claim terms should be given their ordinary and customary meaning.

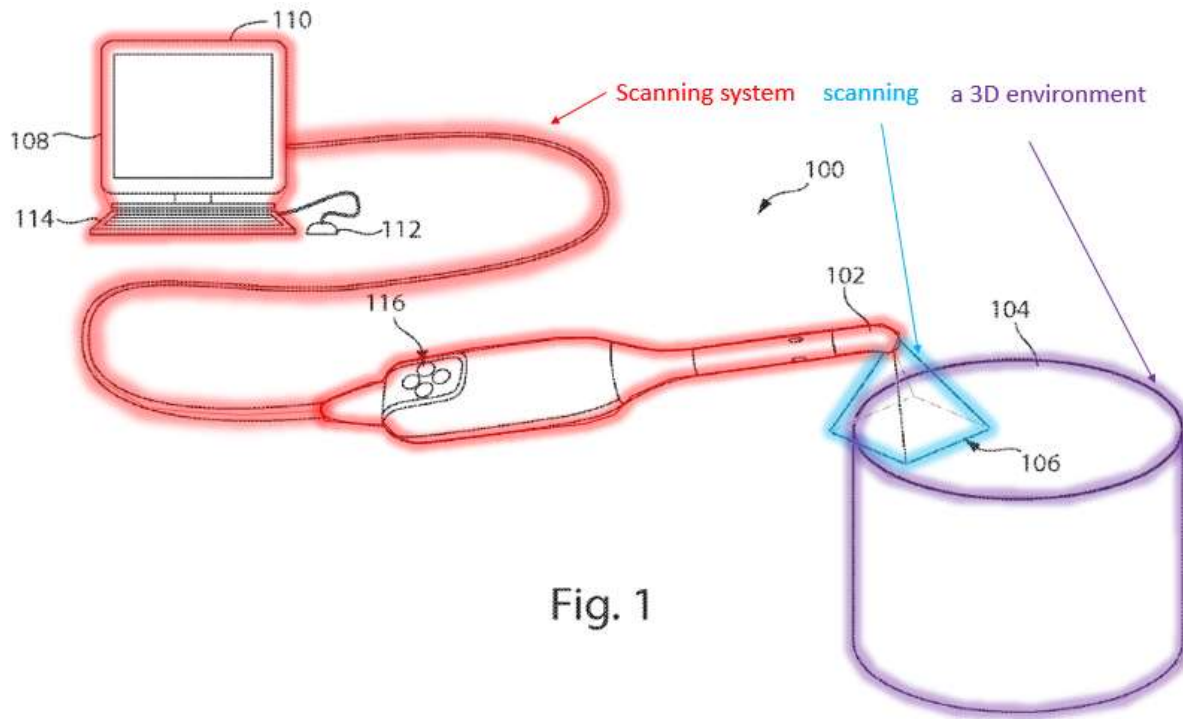
## VII. GROUND 1: CLAIMS 1-3, 5-7, 9-11, 15, 18-21, 23-28, 31-34, AND 40-44 ARE OBVIOUS OVER KRIVESHKO, SERRA, AND HOPKINS

### A. Claim 1

**[1.0] A scanning system for scanning a 3D environment, the scanning system comprising:**

Kriveshko discloses the features of the preamble. Ex. 1003, ¶¶166-69. *The Board previously found this limitation disclosed by Kriveshko. See Ex. 1034, 28.* Kriveshko discloses a scanning system for scanning a 3D environment: “In general, the system 100 may include a scanner 102 that captures images of a subject 104

within an image plane 106 . . .” Ex. 1106, ¶0051. Figure 1 of Kriveshko illustrates the scanning system 100 that scans 106 the 3D environment 104:



Kriveshko explains that, “[i]n general, the system 100 may include a scanner 102 that captures images of a subject 104 within an image plane 106, and forwards the images to a computer 108, which may include a display 110 and one or more user input devices such as a mouse 112 or a keyboard 114.” *Id.*, ¶0051. Kriveshko further explains that, “in a dental imaging application, the subject 104 may include a tooth, a quadrant of teeth, or a full collection of teeth. . .” *Id.*, ¶0054. A POSA would have understood the subject 104 to correspond to the claimed 3D environment. Ex. 1003, ¶168; *see also, e.g.*, Ex. 1106, ¶¶0002, 0049, 0052, 0058, 0060; FIGS. 1, 2, 4-9.

**[1.1] a handheld device including an optical scanner**

Kriveshko discloses these limitations of claim 1. Ex. 1003, ¶¶170-72. *The Board previously found this limitation disclosed by Kriveshko. See Ex. 1034, 29-30.* Kriveshko describes the scanner 102 as “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.” Ex. 1106, ¶0052.

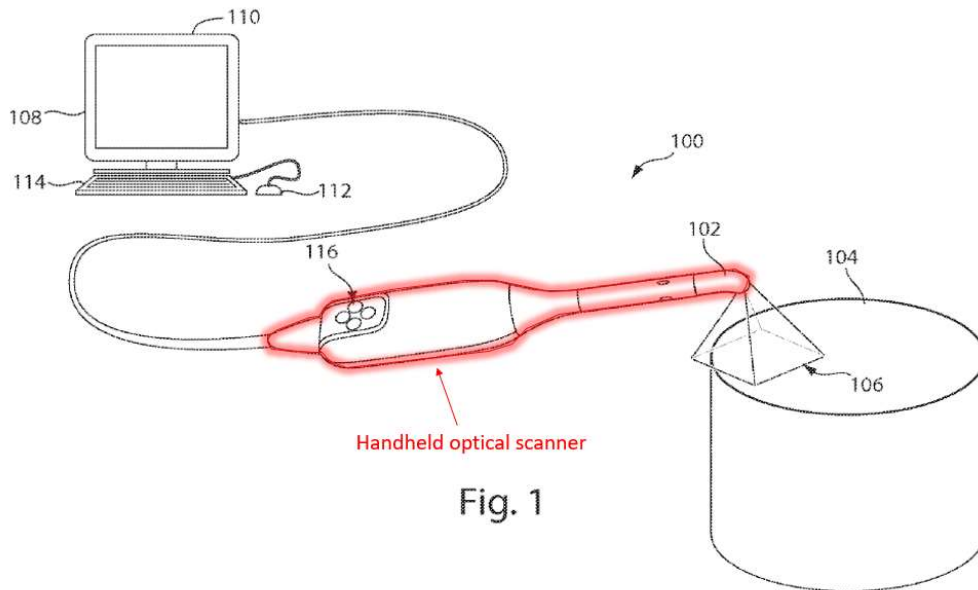


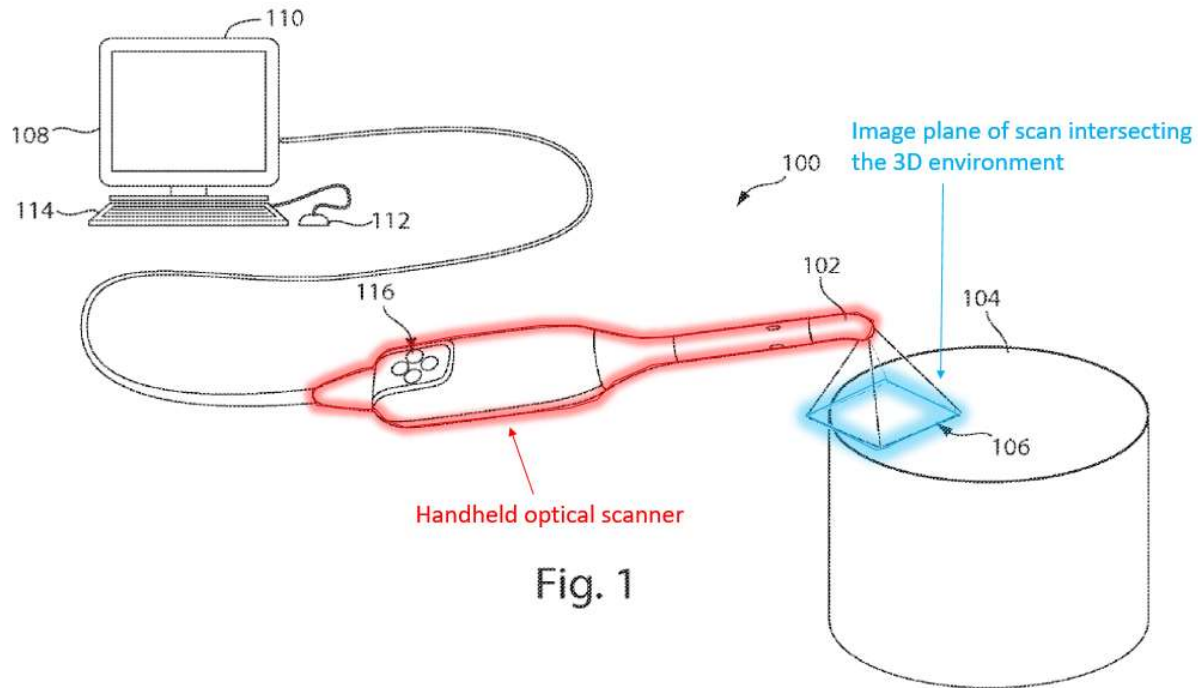
FIG. 1 (annotated). Kriveshko discloses that the scanner 102 includes a camera for scanning and apertures positioned along an optical axis; there scanner 102 is thus an optical scanner. Ex. 1106, ¶0052.

**[1.2] 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**

Kriveshko discloses these limitations of claim 1. Ex. 1003, ¶¶173-75. *The*

***Board previously found these limitations disclosed by Kriveshko.*** Ex. 1034, 29-30.

Kriveshko describes that scanner 102 captures subject 104 within an image plane 106 and forwards the images to a computer 108. Ex. 1106, ¶0051. Figure 1 below illustrates the scanner 102 pointed at the subject 104 for the purpose of scanning:



Ex. 1106, FIG. 1 (annotated).

A POSA would understand that the scanner 102 of Kriveshko is remotely connected to the display of the computer 108. Ex. 1003, ¶174. “Communications between the computer 108 and the scanner 102 may use any suitable communications link including, for example, a wired connection or a wireless connection based upon, for example, IEEE 802.11 (also known as wireless Ethernet), BlueTooth, or any other suitable wireless standard using, e.g., a radio

frequency, infrared, or other wireless communication medium.” Ex. 1106, Kriveshko, ¶0057.

**[1.3] wherein the handheld device is adapted for performing at least one scanning action in a physical 3D environment**

Kriveshko discloses these limitations of claim 1. Ex. 1003, ¶¶176-78. *The Board previously found these limitations disclosed by Kriveshko.* Ex. 1034, 30-31. Capturing images is a scanning action. Ex. 1003, ¶178. As discussed, Kriveshko captures images in a physical 3D environment. Ex. 1106, ¶0051. Kriveshko is therefore adapted for performing various scanning actions in a 3D environment. *See, e.g.,* Ex. 1106, ¶¶0052; 0060-76; 0077-0089.

**[1.4] the at least one display is adapted for visually representing the physical 3D environment**

Kriveshko discloses these limitations of claim 1. Ex. 1003, ¶179. The Board previously found these limitations disclosed by Kriveshko. Ex. 1034, 31-32. The display 110 of Kriveshko displays a video image of the 3D environment (subject 104) and can “superimpose” a 3D model of the same over the displayed image. Ex. 1106, ¶0076; *see also id.*, ¶¶0060, 0080-82, 0100-01. This is depicted in Figure 1 below.

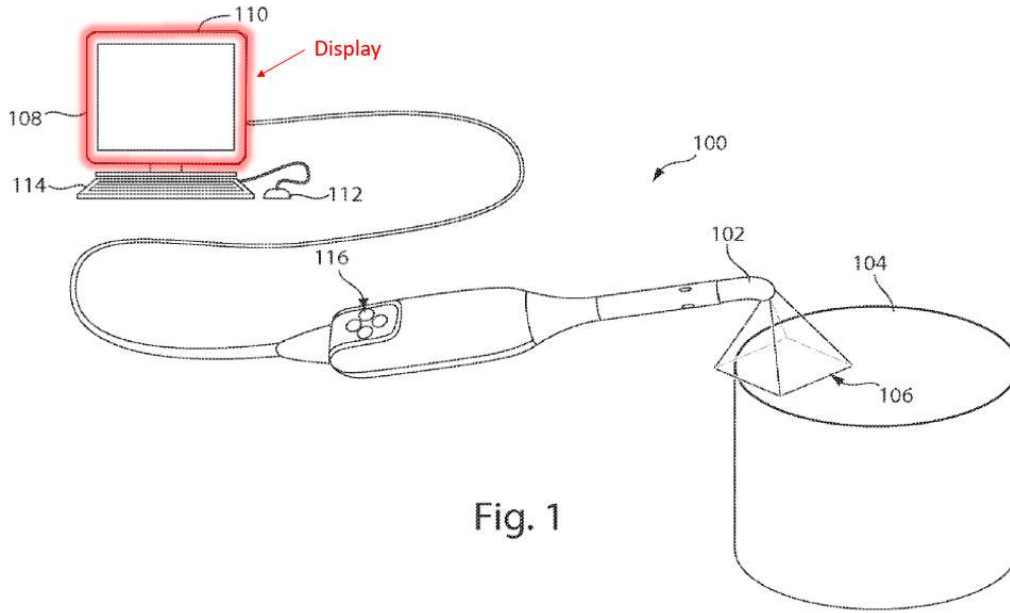


Fig. 1

*Id.*, FIG. 1. Figures 4-9 illustrate various visual representations of the subject 104 (3D environment) that are presented on the display 110. *Id.*, ¶¶0041-45, 90.

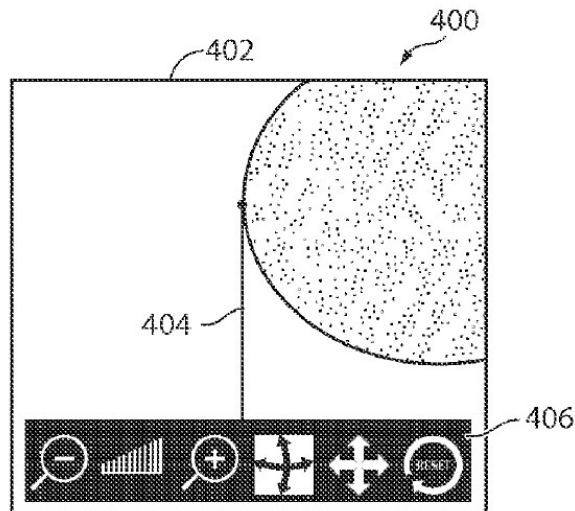


Fig. 4

*Id.*, FIG.4; *see also id.*, ¶0090 (“FIG. 4 depicts a view of a user interface for an image capture system. The user interface 400 may include a window 402 rendered on a

monitor such as the display 110 of FIG. 1[ ]”). The display is accordingly adapted for visually representing the physical 3D environment.

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

Kriveshko in combination with Serra satisfies these limitations of claim 1. Ex. 1003, ¶¶180-89. First, the Board previously a nearly identical limitation disclosed by Kriveshko. Ex. 1034, 32-33. The Board found 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” was met by Kriveshko’s image/view manipulation functions. *Id.* Thus, the only amendment to this claim made by 3Shape during reissue prosecution was to change “user interface” to “3D user interface.” *This limitation, however, does not impart patentability because the Board already determined that it would have been obvious to combine the teachings of Serra with Kriveshko to satisfy a substantively identical limitation. See id.*, 40-42.

The Board previously found that it would have been obvious to incorporate the 3D user interface of Serra into the optical handheld device of Kriveshko. *Id.* Serra discloses a handheld device that includes a 3D user interface for remotely controlling the display to adjust the view with which the 3D environment is represented on the display. In particular, Serra discloses a handheld 3D scanning

device that can control display parameters to interactively manipulate 3D data in an interactive visualization mode. Ex. 1107, ¶¶0053-0054. Serra discloses that “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.*, ¶¶0054, 0074. Serra further discloses, “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.* Thus, Serra teaches a single device with two alternative modes of scanning, and 3D data set interactive visualization actuated by one or more buttons. *Id.* Serra also teaches ergonomic advantages from permitting a scanning process and an examination process with the same device because a user is always holding the device. Ex. 1006, ¶53.

According to the Board, the motivation to modify Kriveshko in such a manner is provided by Serra’s “explicit acknowledgement of the ergonomic benefits of modifying a scanning device to include the ability to adjust display parameters.” *See id.*, 42. Thus, to the extent Kriveshko does not disclose a “3D user interface,” Serra does and its combination with Kriveshko has already been determined to be obvious.

Petitioner’s expert agrees it would have been obvious to a POSA to modify the user interface in Kriveshko to meet the 3D user interface limitation of this claim. Ex. 1003, ¶¶186-89. A POSA would improve the user interface of Kriveshko by

implementing Serra's controls (button switch/3D sensor) and processes for interactively manipulating 3D data presented on a display using a scanning device. Ex. 1003, ¶187. This is especially true because Serra explains that "[w]hat is further needed is an efficient and ergonomic interface that can allow a user to easily interact with ultrasound scan data as well as preoperative imaging and planning data in three dimensions." Ex. 1107, ¶0011; Ex. 1003, ¶187. The 3D user interface of the combination is thus the 3D motion sensor of Serra. Ex. 1003, ¶188.

**[1.6] wherein the handheld device comprises at least one motion sensor**

Kriveshko in combination with Serra satisfies these limitations of claim 1. Ex. 1003, ¶¶190-91. *The Board previously found that Serra satisfied claims 4, 5, 8, and 19 of the '675 patent, requiring a "motion sensor," because "Serra's '3D sensor' senses motion through tracking position and orientation."* See Ex. 1034, 54-55. Serra thus discloses a "3D sensor" that detects motion. Serra teaches rotating the 3D data presented on the display using tracking information corresponding to the movement of the scanning device. Ex. 1107, ¶54; Ex. 1003, ¶190. A POSA would have understood that Serra's 3D sensor is a motion sensor given that Serra's 3D sensor is used to determine the three-dimensional movement of the scanning device. Ex. 1003, ¶¶190-91. It would have been obvious to incorporate Serra's motion sensor into the scanner 102 of Kriveshko for the reasons discussed above. Ex. 1034, 42; Ex. 1003, ¶¶190-91.

**[1.7] wherein the at least one motion sensor is a sensor that  
directly detects motion**

Kriveshko in combination with Serra and Hopkins satisfies these limitations of claim 1. Ex. 1003, ¶¶192-97. The “directly detects motion” limitation was added during reissue, and does not appear anywhere in the specification. Nonetheless, Serra’s motion sensor directly detects motion via tracking position and orientation. Ex. 1003, ¶192. To the extent Serra does not disclose “directly detecting motion,” it would have obvious to incorporate such a sensor based on Serra’s teaching and the knowledge of the POSA at the time of the invention, including the teaching of Hopkins.

In particular, it would have been obvious to a POSA to use an accelerometer as the 3D sensor in Serra. Ex. 1003, ¶197. First, Serra specifically calls for “3D sensor 720 which is attached to ultrasound probe 715.” Ex. 1107, ¶0074. Second, the application of accelerometers for 3D motion sensing was well known. For example, Hopkins describes an ultrasonic probe that scans a subject with beams of high frequency sound in order to produce 3D images on a display. Ex. 1108, 1:25-55. Ferreira describes a “Tele-3D handheld 3D scanning system” from 2002 which uses “gyroscopes and accelerometers” to determine position and orientation. ¶3 C2, Ex. 1023 at “3D Information Integration.” *See also*, Ex. 1008 (“Wiimote”), Ex. 1021

(describing handheld device applications of motion sensing in 2002). Based on the known use and purpose of accelerometers in similar medical devices, a POSA would have had a reasonable expectation of success when choosing to implement an accelerometer as the 3D motion sensor in Serra. Ex. 1003, ¶196. This limitation is accordingly obvious based on the combination of Kriveshko and Serra based on the knowledge of the person of ordinary skill in the art.

However, to the extent that it is argued that Serra's 3D sensor is not a sensor that directly detects motion because of an alleged distinction between detecting position and sensing motion (or based on some other supposed distinction), Hopkins discloses a sensor that directly detects motion such that its combination with Kriveshko and Serra satisfies the limitations of claim 1.

As discussed *supra*, a POSA would understand that an accelerometer was a known motion sensor that directly detects motion. Ex. 1003, ¶194. Hopkins is an example. Hopkins is titled, "Ultrasound Probe with Accelerometer." Ex. 1108. Hopkins describes an ultrasonic probe that scans a subject with beams of high frequency sound in order to produce 3D images on a display. Ex. 1108, 1:25-55. The probe uses a three-axis accelerometer, for example a low cost analog device such as the LIS3LV02DL accelerometer made by STMicroelectronics. *Id.* Hopkins explains "[t]he accelerometer (32) is configured to detect the movement of the probe (10) in [] two to three axes when the probe (10) is rotated or moved in a linear direction to

allow the probe (10) to detect images from more than one plane.” Ex. 1108, Abstract.

Figure 4 of Hopkins illustrates the attachment of the accelerometer 32 to the ultrasound probe.

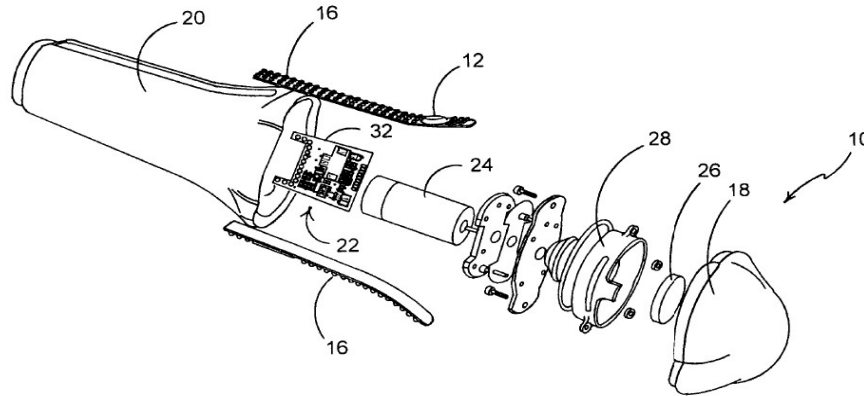


FIGURE 4

Ex. 1108, FIG. 4.

It would have been obvious to a POSA to use the accelerometer of Hopkins as the 3D sensor in Serra for reasons already provided. Ex. 1003, ¶197. This limitation is accordingly obvious in view of Kriveshko, Serra, and Hopkins.

## B. Claim 2

**The scanning system according to claim 1, wherein the handheld device is adapted to record the 3D geometry of the 3D environment.**

Kriveshko satisfies these limitations of claim 2. Ex. 1003, ¶¶198-99. Scanner 102 of Kriveshko can “capture approximately 1,500 points per image set in real time using the techniques described herein, and store an aggregated point cloud of over one million points.” Ex. 1106, Kriveshko, ¶0056, 0094 (“stored three-

dimensional model”), 0095, 0098. A POSA understands that both three-dimensional points and three-dimensional models describe 3D geometry of a 3D environment. Ex. 1003, ¶199.

**C. Claim 3**

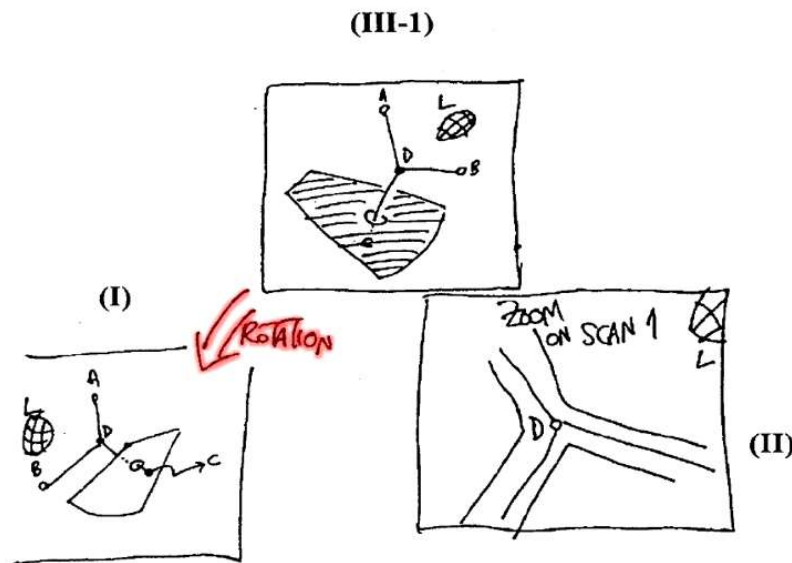
**The scanning system according to claim 1, wherein the handheld device includes an actuator for manually switching between performing the at least one scanning action and remotely controlling the view.**

Kriveshko in combination with Serra satisfies these limitations of claim 3. Ex. 1003, ¶¶200-04. Serra discloses, “an ultrasound hand-held probe can operate in two modes of interaction, one in scanning mode (*with button switch ON, for example*) as in most ultrasound scanners, and the other in interactive mode (*with the button switch in the alternate position, here OFF*). *The user can scan the patient by pressing the ON button on the ultrasound probe and moving the probe over the region of interest.*” Ex. 1107, Serra, ¶0054 (emphasis added). As discussed, when the button/actuator is on, the scanning action can occur; and when the button actuator is off, the view can be remotely controlled. As discussed previously, it would have been obvious to modify Kriveshko to include the claimed button/actuator of Serra to create an efficient and ergonomic interface.

**D. Claim 5**

**The scanning system according to claim 1, wherein 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.**

Kriveshko in combination with Serra satisfies these limitations of claim 5. Ex. 1003, ¶¶205-08. Serra discloses, “*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).*” Ex. 1107, Serra, ¶0054. View III-1 to I in Figure 5 below illustrates the view rotation of Serra based on the 3D sensor attached to the scanning device. Ex. 1107, ¶¶0054, 0058.



Ex. 1107, FIG. 5 (annotated).

It would have been obvious to improve Kriveshko with the teachings of Serra, as discussed previously, and further with the rotation capabilities of Serra in view of

Serra's disclosure that such rotation "reveal[s] detail not easily appreciated from the original scanning viewpoint," and "greatly enhanc[es] examination of a patient." Ex. 1003, ¶208.

**E. Claim 6**

**The scanning system according to claim 1, wherein functionality of the 3D user interface comprises a use of gestures.**

Kriveshko in combination with Serra and Hopkins discloses these limitations of claim 6. Ex. 1003, ¶¶209-12. As discussed previously, the user interface of Kriveshko is improved by Serra to have a scanning mode and an interactive mode where the user can freely manipulate the view on a display using the motion of the handheld device (probe).

Hopkins further discloses use of gestures in connection with manipulation of the 3D user interface. Ex. 1108, 4:52-57. The '221 patent provides examples of gestures such as taps, waving, or shaking of the handheld device. Ex. 1001, 7:10-15. One of Hopkin's gestures involves 90-degree rotation of the probe. Ex. 1108, 3:56-61. "The image shown in FIG. 6 are two scans taken at right angles to each other of the bladder of a person (Transverse and Sagittal planes). By using both images a more accurate valuation of the bladder volume can be made. By using the MEMS accelerometer 32 sensor the 90° turn in the probe 10 can be detected and the image automatically switched to the other window . . . ." *Id.*

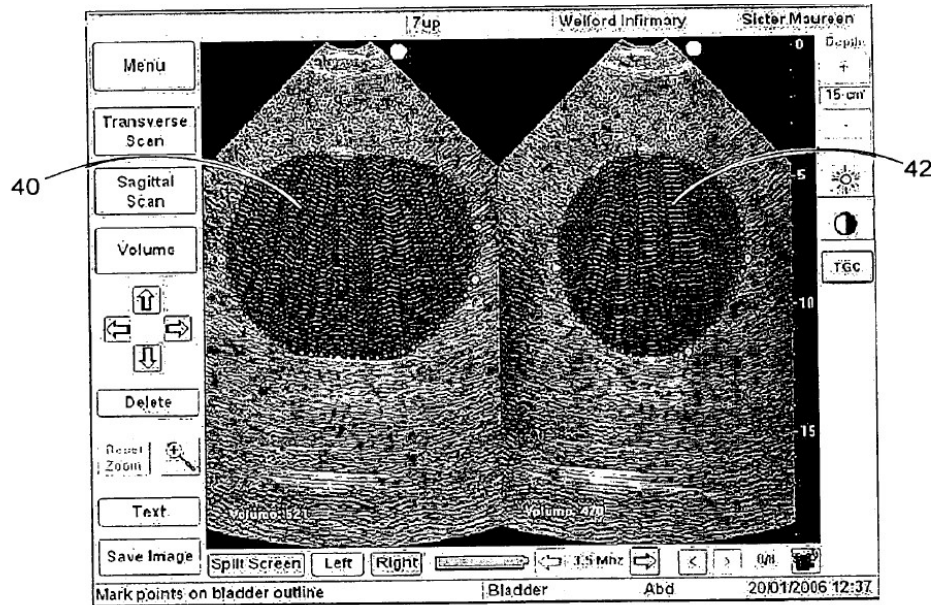


FIGURE 6

A POSA would have found it obvious at the time of the invention to improve the scanning mode capabilities of the combination of Kriveshko and Serra with the gestures of Hopkins to improve visual evaluation of objects from different perspectives. Ex. 1003, ¶¶211-12. Implementing gesture functionality would require incorporation of a simple software module that manipulates the display based on received predetermined sensor and image data. *Id.* A POSA would have had a reasonable expectation of success incorporating the gesture control of Hopkins because it was well within a POSA's skill to use detected motion to trigger computer functionality. *Id.*

**F. Claim 7**

**The scanning system according to claim 6, wherein the gestures are detected by the at least one motion sensor.**

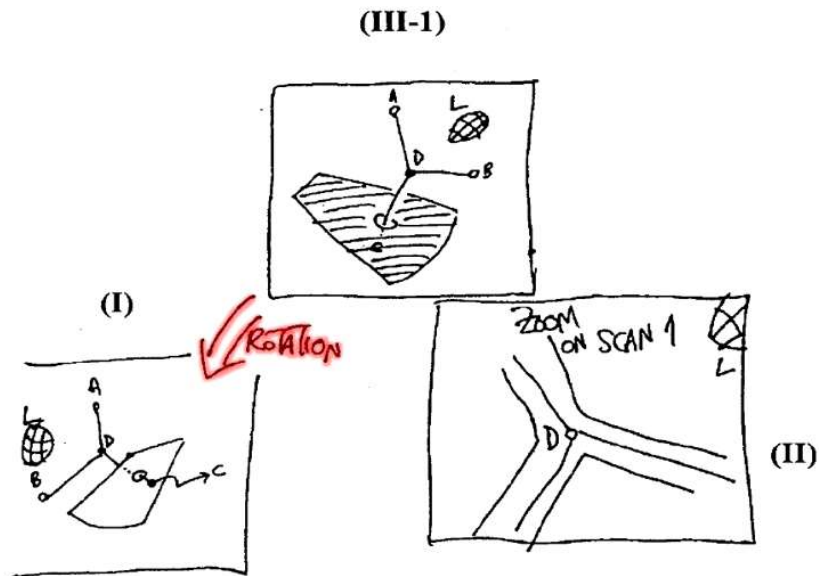
Kriveshko in combination with Serra and Hopkins satisfies these limitations of claim 7. Ex. 1003, ¶¶214-15. As discussed in connection with claim 6 of this Ground, it would have been obvious to incorporate Hopkins' gesture control into the Kriveshko/Serra combination. In Hopkins, the gestures are detected using an accelerometer. *Id.*, 4:52-57 (“The sagittal scan can also be obtained automatically such that when the operator rotates the probe 10 by 90°. The MEMS 32 accelerometer sensor automatically senses when the probe 10 is rotated 90° to automatically display the sagittal plane on the display either individually or side by side with the transverse scan[.]”). Thus, it would have been further obvious to detect the gestures using a motion sensor because Hopkins already does so and because it would not have been economical or necessary to include separate motion sensors for detecting gestures. *Id.*, ¶215.

**G. Claim 9**

**The scanning system according to claim 1, wherein the handheld device is adapted to change a viewing angle with which the 3D environment is represented on the at least one display.**

Kriveshko in combination with Serra satisfies these claim 9 limitations. Ex. 1003, ¶¶216-19. As discussed previously, Serra discloses using a scanning device to rotate an entire virtual scene. Ex. 1107, ¶¶0051-54. Rotating the entire virtual scene

is changing the viewing angle.



Ex. 1107, FIG. 5 (illustrating rotation of the 3D scene) (annotated).

To the extent that the combination of Kriveshko and Serra does not disclose rotating the 3D environment *on the display*, it would have been obvious to modify the combination to arrive at the limitations of claim 9 for the same reasons discussed in connection with claims 1 and 5 of this Ground. Ex. 1003, ¶219.

#### H. Claim 10

**The scanning system according to claim 1, wherein the handheld device is adapted to change a magnification factor with which the 3D environment is represented on the at least one display.**

Kriveshko in combination with Serra satisfies these limitations of claim 10. Ex. 1003, ¶¶220-24. Kriveshko discloses using controls on scanning device 102 to control magnification of the display. “The computer 108 may generate control signals to the scanner 102 which, in addition to image acquisition commands, may

include conventional camera controls such as focus or zoom.” Ex. 1106, ¶0057. A POSA would understand “zoom” to be a method for “controlling operation of the image capture system . . . .” Ex. 1106, ¶0091. This understanding is reinforced by the use of the -/+ magnifying glasses in Figure 4 reproduced below:

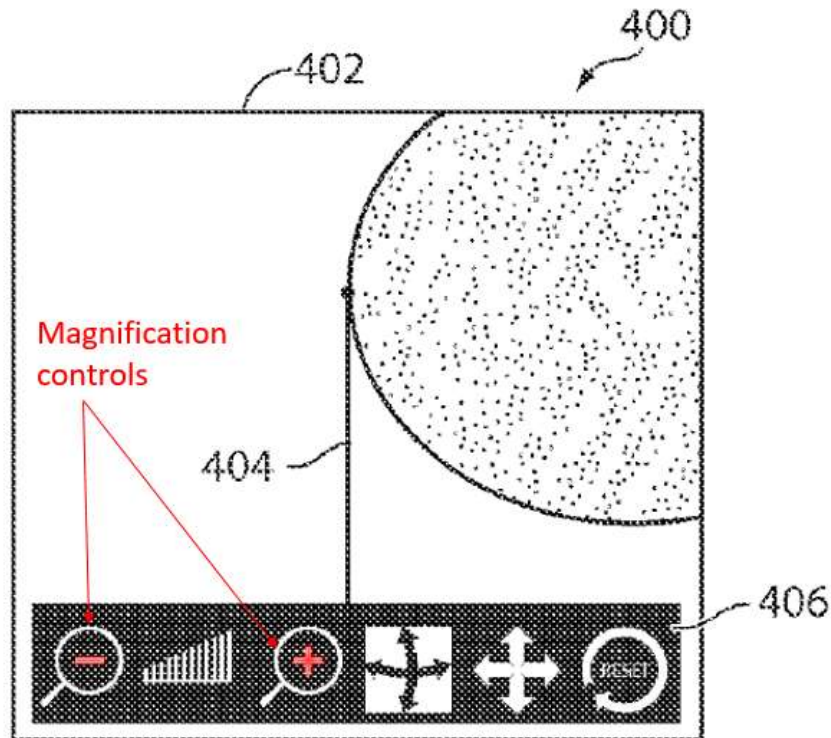
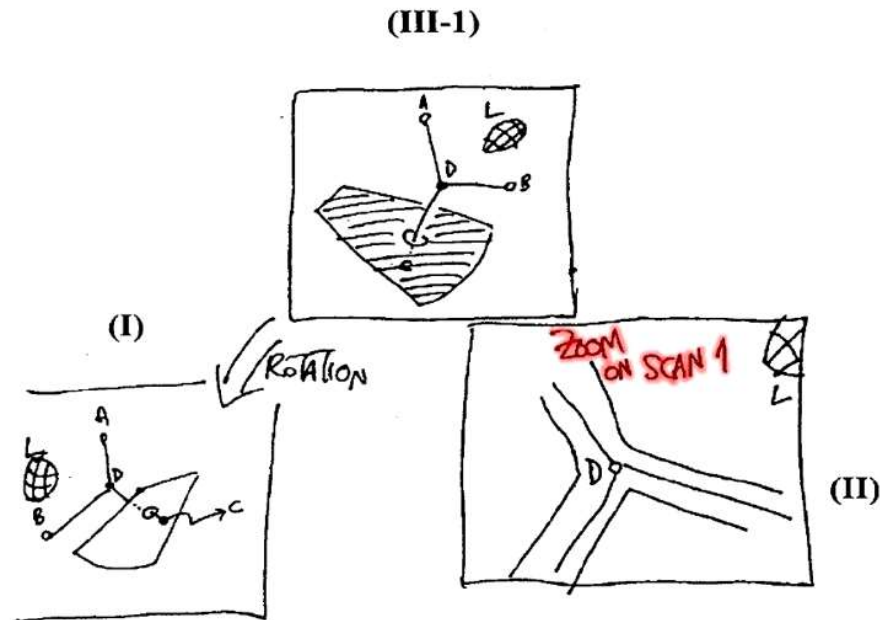


Fig. 4

*Id.*, FIG. 4 (annotated).

To the extent it is argued that Kriveshko does not disclose using the scanner 102 to change the magnification on the display, Serra discloses “[o]nce 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 . . . .” Ex. 1107, ¶0057. The zoom operation of Serra is illustrated by contrast between III-1 and II in Figure 5.



*Id.*, FIG. 5 (annotated). It would have been obvious to combine Kriveshko and Serra to achieve the limitations of claim 10 in view of Serra’s disclosure that zoom can “reveal detail not easily appreciated from the original scanning viewpoint,” and “greatly enhance examination of a patient.” *Id.*, ¶0058; Ex. 1003, ¶224.

Magnification is a well-known and frequently implemented image processing techniques and, for reason, a POSA would have had a reasonable expectation of success implementing the claimed magnification in the combination. Ex. 1003, ¶224.

**I. Claim 11**

**The scanning system according to claim 1, wherein the handheld device is an intra-oral 3D scanner.**

Kriveshko satisfies these limitations of claim 11. Ex. 1003, ¶¶225-26. Kriveshko's implementation of the scanner 102 to scan teeth inside a mouth means that the scanner 102 is an intraoral scanner. Ex. 1106, ¶0103.

**J. Claim 15**

**The scanning system according to claim 1, wherein the at least one display is defined as a first display; where the system further comprises a second display**

Kriveshko in combination with Serra satisfies these limitations of claim 15. Ex. 1003, ¶¶227-33. Serra discloses the use of two displays: a first display of a two dimensional image, and second display of a three-dimensional rendering. Ex. 1107, ¶¶0074-76. Figure 8 illustrates the dual display setup of Serra:

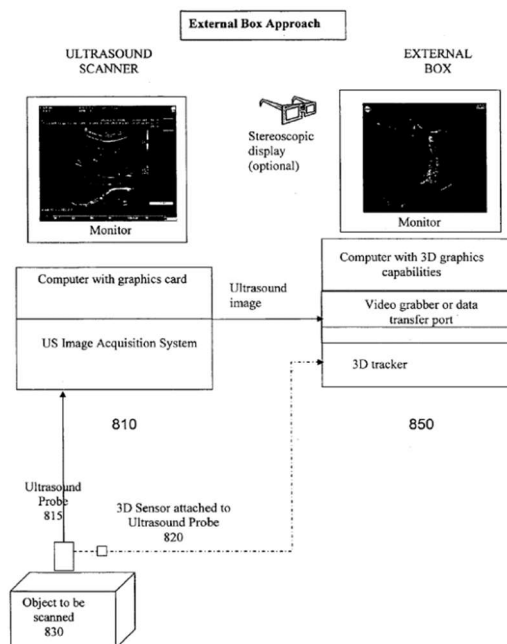


FIG. 8

The second display, or “External Box,” is a 3D display, described as “a box 850 external to the ultra sound scanner 810 that takes 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.” Ex. 1107, ¶0075.

It would have been obvious to modify Kriveshko with Serra to utilize two displays for the reasons discussed previously in connection with claim 5, and additionally because Serra describes that a benefit of providing a stereoscopic display is that it “afford[s] superior depth perception, which is the key to any 3D interface,” in addition to a conventional display. Ex. 1107, ¶0046; Ex. 1003, ¶232. A POSA would have had a reasonable expectation of success implementing two monitors because the output of different data to different monitors was common practice at the time. Ex. 1003, ¶233.

#### **K. Claim 18**

**The scanning system according to claim 1, wherein audible information is provided to the operator.**

Kriveshko satisfies these limitations of claim 18. Ex. 1003, ¶¶234-35. Kriveshko discloses that verbal cues may be implemented to during the scanning operation “to coach a user back to an appropriate location relative to the subject 104.” Ex. 1106, ¶0076. A POSA would understand these verbal cues to be audible information that is provided to the operator. Ex. 1003, ¶235.

**L. Claim 19**

**[19.0] A system comprising:**

Kriveshko discloses the features of the preamble. *See* [1.0] of this Ground.

**[19.1] a handheld device and at least one display**

Kriveshko discloses these limitations. *See* [1.1] and [1.4] of this Ground.

**[19.2] wherein the handheld device is adapted for switching  
between performing at least one action in a physical 3D  
environment**

Kriveshko in combination with Serra discloses these limitations. *See* [3.0] of  
this Ground.

**[19.3] wherein the at least one display is adapted for visually  
representing the physical 3D environment**

Kriveshko discloses these limitations. *See* [1.4] of this Ground.

**[19.4] remotely controlling the display to adjust the view with  
which the 3D environment is represented on the display**

Kriveshko in combination with Serra discloses these limitations. *See* [1.5] of  
this Ground.

**[19.5] 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**

Kriveshko in combination with Serra discloses these limitations. *See* [11.0],  
[3.0], [1.5], [1.6] of this Ground.

**[19.6] wherein an actuator provided on the handheld device switches between performing the at least one action and remotely controlling the view**

Kriveshko in combination with Serra discloses these limitations. *See* [3.0] of this Ground.

**[19.7] wherein the at least one motion sensor is a sensor that directly detects motion**

Kriveshko in combination with Serra and Hopkins discloses these limitations. *See* [1.6], [1.7] of this Ground.

**M. Claim 20**

**The scanning system according to claim 1, wherein the at least one motion sensor is an accelerometer, gyro, or magnetometer.**

Kriveshko in combination with Serra and Hopkins satisfies these limitations of claim 20. Ex. 1003, ¶¶245-46. It would have been obvious to use the accelerometer of Hopkins as the 3D sensor of Serra. *See* [1.5], [1.6], [6.0], [7.0] of this Ground; Ex. 1003, ¶246.

**N. Claim 21**

**The scanning system according to claim 1, wherein the at least one motion sensor is adapted for taking the movement of the scanner into account while performing the scanning.**

Kriveshko in combination with Serra satisfies these limitations of claim 21. Ex. 1003, ¶¶247-49. Serra discloses, “a system [that] can record for each acquired real-time image its 3D time and position. Therefore, in such exemplary embodiments, not only can a current image slice be displayed in its correct 3D

position but because the time of acquisition is available for each image, such methods also allow for the display of any previously acquired information at the given position.” Ex. 1107, ¶0036. A POSA would understand recording the 3D time and position of acquisition of an image to be taking the movement of the scanner into account while performing the scanning. Ex. 1003, ¶248.

249. A POSA would have been motivated to combine Kriveshko with Serra for the reasons discussed in [1.5], [1.6], and [1.7] of this Ground; and additionally to allow for the “visualization of time-variant processes.” Ex. 1003, ¶¶248-49. Serra further explains that “a user can manage the entire 3D space within which ultrasound scans from a particular scanning session are obtained in a way that leads to better diagnosis and/or intervention.” Ex. 1107, ¶0037. Therefore, it would have been obvious to have at least one motion sensor adapted for taking the movement of the scanner into account while performing the scanning. Ex. 1003, ¶249.

**O. Claim 23**

**The scanning system according to claim 1, wherein the at least one motion sensor is the 3D user interface for remotely controlling the display, wherein the view on the display is determined by moving the handheld scanner.**

Kriveshko in combination with Serra satisfies these limitations of claim 23. Ex. 1003, ¶¶250-54. Both Kriveshko and Serra disclose displays. *See, e.g.*, Ex. 1106, ¶0060; Ex. 1107, ¶0045. As discussed in [5.0] and [7.0] of this Ground, Serra discloses that the scanner can be used to “rotate the entire virtual scene, which is a

common a 3D data set interactive visualization operation.” Ex. 1107, ¶0053. A POSA reading the disclosure of Serra would understand a “virtual scene” to be a scene displayed on a display. Ex. 1107, ¶0053; Ex. 1003, ¶253. Thus, for the reasons discussed in [1.5], [1.6], and [1.7] of this Ground, it would have been obvious to determine the view of the display by moving the handheld scanner. Ex. 1003, ¶254.

**P. Claim 24**

**The scanning system according to claim 23, wherein moving the handheld scanner to point down causes the view on the display to be a downward viewing angle.**

Kriveshko in combination with Serra satisfies these limitations of claim 24. Ex. 1003, ¶¶255-57. As discussed in [9.0] and [23.0] of this Ground, the virtual scene of the combination is rotated when the probe is moved in an interactive mode and it would have been obvious implement controls in the manner claimed. *Id.* The result is that when the handheld scanner is moved to point down, the view on the display is likewise moved to a downward viewing angle.

**Q. Claim 25**

**The scanning system according to claim 1, wherein the handheld device further comprises a user-interface element.**

Kriveshko satisfies these limitations of claim 25. Ex. 1003, ¶¶258-59. Kriveshko discloses, “the 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.” Ex. 1106, ¶0052. Buttons, levers, dials, thumb wheels, and switches are user interface elements. Ex. 1003, ¶259.

**R. Claim 26**

**The scanning system according to claim 25, wherein the user-interface element comprises a touch-sensitive element, a button, a scroll-wheel, or a proximity sensor.**

Kriveshko satisfies these limitations of claim 26. Ex. 1003, ¶¶260-61. *See* [25.0] of this Ground.

**S. Claim 27**

**The scanning system according to claim 25, wherein the user-interface element provides more than one user input.**

Kriveshko satisfies these limitations of claim 27. Ex. 1003, ¶¶262-63. *See* [25.0] of this Ground. A POSA would consider starting and stopping scans to be different user inputs. Ex. 1003, ¶263.

**T. Claim 28**

**The scanning system according to claim 25, wherein the at least one motion sensor and/or the user-interface element are utilized in a workflow.**

Kriveshko in combination with Serra satisfies these limitations of claim 28. Ex. 1003, ¶¶264-67. A POSA would understand the plain meaning of “workflow” to be a series of steps performed to achieve an objective. *Id.*, ¶152. A POSA would understand a scan to be a “workflow.” Ex. 1106, ¶0059; Ex. 1003, ¶265. Kriveshko discloses the following workflow: “[i]n 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. In a related landing mode, a user may attempt to initiate a new scan registered or connected to an existing three-dimensional model. Similar visual feedback tools may be provided to guide a user to an appropriate scan location, and notify a user when the scan has been reacquired.” Ex. 1106, ¶0059.

Serra discloses “ultrasound probes and instruments can, for example, be tracked by a 3D tracking system so that the each of the probes and instruments respective 3D positions and orientations can be known at all times during the ultrasound scan.” Ex. 1106, ¶0059.

It would have been obvious to use the 3D tracking of Serra as the recover mode workflow of Kriveshko to improve Kriveshko’s ability to guide a user back to an appropriate location because of 3D tracking’s well-known ability to improve location accuracy. Ex. 1003, ¶267. A POSA would not have encountered any technological hurdles in using the motion sensor of Serra to improve the recovery mode workflow of Kriveshko. *Id.*

**U. Claim 31**

**The scanning system according to claim 1, wherein the at least one display is divided into multiple regions.**

Kriveshko in combination with Serra satisfies these limitations of claim 31.

Ex. 1003, ¶¶268-71. Figure 4 of Serra depicts a display divided into a region for controls (*i.e.*, a virtual keyboard) and a region for scans:

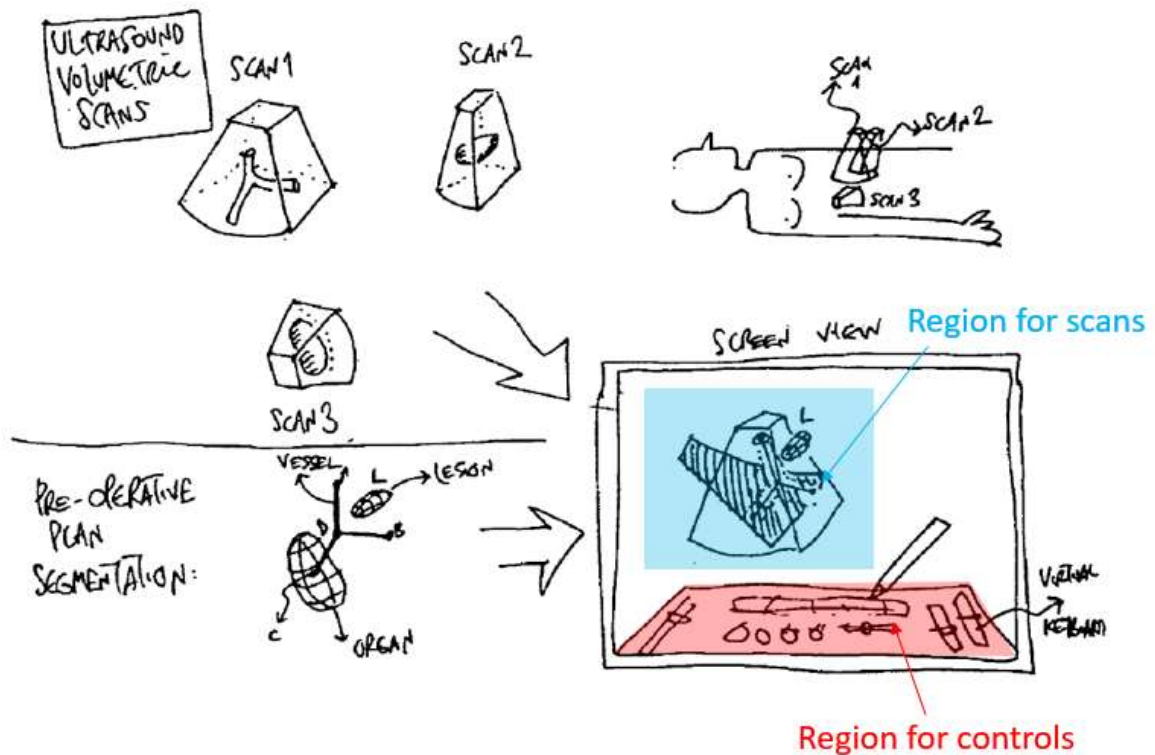


FIG. 4

Ex. 1107, FIG. 4; *see also* FIGS. 7, 10. It would have been obvious to modify the display of Kriveshko to incorporate regions because doing so would permit users greater interactivity and efficiency analyzing scans. *See* Ex. 1003, ¶270. A POSA would know how to implement multiple display regions. And a POSA would have a reasonable expectation of success doing so because incorporating multiple regions on a single display was routine and conventional at the time. *Id.*

**V. Claim 32**

**[32.0] The system according to claim 19, wherein the handheld device further comprises a user interface element**

Kriveshko in combination with Serra satisfies these limitations of claim 32.

*See* [1.5], [1.6], [3.0], [5.0], and [23.0] of this Ground.

**[32.1] wherein switching to remotely controlling the view puts the handheld device into a controller mode,**

Kriveshko in combination with Serra satisfies these limitations of claim 32.

*See* [1.5], [1.6], [3.0], [5.0], and [23.0] of this Ground. Serra switches between a scan mode and an interactive mode made based on the button/actuator described above. Ex. 1107, ¶0054. A POSA would understand the described “interactive mode” to correspond to the claimed “controller mode” because the user can use the probe to rotate the entire scene. Ex. 1003, ¶¶274-75.

**[32.2] wherein holding the user interface element and/or the actuator on the handheld device in conjunction with moving the handheld device determines the view of the 3D environment on the display in accordance with signals from the motion sensor.**

Kriveshko in combination with Serra satisfies these limitations of claim 32.

*See* [1.5], [1.6], [3.0], [5.0], and [23.0] of this Ground. Serra discloses, “the user can scan the patient by pressing the ON button on the ultrasound probe and moving the probe over the region of interest. Then, the user can release the button on the probe, and use the tracking information in the ultrasound probe to rotate the entire scene.” Ex. 1107, ¶0054. The scanner holds the user interface element in a not pressed state

to allow for the determination of view. Ex. 1003, ¶¶276-78.

**W. Claim 33**

Kriveshko in combination with Serra discloses the limitations of claim 33 that are common to claim 1 for the reasons discussed in claim 1 of this Ground. Claim 33 additionally recites:

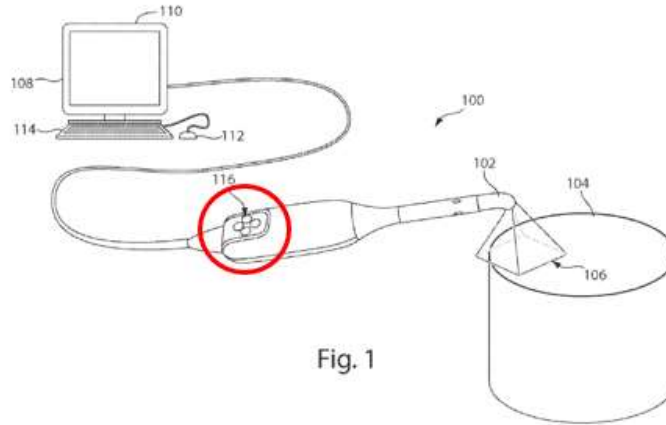
**[33.7] wherein the at least one motion sensor is an accelerometer, gyro, or magnetometer.**

Kriveshko in combination with Serra and Hopkins discloses these limitations of claim 33. *See* [1.6] and [1.7] of this Ground.

**X. Claim 34**

**The scanning system according to claim 33, wherein the handheld device further comprises at least two user interface elements.**

Kriveshko satisfies these limitations of claim 34. Ex. 1003, ¶¶288-89. Kriveshko discloses, “[i]n one embodiment, the 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.” Ex. 1106, Kriveshko, ¶0052. Figure 1 depicts a scanner 102 with four (4) buttons, which are at least two user interface elements. Ex. 1003, ¶289.



Ex. 1106, FIG. 1 (annotated).

**Y. Claim 40**

**[40.0] The scanning system according to claim 1, wherein the at least one display is a 3D display**

Kriveshko in combination with Serra satisfies these limitations of claim 40.

Ex. 1003, ¶291. Serra explains, “[i]n exemplary embodiments according to the present invention, two options can be used to integrate systems implementing an exemplary embodiment of the present invention.” Ex. 1107, ¶¶0070, 0073-74. In the full integration option, Serra describes use of a stereoscopic or autostereoscopic display. *Id.* A POSA would understand displays implementing stereoscopic techniques and autostereoscopic displays to both be 3D displays. Ex. 1003, ¶291.

**[40.1] whereby a 3D representation of the 3D environment is displayed on the 3D display**

Kriveshko in combination with Serra satisfies these limitations of claim 40.

Ex. 1003, ¶292. Serra discloses a variety of 3D representations, explaining pre-

operative segmentations and virtual objects, or 2D and/or 3D images can be fused with live ultrasound data. Ex. 1107, ¶¶0087; 0078-92. While Serra does not explicitly state that any of these representations are displayed on a 3D display, a POSA reading the disclosure of Serra understands the 3D images of Serra are displayed on the 3D display, and it would have been obvious represent the 3D images taken by the Kriveshko-Serra combination on a 3D display like Serra describes. Ex. 1003, ¶¶292, 294-96.

**[40.2] wherein the handheld device is an intra-oral 3D scanner or an in-ear 3D scanner.**

Kriveshko in combination with Serra satisfies these limitations of claim 40. Ex. 1003, ¶293. As discussed in [11.0] of this Ground, Kriveshko discloses an intra oral scanner. Kriveshko also discloses a display 110 and displaying 3D renderings on the display: “For example, in the normal acquisition mode, the display 110 may show a video image of the subject 104, as viewed from the scanner 102. The computer may render the three-dimensional model, which may be a three-dimensional point cloud of surface data acquired for the subject 104, superimposed on the video image.” Ex. 1106, Kriveshko, ¶0076.

As discussed above, Serra is also directed to display of 3D images. Serra discloses, “the system and methods of the present invention can apply to any substantially real-time image acquisition system, not being restricted to ultrasound.” Ex. 1107, ¶0093. It would have been obvious to display Kriveshko’s 3D renderings

on a 3D display such as the 3D displays disclosed by Serra. Ex. 1003, ¶¶294-96.

There would have been no technical obstacle to doing so and a POSA would have been motivated to do so in the natural course development following the teachings of Serra. Ex. 1003, ¶¶294-96.

**Z. Claim 41**

**The scanning system according to claim 40, wherein the 3D display is configured to project stereoscopic image pairs of the 3D representation.**

Kriveshko in combination with Serra satisfies these limitations of claim 41. Ex. 1003, ¶¶297-99. As discussed in [40.0] of this Ground, Serra discloses stereoscopic and autostereoscopic displays, noting “any stereoscopic display technique can be used, such as autostereoscopic displays, or anaglyphic red-green display techniques, using known techniques.” Ex. 1107, ¶0074. A POSA understands that a stereoscopic display necessarily displays stereoscopic image pairs. Ex. 1003, ¶¶298-99. It would have been obvious to use the 3D display to project stereoscopic image pairs of the 3D representation for the reasons discussed in connection with claim 40. Ex. 1003, ¶¶298-99.

**AA. Claim 42**

**The scanning system according to claim 40, wherein the 3D display is volumetric display configured to create a 3D effect of the 3D representation.**

Kriveshko in combination with Serra satisfies these limitations of claim 42. Ex. 1003, ¶¶300-01. Serra discloses the rendering of volumetric images: “In

exemplary embodiments of the present invention a 3D interactive system is provided that can work with either ultrasound planes (shown in their respective 3D context), volumetric reconstructions of such ultrasound information.” A POSA understands that stereoscopic and autostereoscopic displays are volumetric displays. Ex. 1003, ¶301. It would have been obvious to use a 3D display as a volumetric display configured to create a 3D effect of the 3D representation for the reasons discussed in connection with claim 40. *Id.*

**BB. Claim 43**

**[43.0] The system according to claim 19, wherein the at least one display is a 3D display**

Kriveshko in combination with Serra satisfies these limitations. *See* [40.0] of this Ground.

**[43.1] whereby a 3D representation of the 3D environment is displayed on the 3D display**

Kriveshko in combination with Serra satisfies these limitations. *See* [40.1] of this Ground.

**[43.2] wherein the 3D display is configured to project stereoscopic image pairs of the 3D representation**

Kriveshko in combination with Serra satisfies these limitations. *See* [40.2] and [41.1] of this Ground.

**CC. Claim 44.0**

**[44.0] The scanning system according to claim 33, wherein the at least one display is a 3D display**

Kriveshko in combination with Serra satisfies these limitations. *See* [40.0] of this Ground.

**[44.1] whereby a 3D representation of the 3D environment is displayed on the 3D display**

Kriveshko in combination with Serra satisfies these limitations. *See* [40.1] of this Ground.

**[44.2] wherein the handheld device is an intra-oral 3D scanner or an in-ear 3D scanner**

Kriveshko in combination with Serra satisfies these limitations. *See* [40.2] of this Ground.

**[44.3] wherein the 3D display is configured to project stereoscopic image pairs of the 3D representation**

Kriveshko in combination with Serra satisfies these limitations. *See* [41.0] of this Ground.

**VIII. GROUND 2: CLAIM 22 IS OBVIOUS OVER KRIVESHKO, SERRA, HOPKINS, AND WILSON**

**A. Claim 22**

**The scanning system according to claim 1, wherein the system comprises at least two motion sensors and wherein the at least two motion sensors provide sensor fusion.**

Kriveshko in combination with Serra, Hopkins, and Wilson satisfies these limitations of claim 22. Ex. 1003, ¶¶311-17. The limitations of claim 1 are met by

the combination of Kriveshko, Serra, and Hopkins for the reasons provided in connection with Ground 1. Wilson discloses a handheld wand for performing gestures, and “pointing” the wand to determine a device to be controlled and the control action to be performed on that device. Ex. 1010, Abstract. Wilson explains that in an operating room implementation, “the medical person 1306 uses the wireless remote control user interface (UI) device 1404 (hereinafter referred to as a ‘wand’) to facilitate control of the operation computer system 1308.” *Id.*, ¶0145.

Wilson also explains that, “[t]he orientation sensors of the wand 1404 include at least, an accelerometer, which provides separate x-axis and y-axis orientation signals, and a magnetometer, which provides separate tri-axial measurements (x-axis, y-axis, and z-axis) orientation signals.” *Id.*, ¶0146. Wilson explains that, “[t]he orientation of the pointer is defined in terms of its pitch, roll and yaw angle about the respective x, y and z axes of the environment’s pre-defined coordinate system. These angles can be determined via various sensor fusion processing schemes that essentially compute the angle from the readings from the accelerometer and magnetometer of the pointer.” *Id.*, ¶0151.

It would have been obvious to combine Wilson with Kriveshko, Serra, and Hopkins in order to eliminate sensor drift caused by accelerometer calculations. Ex. 1003, ¶317. A POSA could have done so with a reasonable expectation of success because doing so in similar devices was well known. Ex. 1003, ¶316.

**IX. GROUND 3: CLAIM 30 IS OBVIOUS OVER KRIVESHKO, SERRA, HOPKINS, AND QUAID**

**A. Claim 30**

**The scanning system according to claim 1, wherein the at least one display is arranged on a cart.**

Kriveshko in combination with Serra, Hopkins, and Quaid satisfies the limitations of claim 30. Ex. 1003, ¶¶318-21. The limitations of claim 1 are met by the combination of Kriveshko, Serra, and Hopkins for the reasons provided in connection with Ground 1. Quaid discloses placing monitors on carts. Ex. 1111, ¶0093. Quaid explains that placing a system on a cart provides ease of mobility for the system and allows it to be moved to a location necessary for a given procedure. *Id.*, ¶0096. It would have been obvious to place at least one display of the combination of Kriveshko-Serra-Hopkins on a cart. Ex. 1003, ¶321. A POSA would have a reasonable expectation of successfully arranging a display on a cart because doing so with medical devices and displays was well known. *Id.*

**X. GROUND 4: CLAIMS 1-3, 5-7, 9-11, 15, 19-28, 31-34, AND 40-44 ARE OBVIOUS OVER KRIVESHKO, SERRA, AND MARVIT**

Ground 5 is the same as Ground 1 except rather than combine Kriveshko and Serra with Hopkins, the Kriveshko and Serra are combined with Marvit. Only the claims having limitations requiring combination with Marvit are addressed below. The remaining Ground 5 limitations not addressed below are satisfied by the combination of Kriveshko with Serra for the reasons provided in Ground 1. Ex.

1003, ¶¶322-423.

**A. Claim 1**

The combination of Kriveshko and Serra discloses all of the claim 1 limitations for the reasons provided in connection with Ground 1. Ex. 1003, ¶¶323-29. However, to the extent the Board determines that Serra does not disclose the “directly detects motion” limitation, the combination of Kriveshko, Serra, and Marvit does. Ex. 1003, ¶¶330-35.

**[1.7] wherein the at least one motion sensor is a sensor that directly detects motion**

Kriveshko in combination with Serra and Marvit discloses these limitations of claim 1. Ex. 1003, ¶¶330-35. Marvit discloses a handheld device that uses a variety of sensors including accelerometers and gyros to implement user functions. Ex. 1109, ¶¶0034-35, 0038-0044, 0051, 0052, 0055-0057, FIGS. 2, 4. A POSA would have been motivated to use the accelerometers or gyros of Marvit as the 3D sensor of Serra to recognize translation, rotation, and/or gesture inputs (*e.g.*, position and orientation data) from the motion of the scanner of the combination of Kriveshko and Serra. Ex. 1107, ¶0042 (discussing continuous tracking of position and orientation); Ex. 1003, ¶¶333. User input techniques and gesture-based input functionality for controlling or manipulating an image on a display that were well known, and Kriveshko, Serra, and Marvit are from analogous fields of art. Ex. 1107, ¶¶4, 12, 37, 50-54, FIGS. 7-8, 10; Ex. 1109, ¶¶0035, 0038-44, 0051-52, 0055-57,

FIGS. 2, 4; Ex. 1003, ¶333.

A POSA would have incorporated Marvit's accelerometer or gyro as the 3D sensor of Serra with a reasonable expectation of success because the principles of operation for both systems were well understood and predictable, such that it would have been straight forward to incorporate an accelerometer or gyro of Marvit as the 3D sensor using routine steps to produce a 3D sensor having an accelerometer or gyro to measure position and orientation data of a scanner. Ex. 1003, ¶334.

Incorporation of an accelerometer or a gyro into a handheld device for detecting position or orientation data of the handheld device in order to manipulate a display was conventional within the medical field, motion detection, as well as smart devices by the earliest possible priority date. Ex. 1003, ¶335. Indeed, MEMS accelerometers were developed as early as the 1980s, and a compact accelerometer chip could be implemented in a variety of devices, which is explicitly demonstrated by Marvit itself. Ex. 1003, ¶335.

**B. Claim 6**

**The scanning system according to claim 1, wherein functionality of the 3D user interface comprises a use of gestures.**

Kriveshko in combination with Serra and Marvit discloses these limitations of claim 6. Ex. 1003, ¶¶343-45. Marvit discloses the use of gestures to control a display. *See, e.g.*, Ex. 1109, ¶¶0040, 0066, 0074-82, 0102-04, 0134-39. A POSA would have been motivated to include the use of gestures in the 3D user interface of

the combination in order to increase its functionality. Ex. 1003, ¶344. A POSA would recognize that gestures further Serra's goal of creating an "efficient and ergonomic interface that can allow a user to easily interact with ultrasound scan data as well as preoperative imaging and planning data in three dimensions." Ex. 1107, ¶0011; Ex. 1003, ¶344. For example, a POSA would recognize gestures would be better able to navigate application interfaces for manipulating 3D data. Ex. 1109, ¶¶0040, 0066, 0074-82, 0102-04, 0134-39; Ex. 1003, ¶344. Thus, it would have been obvious to incorporate Marvit's gestures into the 3D user interface of the combination. *Id.*

**C. Claim 7**

**The scanning system according to claim 6, wherein the gestures are detected by the at least one motion sensor.**

Kriveshko in combination with Serra and Marvit discloses these limitations of claim 7. Ex. 1003, ¶347; *see also* [6.0] of this Ground. It would have been obvious to modify Kriveshko and Serra to implement gestures according to Marvit, with such gestures being detected by the motion sensor of Kriveshko and Serra for the reasons discussed in [6.0] of this Ground.

**D. Claim 19**

Kriveshko in combination with Serra discloses the limitations of claim 19 for the reasons provided in connection with Ground 1. Ex. 1003, ¶¶323-29. However, to the extent the Board determines that Serra does not disclose the "directly detects

motion” limitation, the combination of Kriveshko, Serra, and Marvit does. Ex. 1003, ¶¶330-35.

**[19.7] wherein the at least one motion sensor is a sensor that directly detects motion**

Kriveshko in combination with Serra and Marvit discloses these limitations of claim 19. *See* [1.7] of this Ground.

**E. Claim 20**

**The scanning system according to claim 1, wherein the at least one motion sensor is an accelerometer, gyro, or magnetometer.**

Kriveshko in combination with Serra and Marvit discloses these limitations of claim 20. Ex. 1003, ¶¶367-68. It would have been obvious to incorporate the accelerometer of Marvit as the sensor that directly detects motion. *See* [1.7], [19.6] and [19.7] of this Ground.

**F. Claim 22**

**The scanning system according to claim 1, wherein the system comprises at least two motion sensors and wherein the at least two motion sensors provide sensor fusion.**

Kriveshko in combination with Serra and Marvit discloses these limitations of claim 22. Ex. 1003, ¶¶372-74. Marvit discloses a handheld device that uses a variety of sensors including accelerometers and gyros to implement use functions. Ex. 1109, ¶¶0034-35, 0038-0044, 0051, 0052, 0055-0057, FIGS. 2, 4. Marvit further discloses that sensor fusion can combine data from multiple sensors to determine the motion of the handheld device. Ex. 1109, ¶¶0107, 0161.

A POSA would have been motivated to use multiple sensors and sensor fusion techniques to provide the position and orientation data because it is well known that sensor fusion provides more robust and accurate sensor data. Such sensors are inexpensive and have small device footprints. Further, sensor fusion techniques are well known and had been implemented by others in similar handheld devices. A POSA would also have had a reasonable expectation of success when seeking to add additional sensors and sensor fusion logic to the 3D user interface of the Kriveshko-Serra combination.

**G. Claim 33**

Kriveshko in combination with Serra discloses the limitations of claim 33 that are common to claim 1 for the reasons discussed in claim 1 of this Ground. Claim 33 additionally recites:

**[33.7] wherein the at least one motion sensor is an accelerometer, gyro, or magnetometer.**

The combination of Kriveshko, Serra, and Marvit discloses these limitations of claim 33. *See* [1.7] of this Ground.

**XI. GROUND 5: CLAIM 30 IS OBVIOUS OVER KRIVESHKO, SERRA, MARVIT, AND QUAID**

**A. Claim 30**

**The scanning system according to claim 1, wherein the at least one display is arranged on a cart.**

Kriveshko in combination with Serra, Marvit, and Quaid discloses these

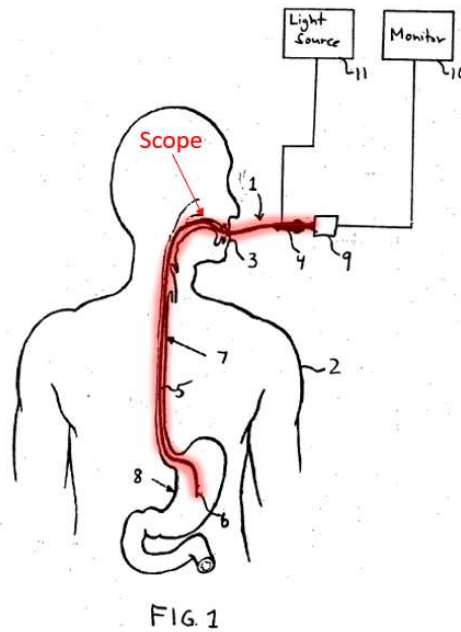
limitations of claim 30. Ex. 1003, ¶¶424-25. Quaid discloses placing monitors on carts. Ex. 1111, ¶0093. Quaid explains that placing a system on a cart provides ease of mobility for the system and allows it to be moved to a location necessary for a given procedure. Ex. 1111, ¶0096. It would have been obvious to place at least one monitor of the combination of Kriveshko-Serra-Marvit on a cart and a POSA would have a reasonable expectation of success doing so. Ex. 1003, ¶425. A POSA would have a reasonable expectation of successfully arranging a display on a cart because doing so with medical devices and displays was well known. *Id.*

## **XII. GROUND 6: CLAIMS 1, 5, 9, 18, 22-26, 28, 31, AND 33 ARE ANTICIPATED BY GATTANI**

### **A. Claim 1**

#### **[1.0] 1. A scanning system for scanning a 3D environment, the scanning system comprising:**

Gattani discloses the features of the preamble. Ex. 1003, ¶¶110-12. Gattani discloses “an endoscopic surgical navigation system” for scanning a human body, which is a 3D environment. Ex. 1105, Abstract. As shown in Figure 1 below, a scope 1 is inserted into and scans the body for live video display on a remote monitor 10. Ex. 1105, ¶0054.



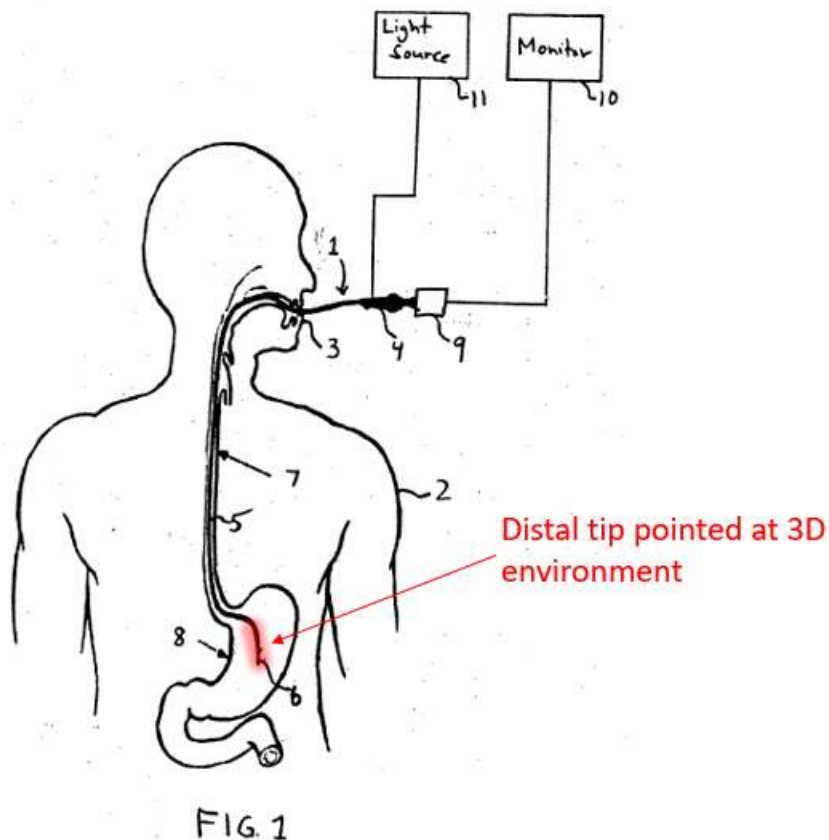
Ex. 1105, FIG. 1 (annotated). By recording and displaying live video image of the target body anatomy, Gattani discloses the scanning system of the preamble.

**[1.1] a handheld device including an optical scanner**

Gattani discloses these limitations of claim 1. Ex. 1003, ¶¶113-14. The scope 1 of Gattani's scanning system is a handheld device because it is held in the surgeon's hand during scanning procedures. Ex. 1105, ¶0054 (stating that the surgeon navigates the scope through a natural body to the target anatomy). Gattani also discloses that scope 1 is optically coupled to endoscopic video camera 9. Ex. 1105, ¶0055. Gattani accordingly comprises a handheld device including an optical scanner.

**[1.2] 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**

Gattani discloses these limitations of claim 1. Ex. 1003, ¶¶115-17. Video camera 9 receives images from the distal tip 6 of scope 1 via the optical connection described above. When the scope 1 is inserted into the human body, the user may point the distal tip 6 at the target anatomy to collect image data. Ex. 1105, ¶0054-55. As shown below in Figure 1 below, the 3D environment is scanned by pointing the optical scanner at the 3D environment.



Ex. 1105, FIG. 1 (annotated); Ex. 1003, ¶116. Gattani also includes a monitor 10

separate from scope 1 and connected via a network, which is an at least one display remotely connected to the handheld device.

**[1.3] wherein the handheld device is adapted for performing at least one scanning action in a physical 3D environment,**

Gattani discloses these limitations of claim 1. Ex. 1003, ¶118. Gattani describes a Visual Navigation System (VNS) 30 that receives “live video” of the body from the endoscopic video camera 9. Ex. 1105, ¶¶0058, 0064. The target anatomy of the human body is a physical 3D environment. Gattani explains that, “during endoscopic surgery, the video that is acquired from the endoscopic video camera 9 is a sequence of images captured through the scope 1, while the scope 1 is pointed in different directions at different instants in time. The video can be recorded as it is acquired.” Ex. 1005, ¶0112. The pointing and capturing of images by the video camera for remote display is an at least one scanning action in a physical 3D environment.

**[1.4] and the at least one display is adapted for visually representing the physical 3D environment; and**

Gattani discloses these limitations of claim 1. Ex. 1003, ¶¶119-20. As discussed, Gattani describes use of a monitor 10 (a cathode ray tube (CRT), liquid crystal display (LCD) or other suitable type of display device) to visually represent the physical 3D environment inside a human body. Ex. 1105, ¶0064. The display is depicted in Figure 2 below:

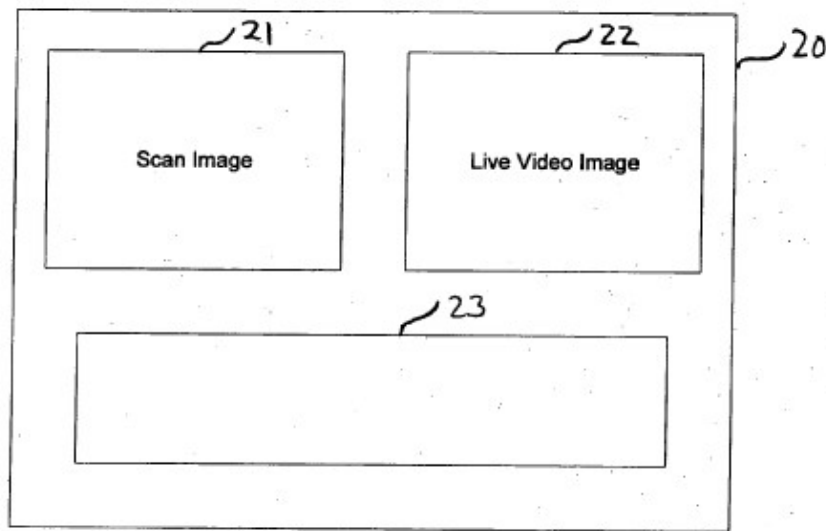


Fig. 2

*Id.*, FIG. 2. Referencing Figure 2, Gattani explains, “a display 20 generated by the VNS includes several windows in proximity to each other, including a window 21 that contains a scan image and a window 22 that contains a corresponding live video image, presented side-by-side.” Ex. 1105, ¶0064. Display 10/20 with windows 21 and/or 22 is thus a display adapted for visually representing the physical 3D environment. Ex. 1003, ¶120.

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

Gattani discloses these limitations of claim 1. Ex. 1003, ¶¶121-24. In Gattani, the distal tip 6 of the scope 1 is part of the flexible portion 5 and can be flexed about two or more orthogonal axes by the surgeon during a scanning action through use of

controls mounted on the base 4. Ex. 1105, ¶0054. The VNS also includes a “user interface subsystem,” which interprets and passes user commands including voice, gestures, touch screen inputs, and button presses (among others). *Id.*, ¶0061.

Gattani discloses a “3D user interface” by providing “three-dimensional (3D) visualization and navigation assistance to the surgeon in navigating an endoscope to the target anatomy.” *Id.*, ¶0037. Gattani explains:

In response to scope movements, the data processing subsystem 44 can also automatically identify a particular slice of intra-operative or pre-operative scan data corresponding to the current location and orientation of the endoscope tip and cause an image of that slice to be displayed to the user from the viewpoint of the scope tip.

*Id.*, ¶0113. Gattani does this by computing position and orientation of an image plane for each video frame as a function of the corresponding position and orientation of the distal tip of the endoscope and transforming the image planes for the frames to user-specific spatial positions and orientations in response to user inputs. *Id.*, ¶0062, 0064, 0073, 0088, 0098, claims 1-4.

The VNS 30 receives inputs 32 from various sensors on the endoscope 1, which are used to determine the current position and orientation of the distal tip 6 of the scope 1. *Id.*, ¶0058. More particularly, Gattani uses sensors 104 on the scope 1 containing three small wire coils oriented perpendicular to each other. Ex. 1105, ¶0100. The electromagnetic field 103 generated by the generator induces current through these coils, which at any particular instant in time is dependent upon the

electromagnetic field strength at the location of the sensor and the orientation of the sensor relative to the generator. *Id.* “Hence, the distance and orientation of the sensor 104 relative to the generator can be determined from those currents.” *Id.*

The position/orientation sensors 104 of Gattani that determine the current location and orientation of the endoscope are the 3D user interface. *Id.*, ¶¶0099-100; Abstract; Ex. 1003, ¶124. Gattani accordingly discloses a 3D user interface for remotely controlling the display to adjust the view with which the 3D environment is represented on the display.

**[1.6] wherein the handheld device comprises at least one motion sensor, and**

Gattani discloses these limitations of claim 1. Ex. 1003, ¶¶125-26. The '221 patent defines a “motion sensor” as a “sensor detecting motion” and identifies, *inter alia*, electromagnetic induction (inductive-loop detectors) as an example. Ex. 1001, 10:62-11:3. Gattani discloses motion sensing via electromagnetic induction. Gattani performs scope tracking using “signals from position/orientation sensors on the scope to track the current position and orientation of the distal tip of the scope.” Ex. 1105, ¶¶0099-100, 0104-11. Sensors 104 are depicted in Figure 10 below.

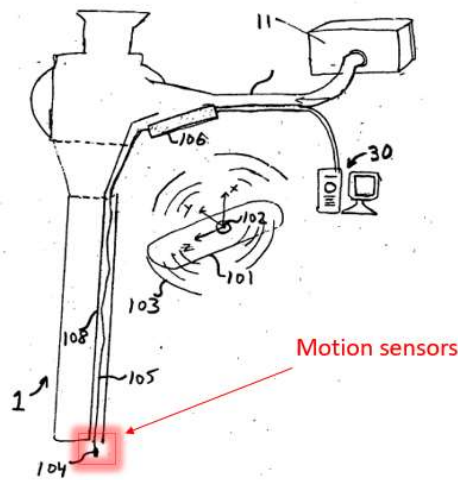


FIG. 10

*Id.*, FIG. 10 (annotated). Gattani further explains that an electromagnetic field generator is placed under a patient table 10, and, as discussed in connection with Gattani's "3D user interface," the position and orientation of the scope 1 is tracked using sensors 104 containing three perpendicularly oriented coils each of which receives a magnetic field induced from the field generator and by calculating the strength and vector direction of the field via these sensors, one is able to determine position (through various computational techniques.) *Id.*, ¶0100. Thus, the handheld device in Gattani comprises at least one motion sensor. Ex. 1003, ¶126.

**[1.7] wherein the at least one motion sensor is a sensor that directly detects motion**

Gattani discloses these limitations of claim 1. Ex. 1003, ¶¶127-29. The '221 patent identifies, *inter alia*, electromagnetic induction (inductive-loop detectors) as an exemplary motion sensor that detects motion. Ex. 1001, 10:62-11:3. The sensors

104 of Gattani accordingly directly detect motion. Ex. 1003, ¶127 (explaining “a POSA would understand that position and orientation measurements would be acquired by these sensors at discrete and consecutive sample times, such that any change or absence of change between two consecutive samples is a direct indication of motion between the consecutive samples”).

This is further evidenced by Gattani’s explanation that the detected motion of the scope 1 can be used to create a travel path for the scope, which can be visually displayed to a user in 3D: “The path correlation module 79 receives data indicating the current position and orientation of the scope from the tracking subsystem 42. It converts the data into a dataset representing the path taken by the scope, and transforms that dataset into graphic model parameters to enable the path to be rendered and displayed to a user in 3D.” Ex. 1105, ¶0134-35.

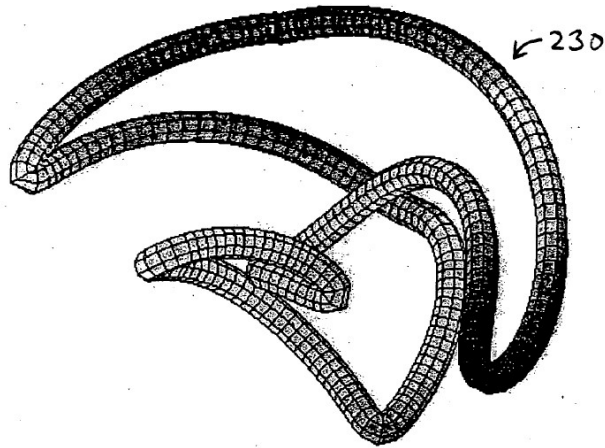


FIG. 23

*Id.*, FIG. 23 (illustrating a 3D path displayable to user).

**B. Claim 5**

**The scanning system according to claim 4, wherein 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.**

Gattani discloses these limitations of claim 5. Ex. 1003, ¶¶130-31. Gattani discloses that displays can be generated to match the viewpoint determined by the position of the distal tip 6 of the scope 1. Ex. 1105, ¶0097 (“*In response to scope movements*, the data processing subsystem 44 can also automatically identify a particular slice of intra-operative or pre-operative scan data corresponding to the current location and orientation of the endoscope tip and *cause an image of that slice to be displayed to the user from the viewpoint of the scope tip*” (emphasis added)).

**C. Claim 9**

**The scanning system according to claim 1, wherein the handheld device is adapted to change a viewing angle with which the 3D environment is represented on the at least one display.**

Gattani discloses these limitations of claim 9. Ex. 1003, ¶¶132-33. As discussed in [5.0] if this Ground, the viewing angle of the images displayed on the screen in Gattani are automatically changed based on movements of the scope, which is controlled by the user. Ex. 1105, ¶¶0054-55, ¶0096; *see also* ¶0090, ¶0097.

**D. Claim 18**

**The scanning system according to claim 1, wherein audible information is provided to the operator.**

Gattani discloses these limitations of claim 18. Ex. 1003, ¶¶134-35. Gattani discloses that “the VNS 30 may also output synthesized speech and/or other forms of audible output (e.g., warnings or distance to target) to the user through an audio speaker 36.” Ex. 1105, ¶0059.

**E. Claim 22**

**The scanning system according to claim 1, wherein the system comprises at least two motion sensors and wherein the at least two motion sensors provide sensor fusion.**

Gattani discloses these limitations of claim 22. Ex. 1003, ¶¶136-40. Sensor fusion is the combining of sensor outputs from different sensor groups or modalities into a single measurement an improved measurement in accuracy, noise, lag, drift, speed or combination utilizing the qualities of each sensor for overall improved tracking performance. *Id.*, ¶¶137-38. The “hybrid approach” described in Gattani is a form of sensor fusion using two sensors: one on the base using LEDs and cameras to compute position and orientation of the base 4, and one on the distal tip using fiber optic curvature sensors. *Id.*, ¶138.

Gattani describes its sensor fusion model succinctly in Figure 15, explaining that the fusion model is used to compute a position and orientation of the distal tip of the scope 1. *Id.* The fusion model uses the relative relationship between a

measured position and orientation of the distal tip 6 and a measured position and orientation of the base 4, with the position and orientation of the base 4 used as a reference point to determine the current position and orientation of the distal tip 6. *Id.*

Because the model uses the “current computed reference point” and the “current computed position and orientation of the distal tip relative to the reference point,” Gattani discloses at least two motion sensors wherein the at least two motion sensors provide sensor fusion. *Id.*, ¶139. Because each of the motion sensors detect both position and orientation, both sensors are motion sensors within the scope of the claims. *Id.*, ¶¶139-40.

**F. Claim 23**

**The scanning system according to claim 1, wherein the at least one motion sensor is the 3D user interface for remotely controlling the display, wherein the view on the display is determined by moving the handheld scanner.**

Gattani discloses these limitations of claim 23. Ex. 1003, ¶¶141-42. As discussed, Gattani uses sensors 104 to implement a 3D user interface for controlling the display, and when the distal tip of scope is moved the view on the display is determined by that movement. Ex. 1105, ¶¶0090 (“A rendering window that includes a volumetric perspective image, based on scan data, rendered from a point of view that correlates to the outputs of the position/orientation sensors attached to the endoscope (i.e., the endoscopic camera point of view) . . .”), 0096-97.

**G. Claim 24**

**The scanning system according to claim 23, wherein moving the handheld scanner to point down causes the view on the display to be a downward viewing angle.**

Gattani discloses these limitations of claim 24. Ex. 1003, ¶¶143-44. Gattani discloses that the distal tip of scope 1 can be moved with six degrees of freedom. Ex. 1105, ¶0113. As discussed, the view of the position and orientation of the distal tip 6 determines the view of display. Thus, if the probe tip is pointed down, the view on the display is a downward viewing angle. Ex. 1003, ¶144.

**H. Claim 25**

**The scanning system according to claim 1, wherein the handheld device further comprises a user-interface element.**

Gattani discloses these limitations of claim 25. Ex. 1003, ¶¶145-48. As discussed in claim 1, in Gattani, “[t]he distal tip 6 of the scope 1 is part of the flexible portion 5 and can be flexed about two or more orthogonal axes by the surgeon, by using controls (not shown) mounted on the base 4.” Ex. 1105, ¶0054 (emphasis added); *see also*, ¶¶0093 (“camera controls”), 0125 (“button”). These controls comprise a user interface element.

**I. Claim 26**

**The scanning system according to claim 25, wherein the user-interface element comprises a touch-sensitive element, a button, a scroll-wheel, or a proximity sensor.**

Gattani discloses these limitations of claim 26. Ex. 1003, ¶¶149-50. As

discussed, the scope 1 includes, for example, a button. Ex. 1105, ¶0125.

**J. Claim 28**

**The scanning system according to claim 25, wherein the at least one motion sensor and/or the user-interface element are utilized in a workflow.**

Gattani discloses these limitations of claim 28. Ex. 1003, ¶¶151-53. A POSA would understand the plain meaning of “workflow” to be a series of steps performed to achieve an objective. *Id.*, ¶152. Gattani discloses a workflow for determining an implicit function. Ex. 1105, ¶¶0122-25. In Gattani’s workflow, the button on the scope 1 is used to determine a set of points. Ex. 1105, ¶0125. “The set of points needed to fit the implicit function are initially collected by the user’s pressing a predetermined control input (e.g., pressing a designated button on the scope 1 or the endoscopic video camera 9).” *Id.*; *see also* FIGS. 20-21. For example, the user might press the control input (button) three times on a particular region of interest in the 3D environment to prompt display of the region on the monitor. *Id.*, ¶¶152-53. Because the button is a user interface element, the workflow in Gattani satisfies this limitation.

**K. Claim 31**

**The scanning system according to claim 1, wherein the at least one display is divided into multiple regions.**

Gattani discloses these limitations of claim 31. Ex. 1003, ¶154-56. As illustrated in Figure 2 below, the display 20 is divided into regions 21, 22, and 23.

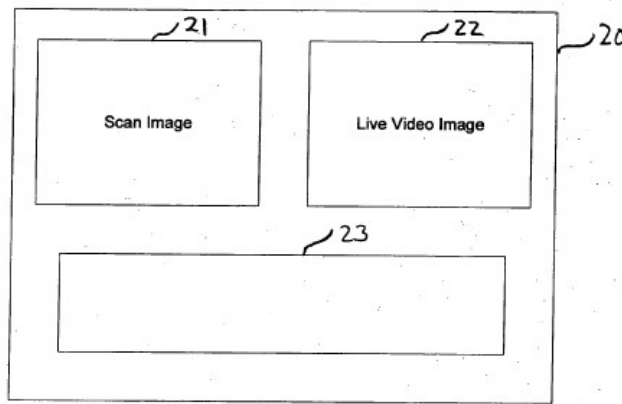


Fig. 2

Ex. 1105, FIG. 2. Referring to FIG. 2, Gattani explains, “a display 20 generated by the includes several windows in proximity to each other, including a window 21 that contains a scan image and a window 22 that contains a corresponding live video image . . . .” Ex. 1105, ¶0064. Gattani further explains another portion of the screen can be used to display text, graphics, and touch screen controls. Ex. 1105, ¶0057. By utilizing side-by-side windows 21 and 22, and separate portion 23, Gattani discloses wherein the at least one display is divided into multiple regions.

**L. Claim 33**

Gattani discloses the limitations of claim 33 that are common to claim 1 for the reasons discussed in claim 1 of this Ground. Claim 33 additionally recites:

**[33.7] wherein the at least one motion sensor is an accelerometer, gyro, or magnetometer.**

Gattani discloses the additional limitation of claim 33 because the magnetic sensors 104 of Gattani are magnetometers. *Id.* Ex. 1003, ¶¶157-65.

### **XIII. MANDATORY NOTICES PURSUANT TO 37 C.F.R. § 42.8**

#### **A. Real Party-In-Interest (37 C.F.R. § 42.8(b)(1))**

Pursuant to 37 C.F.R. § 42.8(b)(1), Petitioner certifies that DITC is the real party-in-interest in this matter. Petitioner also identifies an additional real party-in-interest, Carestream Dental LLC, which was the original defendant in related district court litigation (*3Shape A/S v. Carestream Dental LLC*, *infra*) and which as of April 20, 2022 has no past or future liabilities associated with the claims, accused products, or associated business in that litigation.

#### **B. Related Matters (37 C.F.R. § 42.8(b)(2))**

Pursuant to 37 C.F.R. § 42.8(b)(2), Petitioner hereby states that RE'221 is a subject of civil action *3Shape A/S v. Carestream Dental LLC et al.*, Civil No. 1:22-cv-01829 (N.D. Ga.), which was transferred from the Western District of Texas (previously styled *3Shape A/S v. Carestream Dental LLC*, Civil No. 6:21-cv-01110 (W.D. Tex.)). The original case was filed October 26, 2021. RE'221 was also the subject of the below proceedings that are resolved:

| <b>No.</b> | <b>Case Name</b>                      | <b>Case No.</b> | <b>District</b> | <b>Relation</b>                                                    |
|------------|---------------------------------------|-----------------|-----------------|--------------------------------------------------------------------|
| 1.         | <i>Align Technology v. 3Shape A/S</i> | 6:20-cv-00979   | W.D. Tex.       | RE'221 asserted against Align; case settled after <i>Markman</i> . |
| 2.         | <i>Align Technology v. 3Shape A/S</i> | IPR2022-00144   | PTAB            | RE'221 subject of IPR Petition filed                               |

Petition for *Inter Partes* Review  
of U.S. Patent No. RE48,221

| No. | Case Name                                 | Case No.          | District | Relation                                                                                                               |
|-----|-------------------------------------------|-------------------|----------|------------------------------------------------------------------------------------------------------------------------|
|     |                                           |                   |          | by Align;<br>terminated<br>prior to<br>institution due<br>to settlement.                                               |
| 3.  | <i>Align Technology v.<br/>3Shape A/S</i> | IPR2022-<br>00145 | PTAB     | RE'221<br>subject of IPR<br>Petition filed<br>by Align;<br>terminated<br>prior to<br>institution due<br>to settlement. |

**C. Counsel and Service Information  
(37 C.F.R. § 42.8(b)(3), 42.8(b)(4))**

Pursuant to 37 C.F.R. §§ 42.8(b)(3) and 42.10(a), Petitioner provides the following counsel and service information. Pursuant to 37 C.F.R. § 42.10(b), a Power of Attorney accompanies this Petition.

| LEAD COUNSEL                                                                                                                                                                                                                                                       | BACK-UP COUNSEL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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**D. Payment of Fees**

The Office is authorized to charge fees for this Petition to Deposit Account No. 50-5708. Any additional fees that might be due are also authorized.

**XIV. GROUNDS FOR STANDING**

Pursuant to 37 C.F.R. § 42.104(a), Petitioner certifies that RE'221 is available for IPR and that Petitioner is not barred or estopped from requesting IPR of any

claim of RE'221 on the grounds identified herein. This Petition is filed in accordance with 37 C.F.R. § 42.106(a) along with a Power of Attorney and an Exhibit List pursuant to 37 C.F.R. § 42.10(b) and § 42.63(e).

## **XV. DISCRETIONARY ANALYSIS**

In addition to the strong merits presented herein, Petitioner also hereby provides a *Sotera*-type stipulation and stipulates that if the PTAB institutes *inter partes* review in relation to any petition filed by DITC with respect to RE'221, the Petitioner will not pursue in the district court litigation any ground raised or that could have been reasonably raised in the instituted IPR with respect to the patent claim subject to the instituted IPR. This stipulation precludes discretionary denial under §314(a). *See* Director Vidal Memorandum, Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation, at 3-5, 7-8 (June 21, 2022).

Under § 325(d), although this is the second time RE'221 has been challenged in the Patent Office, the prior proceeding was not instituted due to settlement, and accordingly provided no “roadmap” for the present Petition. Further, Gattani, Wilson, Quaid, Hopkins, and Marvit were not considered by the Patent Office. Kriveshko and Serra are cited on the face of RE'221, however, the examiner did not consider the presented combinations involving Kriveshko and Serra.

## **XVI. CONCLUSION**

For the foregoing reasons, Petitioner respectfully requests that Trial be instituted and that the Challenged Claims of RE'221 be canceled.

Respectfully submitted,

Dated: December 20, 2022

By: /s/ John T. McKee  
John T. McKee (Reg. No. 65,926)

*Counsel for Petitioner*

**CERTIFICATE OF COMPLIANCE**

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that the word count for the foregoing Petition for *Inter Partes* Review of U.S. Patent No. RE48,221 totals 13,875 words, which complies with the 14,000 allowed under 37 CFR § 42.24(a)(1)(i). This word count does not include the items excluded by 37 C.F.R. § 42.24 as not counting towards the word limit.

Dated: December 20, 2022

By: /s/ John T. McKee  
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**CERTIFICATE OF SERVICE**

The undersigned hereby certifies that a copy of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. RE48,221 together with all exhibits and other papers filed therewith was served on December 20, 2022, by Federal Express directed to the attorneys of record for the patent at the following address:

BUCHANAN, INGERSOLL & ROONEY PC  
1737 KING STREET, SUITE 500  
ALEXANDRIA VA 22314-2727

A courtesy copy is also provided to the Patent Owner's litigation attorneys by FedEx at the address below:

Kimberly E. Coghill  
TROUTMAN PEPPER HAMILTON SANDERS LLP  
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Courtesy copies of the same documents were served electronically by email

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