

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ALIGN TECHNOLOGY, INC.
Petitioner

v.

3SHAPE A/S
Patent Owner

Case IPR2018-00197
Patent 9,329,675

PETITION FOR *INTER PARTES* REVIEW

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

3SHAPE EXHIBIT 2010
DITC v. 3Shape
IPR2023-00387

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EXHIBIT LIST

Exhibit	Description
1001	U.S. Patent No. 9,329,675 to Öjelund et al.
1002	'675 Patent File History
1003	Declaration of Dr. Chandrajit L. Bajaj
1004	Dr. Chandrajit L. Bajaj Curriculum Vitae
1005	U.S. Patent Publication No. 2007/0171220 to Kriveshko
1006	U.S. Patent Publication No. 2006/0020204 to Serra et al.
1007	U.S. Patent No. 8,903,746 to Brennan et al.
1008	U.S. Patent Publication No. 2006/0212260 to Kopelman et al.
1009	U.S. Patent Publication No. 2007/0172112 to Paley et al.
1010	U.S. Patent Publication No. 2012/0179035 to Boudier
1011	U.S. Patent Publication No. 2009/0322676 to Kerr et al.
1012	International Patent Publication No. 2010/064156 to Poland et al.
1013	U.S. Patent No. 7,221,332 to Miller et al.
1014	U.S. Patent No. 5,377,011 to Koch
1015	U.S. Patent No. 6,485,413 to Boppart et al.
1016	Karatas et al., "Three-dimensional imaging techniques: A literature review," European Journal of Dentistry , Vol. 8, Issue 1, 2014; pp. 132-140
1017	Broadbent H.B., "A New X-Ray Technique and Its Application to Orthodontia," The Angle Orthodontist, Vol. I, No. 2, February 4, 1931; pp. 45-66

Exhibit	Description
1018	Birnbaum et al., “Dental Impressions Using 3D Digital Scanners: Virtual Becomes Reality,”
1019	European Patent No. 2200332 to Thominet
1020	U.S. Patent No. 5,131,844 to Marinaccio et al.
1021	U.S. Patent No. 6,592,371 to Durbin et al.
1022	Ireland et al., “3D surface imaging in dentistry what we are looking at,” British Dental Journal, Vol. 205, No. 7, October 11, 2008; pp. 387-392
1023	Hajeer et al., “Current Products and Practices Applications of 3D imaging in orthodontics: Part II,” Journal of Orthodontics, Vol. 31, 2004; pp. 154-162
1024	U.S. Patent No. 5,722,412 to Pflugrath et al.
1025	U.S. Patent No. 6,645,148 to Nguyen-Dinh et al.
1026	U.S. Patent Publication No. 2005/0237581 to Knighton et al.
1027	U.S. Patent No. 5,181,181 to Glynn
1028	U.S. Patent Publication No. 2006/0092133 to Touma et al.
1029	Bornik et al., “A Hybrid User Interface for Manipulation of Volumetric Medical Data,” 3D User Interfaces, 2006; 8 pages
1030	U.S. Patent No. 6,227,850 to Chishti et al.
1031	U.S. Patent Publication No. 2010/0009308 to Wen et al.
1032	U.S. Patent No. 7,213,214 to Baar et al.
1033	U.S. Patent Publication No. 2003/0164952 to Deichmann et al.

Exhibit	Description
1034	U.S. Patent No. 7,551,353 to Kim et al.
1035	Öjelund Provisional, U.S. Provisional Application No. 61/420,138 (filed December 6, 2010).
1036	Giammanco, et. al., “Using 3D Laser Scanning Technology to Create Digital Models of Hailstones,” American Meteorological Society, July 2017; pp. 1341-1347.

I. Introduction

Handheld three-dimensional (3D) scan tools have been used for many years to measure surface geometry of a 3D environment by acquiring surface data points as the scan tool is passed over the 3D environment. Typically, the data points are used to generate a 3D model. The 3D model is then displayed on a computer monitor connected to the handheld scanner, and a user can interact with the 3D model by rotating, scaling, etc. it on the moitor. Dental applications that use this well-known technique generate a 3D model of an intraoral cavity. The model is used for many things, such as visual inspection of the intraoral cavity and planning an orthodontic or prosthodontic procedure.

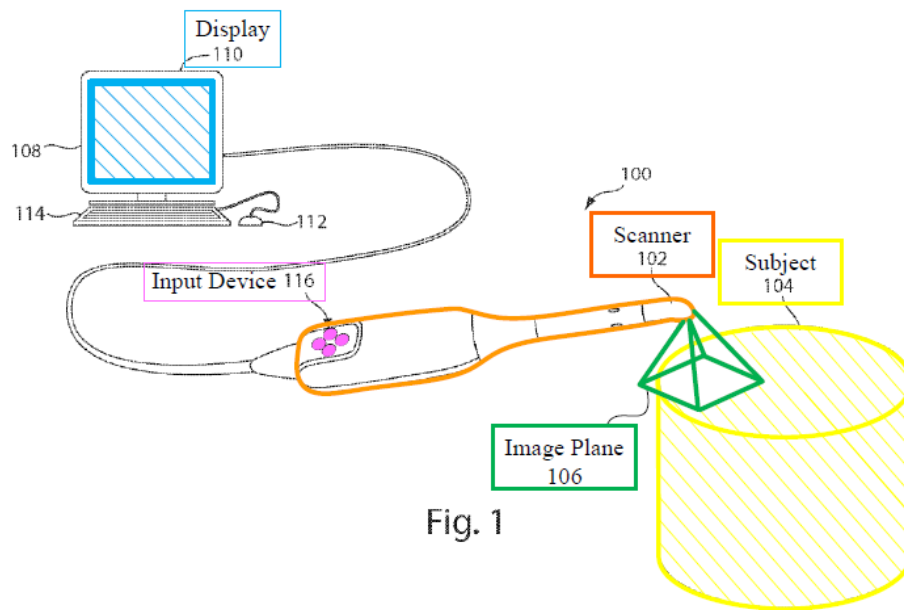
The '675 Patent (U.S. Patent No. 9,329,675 is an application of this decades old technique. The '675 Patent describes a handheld device that performs basic functions such as 3D scanning actions in a physical 3D environment and remotely controlling a visual representation of the 3D environment presented on a display. For example, the '675 Patent uses a conventional intra-oral 3D scanner with motion sensor control of the display. The '675 Patent purports to allow an operator of a scanning device to scan a three-dimensional environment “and subsequently verify[] that the scan has been executed correctly without having to move away from the patient or touch[] any other equipment than already present in his hands.”

(Ex1001, 4:10-14.) But the claimed systems of the '675 Patent directed to these features were well known at the time of filing.

In fact, the '675 Patent acknowledges that intra-oral 3D scanning devices with user interface functionality built into the device, such as the Lava C.O.S. scanner by 3M ESPE, were well known at the time of the '675 Patent. And the '675 Patent acknowledges that devices with 3D user interfaces, such as 3D mice, space balls, and touch screens, were also well known at the time of the '675 Patent. All the user interface capabilities recited by the '675 Patent were obvious, as demonstrated by the prior art. The '675 Patent attempts to find deficiencies in the Lava C.O.S scanner because, although it has additional user interface buttons on the handheld device, it is not possible to manipulate the view by these. Their only purpose is to allow navigation through a menu system, and to start/stop scanning. But not only would it have been obvious to put user interface functionality for controlling a 3D view into a scanner that already has other user interface functionality built in, the art expressly taught this.

Kriveshko, for example, used a 3D intraoral scanning device with a user interface functionality for remotely controlling a display to rotate, scale, and pan a visual representation of a scanned object. As another example, Serra incorporated a three-dimensional user interface into a scanning device. In particular, Serra's scanning device included an interactive mode in which an operator uses the

movement of the scanning device to rotate a visual representation of a scanned object. Serra further provided that incorporating a 3D user interface into a 3D scanning device freed a user from continually having to move the scanning area and interacting with a separate interface on or within the ultrasound machine or the display. Annotated FIG. 1 of Serra shows this.



The Examiner's reasoning for issuing the '675 Patent is erroneous because, as shown by the prior art, the claimed scanning system with handheld 3D scanner was well known in the prior art. In addition, every limitation of the challenged claims, claims 1-19, was broadly applied and known in the industry, and there was nothing novel about the manner in which the limitations were combined.

Petitioner therefore requests *inter partes* review ("IPR") of claims 1–19 ("the challenged claims") of the '675 patent (Ex1001), which, according to PTO

records, is assigned to 3Shape A/S (“Patent Owner”). The Board should institute review and issue a final written decision finding all challenged claims unpatentable

II. Identification of challenge (37 C.F.R. § 42.104(b)) and statement of relief requested

A. Proposed Grounds and Prior Art

The challenged claims should be canceled as unpatentable on the following Grounds.

IPR2018-00197 (current petition):

Ground	References	Basis	Claims Challenged
1	Kriveshko ¹	§ 102	1-2, 9-11, and 18
2	Kriveshko and Serra ²	§ 103	1-5, 8-11, and 14-19
3	Kriveshko, Serra, and Brennan ³	§ 103	6, 7, 12, and 13

¹ Kriveshko, U.S. Patent Publication No. 2007/0171220 (Ex1005) published Jul. 26, 2007, and is prior art under §102(b).

² Serra, U.S. Patent Publication No. 2006/0020204 (Ex1006) published Jan. 26, 2006, and is prior art under §102(b).

³ Brennan, U.S. Patent No. 8,903,476 (Ex1007) filed March 5, 2010 and claims priority to a provisional application filed on March 8, 2009, a provisional application filed on October 20, 2009, and a provisional application filed on December 1, 2009. Brennan is prior art under §102(e).

IPR2018-00198 (co-pending petition):

Ground	References	Basis	Claims Challenged
1	Kopelman ⁴ and Paley ⁵	§ 103	1-2, 9-11, 14, and 18
2	Kopelman, Paley, and Boudier ⁶	§ 103	3 and 19
3	Kopelman, Paley, and Kerr ⁷	§ 103	4-8
4	Kopelman, Paley, and Poland ⁸	§ 103	15-17

⁴ Kopelman, U.S. Patent Publication No. 2006/0212260 (Ex1008) published Sept. 21, 2006, and is prior art under §102(b).

⁵ Paley, U.S. Patent Publication No. 2007/0172112 (Ex1009) published Jul. 26, 2007, and is prior art under §102(b).

⁶ Boudier, U.S. Patent Publication No. 2012/0179035 (Ex1010) published Jul. 12, 2012, and is prior art under §102(e).

⁷ Kerr, U.S. Patent Publication No. 2009/0322676 (Ex1011) published Dec. 31, 2009, and is prior art under §102(b).

⁸ Poland PCT Publication No. WO 2010/064156 (Ex1012) published June 10, 2010, and is prior art under §102(a).

B. Both Petitions Should be Instituted

Each Ground in these two petitions relies on prior art that discloses the claims in different ways, with different strengths. Moreover, the two petitions rely on references that provide stronger disclosures with respect to different claim elements. For example, this petition relies on Kriveshko as a primary reference. Kriveshko explicitly discloses an image capture system (3D scanner) that permits an operator to employ input devices to remotely control a display to adjust a view of a scanned 3D environment with a user interface of the 3D scanner. Kriveshko further discloses that the image capture system includes a handheld optical scanner comprising an input device. In comparison, the concurrently-filed petition relies on the combination of Kopelman and Paley. Kopelman explicitly discloses an image capture system that includes a handheld optical scanner for scanning a 3D environment. Further, Paley teaches modifying Kopelman's handheld optical scanner to include an input device capable of remotely controlling a display to adjust a view of a scanned 3D environment. The references in this petition and the concurrently-filed petition are used to teach different claim features in different ways, and are therefore not cumulative to each other. Accordingly, Petitioner respectfully requests that the Board adopt all grounds in both petitions because the record has not yet been fully developed with respect to these issues.

III. The '675 Patent

A. Overview of the '675 Patent

The '675 Patent allegedly provides a scanning system with a handheld device for scanning a 3D environment and remotely controlling a view of a virtual 3D representation of the 3D environment. (Ex1001, 15:29-42.) A scanning mode of operation employs an optical scanner of the handheld device to capture a 3D geometry of a 3D environment. (Ex1001, 1:47-64.) While the scanning is performed, a virtual 3D representation of the 3D environment is visually built on a display based on the 3D geometry. (Ex1001, 3:6-14.)

A remote control mode of operation permits an operator to adjust a view of the virtual 3D representation with the handheld device. (Ex1001, 4:20-26.) In particular, the handheld device may be used rotate, pan, and zoom the view of the virtual 3D representation. (Ex1001, 2:9-20.) The operator may adjust the view using one or more user input elements (e.g., motion sensors, buttons, scroll wheels) of the handheld device. For example, the operator may adjust the view using a position and/or orientation of the handheld device detected by a motion sensor. (Ex1001, 7:13-17.)

The '675 Patent presents this scanning system as a solution to problems it alleges had not been solved. Allegedly, commercially-available systems required operators to use user interface devices (e.g., a touch screen, a trackball, or a mouse)

separate from the handheld scanning device to adjust the virtual 3D representation presented on the computer display, which were inconvenient, awkward, difficult to use, labor-intensive, and costly to sterilize or disinfect. (Ex1001, 4:38-45.) And the '675 Patent alleges intraoral devices required an operator to move away from a patient and use a separate device to remotely control the virtual 3D representation of the scanned 3D environment. (Ex1001, 4:9-14.)

Thus, the '675 Patent purports to solve these problems by providing a handheld device that permits an operator to work continuously without having to release the handheld device when switching between scanning a subject and adjusting a view of previously scanned images. (Ex1001, 4:55-5:3; 5:10-13.) But, as shown below, such systems were well known in the art.

B. Claim construction

Claim terms of the unexpired '675 Patent are interpreted according to their broadest reasonable interpretation (BRI) in light of the specification. 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2142 (2016).⁹

⁹ Petitioner reserves the right to present different constructions in another forum where a different claim construction standard applies. Petitioner further reserves the right to challenge indefiniteness of all claim terms in litigation.

1. Terms Defined in the '675 Patent

Consistent with the BRI standard, Petitioner believes that the claim terms of the '675 Patent should be given their ordinary and customary meaning. However, the '675 Patent specification provides definitions for certain terms, which are assumed to apply for purposes of claim analysis.

a) “3D geometry”

A constellation of matter or its virtual representation in a three-dimensional space. (Ex1001, 9:64-65.)

b) “3D environment”

A constellation of physical objects each having a 3D geometry in a three-dimensional space. (Ex1001, 9:66-67.)

c) “View”

The way a 3D environment is represented on a display. Geometrically, a view is determined by the virtual observer's/camera's position and orientation. If the display is two-dimensional, the view is also determined by the type of projection. A view may also be determined by a magnification factor. Graphically, a view can show the 3D environment by means of photographs or as some kind of virtual representation such as a computer graphic, or similar. A computer graphic can be rendered for example with texture and/or shading and/or virtual light sources and/or light models for surface properties. A computer graphic can also be

a simplified representation of the 3D environment, for example a mesh, an outline, or an otherwise simplified representation. All or parts of the 3D environment can also be rendered with some degree of transparency. A view may represent the 3D environment in total or only parts thereof. (Ex1001, 10:1-16.)

d) “Handheld device”

An object that has at least one functionality and that is held by a human operator's hand or both hands while performing this at least one functionality. (Ex1001, 10:27-29.)

e) “3D scanner”

A device that analyzes a real-world object or 3D environment to collect data on its shape and possibly its appearance. (Ex1001, 10:30-32.)

f) “Motion sensor”

A sensor detecting motion. Motion can be detected by: sound (acoustic sensors), opacity (optical and infrared sensors and video image processors), geomagnetism (magnetic sensors, magnetometers), reflection of transmitted energy (infrared laser radar, ultrasonic sensors, and microwave radar sensors), electromagnetic induction (inductive-loop detectors), and vibration (triboelectric, seismic, and inertia-switch sensors). MEMS accelerometers, gyros, and magnetometers are examples of motions sensors. (Ex1001, 10:35-39.)

2. “means for manually switching between performing the at least one scanning action and remotely controlling the view” (Claim 3)

In accordance with 37 C.F.R. § 42.104(b)(3), where a claim to be construed contains means-plus-function language, “the construction of the claim must identify the specific portions of the specification that describe the structure, material, or acts corresponding to each claimed function.”

Claim 3 recites “wherein the user interface includes means for manually switching between performing the at least one scanning action and remotely controlling the view.” This means for manually switching is disclosed in the specification to be an “actuator,” which can be in the form of “a button, switch or contact” or also “a touch sensitive surface or element” or “a motion sensor provided in the handheld device that function [sic] as the actuator when it registers a specific type of movement.” (Ex1001, 3:28-46.)

C. Prosecution History of the '675 Patent

Patent Owner amended the independent claims by adding the following limitation in a request for continued examination:

wherein the handheld device is adapted for switching between performing at least one action in a physical 3D environment, ... and remotely controlling the display to adjust the view with which the 3D environment is represented on the display.
(Ex1002, 442.)

In addition, Patent Owner argued that the prior art required an operator to use “two different devices to control both the object of the scanning and the display thereof.” (Ex1002, 444-445.) In the response to the RCE, the Office issued a Notice of Allowance that did not include any reasons for allowance.

D. POSITA

With respect to the '675 Patent, a person of ordinary skill in the art (POSITA) would have a bachelor's degree in computer engineering, computer science, computer vision or an equivalent field, as well as at least one or two years of industry experience in three-dimensional imaging systems, or at least five years of comparable industry experience in three-dimensional imaging systems. In particular, a POSITA would have had experience with, and knowledge of, three-dimensional imaging systems. (Ex1003, ¶¶19-22.)

E. Overview of the Prior Art

1. Overview of Kriveshko

Like the '675 Patent, Kriveshko discloses a scanning system including an intraoral scanning device that captures images of a subject (e.g., a tooth, a quadrant of teeth, or a full collection of teeth) within an image plane, and forwards the images to a computer for display. (Ex1005, ¶¶ 0049, 0054.) Kriveshko further discloses displaying the images as a three-dimensional model within a user interface rendered on a monitor connected to the computer. (Ex1005, ¶ 0076.) The

user interface additionally presents user controls for manipulating the three-dimensional model. (Ex1005, ¶¶ 0090-0091.) In some embodiments, the user controls provide functionality for rotating, scaling, and panning the three-dimensional model. (Ex1005, ¶ 0091.) Additionally, Kriveshko teaches that the user controls are selected via a user input element of the scanning device. (Ex1005, ¶¶ 0090-0091.)

2. Overview of Serra

Again, like the '675 Patent, Serra discloses a scanning system including a scanning device that acquires 3D data of a subject in a scanning mode, and displays the 3D data on a monitor in an interactive visualization mode. (Ex1006, ¶ 0012.) Serra further discloses employing a user interface of the scanning device to control display parameters of 3D data in the interactive visualization mode. (Ex1006, ¶¶ 0053-0054.) For example, an operator of the scanning system may rotate a visual representation of the 3D data displayed on the monitor based on movement of the scanning device and/or one or more buttons of the scanning device. (Ex1006, ¶¶ 0049, 0053-0054; FIG. 7.)

3. Overview of Brennan

Brennan discloses a handheld device including “probes with multiple diagnostic and/or therapeutic functions used in medical and veterinary applications.” (Ex1007, 1:18-21.) For instance, Brennan discloses combining a

probe with optical coherence tomography (OCT) functionality with other probes having diagnostic and/or therapeutic functionalities (e.g., an electrocautery probe, an ablation probe, a cryosurgical probe, a mechanical probe, etc.). (Ex1007, 17:40-43.) Like the '675 Patent, OCT is a technique used for noninvasive diagnosis and medical imaging. (Ex1007, 1:57-60.)

Brennan further discloses that the handheld device includes a motion sensor responsive to movement and/or handling. (Ex1007, 5:25-30.) Additionally, Brennan discloses recognizing gestures made by an operator while holding the handheld scanning device via the motion sensor. (Ex1007, 5:25-36, 22:49-23:21.) Based on the recognized gestures, the operator of the handheld scanning device is able to control functions of the handheld scanning device. *Id.*

IV. Ground 1: Kriveshko anticipates claims 1-2, 9-11, and 18

A. Kriveshko anticipates independent claim 1

The claim limitations have been labeled for ease of discussion.

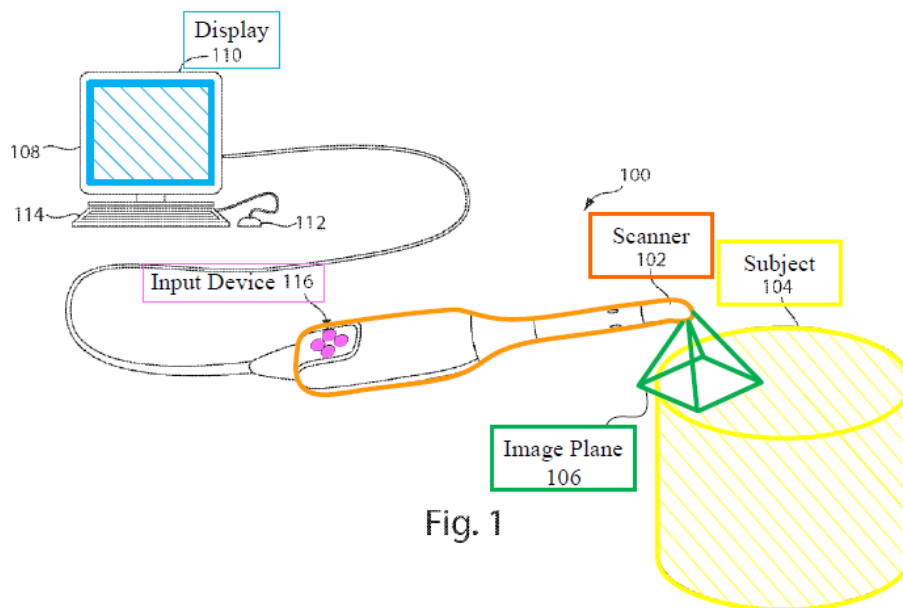
1. [1.P]: “A scanning system for scanning a 3D environment, the scanning system comprising”

Kriveshko discloses a system 100 (i.e., the scanning system) for “scan[ning] complex surfaces ... by maintaining a continuous three-dimensional scan across separated subsections of the surface.” (Ex1005, ¶¶0008, 0013-0014, 0051.)

Kriveshko’s FIG. 1 (annotated) shows a system 100 includes a scanning device 102 that acquires images of a subject 104 (i.e., the 3D environment) while the

scanning device 102 is passed over a surface of the subject 104. (Ex1005, ¶0058.)

In particular, the scanning device 102 captures images of the subject 104 within the image plane 106. (Ex1005, ¶0051.)



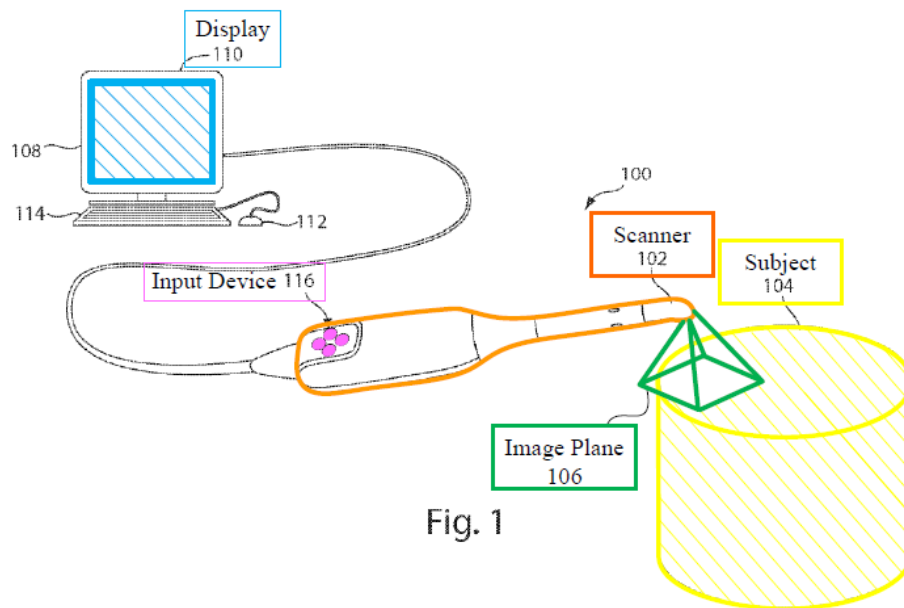
Kriveshko's 3D environment includes "a tooth, a quadrant of teeth, or a full collection of teeth including two opposing arches from which a virtual dental impression is desired." (Ex1005, ¶0054; Ex1003, ¶¶89-93.)

2. [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"

Kriveshko's scanning device 102 is a "handheld, freely positionable probe." (Ex1005, ¶0052; Ex1003, ¶ 95.) The scanning device 102 includes an "optical scanner" because it optically acquires three-dimensional data by employing structured light, laser scanning, or direct ranging. (Ex1005, ¶ 0051; Ex1003, ¶ 95.)

Given that the scanning device 102 is “a handheld, freely positionable probe,” the 3D environment to be scanned is selected by freely positioning (i.e., pointing) the scanning device 102 over the surface of the subject 104 (i.e., the 3D environment) and capturing images of the subject within image plane 106.

(Ex1003, ¶¶94-96.) Annotated FIG. 1 shows this:



3. [1.2]: “at least one display remotely connected to the handheld device”

Kriveshko’s scanning system 100 discloses a computer 108 that includes a display 110 (i.e., the at least one display). (Ex1005, ¶ 0051; FIG. 1; Ex1003, ¶98.) The display 110 is remotely connected to the handheld optical scanning device 102. (Ex1005, ¶0051; FIG. 1.) For example, like the ’675 Patent’s wired scanning device 100 (Ex1001, FIG. 3) remotely connecting to a display 101, Kriveshko’s scanner 102 is remotely connected to the display 110 by a wire. (Ex1005, FIG. 1;

Ex1003, ¶¶98-99.) Thus, Kriveshko's display 110 is remotely connected to its handheld scanner 102 in the same way that the '675 Patent's display 101 is remotely connected to the scanning device 100. (Ex1003, ¶¶97-100.)

When handheld scanning device 102 performs a scan of subject 104, the computer 108 presents images of the scan on the display 110 for viewing by an operator of the scanning device 102. (Ex1005, ¶¶0060, 0090, FIG. 1; Ex1003, ¶¶97-100.)

4. [1.3.1]: “wherein the handheld device is adapted for performing at least one scanning action in a physical 3D environment”

Kriveshko's handheld scanning device 102 is adapted for performing at least one scanning action in a physical 3D environment in which the subject 104 is located. (Ex1003, ¶¶75, 101-104.) Namely, the handheld scanning device 102 captures images of subject 104 in an image plane 106 when the handheld scanning device 102 is passed over subject 104. (Ex1005, ¶¶0051, 0056, 0058.)

The scanning action is “performed in a physical 3D environment” in which the subject 104 is located, as claimed, that the handheld scanning device 102 is passed over the subject 104 to capture images of the subject 104. (Ex1003, ¶¶75, 101-104.)

5. [1.3.2]: “and the at least one display is adapted for visually representing the physical 3D environment”

Kriveshko discloses that display 110 presents a virtual representation of the subject 104 in its environment, which is an example of “visually representing the physical 3D environment,” as claimed. (Ex1005, ¶¶0060, 0090; FIG. 4; Ex1003, ¶¶76, 105-108.) For instance, the visual representation of the subject 104 in its environment is rendered within a window 402 of a user interface 400 on the display 110. (Ex 1005, ¶¶0060, 0090.)

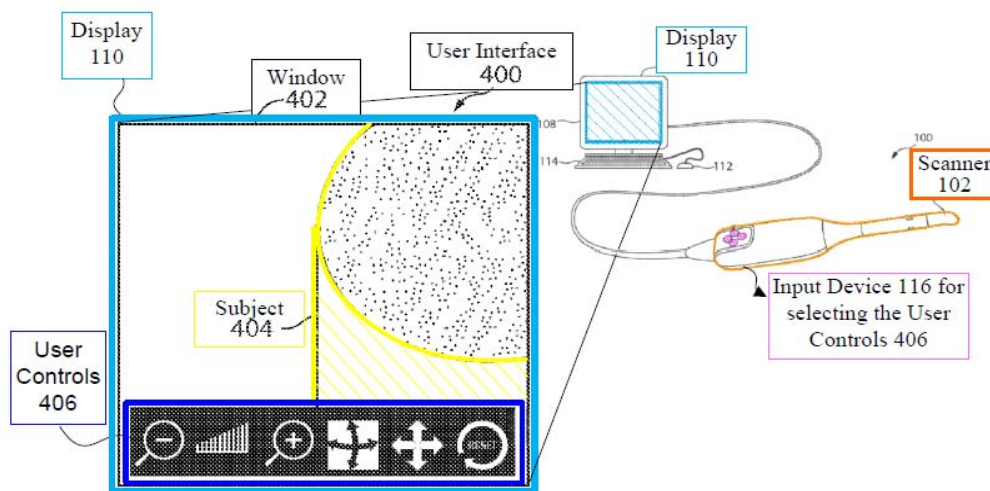


Fig. 4

Kriveshko FIG. 4 (annotated) shows “[w]ithin the window 402, a video image may be displayed including a field of view of a scanner, such as the scanner 102 of FIG. 1. Within the field of view, a subject 404, such as the subject 104 of Figure 1 may be displayed, along with one or more user controls 406.” (Ex1005, ¶0090.)

6. [1.4]: “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”

Kriveshko’s handheld scanning device 102 includes a user input device 116 (e.g., a button, lever, dial, thumb wheel, or switch) for user control of the image capture system 100. (Ex1005, ¶0052.) Kriveshko explains that the user interface of user input device 116 is used to select one or more controls that are presented on display 110—resulting in the manipulation of a three-dimensional model resulting from a scan of the 3D environment. (Ex1005, ¶¶0090-0091; Ex1003, ¶¶76, 109-111.) Such manipulation includes adjusting the view which the 3D environment is represented on the display by rotating, scaling, or panning the view of the three-dimensional model. (*Id.*)

B. Claim 2: “wherein the handheld device is adapted to record the 3D geometry of the 3D environment.”

Kriveshko discloses “*wherein the handheld device is adapted to record the 3D geometry of the 3D environment,*” as required by dependent claim 2. The handheld scanning device 102 records 3D geometry of the 3D environment by using its cameras to capture (i.e., record) images of the 3D environment from which “a three-dimensional point cloud may be recovered.” (i.e., 3D geometry of the 3D environment). (Ex1005, ¶¶0052, 0060-0061; Ex1003, ¶¶75, 112-114.)

C. Claim 9: “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 discloses “*wherein the handheld device is adapted to change a viewing angle with which the 3D environment is represented on the at least one display,*” as required by dependent claim 9.

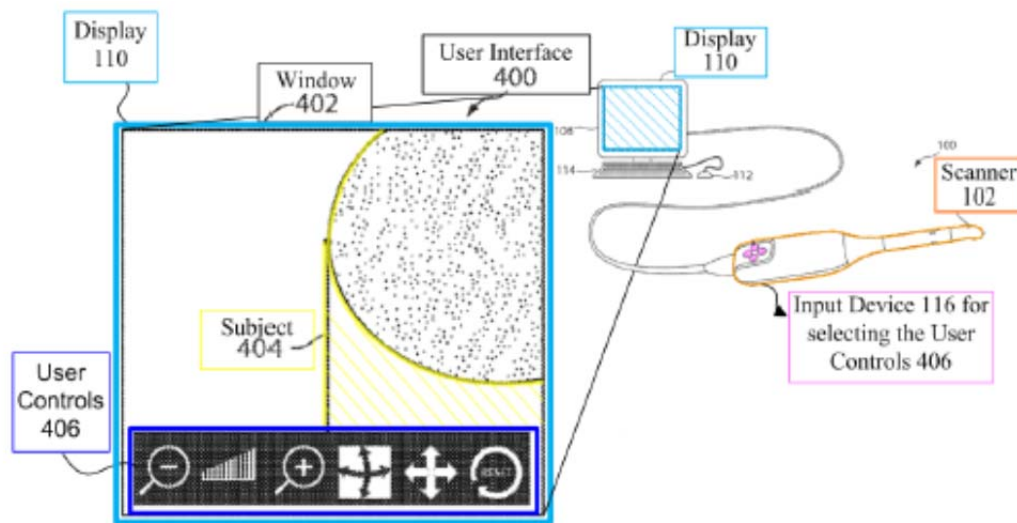
The handheld scanning device 102 (i.e., the handheld device) is used to rotate the three-dimensional environment represented on the display 110 via the user controls 406. (Ex1005, ¶¶0090-0091; Ex1003, ¶¶76.) Specifically, Kriveshko's handheld scanning device 102 includes an input device 116. (Ex1005, ¶0052.) The user is able to rotate the virtual representation of the 3D environment using the input device 116. (Section IV.A.6.) Rotating a view of an environment is an example of changing a viewing angle of that environment. (Ex1003, ¶116.) Thus, Kriveshko discloses that its handheld scanning device 102 is adapted to rotate the 3D environment with its integrated user interface 116 such that a viewing angle of the virtual 3D environment is changed. (Ex1003, ¶¶115-116.)

D. Claim 10: “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 discloses “*wherein the handheld device is adapted to change a magnification factor with which the 3D environment is represented on the at least one display,*” as required by dependent claim 10.

The handheld scanning device 102 scales (i.e., change a magnification factor) the three-dimensional environment represented on the display 110 via the user controls 406, which is manipulated by the handheld scanning device 102. (Ex1005, ¶¶0090-0091; Ex1003, ¶¶118-121.)

Kriveshko FIGS. 1 and 4 (annotated)



FIGS. 1 and 4

show that the user controls 406 include a first graphical user interface icon that includes a magnifying glass and plus sign and a second graphical user icon that includes a magnifying glass and a minus sign. (Ex1003, ¶¶118-121.) The first graphical user interface icon and the second graphical user interface icon represent icons for changing the magnification factor with which a 3D environment is represented on a display. (Ex1003, ¶¶118-120.) Further, the first graphical user interface icon and the second graphical user interface icon are selectable by the

user via the input device 116 of the handheld scanning device 102. (Ex1003, ¶¶118-120.) Thus, Kriveshko discloses that its handheld scanning device 102 is adapted to change a magnification factor with which the 3D environment is represented on the at least one display. (Ex1003, ¶¶117-121.)

E. Claim 11: “wherein the handheld device is an intra-oral 3D scanner.”

Kriveshko discloses “*wherein the handheld device is an intra-oral 3D scanner,*” as required by dependent claim 11. Kriveshko discloses a dental imaging application where subject 104 scanned using the scanning device 102 includes a tooth, a quadrant of teeth, or a full collection of teeth. (Ex1005, ¶0054.) Kriveshko FIG. 10 discloses:

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

(Ex1005, ¶0103; Ex1003, ¶¶123-124.)

Given that the scan occurs from within a dental patient’s mouth and that the scanning device 102 has a probed end, Kriveshko’s scanning device 102 is an example of an “intra-oral 3D scanner.” (Ex1003, ¶¶122-125.)

F. Claim 18: “wherein audible information is provided to the operator.”

Kriveshko discloses “*wherein audible information is provided to the operator,*” as required by dependent claim 18. Kriveshko discloses providing

verbal cues (i.e. the audible information) to the user (i.e., the operator) while the user re-acquires three-dimensional data for an existing three-dimensional model. (Ex1003, ¶¶126-128; Ex1005, ¶0076 (“It will be appreciated that other techniques may be employed, such as directional arrows or verbal cues, to coach a user back to an appropriate location relative to the subject 104.”)) Additionally, Kriveshko’s image capture system 100 provides audible indicators to a user communicating “whether the image capture system 100 is in a recover mode or a normal acquisition mode.” (Ex1005, ¶0076; Ex1003, ¶¶127-128.) As such, Kriveshko’s system provides audible information to a user that will assist the user in re-centering the scanning device 102 at the desired position on the subject 104. (Ex1005, ¶0076; Ex1003, ¶¶126-128.)

V. Ground 2: Kriveshko and Serra render claims 1-5, 8-11, and 14-19 obvious.

A. Claim 1

1. Kriveshko

Petitioner asserts Kriveshko anticipates all elements of independent claim 1. (Ex1003, ¶¶88-111, 129-164.) Patent Owner may argue that Kriveshko does not expressly teach element [1.4], e.g., that the scanning device 102 includes a user interface for remotely controlling the display to adjust the view with which the 3D environment is represented on the display. But this was well known in the prior art, e.g., as is explicitly taught by Serra.

2. Serra

Serra is directed to the interactive display and manipulation of a three-dimensional space for which a plurality of scans have been performed. (Ex1006, ¶¶ 0003, 0040; Ex1003, ¶¶ 77-79.) Serra's system includes a handheld optical scanning device (i.e., the hand held probe) that acquires 3D images. The handheld scanning device includes a user interface consisting of a 3D sensor, one or more switches, or other manual actuators that are used to manipulate a view of the 3D images. (Ex1006, ¶¶ 0053-0054; Ex1003, ¶¶ 157-158.) Serra discloses that 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)." (Ex1006, ¶ 0054; Ex1003, ¶¶ 79, 157-158.)

3. KSR

Enhancing Kriveshko's scanning device with the 3D user interface of Serra's scanning device would have been obvious to a POSITA in view of the teachings of Serra and the knowledge of a POSITA. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007). (Ex1003, ¶¶ 153-164, 239-244.)

Kriveshko and Serra are from the same field of endeavor - both systems are directed to acquiring 3D data via a scanning device, and interactively presenting

the 3D data on a monitor for medical diagnosis. (Ex1005, ¶¶0051, 0054; Ex1006, ¶¶0004, 0012, 0037, 0051.)

Further, although Kriveshko and Serra employ different scanning methodologies, incorporating Serra's 3D user interface into Kriveshko would not have altered the principle of operation of Kriveshko's scanner given that the user interfaces of both Kriveshko and Serra are independent from their respective imaging modalities. (Ex1003, ¶¶159-160, 239-244); *In re Mouttet*, 686 F.3d 1322, 1332–33 (Fed. Cir. 2012). In fact, a POSITA would have been encouraged to look to the teachings of Serra, given that both Kriveshko and Serra include user interfaces for manipulating visual representations of 3D data. (Ex1005, ¶0091; Ex1006, ¶0035.) In particular, Serra's scanning device includes a 3D user interface that rotates a visual representation of 3D data based on movement of the scanning device determined by a motion sensor. (Ex1006, ¶¶0049, 0053-0054; FIG. 7.)

Serra discloses that the 3D user interface provides an improvement over 2D input devices, such as the input device 116 of Kriveshko, given that 2D user input devices “necessitate[] awkward mappings of 3D manipulations onto essentially 2D devices.” (Ex1006, ¶0009.) Serra further discloses that incorporating the 3D user interface into a scanning device provides ergonomic advantages over other scanning systems by permitting the user to both perform a scanning process and examination process with the same device. (Ex1006, ¶0053.)

Given Serra's explicit acknowledgment of the ergonomic benefits of modifying a scanning device to include the ability to adjust display parameters, a POSITA would have been motivated and found it obvious to incorporate Serra's 3D user interface into Kriveshko's optical handheld device in order to provide an ergonomic handheld scanning device with a user interface that is adapted to control the display of three-dimensional imaging data displayed from an optical scan of 3D environment. (Ex1006, ¶¶0011, 0053; Ex1003, ¶¶153-164, 239-244.) Utilizing Serra's known technique would have been obvious since it had been used to improve Serra's scanning device and a POSITA would have recognized that implementation of Serra's technique in Kriveshko's similar device would render the same result of providing an ergonomic scanning device better suited to manipulate a display of three-dimensional imaging data. *KSR* 550 U.S. at 417. (Ex1003, ¶¶153-160, 239-244.)

In addition, modifying Kriveshko's user interface to include the functionality of the user interface of Serra's scanning device would have been obvious to a POSITA because doing so would have been nothing more than the use of known technique to improve similar devices in the same way. *KSR Int'l Co.*, 550 U.S. at 416. (Ex1003, ¶¶153-164, 239-244.) Serra discloses that its handheld scanning device is capable of performing a zoom operation and rotation operation on a visual representation of 3D data. (Ex1006, ¶¶0057, 0060; Ex1003, ¶¶243-

244.) Consistent with this disclosure, a POSITA would have recognized that implementing the functionality of Serra's user interface, would have been a design consideration well within the knowledge of a POSITA designing a system, like those disclosed by Kriveshko and Serra, for interactively presenting the 3D data on a monitor. (Ex1003, ¶¶239-244.)

Serra explicitly states that "[b]ecause a user is generally always holding the ultrasound (or other substantially real-time image acquisition) probe, it is ergonomically convenient to allow him to control display parameters by actuating one or more buttons on the probe." (Ex1006, ¶0053.) For instance, by incorporating a user interface for adjusting display parameters into the scanning device, Serra's scanning system does not require the user to be inconvenienced with putting down the scanning device and using another device. (Ex1003, ¶ 244.)

Further, Serra states that the disclosed zooming and rotation techniques "reveal detail not easily appreciated from the original scanning viewpoint," and "greatly enhance[] examination of a patient." (Ex1006, ¶0058.) Thus, a POSITA would have been motivated and found it obvious to enhance the system of Kriveshko by including the functionality of Serra's user interface, given that Serra explicitly teaches the ergonomic and examination benefits of modifying a scanning device to include the ability to adjust display parameters. (Ex1003, ¶¶239-244.)

Furthermore, both Kriveshko and Serra teach interactively presenting the 3D data on a monitor for medical diagnosis. (Ex1005, ¶¶0051, 0054; Ex1006, ¶¶0004, 0012, 0037, 0051.) Additionally, Serra discloses a scanner system that employs a second computer with 3D graphics capabilities and a second monitor with stereoscopic capabilities. (See Ex1006, FIG. 8; ¶¶0075-0076.) Serra explicitly describes that stereoscopic displays “afford superior depth perception, which is the key to any 3D interface.” (Ex1006, ¶0046; *see also* FIGS. 7-8.) It would have been obvious to a POSITA to make such modification so that Kriveshko’s scanning system includes a second monitor with stereoscopic capabilities, like that disclosed by Serra, to aid in the presentation of 3D data acquired during the scanning process. (Ex1006, ¶0046; *see also* FIGS. 7-8.) A POSITA would have recognized that a stereoscopic display would have presented an enhanced visual experience that would assist operators in examining 3D data. (Ex1003, ¶¶217-224, 245-246.)

Thus, a POSITA would have been motivated and found it obvious to enhance the system of Kriveshko by including a second monitor, given that Serra explicitly teaches the visual benefits of displaying information via a stereoscopic display. (Ex1003, ¶¶217-224, 245-246.)

B. Claim 2: “wherein the handheld device is adapted to record the 3D geometry of the 3D environment.”

Kriveshko teaches or suggests “*wherein the handheld device is adapted to record the 3D geometry of the 3D environment,*” as required by dependent claim 2. The modified handheld scanning device 102 records 3D geometry of the 3D environment by using its cameras to capture (i.e., record) images of the 3D environment from which “a three-dimensional point cloud may be recovered.” (i.e., 3D geometry of the 3D environment) (Ex1005, ¶¶0052, 0060-0061; Ex1003, ¶¶ 165-167.)

C. Claim 3: “wherein the user interface includes means for manually switching between performing the at least one scanning action and remotely controlling the view.”¹⁰

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

¹⁰ The provisional application the ’675 Patent claims benefit of does not provide written description support for this claim. (Ex1003, ¶¶58-63.) Therefore, this claim is only entitled to priority of the PCT application filing date of December 5, 2011 at earliest, and not the provisional application filing date.

The Patent Owner may argue that Kriveshko does not expressly disclose this claim element. But this element was well known in the prior art, e.g., as explicit taught by Serra.

Serra discloses that its handheld optical scanning device includes means for manually switching between performing the at least one scanning action and remotely controlling the view by virtue of the button on Serra's handheld device. (Ex1006, ¶0053.) Serra discloses that the "button can be used to indicate when to use the probe to scan real-time or when to use it to rotate the entire virtual scene, which is a common a 3D data set interactive visualization operation." *Id.*

Additionally, Serra discloses that the button can be used to activate two modes of operation: (i) a scanning mode (where the button switch is ON) and (ii) an interactive mode (where the button switch is OFF). (*Id.*, ¶0054; Ex1003, ¶¶168-172.)

A POSITA would have understood how and why to modify Kriveshko to include this teaching of Serra to meet this claim because doing so would have been nothing more than the use of known technique to improve similar devices in the same way. *KSR Int'l Co.*, 550 U.S. at 416. (Section V.A; Ex1003, ¶¶153-164, 168-173, 239-244.)

D. Claim 4: “wherein the handheld device comprises at least one motion sensor.”

Kriveshko as modified by Serra teaches or suggests, “*wherein the handheld device comprises at least one motion sensor,*” as required by dependent claim 4.

The Patent Owner may argue that Kriveshko does not expressly disclose this claim element. But this element was well known in the prior art, e.g., as explicit taught by Serra.

Serra discloses that its handheld scanning device includes a 3D sensor. (Ex1006, ¶¶0036, 0042, 0049, FIG. 7.) Using the 3D sensor (i.e., the at least one motion sensor), Serra’s handheld scanning device collects tracking information corresponding to the movement (e.g., three-dimensional position and orientation) of the scanning device. (Ex1006, ¶ 0054; Ex1003, ¶¶78, 174-179.)

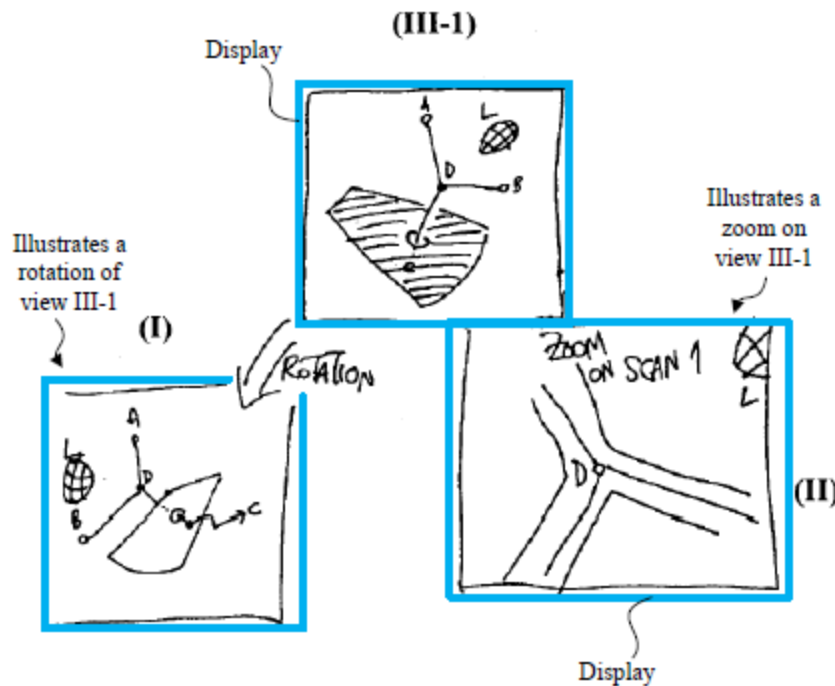
A POSITA would have understood how and why to modify Kriveshko to include this teaching of Serra to meet this claim because doing so would have been nothing more than the use of known technique to improve similar devices in the same way. *KSR Int’l Co.*, 550 U.S. at 416. (Section V.A; Ex1003, ¶¶ 153-164, 174, 180, 239-244.)

E. Claim 5: “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 as modified by Serra teaches or suggests, “*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*” as required by dependent claim 5.

The Patent Owner may argue that Kriveshko does not expressly disclose this claim element. But this element was well known in the prior art, e.g., as explicit taught by Serra.

Serra’s handheld scanning device includes a motion sensor that collects tracking information corresponding to the scanning device’s position. (Section V.D; Ex1006, ¶0053; Ex1003, ¶¶174-184.) Serra further discloses that the scan from the motion sensor results in a view of the 3D environment on its display. (Ex1006, ¶¶0053, 0054.) Serra’s FIG. 5 (annotated) illustrates the view of the 3D environment produced by the scanner of the handheld device.



Annotated Figure 5 illustrates changing the viewpoint of the user over the entire three-dimensional scene based on the 3D sensor of the handheld scanning device. (Ex1003, ¶¶185-186; Ex1006, ¶¶0057, 0060.) In particular, FIG. 5 illustrates a zoom operation from view III-1 to view II, and a rotation operation from view III-1 to view I. (Ex1006, ¶¶0057, 0060; Ex1003, ¶ 185.)

A POSITA would have understood how and why to modify Kriveshko to include this teaching of Serra to meet this claim because doing so would have been nothing more than the use of known technique to improve similar devices in the same way. *KSR Int'l Co.*, 550 U.S. at 416. (Section V.A; Ex1003, ¶¶153-164, 181, 187-188, 239-244.)

F. Claim 8: “wherein the user-interface is other than the at least one motion sensor.”

Kriveshko teaches or suggests, “*wherein the user-interface is other than the at least one motion sensor,*” as required by dependent claim 8. As described in section V.D., the combination of Kriveshko and Serra teaches a scanning device that includes a motion sensor. Additionally, the modified handheld scanning device 102 includes additional input devices, other than the motion sensor. For example, Kriveshko discloses that the scanning device 102 includes a user interface that can include a button, lever, dial, thumb wheel, or switch. (Ex1005, ¶¶0052; Ex1003, ¶¶189-194.)

G. Claim 9: “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 view of Serra teaches or suggests, “*wherein the handheld device is adapted to change a viewing angle with which the 3D environment is represented on the at least one display,*” as required by dependent claim 9.

The modified handheld scanning device 102 rotates the three-dimensional environment represented on the display 110 via the user controls 406. (Ex1005, ¶¶0090-0091; Ex1003, ¶¶195-196.) Further, to the extent Patent Owner may argue that Kriveshko does not explicitly teach that the scanning device 102 is adapted to change a viewing angle with which the 3D environment is represented on the at

least one display, this was well known in the prior art, e.g., as is explicitly taught by Serra.

Serra discloses rotating a visual presentation of 3D scene using the movement of a scanning device. (Ex1006, ¶¶0053, 0054; Ex1003, ¶¶ 197-198.) Serra further discloses that the scanning device is used to rotate a virtual scene presented on a display— **effectively changing the viewpoint of the user over the entire 3D scene.** (Ex1006, ¶¶0053, 0054; Ex1003, ¶¶197-197.)

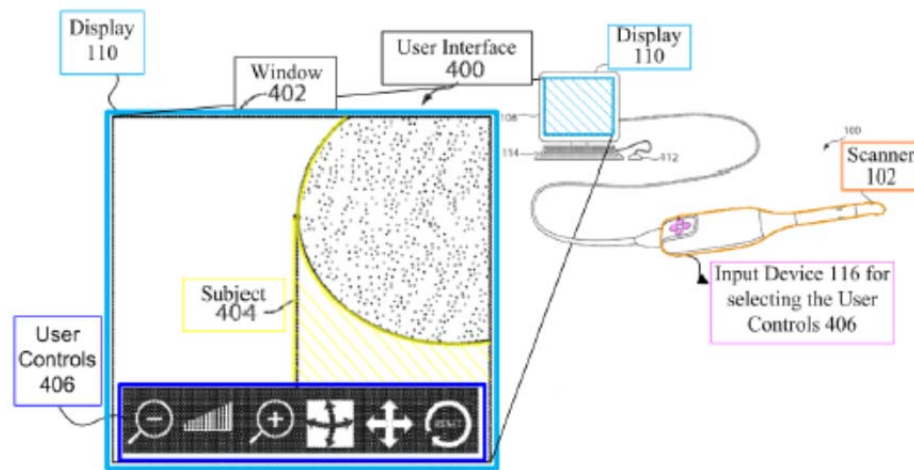
A POSITA would have understood how and why to modify Kriveshko to include this teaching of Serra to meet this claim because doing so would have been nothing more than the use of known technique to improve similar devices in the same way. *KSR Int'l Co.*, 550 U.S. at 416. (Section V.A; Ex1003, ¶ 199.)

H. Claim 10: “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 teaches or suggests, “*wherein the handheld device is adapted to change a magnification factor with which the 3D environment is represented on the at least one display,*” as required by dependent claim 10.

The modified handheld scanning device 102 is adapted to scale the three-dimensional environment represented on the display 110 via the user controls 406, which can be manipulated by the handheld device. (Ex1003, ¶¶200-204.) For example, FIGS. 1 and 4 (annotated below) illustrate that the user controls 406

include a first graphical user interface icon that includes a magnifying glass and plus sign, and a second graphical user icon that includes a magnifying glass and a minus sign. (Ex1003, ¶¶200-204.)



FIGS. 1 and 4

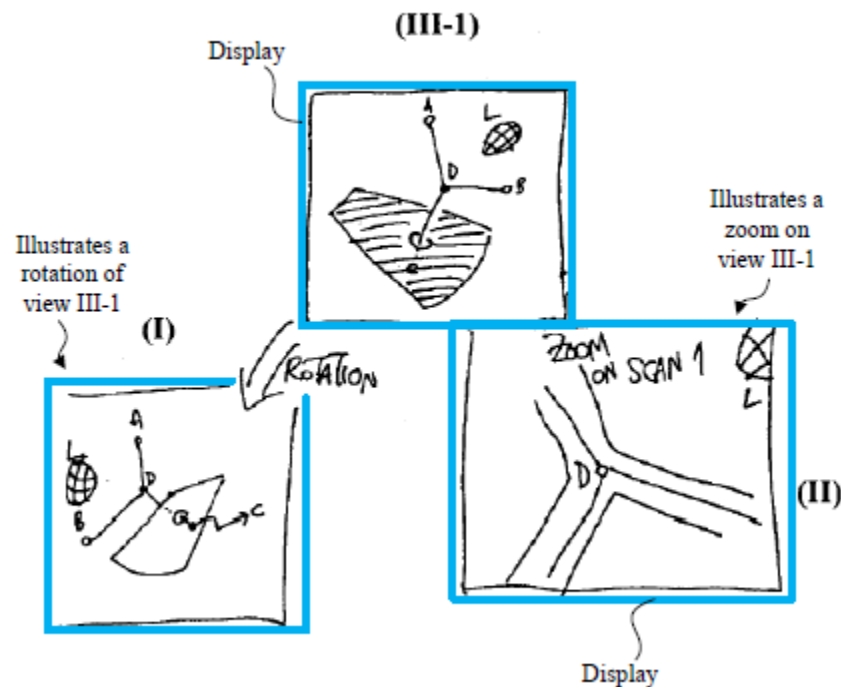
To the extent Patent Owner may argue that Kriveshko does not explicitly teach that the scanning device 102 is adapted to change a magnification factor with which the 3D environment is represented on the at least one display, this was well known in the prior art, e.g., as is explicitly taught by Serra.

Serra discloses that its handheld scanning device performs three-dimensional volumetric operations to modify a magnification factor of a viewpoint of scanned objects. (Ex1006, ¶ 0057, “Once such a selection is made, the clinician can, for example, use the pen or other tracked handheld tool to control the way in which to see the objects by performing various 3D volumetric operations upon them, such

as, for example, described in detail in **Zoom Slider, Zoom Context** and 3D

Matching" Ex1003, ¶¶205-207 (Emphasis added.))

Serra's zoom operation is illustrated in the transition from III-1 to II in Figure 5 (annotated). (Ex1006, ¶0058.) As illustrated in Figure 5, the size of a scanned subject displayed on a monitor is magnified in response to a zoom effect operation (performed by the handheld device) in order to realize an optimal viewpoint for viewing the objects present within the 3D environment. (Ex1003, ¶¶205-206, Ex1006, FIG. 5 and ¶¶0057-0058.)



A POSITA would have understood how and why to modify Kriveshko to include this teaching of Serra to meet this claim because doing so would have been nothing more than the use of known technique to improve similar devices in the

same way. *KSR Int'l Co.*, 550 U.S. at 416. (Section V.A; Ex1003, ¶¶200-207, 239-246)

I. Claim 11: “wherein the handheld device is an intra-oral 3D scanner.”

Kriveshko teaches or suggests, “*wherein the handheld device is an intra-oral 3D scanner,*” as required by dependent claim 11. Kriveshko discloses a dental imaging application of the invention wherein the subject 104 scanned using the scanning device 102 includes a tooth, a quadrant of teeth, or a full collection of teeth. (Ex1005, ¶0054; Ex1003, ¶¶208-211.) With respect to FIG. 10, Kriveshko states:

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

(Ex1005, ¶0103; Ex1003, ¶¶209-210.)

J. Claim 14: “wherein the handheld device is an in-ear 3D scanner.”

Kriveshko teaches or suggests, “*wherein the handheld device is an in-ear 3D scanner,*” as required by dependent claim 14. Kriveshko discloses an imaging application of the invention wherein the subject 104 includes “a human head, or a portion thereof, from which a three-dimensional model is desired for custom fitting of a hearing aid” (Ex1005, ¶0054.) Additionally, a POSITA would have understood that the fitting of a hearing aid requires the handheld device to be an in-

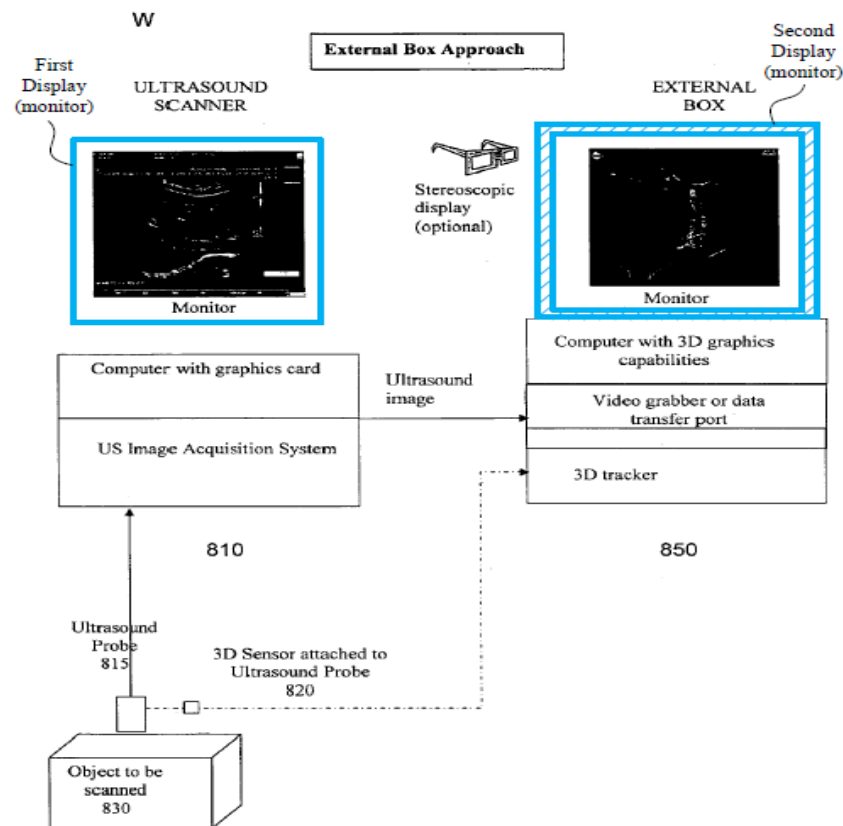
ear 3D scanner allowing for collection of three-dimensional data used to fit the hearing aid inside the hearing canal of a human. (Ex1003, ¶¶ 212-215.)

K. Claim 15: “wherein the at least one display is defined as a first display, and where the system further comprises a second display.”

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

Although Kriveshko does not explicitly disclose wherein the at least one display is defined as a first display, and where the system further comprises a second display, this was well known in the prior art, e.g., as is explicitly taught by Serra.

Serra FIG. 8 (annotated) shows an ultrasound scanner system comprising a first computer and a main monitor, and an external box system comprising a second computer with 3D graphics capabilities and a second monitor. (Ex1006, FIG. 8; ¶¶0075-0076; Ex1003, ¶¶ 216-220.)



Serra further discloses that the second monitor receives “as an input the ultrasound image (either as a standard video signal or as a digital image), and provides as an output a 3D display.” (Ex1006, ¶¶0075; FIG. 8.) As an example, Serra provides that the three-dimensional display output by the second monitor includes an autostereoscopic display or a polarized display. (Ex1006, ¶¶0076; Ex1003, ¶¶216-220.)

A POSITA would have understood how and why to modify Kriveshko to include this teaching of Serra to meet this claim because doing so would have been nothing more than the use of known technique to improve similar devices in the

same way. *KSR Int'l Co.*, 550 U.S. at 416. (Section V.A; Ex1003, ¶¶221-224, 245-246.)

L. Claim 16: “wherein the second display indicates where the handheld device is positioned relative to the 3D environment.”

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

As described above, the combination of Kriveshko and Serra discloses a scanning system for scanning a three-dimensional environment, the scanning system including a first monitor and a second monitor.

Kriveshko further discloses displaying images and visual cues that indicate the position of a scanning device relative to the three-dimensional environment during an acquisition mode. (Ex1003, ¶¶225-228.) For instance, Kriveshko discloses (emphasis added):

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

(Ex1005, ¶0060; Ex1003, ¶226.)

The Patent Owner may argue that Kriveshko does not expressly disclose this claim element. But this element was well known in the prior art, e.g., as explicit taught by Serra.

Serra discloses an ultrasound scanner system comprising a first computer and a main monitor, and an external box system comprising a second computer with 3D graphics capabilities and a second monitor. (Section V.K; Ex1006, FIG. 8; ¶¶ 0075-0076.) The position indication relative to the 3D environment provided by Kriveshko, displayed on the second monitor of Serra (which is used specifically “as an input the ultrasound image (either as a standard video signal or as a digital image), and provides as an output a 3D display,” (Ex1006, ¶0075; see also FIG. 8), teaches the claimed feature. (Ex1003, ¶¶225-228.)

A POSITA would have understood how and why to modify Kriveshko to include this teaching of Serra to meet this claim because doing so would have been nothing more than the use of known technique to improve similar devices in the same way. *KSR Int'l Co.*, 550 U.S. at 416. (Section V.A; Ex1003, ¶¶228, 245-246.)

M. Claim 17: “wherein the first display and/or the second display provides instructions for the operator.”

Kriveshko teaches or suggests, “*wherein the first display and/or the second display provides instructions for the operator,*” as required by dependent claim 17. Kriveshko discloses that the display 110 is configured to provide guidance (i.e. the

instructions) to an operator of the handheld scanning device 102 during a recovery mode. (Ex1005, ¶0014; Ex1003, ¶¶ 229-233.) For example, Kriveshko discloses:

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

(Ex1005, ¶0059 (Emphasis added); Ex1003, ¶ 231.)

N. Claim 18: “wherein audible information is provided to the operator.”

Kriveshko teaches or suggests, “*wherein audible information is provided to the operator,*” as required by dependent claim 18. Kriveshko discloses providing verbal cues (i.e. the audible information) to the user while the user re-acquires three-dimensional data for an existing three-dimensional model. (Ex.1005, ¶0076 (“It will be appreciated that other techniques may be employed, such as directional arrows or verbal cues, to coach a user back to an appropriate location relative to the subject 104.”); Ex1003, ¶¶234-236.) Additionally, Kriveshko’s image capture system 100 provides audible indicators to a user communicating “whether the image capture system 100 is in a recover mode or a normal acquisition mode.” (Ex1005, ¶0076. Ex1003, ¶235.) As such, Kriveshko’s system provides audible information to a user that will assist the user in re-centering the scanning device 102 at the desired position on the subject 104. (Ex1003, ¶¶234-236.)

O. Kriveshko in view of Serra render obvious independent claim 19¹¹

Claim 19 merely recites a system that includes all the limitations of claims 1, 3-5, and 11. All of those limitations have been addressed above. (Sections IV.A.1-6, V.A., V.C.-V.E, V.I) Thus, Kriveshko in view of Serra also renders claim 19 obvious for all the reasons discussed above for claims 1, 3-5, and 11. (Sections IV.A.1-6, V.A., V.C.-V.E, V.I.)

Claim 19	Claims 1, 3, 4, and 11
[19.P] A system, comprising:	[1.P] A scanning system for scanning a 3D environment, the scanning system comprising:
[19.1] a handheld device and at least one display;	[1.1] a handheld device...; and [1.2] at least one display remotely connected to the handheld device;
[19.2.1] wherein the handheld device is adapted for switching between performing at least one action in a physical 3D environment,	[3] wherein the user interface [of the handheld device] includes means for manually switching between performing the at least one scanning action and remotely controlling the view.
[19.2.2] wherein the at least one display is adapted for visually representing the physical 3D environment;	[1.3.2] and the at least one display is adapted for visually representing the physical 3D environment;
[19.2.3] and remotely controlling the display to adjust the view with which	[1.4] the handheld device includes a user interface for remotely controlling

¹¹ The provisional application the '675 Patent claims benefit of does not provide written description support for this claim. (Ex1003, ¶¶58-63.) Therefore, this claim is only entitled to priority of the PCT application filing date of December 5, 2011 at earliest, and not the provisional application filing date.

Claim 19	Claims 1, 3, 4, and 11
the 3D environment is represented on the display;	the display to adjust the view with which the 3D environment is represented on the display.
[19.3.1] wherein the handheld device is an intra-oral 3D scanner and	[11] wherein the handheld device is an intra-oral 3D scanner.
[19.3.2] the at least one action performed in the physical 3D environment is scanning and that the view is remotely controlled by at least one motion sensor arranged in the handheld device, and	[1.3.1] wherein the handheld device is adapted for performing at least one scanning action in a physical 3D environment, [4] wherein the handheld device comprises at least one motion sensor. [5] 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.
[19.3.3] wherein an actuator provided on the handheld device switches between performing the at least one action and remotely controlling the view.	[3] wherein the user interface [of the handheld device] includes means for manually switching between performing the at least one scanning action and remotely controlling the view.

VI. Ground 3: Kriveshko, Serra, and Brennan render obvious claims 6, 7, 12, and 13.

A POSITA would have understood that the combination of Kriveshko, Serra, and Brennan renders claims 6, 7, 12, and 13 obvious. (Ex1003, ¶¶247-286.) Claim 6 depends from claim 4, and claim 7 depends from claim 6. Further, claims 12 and 13 both depend directly from claim 1.

A. Motivation to Combine Kriveshko, Serra, and Brennan

Enhancing Kriveshko-Serra with the gesture based user interface of Brennan's scanning device would have been obvious to a POSITA because doing

so would have been nothing more than simple substitution of one known element for another to obtain predictable results. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007). (Ex1003, ¶¶277-279.)

A POSITA would have understood that each of Kriveshko, Serra and Brennan disclose handheld scanning devices with well-known user input techniques for controlling an image capturing system. (Ex1003, ¶¶74-85, 248-254, 277-279.) Kriveshko discloses a scanning device 102 that includes a user input device 116 (e.g., a button, lever, dial, thumb wheel, or switch) for user control of the image capture system 100. (Ex1005, ¶0052; Ex1003, ¶76.) Serra discloses a scanning device that includes a motion sensor that collects tracking information corresponding to the movement of the scanning device using the motion sensor. (Ex1006, ¶¶0049, 0053-0054; see also FIG. 7; Ex1003, ¶79.) Brennan discloses using gestures for user control of an image capture system. (Ex1007, 5:25-36, 22:49 – 23:21.)

Thus, a POSITA would have recognized that modifying the combination of Kriveshko-Serra, as noted above, would have been nothing more than a simple substitution of known technologies and features for another, and would have been well within the capabilities of a POSITA at the time of the alleged invention. (Ex1003, ¶¶248-254, 277-279.) The predictable results being a scanning device

capable of controlling an image capture system using a gesture based interface.

(Ex1003, ¶¶277-280.)

Further, it would have been obvious to a POSITA to incorporate the gesture based input techniques of Brennan into the combination of Kriveshko's scanning device and Serra's scanning device in order to provide an intuitive means of user input via a motion sensor. (Ex1003, ¶280.) Utilizing Brennan's known technique would have been obvious since it had been used to improve Brennan's scanning device and a POSITA would have recognized that implementation of Brennan's technique in the combination of Kriveshko-Serra's similar device would render the same result of providing an intuitive means of user input via gestures. *KSR* 550 U.S. at 417 (Ex1003, ¶ 280.)

Additionally, enhancing the combination of Kriveshko's scanning device and Serra's scanning device with the surgical instruments of Brennan would have been obvious to a POSITA in view of the teachings of Brennan. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007) (Ex1003, ¶¶281-283.)

Brennan teaches combining a scanning device with a surgical instrument in order to avoid having to constantly swap out surgical instruments within a surgical site. (Ex1007, 2:4-8.) For instance, Brennan discloses that "[t]he need to constantly swap out instruments because of limited access to the surgical site is frequently a problematic and time-consuming distraction to the surgeon." (Ex1007, 1: 46-49.)

Further, Kriveshko discloses that its scanner has applications in the medical space, such as use by a dentist. Dentist often perform surgery, e.g., tooth extractions, tooth implants, wisdom teeth removal, etc., that require the use of surgical tools. (Ex1003, ¶ 282.) Thus, a POSITA would have recognized that incorporating a surgical instrument into Kriveshko's scanning device would have permitted a dentist to perform a scanning process and a surgical process at a surgical site without having to use multiple devices. (Ex1003, ¶¶281-283.) Additionally, a POSITA would have recognized the importance of reducing distractions for a medical practitioner performing a dental procedure on a patient, like that disclosed by Kriveshko. (Ex1003, ¶281-283.)

Thus, a POSITA would have been motivated and found it obvious to enhance the combination of Kriveshko-Serra by incorporating a surgical instrument, given that Brennan explicitly teaches the efficiency benefits of combining a scanning device with other devices having diagnostic and/or therapeutic functions. (Ex1003, ¶¶281-283)

Additionally, enhancing the combination of Brennan's scanning device and Serra's scanning device by incorporating the mechanical tool of Brennan would have been motivated and found it obvious to a POSITA in view of the teachings of Brennan. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007). (Ex1003, ¶¶284-86.)

Brennan teaches combining a scanning device with a mechanical tool in order to avoid having to constantly swap out surgical instruments within a surgical site. (Ex1007, 2:4-8.) For instance, Brennan discloses “[t]he need to constantly swap out instruments because of limited access to the surgical site is frequently a problematic and time-consuming distraction to the surgeon.” (Ex1007, 1: 46-49.) Further, Kriveshko discloses that its scanner has applications in the medical space, such as use by a dentist. Dentist often perform surgery, e.g., tooth extractions, tooth implants, wisdom teeth removal, etc., that require the use of mechanical tools. (Ex1003, ¶ 285.) Further, a POSITA would have recognized that incorporating a mechanical instrument into Kriveshko’s scanning device would have permitted a dentist to perform a scanning process and a surgical process at a surgical site without having to use multiple devices. (Ex1003, ¶¶ 284-286.) Additionally, a POSITA would have recognized the importance of reducing distractions for a medical practitioner performing a dental procedure on a patient, like that disclosed by Kriveshko. (Ex1003, ¶ 284-286.)

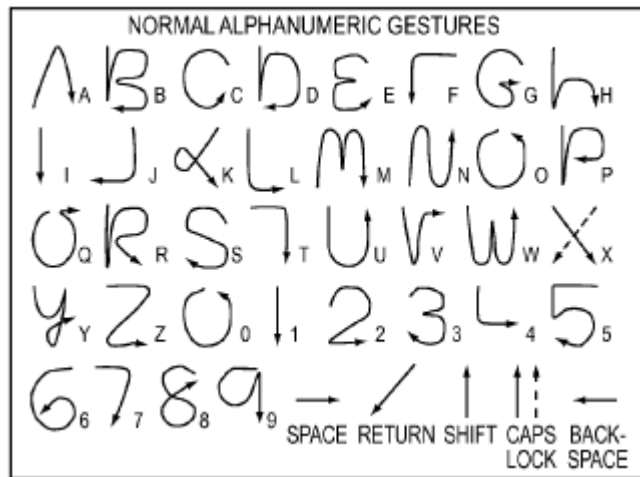
Thus, a POSITA would have been motivated and found it obvious to enhance the combination of Kriveshko and Serra by incorporating a mechanical tool, given that Brennan explicitly teaches the efficiency benefits of combining a scanning device with other devices having diagnostic and/or therapeutic functions. (Ex1003, ¶¶284-286.)

B. Claim 6: “wherein functionality of the user interface comprises a use of gestures.”

Kriveshko in view of Serra and Brennan teaches or suggests, “*wherein functionality of the user interface comprises a use of gestures,*” as required by dependent claim 6.

The Patent Owner may argue that Kriveshko-Serra does not expressly disclose this claim element. But this element was well known in the prior art, e.g., as explicit taught by Brennan.

Brennan discloses a handheld scanning device. (Ex1007, 17:40-42; Ex1003, ¶¶80-85, 249-254.) Brennan discloses triggering user interface commands via gestures performed with the scanning device. (Ex1007, 5:25-36; Ex1003, ¶¶249-254.) For instance, Brennan describes controlling the functionality of the scanning device via the gestures. (Ex1007, 22:56-59, “For example, an “R” gesture may start the “Recording” on the OCT monitor. Other gestures may correspond to commands for laser type, brightness, OCT wavelength, or other variables to aid surgery.”) Figure 19



depicts exemplary gesture-based alphanumeric input strokes that may be utilized to control various functions of the scanning device. (Ex1007, 22:31-23:65.)

A POSITA would have understood how and why to modify Kriveshko-Serra to include this teaching of Brennan to meet this claim because doing so would have been nothing more than the use of known technique to improve similar devices in the same way. *KSR Int'l Co.*, 550 U.S. at 416. (Section VI.A; Ex1003, ¶¶ 252-254, 277-280.)

C. Claim 7: “wherein the gestures are detected by the at least one motion sensor.”

Kriveshko as modified by Serra and Brennan teaches or suggests, “*wherein the gestures are detected by the at least one motion sensor*,” as required by dependent claim 7.

The Patent Owner may argue that Kriveshko-Serra does not expressly disclose this claim element. But this element was well known in the prior art, e.g., as explicit taught by Brennan.

Brennan discloses that its scanning device includes a motion sensor responsive to movement and handling. (Ex1003, ¶¶255-261.) Specifically, Brennan’s motion sensor may include a gyroscope to sense an orientation of the scanning device or an accelerometer to sense motion of the scanning device along particular axes. (Ex1007, 22:33-37.) Brennan discloses using the motion sensor to determine that the movement of the scanning device matches a predetermined gesture. (Ex1007, 5:20-60.) Upon detection of a gesture by the motion sensor, a

functionality of the scanning device corresponding to the gesture is enabled.

(Ex1007, 22:31-23:65; Ex1003, ¶257-258.)

A POSITA would have understood how and why to modify Kriveshko-Serra to include this teaching of Brennan to meet this claim because doing so would have been nothing more than the use of known technique to improve similar devices in the same way. *KSR Int'l Co.*, 550 U.S. at 416. (Section VI.A; Ex1003, ¶¶260-261, 277-280.)

D. Claim 12: “wherein the handheld device includes a surgical instrument.”

Kriveshko as modified by Serra and Brennan teaches or suggests, “*wherein the handheld device includes a surgical instrument*,” as required by dependent claim 12.

The Patent Owner may argue that Kriveshko-Serra does not expressly disclose this claim element. But this element was well known in the prior art, e.g., as explicit taught by Brennan.

Brennan discloses combining a scanning probe with a cryosurgical probe for destroying biological tissues and/or skin lesions, a mechanical probe for manipulating or cutting biological tissue, and an electrocautery or ablation probe for burning tissue and/or cauterizing blood vessels. (Ex1007, 17:60-18: 25; 18:59-65; Ex1003, ¶¶262-268.)

A POSITA would have understood how and why to modify Kriveshko-Serra to include this teaching of Brennan to meet this claim because doing so would have been nothing more than the use of known technique to improve similar devices in the same way. *KSR Int'l Co.*, 550 U.S. at 416. (Section VI.A; Ex1003, ¶¶ 267-268, 281-283.)

E. Claim 13: “wherein the handheld device includes a mechanical tool.”

Kriveshko as modified by Serra and Brennan teaches or suggests, “wherein the handheld device includes a mechanical tool,” as required by dependent claim 13.

The Patent Owner may argue that Kriveshko-Serra does not expressly disclose this claim element. But this element was well known in the prior art, e.g., as explicit taught by Brennan.

Brennan discloses combining a scanning probe with a mechanical probe for manipulating or cutting biological tissue. (Ex1007, 18:59-61; Ex1003, ¶¶ 269-276.)

A POSITA would have understood how and why to modify Kriveshko-Serra to include this teaching of Brennan to meet this claim because doing so would have been nothing more than the use of known technique to improve similar devices in the same way. *KSR Int'l Co.*, 550 U.S. at 416. (Section VI.A; Ex1003, ¶¶ 275-276, 284-286.)

VII. Mandatory notices under 37 C.F.R. §42.8

A. Real parties-in-interest (§42.8(b)(1))

The real party-in-interest is Align Technology, Inc.

B. Notice of related matters (§42.8(b)(2))

The '675 Patent has not been involved in any litigation proceedings. This Petition is being filed concurrently with another *inter partes* review proceeding involving the same patent, IPR2018-00198.

C. Lead and back-up counsel with service information (§42.8(b)(3) and (4))

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Petitioner consents to service via email at PTAB@skgf.com and the counsels' email addresses noted above.

VIII. Grounds for standing

Petitioner certifies that the '675 Patent is eligible for *inter partes* review, and Petitioner is not barred or estopped from requesting *inter partes* review. The required fee is paid via deposit account. The Office is authorized to charge fee deficiencies and credit overpayments to Deposit Acct. No. 19-0036 (Customer ID No. 45324).

IX. Conclusion

This Petition demonstrates that claims 1-19 of the '675 Patent are unpatentable. Thus, Petitioner respectfully requests institution of *inter partes* review.

Respectfully submitted,
STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.



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CERTIFICATION OF WORD COUNT

The undersigned hereby certifies that the portions of the above-captioned **PETITION FOR *INTER PARTES* REVIEW** specified in 37 C.F.R. § 42.24 have 10,456 words, in compliance with the 14,000 word limit set forth in 37 C.F.R. § 42.24(a)(1)(i). This word count was prepared using Microsoft Word 2010.

Respectfully submitted,

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CERTIFICATION OF SERVICE

The undersigned hereby certifies that the foregoing **PETITION FOR
INTER PARTES REVIEW**, Petitioner's power of attorney, and all supporting
exhibits were served via USPS Express Mail or FedEx Express on November 22,
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