

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VALVE CORPORATION
Petitioner,

v.

IMMERSION CORPORATION
Patent Owner.

Case No. IPR2024-00557
U.S. Patent No. 10,665,067

EXHIBIT 2007

**DECLARATION OF DR. ROBERT AKL, D.SC.
IN SUPPORT OF IMMERSION CORPORATION'S
PATENT OWNER RESPONSE**

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I, Robert Akl, declare as follows:

1. I have been retained by Folio Law Group PLLC, counsel for Patent Owner Immersion Corporation (“Immersion”) to assess the challenged claims of U.S. Patent No.10,665,067 (“the ’067 Patent”) in connection with this case which is the Petition for *Inter Partes* Review of the ’067 Patent (“the Petition”).

2. I am being compensated for my work on this case at my standard rate of \$995 per hour (plus reimbursement for expenses) in connection with my preparation of this declaration, as well as for each hour spent providing deposition testimony. My fee is not contingent on my performance, the outcome of this case, any issues involved in or related to this case, or on any of my opinions or the technical positions I explain in this report. In addition, I have no financial interest in the outcome of this case or any of the parties involved in this case.

3. I believe I am qualified to serve as a technical expert in this proceeding based on my educational and work experience, including my 30+ years of experience in haptic feedback effects, user interface design, user interaction design, human-computer interaction, software engineering from 1990 through today.

4. This declaration sets forth my opinions, which I formed based on my study of the evidence; my understanding as an expert in the field; and my training, education, research, knowledge, and personal and professional experience. All of my opinions stated in this declaration are based on my own personal knowledge,

expertise, training, education, and professional judgment. In forming my opinions, I have relied on my knowledge and experience in human factors, user interface design, user interaction design, human-computer interaction, and software engineering.

5. If I am called upon to do so, I would be competent to testify to the matters set forth herein. My qualifications to testify about the technical subject matter in this case and the relevant technology are outlined in my curriculum vitae and this section of this declaration. A copy of my current curriculum vitae is provided for this proceeding as Exhibit 2008.

6. This declaration is based on the information currently available to me. If additional information becomes available to me, I reserve the right to continue my analysis, which may include a review of documents and information that may be provided to me, as well as testimony from depositions that have not yet been taken at this time.

I. BACKGROUND AND QUALIFICATIONS

7. I earned two Bachelor of Science degrees in Electrical Engineering and Computer Science *summa cum laude* with a grade point average of 4.0/4.0 and a ranking of first in my undergraduate class from Washington University in St. Louis in 1994. In 1996, I earned my Master of Science degree in Electrical Engineering from Washington University in St. Louis with a grade point average of 4.0/4.0. I earned my Doctor of Science in Electrical Engineering from Washington University

in St. Louis in 2000, again with a grade point average of 4.0/4.0, with my dissertation being on “Cell Design to Maximize Capacity in Cellular Code Division Multiple Access (CDMA) Networks.”

8. While a graduate student, from 1997 through 1999, I worked at MinMax Corporation in St. Louis, where I designed software packages that provided tools to flexibly allocate capacity in a CDMA communications network and maximize the number of subscribers. I also validated the hardware architecture for an Asynchronous Transfer Mode (ATM) switch capable of channel group switching, as well as performed logical and timing simulations, and developed the hardware architecture for the ATM switch. I also worked with Teleware Corporation in Seoul, South Korea, where I designed and developed algorithms that were commercially deployed in a software package suite for analyzing the capacity in a CDMA network implementing the IS-95 standard to maximize the number of subscribers.

9. After obtaining my Doctor of Science degree, I worked as a Senior Systems Engineer at Comspace Corporation from October of 2000 to December of 2001. At Comspace, I designed and developed advanced data coding and modulation methods for improving the reliability and increasing the available data rates for cellular communications. I coded and simulated different encoding schemes (including Turbo coding, Viterbi decoding, trellis coded modulation, and Reed-Muller codes) and modulation techniques using amplitude and phase characteristics

and multi-level star constellations. This work further entailed the optimization of soft decision parameters and interleavers for additive white Gaussian and Rayleigh faded channels. In addition, I also extended the control and trunking of Logic Trunked Radio (LTR) to include one-to-one and one-to-many voice and data messaging.

10. In January of 2002, I joined the faculty of the University of New Orleans in Louisiana as an Assistant Professor in the Department of Electrical Engineering. While in this position, I designed and taught two new courses called “Computer Systems Design I and II.” I also developed a Computer Engineering Curriculum with a strong hardware-design emphasis, formed a wireless research group, and advised graduate and undergraduate students.

11. In September of 2002, I received an appointment as an Assistant Professor in the Department of Computer Science and Engineering at the University of North Texas (UNT), in Denton, Texas. In May of 2008, I earned tenure and was promoted to the rank of Associate Professor. As a faculty member, I have taught courses and directed research in networking and telecommunications, including 2G, 3G, 4G, 5G, CDMA/WCDMA, GPS, GSM, UMTS, LTE, ad-hoc networks, antenna design and beamforming, Bluetooth, call admission control, channel coding, channel estimation, communication interfaces and standards, compression, computer architecture, MIMO systems, multi-cell network optimization, network security,

packet-networks, telephony, VoIP, Wi-Fi (802.11), 802.15.4, Zigbee, wireless communication, and wireless sensors. Between January of 2015 and August of 2022, I was appointed to Associate Chair of Graduate Studies in the Department of Computer Science and Engineering. In May of 2023, I was promoted to the rank of Professor.

12. I am also the director of the Wireless Sensor Lab (“WiSL”) at UNT. I am a member of the Center for Information and Cyber Security (CICS). It is the only program in the U.S. to be federally certified by the National Security Agency as a Center of Academic Excellence in Information Assurance Education and Research *and* Cyber Defense Research. I was also a member of the NSF Net-Centric & Cloud Software & Systems: Industry-University Cooperative Research Center (I/UCRC). Several of my research projects are funded by industry and the National Science Foundation and published in *IEEE* conference proceedings and journals.

13. Between 2011 and 2013, I was director of the Bio-Com Project that was funded by Raytheon. The project evaluated the feasibility study using Surface Electromyography (EMG) and bend resistive sensors, that are attached to each of the five fingers of the hand, for hand gesture recognition. This approach is sometimes known as a “data glove.” A prototype was developed and demonstrated at Raytheon, to help soldiers in close-combat situations communicate with hand gestures and hand signals that would be recognized and transmitted to other soldiers’ Head Up Display

(HUD) without breaking radio silence. This work also resulted in a published paper describing the prototype and analysis “Evaluating the Feasibility of EMG and Bend Sensors for Classifying Hand Gestures” and a masters’ thesis “An Accelerometer-Based Gesture Recognition System For A Tactical Communications Application.”

14. In addition to advising and mentoring students at UNT, I was asked to join the faculty of the University of Arkansas in Little Rock as an Adjunct Assistant Professor from 2004 to 2008 in order to supervise the research of two Ph.D. graduate students who were doing research in wireless communications. At UNT, I have advised and supervised more than 250 undergraduate and graduate students, several of whom received a master’s or doctorate degree under my guidance.

15. Further, between 2005 and 2017, I have received over a million dollars in funding from the State of Texas, Texas Higher Education Coordination Board, the National Science Foundation, and industry to design and conduct robotics, video, and mobile gaming (*e.g.*, Xbox, PC, mobile device) programming summer camps for middle and high school students at UNT. By using video and mobile gaming as the backdrop, participants have learned coding and programming principles and developed an understanding of the role of physics and mathematics in video game design. I have used competitive gaming projects in programming courses as a way to motivate and retain students in computer science. This work also resulted in two published papers “Motivating and Retaining CS2 Students with a Competitive Game

Programming Project” and “Intra-Class Competitive Assignments in CS2: A One-Year Study.”

16. In addition to teaching and studying gaming, I am also an avid fan of video games. I have been playing video games for over 30 years. I have had different generations of consoles, including the PlayStation, the Xbox, and Nintendo. My first portable video game console was by Nintendo. I’ve played video games on PCs and handheld devices, and more recently, on my iPad and cell phone. I enjoy playing video games and it is the reason I sought degrees in computer science and electrical engineering.

17. In addition to my academic work, I have remained active in the communication industry through my consulting work. In 2002, I consulted for Input/Output Inc. and designed and implemented algorithms for optimizing the frequency selection process used by sonar for scanning the bottom of the ocean. In 2004, I worked with Allegiant Integrated Solutions in Ft. Worth, Texas to design and develop an integrated set of tools for fast deployment of wireless networks, using the 802.11 standard. Among other features, these tools optimize the placement of Access Points and determine their respective channel allocations to minimize interference and maximize capacity. I also assisted the Collin County Sheriff’s Office (Texas) in a double homicide investigation, analyzing cellular record data to determine user location.

18. I have authored and co-authored over 100 journal publications, conference proceedings, technical papers, book chapters, and technical presentations in a broad array of communications-related technologies, including networking and wireless communication. I have also developed and taught over 100 courses related to communications and computer systems, including several courses on signals and systems, 4G/LTE and 5G/NR, OFDM, VoIP, Wi-Fi (802.11), 802.15.4, Zigbee, wireless communication, antenna design and beamforming, communications systems, communication interfaces and standards, channel estimation, location management, sensor networks, source coding and compression, network security, computer systems design, game and app design, and computer architecture. These courses have included introductory courses on communication networks and signals and systems, as well as more advanced courses on wireless communications. A complete list of my publications and the courses I have developed and/or taught is also contained in my *curriculum vitae*.

19. My professional affiliations include services in various professional organizations and serving as a reviewer for a number of technical publications, journals, and conferences. I have also received a number of awards and recognitions, including the IEEE Professionalism Award (2008), UNT College of Engineering Outstanding Teacher Award (2008), and Tech Titan of the Future (2010) among others, which are listed in my *curriculum vitae*.

20. I have also served as an expert in certain legal proceedings. A list of cases in which I have testified at trial, hearing, or by deposition (including those during the past four years) is provided in my curriculum vitae. Over the years, I have been retained by both patent owners and petitioners, as well as plaintiffs and defendants.

II. BASES OF OPINIONS AND MATERIALS CONSIDERED

21. In the course of performing my analysis and forming my opinions, I have reviewed the Petition and its Exhibits 1001–1084 including, but not limited to, the materials listed below:

- IPR Petition, IPR2024-00557
- Institution Decision, IPR2024-00557
- U.S. Patent No. 10,665,067 (“the ’067 Patent”) (Ex. 1001)
- Prosecution History of the ’067 Patent. (Ex. 1002)
- Declaration of Gregory Welch (Ex. 1003)
- US 2017/0108930 (“Banerjee”) (Ex. 1011)
- US 2012/0045742 (“Meglan”) (Ex. 1012)
- US 2017/0354864 (“Rogers”) (Ex. 1010)
- US 2018/0144549 (“Gonzalez”) (Ex. 1009)
- US 2016/0274662 (“Rimon”) (Ex. 1008)
- Joint Claim Construction Statement in WDWA (Ex. 2003)

- Declaration of Craig Rosenberg, Ph.D. (EX2001).

I have reviewed and agree with the opinions expressed in the Declaration of Craig Rosenberg, Ph.D., and may include and/or incorporate relevant parts of that declaration into my present Declaration. When citing from the patent, the Institution Decision, the Petition, or the prior art references, all emphasis is added unless otherwise noted. My opinions are also based upon my education, training, research, knowledge, and personal and professional experience.

III. SUMMARY OF OPINIONS

22. The Petition raises three grounds of invalidity. Ground 1 of the Petition alleges that claims 1-8, 11-12, and 15-21 are anticipated and/or obvious in view of Banerjee (Ex. 1011). Ground 2 alleges that claims 1-8, 11-12, and 15-21 are anticipated and/or obvious rendered obvious by Meglan (Ex. 1012). Ground 3 alleges that claims 1-8, 11-12, and 15-21 are anticipated and/or obvious by Rogers (Ex. 1010).

23. Based on my analysis of the Petition and the exhibits cited in the Petition, it is my opinion that none of Grounds 1 to 3 renders claims 1-8, 11-12, and 15-21 anticipated and/or obvious by the asserted prior art.

IV. OVERVIEW OF THE '067 PATENT

24. The '067 Patent involves a system that includes a proxy object with one or more haptic output devices, a display for outputting visual effects onto the proxy

object, a sensor for tracking the proxy object's position, and a processor configured to modify visual effects displayed on the proxy object as well as to output haptics based on the position of the proxy object. Ex. 1001, Abstract, 1:27-49.

25. The '067 Patent solves the problems relating to enhancing user interaction with virtual or augmented reality environments and addresses the need for a more immersive experience in such environments. *Id.*, 1:13-23. The '067 Patent does so by integrating haptic feedback and visual effects. *Id.*, Abstract, 1:27-49. Specifically, the inventive system includes a proxy object that comprises haptic output devices, a display for visual effects, a sensor for tracking the position of the proxy object, and a processor that determines and outputs modified visual and haptic effects based on position data from the sensor. *Id.* This system provides users with a tactile experience, such as feeling the texture of objects, that corresponds with what they see in the augmented reality environment. Thus the interaction with virtual content is more realistic and engaging for the user. *Id.*, 1:3-49, 2:30-64.

V. EXEMPLARY CLAIM OF THE '067 PATENT

26. Independent claim 1 is recited below:

1[pre]. A system comprising:

[1A] a proxy object comprising one or more haptic output devices;

[1B] a display configured to output a visual effect onto a surface of the proxy object;

[1C] a sensor for tracking a position of the proxy object; and

[1D] a processor configured to:

- [1D-1] determine a modified visual effect based in part on data received from the sensor; and
- [1D-2] determine a haptic effect based in part on data received from the sensor;
- [1D-3] transmit a display signal associated with the modified visual effect to the display, the modified visual effect to be displayed on the proxy object via the display
- [1D-4] transmit a haptic signal associated with the haptic effect to the one or more haptic output devices; and
- [1D-5] output the haptic effect using the one or more haptic output devices.

VI. APPLICABLE LEGAL STANDARDS

A. Ordinary Skill in the Art

27. My opinions in this declaration are based on the understandings of a person of ordinary skill in the art—sometimes referred to as an “ordinary artisan” or by the acronyms “POSITA” or “POSITA” (person of ordinary skill in the art)—as of the time of the invention, which I understand to be the earliest priority date (June 15, 2018) of the ’067 Patent. I understand that the person of ordinary skill in the art is a hypothetical person who is presumed to have known the art relevant to the challenged claims of the ’067 Patent at the time of the invention.

28. I understand that, in assessing the level of skill of a person of ordinary skill in the art, one should consider the type of problems encountered in the art, the

prior solutions to those problems found in the prior art references, the rapidity with which innovations are made, the sophistication of the technology, the level of education of active workers in the field, and my own experience working with those of skill in the art at the time of the invention. I have considered these factors in reaching my opinion as to the hypothetical POSITA that I set forth below.

29. I understand that the Petitioner has proposed that the level of skill in the art at the time of the '067 Patent is as follows:

POSITAs would have a bachelor's degree in electrical engineering, computer science, or a related field, plus at least two years of industry or graduate level experience with software engineering, haptics programming, and/or human-computer interaction, including experience with user-interfaces and applications involving touchscreens, touchpads, and related technologies.

Pet. at 6 (citing Ex. 1003, ¶¶39).

30. In my opinion, the definition of a POSITA should be defined as:

A person of ordinary skill in the art would have possessed a bachelor's degree in electrical engineering or computer science (or an equivalent degree), and two years of practical or industry experience in the field of human-computer interaction, including implementation of computer-based systems and software for providing haptic feedback effects to a user. A person could also have qualified as an ordinarily skilled artisan with more formal education and less practical or industry experience, or vice versa.

31. Consistent with either definition, I was at the time of the invention, and currently am, a POSITA through my education, research experience and work experience. As of the date of the invention, I was familiar with the types of problems encountered in systems that use haptic feedback and the rapidity at which innovations are made.

B. Claim Construction

32. I understand that Patent Owner proposes the following claim terms constructions, which I agree with and have applied to my analysis in this Declaration:

Claim Term	Patent Owner’s Proposed Construction
“a proxy object comprising one or more haptic output devices”	“a physical object that acts as a proxy for a virtual object and that itself contains inside a haptic output device, e.g., an actuator”
“determine a haptic effect based in part on data received from the sensor”	“determine a haptic effect based in part on position data of the proxy object received from the sensor that tracks a position of the proxy object”

1. “a proxy object comprising one or more haptic output devices”

33. As a POSITA reading the '067 Patent and its intrinsic evidence including the plain language of the claims, the patent specification, and the prosecution history, I understand the meaning of the term “proxy object” to be consistent with the definition stated above. This definition takes is consistent with the three interrelated aspects of the invention which are expressly recited in the claim

as: (1) “a proxy object comprising one or more haptic output devices,” (2) “a sensor for tracking a position of *the proxy object*,” and (3) “the modified visual effect to be displayed on *the proxy object*.” Ex. 1001, cl. 1.

a) The proxy object is a proxy for a virtual object

34. I understand a “proxy object” to mean a physical object in the real world that acts as a proxy for a virtual object in an Augmented Reality (AR) or Virtual Reality (VR) world. For example, the patent explains:

In one illustrative embodiment, a user is wearing an AR headset and is looking at **a proxy object, e.g., a shoe, in real space**. The user may choose a material from a library of materials (e.g., materials such as one or more of leather, plastic, rubber, metal, burlap, suede, denim, wood, cloth, ceramic, foamed material, or glass). **This material will then be displayed on the proxy object via the AR headset** by saying a voice command out loud (e.g., apply leather material) or inputting instructions via a visual menu in a VR or AR headset, a hand controller, a wearable device, or gesture recognition. The illustrative AR display of the AR headset is modified based on the command so that **the appearance of the proxy object is modified through the AR display to show the proxy object made of the selected material**.

EX1001, 2:39-52. Here, the proxy object is an actual shoe in the real world that acts as a proxy for a virtual shoe in the AR or VR world viewed through the AR/VR display headset. *See, e.g.*, EX1001, Figs. 2-3 (showing proxy objects 202 and 302), 2:40 (“a proxy object, e.g., a shoe in real space”), 3:3-4 (“The modified image of the

proxy object through the AR display [...] can then be modified in real-time to reflect any movement of the proxy object”), 5:34-37 (“In some embodiments, **proxy object 202 may take the form of any object**, including, but not limited to, a shoe, a bag, an article of clothing, an electronic device, a display, or an interface object.”)

b) The proxy object contains inside a haptic output device

35. As explained in the specification of the patent shown above, the claimed haptic output device must be contained inside the proxy object, rather than the haptic device be a separate appendage or extension that is mechanically coupled to the proxy object. The express language of the claim recites “a proxy object comprising one or more haptic output devices.” EX1001, 10:42-43. As such, the claimed haptic output device must be contained inside the proxy object. The specification also states:

In one illustrative embodiment, a haptic effect associated with the proxy object is output by a haptic output device, e.g., an actuator, that outputs a haptic effect (e.g., a vibration or ESF effect) simulating a texture of the material selected from the library.

EX1001, 2:53-57.

36. As a further example, the patent specification discloses that the haptic output device 118 is “**integrated into a proxy object.**” Ex. 1001, 2:37-38; *see also id.*, 5:67-6:1 (“a haptic signal is transmitted to the **haptic output device(s) 118 contained in proxy object 202**”), 5:67-6:1 (“As the AR visual effect is changed

through the choice of texture, a haptic signal is transmitted to the **haptic output device(s) 118 contained in proxy object 202**”).

37. I also find support in the prosecution history for this reading of the claim. During prosecution, the Applicant amended the claim scope and disclaimed proxy objects that were mechanically coupled to the haptic output device containing the actuator. Ex. 1002, 280-288. I understand that the Applicant amended claim 1 in the following way:

1. A system comprising:
a proxy object comprising one or more haptic output devices;
~~a haptic output device mechanically coupled to the proxy object;~~
a display configured to output a visual effect onto a surface of
the proxy object;
a sensor for tracking a position of the proxy object; and
a processor configured to:
 determine a modified visual effect based in part on data
 received from the
 determine a haptic effect based in part on data received
 from the sensor;
 transmit a display signal associated with the modified
 visual effect to the display, the modified visual effect to be
 displayed on the proxy object via the display;
 transmit a haptic signal associated with the haptic effect to
 the one or more
 haptic output device; and
 output the haptic effect using the one or more haptic output
 devices.

Ex. 1002, 280.

38. Also, I note that the Applicant had previously amended the “haptic output device” limitation of claim 1 as follows: “a haptic output device ~~mechanically~~

~~coupled to~~ **within** the proxy object,” but that amendment was not entered. *Id.*, 258.

This further shows the Applicant’s intention to narrow the claim scope to only proxy objects with haptic output devices, *e.g.*, actuators, inside of it.

39. Thus, the proxy object itself must contain the actuator inside of it. In other words, a proxy object that is an appendage to and/or connected to be a part of a haptic output device (containing the actuator) is outside the claim scope.

2. “determine a haptic effect based in part on data received from the sensor”

40. I understand that Patent Owner has proposed the following construction for this term, which I agree with: “determine a haptic effect based in part on position data of the proxy object received from the sensor that tracks a position of the proxy object.” I understand that “*the sensor*” in this claim element [1D-2] has an antecedent basis that refers back to the previous claim element [1C], “a **sensor for tracking a position** of the proxy object.” EX1001, 10:46-51. I understand that if a claim term is used in a claim, subsequent use of the definitive article “the” with the term effectively refers back to the same term recited earlier in the claim. As such, determination of the haptic effect must be based in part on the position of the proxy object.

41. I understand that the Board preliminarily found that “the data received from *the sensor*” is not necessarily limited to position or location data, and that it may include other types of sensor data such as velocity, acceleration, etc. DI, 28-29.

The Board bases this on the specification's disclosure that a sensor may comprise a combination of sensors including position sensors and other sensors such as an accelerometer. *Id.*, 28 (citing EX1001, 11:6-7 (dependent claim 7)). The Board also pointed to the following in the specification as support for why they believed the claimed haptic effect can be based on other types of sensor data in addition to position data:

a device may be configured to determine and output haptic effects. In this example, a detection module 124 configures processor 102 to monitor sensor(s) 108 to determine characteristics of haptic output device 118. For example, detection module 124 may sample sensor 108 in order to track one or more of the location, path, velocity, acceleration, pressure, and/or other characteristics of haptic output device 118 over time.

EX1001, 52-55.

42. However, despite the specification's disclosure of various types of sensors and data types (*e.g.*, location, velocity, acceleration, etc.), the claim explicitly specifies “**a sensor for tracking position** of the proxy object” because there is antecedent basis. Thus, if dependent Claim 7 recites **the sensor** of Claim 1 to comprise various types of sensors such as camera, laser, radar, accelerometer, etc., I read Claim 1 by substituting any of those sensors listed in Claim 7 into the occurrence of “sensor” in Claim 1 such as in claim element [1C] “sensor **for tracking a position of the proxy object.**”

43. As such, a POSITA would understand that even though claim element [1C] does not specify the type of sensor used for tracking a position of the proxy object, I would consider subsequent usage of the term sensor for the purpose of tracking position of the proxy object. In other words, any other sensor or type of sensor that is covered by Claim 1 or its dependent claims are sensors **for tracking position** of the proxy object. Therefore, the haptic effects in claim element [1D-2] are based on position data from the sensor for tracking position of the proxy object as recited in claim element [1C].

44. Even if additional sensor data types such as velocity and acceleration are used in determining haptic effects in claim 1, a POSITA would understand that those additional sensor data types are used to calculate the position of the proxy object consistent with the purpose of claim element [1C]. For example, I understand that an accelerometer can indirectly determine the position of an object by measuring its acceleration over time, but it cannot directly measure absolute position without additional information or calculations, as it only measures changes in velocity and not the object's starting point. *Id.* Thus, I understand this claim term to mean that the haptic effects are determined based on “position data.”

C. Anticipation

45. Counsel has informed me, and I understand, that a showing of anticipation involves a comparison of the construed claims to the alleged prior art

and, to anticipate a patent claim, a single prior art reference must disclose each element of the claimed invention, either expressly or inherently. The prior art reference must also have disclosed each element prior to disclosure of the claimed invention.

46. Further, a party claiming inherency must prove that the alleged inherent element or feature necessarily is present by clear and convincing evidence. The fact that the feature is likely to have existed is not sufficient. It must be shown that the feature was necessarily present in the reference to show inherency.

D. Obviousness

47. Counsel has informed me, and I understand, that an issued patent claim is invalid as obvious if it can be shown that the differences between the patented subject matter and the prior art are such that the subject matter as a whole would have been obvious, at the time the invention was made, to a person having ordinary skill in the art. Relevant considerations include the level of ordinary skill in the art; the scope and content of the prior art; differences between the prior art and the claims at issue; and the objective indicia, or secondary considerations, of nonobviousness.

48. In this regard, I am informed and I understand that the secondary considerations of nonobviousness could include factors such as commercial success, long felt but unresolved needs, the failure of others, skepticism by experts, praise by others, award and accolades, and copying.

49. Counsel has informed me, and I understand, that in order to evaluate the obviousness of any claim of the '067 Patent over a given prior art combination, I should analyze whether the prior art references, included collectively in the combination, disclose each and every element of the allegedly invalid claim as those references are read by the person of ordinary skill in the art at the time of the invention.

50. Counsel has informed me, and I understand, that even where all of the claim limitations are expressly disclosed in the prior art references, there must be some showing that a person of ordinary skill in the art would have been motivated to combine such prior art references, and explanation of how the combination would be achieved, and that there would have been a reasonable expectation of successfully achieving the claimed invention from such combination.

51. Counsel has informed me, and I understand, that absent some additional reasoning, mere routine optimization for a person of ordinary skill in the art to arrive at the claimed invention through the combination of prior art references is insufficient to support a conclusion of obviousness.

52. Counsel has informed me, and I understand, that to rely on a reference it must be analogous prior art. Counsel has informed me and I understand that a reference is considered analogous prior art: (1) if the reference is from the same field of endeavor as the claimed subject matter, or (2) if the reference “is reasonably

pertinent to the particular problem with which the inventor is involved,” even though the reference is not within the field of the inventor’s endeavor.

53. Counsel has informed me, and I understand, in considering the obviousness of a claimed invention, one should not view the invention and the prior art with the benefit of hindsight. In an obviousness analysis, one must be aware of the distortion caused by hindsight bias and must be cautious of arguments reliant upon ex post reasoning. Counsel has instructed me, and I understand that when considering obviousness, I should not consider what is known today or what was learned from the invention of the ’067 Patent itself. Instead, obviousness is assessed by the person of ordinary skill in the art at the time the invention of the ’067 Patent was made, but without the knowledge of the invention.

54. In this regard, I am informed and I understand that the ’067 Patent may not be used as a guide or roadmap to select, understand, and combine or modify the prior art, because such an approach would improperly apply hindsight bias to the obviousness analysis. Also, at a minimum, this approach discounts the value of combining various existing features or principles in the prior art in an inventive way so as to achieve a novel result.

55. Counsel has informed me, and I understand, that obviousness cannot be predicated on what was unknown at the time of the invention, even if the inherency of a certain feature is later established. Counsel has also informed me, and I

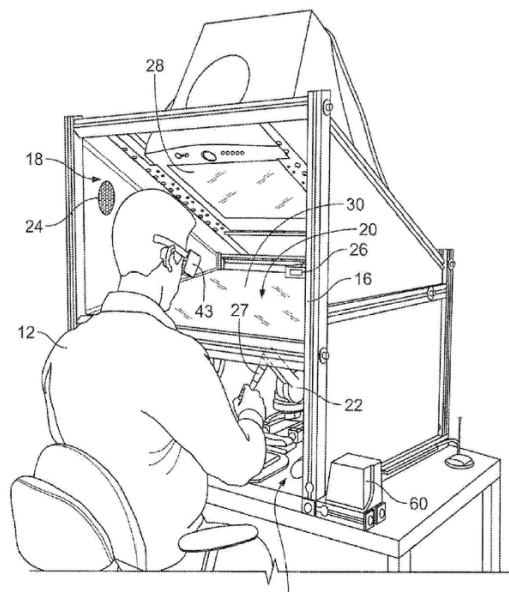
understand, that unknown or undisclosed properties of the prior art (such as features in the prior art that the obviousness combination or rationale to combine might rely on, but are not disclosed or taught by the reference) may not be relied upon to provide the rationale for modifying or combining the prior art to reach the claimed subject matter.

56. Counsel has informed me, and I understand, that a reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant of the '067 Patent.

VII. THE ASSERTED PRIOR ART

A. The Banerjee Reference (Ex. 1011)

57. Banerjee is directed to a surgical workstation for simulation of cerebral aneurysm clipping using an augmented and virtual reality system with haptic feedback. Ex. 1011, Abstract. Banerjee discloses a surgical workstation as shown below that simulates performing surgery. *Id.* This provides interactive and immersive training for surgical trainees, facilitating the practice of complex surgical procedures in a virtual environment rather than on actual patients. *Id.*, ¶¶[0027]-[0029].



Id., Fig. 1.

58. Banerjee addresses the challenges of providing a realistic, interactive training environment for simulating neurosurgical procedures such as cerebral aneurysm clipping. *Id.*, ¶[0003]. By utilizing haptic feedback, augmented and virtual reality technologies, the system provides hands-on training without the risks associated with surgery on live patients. *Id.*, ¶¶[0027]-[0030]. This includes simulating the tactile feedback of surgical instruments and the visual and physical interaction with neurological tissue and organs. *Id.*, ¶¶[0033]-[0035].

B. The Meglan Reference (Ex. 1012)

59. Meglan is directed to devices and methods for training individuals to treat individuals with hemorrhaging injuries. Ex. 1012, ¶3. Meglan discloses a hemorrhage control simulator, as shown below, that measures the application of

hemostatic agents and enables the extraction of objective measures of performance to assess the proficiency of trainees. *See, e.g., id.*, ¶¶11, 100. The simulator also supports real-time mentoring without the need for the presence of an instructor, making it a comprehensive tool for training in the treatment of bleeding injuries. *Id.*, ¶98.

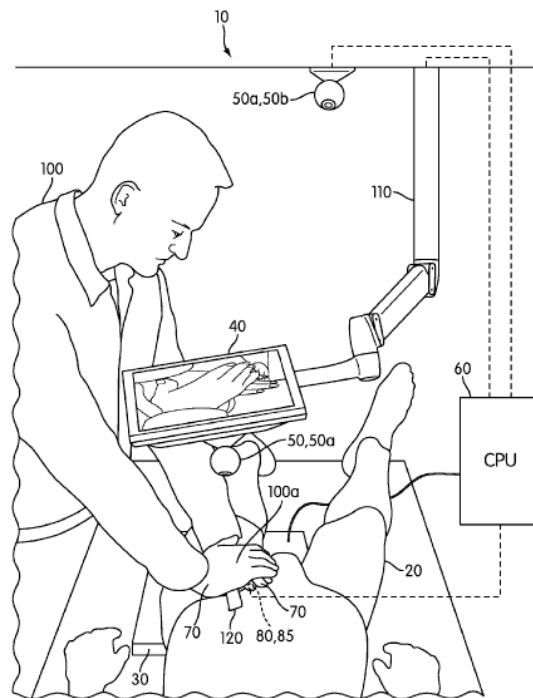


FIG. 1

Ex. 1012, Fig. 1.

60. Thus, Meglan addresses the challenge of providing realistic, effective, and uniform hemorrhage control training without the need for an actual wound or the presence of an instructor. This approach overcomes limitations of traditional training methods, such as the lack of realism in simulated wounds, the difficulty of

assessing performance uniformly, and the logistical challenges of coordinating training sessions with the physical presence of instructors and standardized materials. *Id.*, ¶¶17-22.

C. The Rogers Reference (Ex. 1010)

61. Rogers is directed to the use of a directional interface object designed for various computing environments such as video games and interactive applications. Ex. 1012, ¶39. Rogers discloses embodiments for providing input through this directional interface object in such interactive video games with handheld user devices as shown below. *Id.*

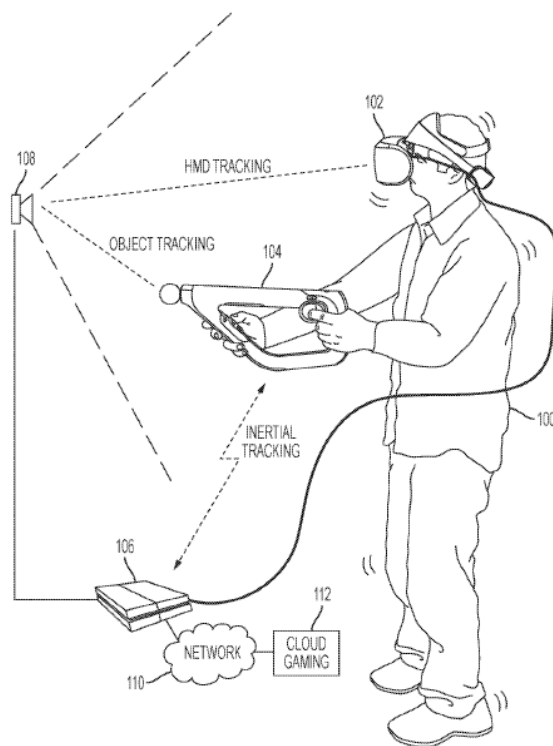


FIG. 1

Ex. 1012, Fig. 1.

62. Rogers addresses issues related to user interactions in virtual reality (VR) environments as experienced through head-mounted displays (HMDs). *Id.*, ¶7. Rogers discloses methods and systems for improving the way users interact with VR content, through specialized interface objects or devices that include features such as determining which hands are grasping different portions of the interface object. *Id.*

VIII. GROUND 1: BANERJEE DOES NOT ANTICIPATE OR RENDER OBVIOUS THE CLAIMS OF THE '067 PATENT

63. Banerjee does not disclose at least the following limitations of the '067 Patent claims:

- (1) “a proxy object comprising one or more haptic output devices,”
- (2) “a sensor for tracking a position of the proxy object,” and
- (3) “the modified visual effect to be displayed on the proxy object.”

A. Banerjee does not disclose the claimed “proxy object”

64. Petitioner alleges that the claimed proxy object is met by Banerjee’s “haptic device 22” (Pet., 14-16) or alternatively, “stylus 27” (Pet., 17). But Banerjee does not disclose a proxy object under the proper construction of the term and in light of the three key interrelated requirements expressly recited in the claims of the '067 Patent: (1) “a proxy object comprising one or more haptic output devices,” (2) “a sensor for tracking a position of *the proxy object*,” and (3) “the modified visual

effect to be displayed on *the proxy object*.” EX1001, cl. 1; *see supra* §IV.A. These three elements require that:

- the proxy object must contain the haptic output devices—i.e., the proxy object that acts as a proxy for a virtual object must directly contain the haptic output device. EX1001, cl. [1A].
- the proxy object’s position is tracked by a sensor and haptic feedback is based on this position sensor data and is produced inside the proxy object. *Id.*, cl. [1C].
- the proxy object must have a modified visual object displayed onto its surface. *Id.*, cl. [1D-3].

Neither of Petitioner’s mappings to Banerjee’s haptic device 22 or stylus 27 meet the claimed proxy object and its three interrelated requirements as understood by a POSITA.

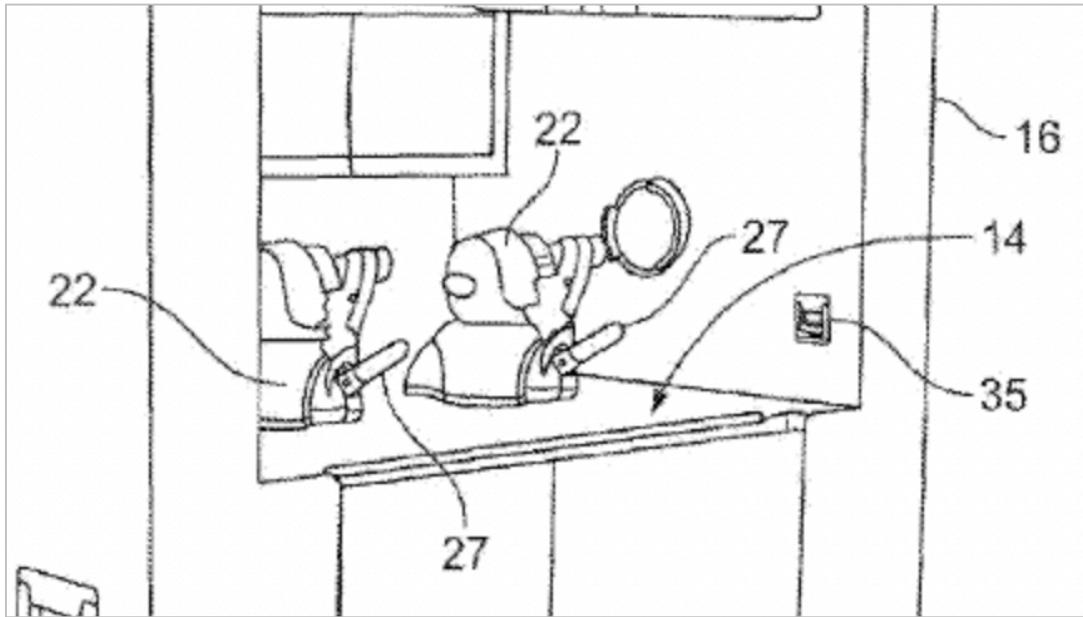
1. Haptic device 22 does not meet the claimed proxy object

65. I understand that Petitioner maps Banerjee’s haptic device 22 to the claimed proxy object because it is a real world object and the user manipulates it to control a virtual tool. Pet., 15. Petitioner also argues that the haptic device 22 “comprises a haptic output device” based on the following arguments: (1) haptic device 22 comprises a haptic output device because it is a haptic device that outputs force feedback; (2) haptic device 22 includes actuators to produce the force feedback

output; and (3) haptic device 22 comprises haptic stylus 27, which is a haptic output device because the user feels the haptic sensations through the stylus. Pet., 16.

66. As I explained in the Claim Construction of this Declaration, a POSITA would understand that the claimed “proxy object comprising a haptic output device” is “a physical object that acts as a proxy for a virtual object and that itself contains haptic output device, e.g., an actuator.” Here, Banerjee’s haptic device 22 is not the claimed proxy object because it is not a physical object that acts as a proxy for a virtual object in the AR or VR world even though the device is a “real world object.”

67. I understand that Petitioner argues that haptic device 22 is a proxy object because the user holds and manipulates stylus 27 as a proxy for the virtual tool that the user controls in the simulation. Petitioner argues this by relying on the fact that stylus 27 is connected to haptic device 22. Pet., 15. But haptic device 22 by itself does not act as a proxy for a virtual surgical tool that is manipulated by the user. Haptic device 22 is a stationary (fixed position) base unit that a stylus 27 is mechanically coupled to as shown below.



EX1001, Figure 4 (excerpted)

68. Also, even though Banerjee's haptic device 22 may contain an actuator and generate force feedback effects, haptic device 22 is not a proxy object I understand the meaning of the term in light of the patent specification and prosecution history. *Supra* §VI.B.1. As for Banerjee's stylus 27 which could act as a proxy for a virtual handheld surgical tool, it still does not contain inside it the actuator as required by the claim.

69. I understand, however, that the Board preliminarily found that haptic device 22 "comprises" stylus 27 (illustrated above) and that they are a part of one another. DI, 16 (citing EX1010 ¶¶ 35, 42, 44, 57, claim 1). But, a POSITA would understand that Banerjee's haptic device 22 and stylus 27 cannot be treated together as a whole to meet the claimed proxy object and its expressly claimed interrelated

requirements. Stylus 27 is an appendage or physical extension mechanically coupled to haptic device 22, as illustrated above in Figure 4.

70. Banerjee also states that there is an “interface” between stylus 27 and haptic device 22, thus confirming that they are separate components coupled together. EX1011, ¶37 (“The haptic augmented and virtual reality system can include [...] the hand tracking device shown as a haptic robot stylus 27, an interface with a haptic device 22”).

71. As I explained above in §VI.B.1.b, the Applicant of the '067 Patent narrowed the claim scope to exclude this type of arrangement that Petitioner is arguing here where the proxy object is mechanically coupled to the haptic output device containing the actuator. Therefore, haptic device 22 is not a physical object that is a proxy for a virtual object and that itself contains a haptic output device such as an actuator as required by the proper construction of the challenged claim.

2. Stylus 27 does not meet the claimed proxy object

72. I understand that Petitioner includes an alternative mapping of the claimed proxy object to stylus 27 and argues that the stylus is a proxy object for controlling a virtual tool and that it comprises a haptic output device because “it is itself a ‘*haptic output device*’ through which ‘tactile sensations’ are felt.” Pet., 17. Petitioner argues that “POSITAs understood that haptic stylus 27 comprises the actuators.” *Id.* But this contradicts Petitioner’s statement that “Banerjee’s haptic

device 22 that generates ‘force feedback’ includes actuators (*e.g.*, motors) to produce the disclosed ‘force feedback.’” The stylus is not a haptic output device, nor does Banerjee disclose that the stylus has any haptics producing hardware such as actuators. The stylus is not a haptic output device. It is merely a passive sink through which a user feels haptic effects produced by a separate haptic source device mechanically coupled to it. *Id.* Thus, Banerjee’s stylus 27 by itself does not meet the claimed proxy object.

B. Banerjee does not disclose the claim limitation “a sensor for tracking a position of the proxy object”

73. Under the proper construction of the term proxy object, this claim limitation requires a sensor for tracking a position of the proxy object, which itself contains inside a haptic output device. Petitioner argues that “Banerjee’s system meets claim element [1C] because haptic device 22 tracks the position of haptic stylus 27.” Pet., 22. Petitioner alleges three reasons for why Banerjee tracks the position of the stylus: (1) “the tracked position/orientation of haptic stylus 27 is a ‘*position*’ of haptic device 22 (a claimed ‘*proxy object*’ [...]) of which the stylus is a part,” (2) because the haptic stylus itself is allegedly a proxy object, the haptic device 22 tracks a position of the proxy object by tracking the position of the stylus, and (3) haptic device 22 purportedly includes sensors that track a position of haptic device 22 “at the corresponding joint, thereby also tracking ‘*a position*’ of the stylus.” *Id.*, 24.

74. First, as I’ve explained above, Banerjee does not disclose the claimed proxy object, and thus also does not disclose this limitation. Also, to the extent Petitioner contends that the tracked position of the stylus 27 is merely “a position” of the separate haptic device 22 (*e.g.*, the first and third alleged reasons listed above), Banerjee does not disclose the claimed “sensor for tracking a position of the *proxy object*” because as detailed above, these two separate components are mechanically coupled and the alleged combination of the two is an arrangement that is outside the scope of the claim in light of the prosecution history. *See supra* §VI.B.1; Haptic device 22 is a stationary base unit that is not movable with its own fixed position in the real world and not position tracked, and on the other hand, stylus 27 does not contain inside the haptic output device actuator. *Id.* Thus, Banerjee does not disclose a sensor that tracks the position of the proxy object, nor does it disclose a proxy object that meets all the requirements of the claim as understood by a POSITA. *Id.*

75. Also to the extent Petitioner contends that the stylus is itself a proxy object and that its position is tracked (*e.g.*, the second alleged reason listed above), Banerjee does not disclose this limitation because as explained above, the stylus does not qualify as the claimed proxy object, *i.e.*, it does not contain inside a haptic actuator such as an actuator.

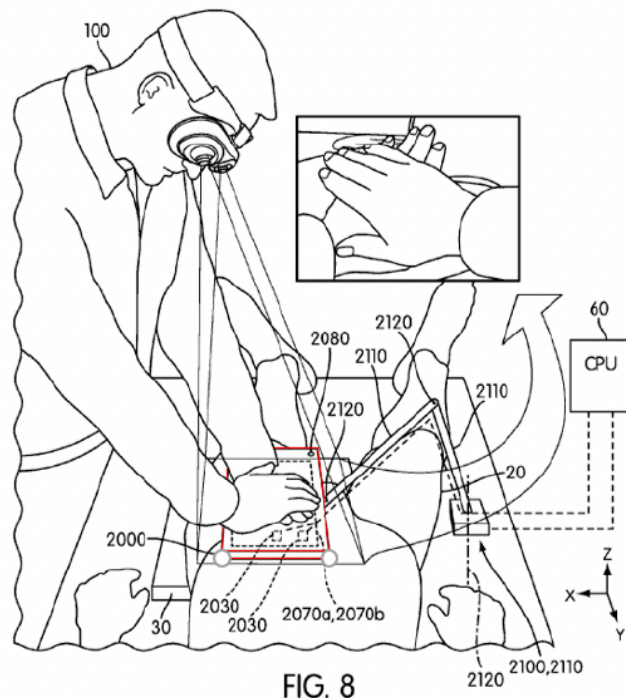
C. Banerjee does not disclose the claim limitation “the modified visual effect to be displayed on the proxy object”

76. Under the proper construction of the term proxy object, this claim limitation requires displaying a modified visual effect on the surface of a proxy object, which itself contains the haptic output device. I understand that Petitioner only relies on stylus 27 for this limitation, alleging that the modified visual effect is displayed on the surface of the stylus, which it contends can be the proxy object. Pet., 32-34. As I’ve explained above, however, Banerjee’s stylus 27 by itself is not a proxy object that contains inside a haptic output device actuator nor is stylus 27 a proxy object even if it were part of an alleged proxy object combination together with haptic device 22. Therefore, even if Petitioner relies on stylus 27 for this limitation, this limitation is still not met by Banerjee because stylus 27 does not meet the requirements of the claimed proxy object.

IX. GROUND 2: MEGLAN DOES NOT ANTICIPATE OR RENDER OBVIOUS THE CLAIMS OF THE ’067 PATENT

A. Megan does not disclose “determine a haptic effect based in part on data received from the sensor” that tracks the position of the claimed proxy object

77. Petitioner alleges that “surrogate 20 and haptic substrate 2000, by themselves or together as a unit” satisfy the claimed proxy object. Pet., 48-51. In reference to Figure 8 shown below, Petitioner alleges that, “‘sensorized substrate 2000’ (boxed in red) provides haptic output via pulse and heat generators so that trainee 100 can feel characteristics of the virtual wound being treated. Pet., 49.



Ex. 1012, FIG. 8 (red box added by Petitioner). Petitioner states that the “sheet-like” substrate 2000 acts as a proxy for the skin of the surrogate body 20 that the trainee is treating “and for the virtual wound for which substrate 2000 provides haptic feedback.” *Id.*, 50.

78. As I explain below, Meglan does not disclose “determine a haptic effect based in part on data received from the sensor” as recited by the claims of the ’067 Patent. Claim 1 recites a system that comprises in relevant part a “*a sensor* for tracking a position of *the proxy object*” (claim element [1C]) and a processor that is configured to, *inter alia*, “determine a haptic effect based in part on data received from *the sensor*” (claim element [1D-2]). Ex. 1001, 10:50-51. The ’067 Patent

discloses that the data received from *the sensor* and which the haptic effect is based on is data reflecting the position of the proxy object tracked by the sensor:

Systems and methods for integrating haptics overlay in augmented reality are disclosed. One illustrative system described herein includes a haptic output device. The system also includes a display configured to output a visual effect. **The system also includes a sensor for tracking a position of a proxy object. The system also includes a processor configured to:** determine a modified visual effect based in part on data received from the sensor, **determine a haptic effect based in part on data received from the sensor**, transmit a display signal associated with the modified visual effect to the display, transmit a haptic signal associated with the haptic effect to the haptic output device; and output the haptic effect using the haptic output device.

Ex. 1001, Abstract; *see also id*, 1:29-40.

79. Meglan does not disclose “determin[ing] a haptic effect based in part on data received from the sensor,” where the data reflects **the proxy object’s position that is tracked by the sensor** as required by claim elements [1C] and [1D-2]. As I will explain further below, Meglan’s haptic effects are not based on data reflecting the alleged proxy object’s position. Instead, according to the Petition, the haptic effects in Meglan are based on the location of the trainee’s hands and fingers—not the alleged proxy object (*i.e.*, what Petitioner points to as surrogate 20 and/or substrate 2000). Pet., 49.

80. Petitioner alleges that “surrogate 20 and haptic substrate 2000, by themselves or together as a unit” satisfy the claimed proxy object. Pet., 48-51. I understand that Petitioner asserts two examples in Meglan to meet claim element [1D-2], but neither of these examples provide haptic feedback based on data that reflects the position of the alleged proxy object (substrate 2000 and/or surrogate 20) tracked by the sensor.

81. In one example, Petitioner alleges that Megan discloses claim element [1D-2] because haptic effects provided by a pulse generator are *based on the trainee’s finger location* that is detected by the camera sensor. Pet., 57-58. In another example, Petitioner argues that haptics effects provided by a heat generator are based on the location of the trainee’s hands as detected by the camera. *Id.*, 58.

82. Both of these examples fail to show any haptic effect that is based on sensed *position data of the proxy object* itself (*i.e.*, the alleged surrogate 20 and/or substrate 2000). They only show that haptic effects are based on position data of the trainee’s hands or fingers. Neither of the trainee’s fingers or hands qualify as the claimed proxy object, nor does Petitioner allege these body parts satisfy the proxy object limitation (claim element [1A]). The trainee’s hands or fingers in Meglan do not include a haptic output device, and thus cannot satisfy the claimed limitation, “a proxy object comprising one or more haptic output devices.” Instead, as Petitioner argues, the claimed haptic output device in Meglan is its “pulse generators” and

“heat generators” contained in substrate 2000 (*i.e.*, the alleged proxy object shown above). Pet., 50-51 (citing, *e.g.*, Ex. 1012, ¶[0107]).

83. I understand, however, that the Board preliminarily found that Megan discloses that the camera system “**tracks not just trainee 100’s hands, but also the position and orientation of surrogate 20.**” DI, 25 (citing Ex. 1012, ¶¶72-74, cls. 1, 13). The Board found that the haptic effect produced by the pulse generator is “based, at least in part, on the position of surrogate 20 as sensed from the camera feed, and whether the user’s hands are in contact with that position.” DI, 25. The Board based its finding on the reasoning that “the system provides a haptic effect, such as ‘the specific feel of [a simulated pulse]’ only when trainee 100’s hands contact the surface of surrogate 20.” *Id.* (citing Ex. 1012, ¶90).

84. However, Meglan does not disclose that the haptic effect is based in part on the location of the surrogate 20. Paragraph 90 of Meglan cited by the Board states:

combining the information from the load sensor 30 beneath the surrogate 20 with the finger location(s) detected by the camera system 50, the status of the injury, and the hemodynamic state, the specific feel of the pulse can be modified to reflect the strength of the trainee's pressing into the surrogate 20

Here, the pulse effect is based on the combination of (1) the data from load sensor 30 beneath surrogate 20 *and* (2) the finger location detected by the camera. Petitioner

agrees that the pulse effect is based on this combination of load sensor data which determines the contact and amount of pressure applied to the surrogate *and* the finger location. Pet., 58.

85. Similarly, Meglan also states:

When the trainee 100 places his/her gloved hand on surrogate 20, the location of the finger(s) over simulated vascular *structures*, combined with the current state of the hemodynamic simulation [...] and whatever the trainee 100 has done thus far on the surrogate 20, will result in the program 90 calculating a simulated pulse.

Ex. 1012, ¶90. Therefore, the simulated pulse is based on the placement of the hand on the surrogate and the amount of pressure applied on the surrogate determined by the load sensor together with the finger location over the simulated vascular structures, which is determined by the camera.

86. Meglan also discloses that “the load sensor 30 senses a magnitude of force applied” and “may comprise a contact sensor that detects whether or not there is contact with the load sensor.” Ex. 1012, ¶64. Therefore, Meglan does not disclose that the pulse effect is based on the location of the surrogate.

87. Petitioner’s second example argues that “program 90 determines that trainee 100’s hands are in contact with surrogate 20 based on the video feed from the camera system” which “causes the heat generator to generate heat [...] so that the trainee feels the heat of the simulated patient’s body and/or blood upon contact

with the simulated patient.” Pet., 58. As I’ve explained, however, contact with the surrogate is determined by the load sensor, and thus the heat generation is based on data from the load sensor, not the location of the surrogate.

88. Therefore, Meglan’s alleged haptics produced by the pulse generator or heat generator are not based on the data received from the sensor tracking a position of the proxy object as required by the claims of the ’067 Patent.

X. GROUND 3: ROGERS DOES NOT ANTICIPATE OR RENDER OBVIOUS THE CLAIMS OF THE ’067 PATENT

A. Overview of Rogers (Ex. 1010)

89. Rogers is directed towards the development and use of a directional interface object designed for interactive applications, such as video games. It discusses embodiments that include devices, methods, and systems for providing input through this directional interface object, which can be utilized in various computing environments, including hand-held devices, microprocessors, and distributed computing systems. The document outlines the technical aspects and potential configurations of the directional interface object, including the presence of joysticks and how it can be held and operated by users to interact with video games or other interactive applications.

90. Rogers aims to address issues related to enhancing the interaction and immersion of users in virtual reality (VR) environments, particularly as experienced through head-mounted displays (HMDs). It outlines methods and systems for

improving the way users interact with VR content, potentially through specialized interface objects or devices that are more responsive or intuitive for gameplay within VR settings. Rogers is focused on creating more engaging and seamless VR experiences by improving the interface between the user and the virtual environment, which can include improving the physical manipulation of virtual objects, enhancing the processing of multimedia content for VR gameplay, and providing more sophisticated methods for user interaction within a VR space.

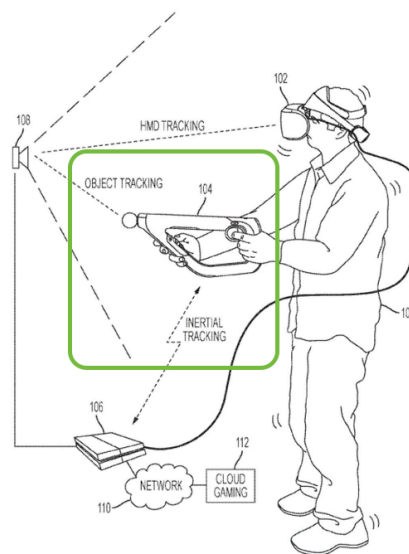


FIG. 1

B. Rogers does not disclose “a sensor for tracking a position of the proxy object”

91. As I explain below, Rogers does not disclose “a sensor for tracking a position of the proxy object” that is used to determine a haptic effect based on the position tracking data from that sensor as required by claim elements [1C] and [1D-2]. As detailed in the Claim Construction Section of this Declaration, I understand

the term “determine a haptic effect based in part on data received from the sensor” to mean: “determine a haptic effect based in part on position data of the proxy object received from the sensor that tracks a position of the proxy object.” Thus, a POSITA would understand that determining haptic effects must be based on position data of the proxy object.

92. I understand Petitioner, at pages 72-73 of the Petitioner, argues that either of the following components in Rogers meets this claim limitation: (1) “camera 108” alone *or* (2) the inertial sensor alone. As I explain below, the haptic effects in Rogers is not determined based on position data from the camera sensor.

1. Rogers’ camera 108 is not a “sensor for tracking a position of the proxy object” to “determine a haptic effect based in part on data received from the sensor”

93. I understand Petitioner argues that Rogers’ “camera 108” for “determin[ing] the location and movements of the...interface object 104” meets this claim limitation: “a sensor for tracking a position of the proxy object.” *See* Pet. at 72 (citing Ex. 1010 at ¶[0044]). But to meet this limitation, Petitioner points to an embodiment in Rogers directed to a use case that does not involve determining the location of the proxy object. Note that Petitioner argues the proxy object is the “virtual weapon” in Rogers. *See* Pet. at 69-70. Petitioner argues that Rogers provides haptic effects *based on direction* (*i.e.*, orientation) of the interface object rather than

on the position or the location of the object. On page 77 of the Petition, Petitioner's argument relies on the embodiment described in ¶[0105], stating that:

When a user reloads their corresponding virtual weapon by, for example, *pointing the directional interface object 104 upward*, the moveable weight 800 may be caused to move so as to mimic the sensation of the weapon reloading mechanism of the virtual weapon.

94. But there is no disclosure whatsoever in Rogers that position tracking data from camera 108 is utilized for this weapon reload use case. Based on the disclosure of Rogers, a POSITA would understand that position tracking data is not used to sense whether the weapon is tilted upward.

95. Additionally, Petitioner' points to another embodiment in Rogers to argue that camera 108 can capture images to be used for determining the location and movements of the interface object. *See* Pet. at 72-73 (citing Ex. 1010 at ¶[0044])). First, a POSITA would understand that this is an entirely different embodiment that is not applicable to the weapon reload use case that Petitioner's mapping is based on. A POSITA would understand that there is no need to track the position of the weapon, *i.e.*, the alleged proxy object, in the weapon reload use case that Petitioner identifies because that embodiment only depends on whether the weapon is tilted upward or not.

96. Second, not only does Rogers fail to disclose the use of position-sensing data for the weapon reload use case, a POSITA would understand that there is no

need for a position-sensing camera to determine whether the weapon is tilted upward. Ex. 1010 at ¶[0105]. A POSITA would understand that this embodiment does not depend on the position of the weapon, nor would there be a need for such location-based dependency because a weapon reload can occur anywhere. A haptic feedback only depends on tilting or movement in the upward direction. Therefore, a POSITA would understand that specifically for the weapon reload use case, haptic feedback is based on “Inertial Tracking” (depicted in Fig. 1), which for this use case only needs to track direction rather than position. Even if the “Object Tracking” line in Figure 1 (*i.e.*, which is based on data from camera 108) is used at all in this embodiment, a POSITA would understand that the camera sensor would only likely be used to aid in the placement of the visual overlay.

97. Thus, Rogers does not disclose “a sensor for tracking a position of the proxy object” that is used to determine a haptic effect based on the position tracking data from that sensor as required by the claims of the '067 Patent.

2. Rogers’ inertial sensor is not a “sensor for tracking a position of the proxy object” to “determine a haptic effect based in part on data received from the sensor”

98. I understand that Petitioner also argues on page 73 of the Petition that “inertial sensor” meets this limitation because the inertial sensor determines “interface object 104’s ‘location and orientation.’” But for purposes of determining whether a weapon is tilted upward in place, a POSITA would understand that

Rogers’ use of “inertial sensors” is to track movement, not position. For example, Rogers at ¶[0016] states: “In some implementations, the directional interface object further includes at least one inertial sensor for *sensing movement* of the directional interface object.” Rogers at ¶[0018] also states that “at least one inertial sensor configured to generate inertial data indicative of *movement* of the directional interface object.” A POSITA would understand that movement is different from position. Position tracking (in three dimensions) is typically tracking the X, Y, and Z coordinates of an object. Sensing the movement can be as simple as determining if an object has moved in either translation or rotation (*e.g.*, true or false), or may involve sensing the magnitude of translational or rotational movement.

99. On page 73 of the Petition, Petitioner’s citation to claim 9 of Rogers also acknowledges this. Claim 9 recites an “inertial sensor for *sensing movement* of the directional interface object.” On page 73, Petitioner also cites to Rogers describing “various kinds of motion sensitive hardware, such as a magnetometer 1210, an accelerometer 1212, and a gyroscope 1214.” Ex. 1010 at ¶[0111]. In the context of the weapon reload use case, in detecting whether a user tilts the gun upward, a POSITA would understand that the use of the inertial sensor is for tracking movement, not the location or position of the weapon.

C. Rogers does not disclose “determine a haptic effect based in part on data received from the sensor”

100. As I have explained above, the weapon reload use case mapped by Petitioner does not depend on position tracking sensor data for the weapon (which is what Petitioner identifies as the proxy object). A POSITA would understand that there would not be a need to use such *position sensor* data because that use case is based on tilting the weapon in the upward direction rather than on the location of the weapon. According to the Petitioner, the weapon reload use case only discloses haptic effects based on direction—not position and as explained above, direction is determined by an inertial sensor—not a camera sensor. The Petition does not show any evidence that camera 108 (for tracking position) is utilized for the weapon reload use case, specifically for the purpose of determining haptics. Therefore, Petitioner fails to demonstrate that Rogers discloses the determination of haptic effects based on data received from the sensor, *i.e.*, a sensor for tracking position of the proxy object for which haptic output is based on as required by the claim.

D. Rogers does not disclose “determine a modified visual effect based in part on data received from the sensor”

101. I understand that the claim requires that both determinations for haptic effect and modified visual effect are based on the same sensor data. *See* Ex. 1001 at Claim 1, elements [1D1] and [1D2]. Claim elements [1D1] and [1D2] for determining a modified visual effect and haptic effects are based on *the* position

sensor, which finds its antecedent basis in claim element [1C]- a sensor for tracking the position sensor of the proxy object. Thus, both limitations for determining a modified visual effect and haptic effects must be based on the same sensor data for tracking the position of the proxy object. But Petitioner has only shown that modified visual effects are based on position sensor data (Pet. at 74-76), and on the other hand, Petitioner has only shown that haptic effects are based on inertial sensor data (Pet. at 77). Although, Petitioner argues that *both* “camera 108’s images and inertial sensor data” are used, it supports this argument by simply referring to the embodiment described in paragraph 44 of Rogers. But, as I’ve explained above, that embodiment is different from the one Petitioner relies on for the haptics limitation (claim element [1D1]). Also, the claim requires a sensor for tracking position to be commonly used for claim element [1D1] and claim element [1D2], and for that additional reason, I disagree with Petitioner’s argument involving the use of both camera 108 and inertial sensor for the weapon reload embodiment.

102. As discussed previously, Petitioner points to the weapon reload use case in Rogers to show that haptics effects are provided when the user tilting the weapon in the upward direction, which is based on “Inertial Tracking” sensor data. Pet. at 77. For the limitation determining a modified visual effect, Petitioner argues that such determination is in response to the user moving interface object 104. Pet. at 74. I understand Petitioner argues that a modified visual effect “changes in

correspondence with the detected location and orientation of interface object 104—*i.e.*, computer 106’s processor determines the ‘*modified visual effect*’ that the user sees as virtual hands gripping a virtual weapon that points in the same direction detected for interface object 104, thus meeting [1D1].” In support, Petitioner cites to Rogers’ disclosures at ¶¶[0018], [0043]-[0045], [0052]-[0055], [0068]-[0070], [0106]-[0109].

103. I disagree with the argument above suggesting that the determination of a modified visual effect is based on inertial sensor data. None of the passages that Petitioner cites indicates that the modified visual effect is determined based on the inertial sensor data that haptic effects also depend on. For example, Petitioner refers to “virtual hands gripping a virtual weapon” in Rogers for the claim limitation of determining a modified visual effect. Pet. at 74. However, Rogers at ¶[0045] states: using these various types of controllers, or even simply hand gestures that are made and captured by one or more cameras, it is possible to interface, control, maneuver, interact with, and participate in the virtual reality environment presented on the HMD 102. Ex. 1010 at ¶[0045]. Therefore, this passage that Petitioner cites to in Rogers shows that the camera sensor is used for the modified visual effect limitation, not the inertial sensor, which is used for the haptics limitation. In other words, Petitioner has not shown that a single sensor is consistently used across both claim elements [1D1] and [1D2].

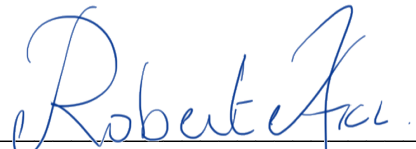
104. As another example, Rogers at ¶[0055] states: depending on the way the directional interface object 104 is being held, the corresponding virtual reality view of the weapon will also be held in a similar fashion, which provides a more realistic and corresponding view to the user.” A POSITA would understand that this does not depend on any inertial sensor data. Rogers explains that the way a user holds the object is determined by a sensor that detects the amount of contact made on the trigger area by the user’s hand. *See, e.g.*, Ex. 1010 at ¶[0055] (“If more surface area is being covered by the user’s hand when the user’s hand is in a gripping position, on a particular side, that may be indicative of the way the user is holding the directional interface object 104”).

105. A POSITA would understand that Rogers does not disclose superimposing a visual effect on the directional interface object using the inertial sensors. As I have explained above, in the context of the weapon reload use case, inertial sensors are used to generate inertial data reflective of the movement of the directional interface object, which can be used together with captured images to determine the position of a virtual object in the virtual environment. But, Rogers does not disclose superimposing the visual effect on the directional interface object using inertial sensor data.

* * *

I declare under penalty of perjury that the foregoing is true and correct. I acknowledge that willful false statements and the like are punishable by fine and/or imprisonment, that all statements made of my own knowledge are true, and that all statements made on information and belief are believed to be true.

Executed November 5, 2024, in Dallas, Texas.

By: 
Dr. Robert Akl, D.Sc.