

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MAGIC LEAP, INC.
Petitioner,

v.

PERCEPT TECHNOLOGIES INC.
Patent Owner.

Patent No. 8,696,113

Inter Partes Review No. IPR2023-00495

DECLARATION OF DR. JOSEPH J. LAVIOLA JR.

TABLE OF CONTENTS

	Page
I. INTRODUCTION	1
II. SUMMARY OF GROUNDS	3
III. QUALIFICATIONS AND EXPERTISE	3
IV. LEGAL UNDERSTANDING	7
A. My Understanding of Claim Construction	7
B. A Person Having Ordinary Skill in the Art	8
C. My Understanding of Obviousness	8
V. THE '113 PATENT	10
A. Background of the '113 Patent	10
B. Priority Date	12
C. Prosecution History Of The '113 Patent	17
D. Claim Construction	18
VI. TECHNICAL ANALYSIS OF PRIOR ART	20
A. Ground 1: Claims 1-3 and 12-14 are Obvious in View of Osterhout	20
1. Summary of Osterhout	21
2. Claim 1	25
3. Claim 2	46
4. Claim 3	47
5. Claim 12	49
6. Claim 13	52
7. Claim 14	52
VII. MANN '526 IN VIEW OF VAISSIE RENDERS OBVIOUS CLAIMS 1-3 AND 12-14	53
A. Ground 2: Claims 1-3 and 12-14 are Obvious in View of Mann '526 and Vaissie	53
1. Summary of Mann '526	53

TABLE OF CONTENTS
(continued)

	Page
2. Summary of Vaissie	59
3. Claim 1	60
4. Claim 2	82
5. Claim 3	83
6. Claim 12	84
7. Claim 13	85
8. Claim 14	86

Petitioner's Exhibit List

Exhibit Description	Exhibit #
U.S. Patent No. 8,696,113 to Lewis (“the ’113 Patent”)	EX-1001
Prosecution History of U.S. Patent No. 8,696,113	EX-1002
Declaration of Dr. Joseph J. LaViola Jr. in Support of Petition for <i>Inter Partes</i> Review of U.S. Patent No. 8,696,113	EX-1003
<i>Curriculum Vitae</i> and Litigation History for Dr. Joseph J. LaViola Jr.	EX-1004
U.S. Patent Appl. Pub. No. 2011/0213664A1 to Osterhout et al. (“Osterhout”)	EX-1005
U.S. Patent No. 6,307,526 to Mann (“Mann ’526”)	EX-1006
U.S. Patent No. 6,433,760 to Vaissie et al. (“Vaissie”)	EX-1007
Patent Owner’s Opening Claim Construction brief in co-pending litigation No. 1:22-cv-0025-RGA	EX-1008
Petitioner’s Answering Claim Construction brief in co-pending litigation No. 1:22-cv-0025-RGA	EX-1009
Patent Owner’s Reply Claim Construction brief in co-pending litigation No. 1:22-cv-0025-RGA	EX-1010
Petitioner’s Sur-Reply Claim Construction brief in co-pending litigation No. 1:22-cv-0025-RGA	EX-1011
Return of Service in co-pending litigation No. 1:22-cv-0025-RGA	EX-1012
Application as filed for U.S. Patent Appl. No. 13/841,141	EX-1013
Application as filed for U.S. Patent Appl. No. 13/739,929	EX-1014
Application as filed for U.S. Patent Appl. No. 13/078,589	EX-1015

Exhibit Description	Exhibit #
Application as filed for U.S. Patent Appl. No. 12/621,423	EX-1016
Application as filed for U.S. Patent Appl. No. 12/029,068	EX-1017
Application as filed for U.S. Patent Appl. No. 11/245,756	EX-1018
Excerpts from ANDREW S. TANENBAUM, MODERN OPERATING SYSTEMS (Prentice-Hall, Inc. 2nd ed. 2002)	EX-1019
Excerpts from ANDREW S. TANENBAUM ET AL., STRUCTURED COMPUTER ORGANIZATION (Prentice-Hall, Inc. 6th ed. 2013)	EX-1020

I, Joseph J. LaViola Jr., make this declaration in connection with the proceeding identified above.

I. INTRODUCTION

1. I have been retained by counsel for Magic Leap, Inc. (“Petitioner” or “Magic Leap”) in connection with the proceeding identified above. I submit this declaration in support of Magic Leap’s Petition for *Inter Partes* Review of United States Patent No. 8,696,113 (EX-1001, “the ’113 Patent”). I understand that Percept Technologies Inc. (“Patent Owner”) states that it is the owner of the ’113 Patent.

2. I have reviewed and am familiar with the ’113 patent, which issued to Scott W. Lewis on April 15, 2014. I understand that the ’113 patent includes 17 claims of which claims 1, 4, 12, and 15 are the independent claims. I also understand that the Petition for *inter partes* review that accompanies this Declaration (the “Petition”) seeks to cancel claims 1-3 and 12-14 (the “challenged claims”) of the ’113 patent. My analysis and opinions will focus on the challenged claims of the ’113 patent.

3. In preparation for this Declaration, I studied Exhibits EX-1005 through EX-1018 provided by the Petitioner, in addition to the ’113 Patent. In addition to the above exhibits and other documents, my opinions herein are based

upon my personal knowledge, professional judgment, education, and experience gained through my years as a computer scientist, professor, and consultant.

4. The '113 patent is generally directed to wearable optics devices, such as those that utilize eye tracking. (EX-1001, Abstract, 8:27-39.) I am familiar with the technology described in the '113 patent as of its filing date, and earliest possible priority date, of March 15, 2013. I am also familiar with the technology described in the '113 patent as of the earliest filing date of the patent applications in its application family, which is October 7, 2005.

5. I have been asked to consider how a person of ordinary skill in the art ("POSITA") would have understood the challenged claims in light of the disclosure of the '113 patent. I also have been asked to consider how a POSITA would have understood the prior art references Osterhout, Mann '526, and Vaissie. Further, I have been asked to consider and provide my technical review, analysis, insights, and opinions regarding whether a POSITA would have understood the disclosures of Osterhout, and the disclosures of Mann '526 in view of Vaissie, to render obvious claims 1-3 and 12-14.

6. I am being paid \$450 an hour for my work on this matter. My compensation is not dependent on the outcome of this *inter partes* review and in no way affects the substance of my statements in this declaration.

7. I reside in Oviedo, Florida, USA.

II. SUMMARY OF GROUNDS

8. I understand that the Petition for *inter partes* review of the '113 patent asserts the following grounds of unpatentability:

Ground	35 U.S.C. §	Claims(s)	Prior Art Reference(s)
1	103	1-3, 12-14	Osterhout
2	103	1-3, 12-14	Mann '526, Vaissie

III. QUALIFICATIONS AND EXPERTISE

9. In formulating my opinions, I have relied upon my knowledge, training, and experience. My qualifications are stated more fully in my *curriculum vitae*, which has been provided as EX-1004. Here, I provide a brief summary of my qualifications.

10. I have almost 25 years of experience working in the virtual reality (“VR”) and augmented reality (“AR”) fields, as well as advancing three-dimensional (“3D”) interaction techniques and user interfaces for use in both VR and AR applications. More specifically, I have worked extensively on and with user and object motion tracking sensors, algorithms and systems.

11. I am the Charles N. Millican Professor of Computer Science in the Department of Computer Science at the University of Central Florida, located in Orlando, Florida. I also serve as the Director of the Interactive Computing Experiences Research Cluster at the University of Central Florida. Through these

functions, I supervise over ten graduate and undergraduate students working on various research projects in the general area of human-computer interaction. In addition, since 2013, I have served as an Adjunct Associate Professor of Computer Science at Brown University, located in Providence, Rhode Island.

12. I received my Bachelor of Science degree in Computer Science from Florida Atlantic University in 1996. I also hold two Masters degrees—an Sc.M. in Computer Science and an Sc.M. in Applied Mathematics from Brown University—which were awarded in 2000 and 2001 respectively. I received my Ph.D. in Computer Science from Brown University in 2005.

13. I serve as Associate Editor for various publications in the area of human-computer interaction, including the International Journal of Human-Computer Studies and the Association for Computing Machinery's (ACM) Transactions on Interactive Intelligent Systems. I have also served as an associate editor for IEEE Computer Graphics & Applications.

14. I have contributed to more than 35 peer-reviewed journal publications and nearly 150 refereed conferences, workshop papers, and other writings, the majority of which deal with virtual and augmented reality and user and object motion tracking. I am the lead author of the second edition of the most comprehensive textbook on 3D user interaction, entitled "3D User Interfaces: Theory and Practice." As part of that work, I analyzed many different types of

input and output hardware, 3D user interfaces, perceptual user interfaces, and general topics related to virtual and augmented reality—including, for example, eye trackers and wearable circuitry such as described in the '113 Patent. I have also worked specifically with wearable devices, including eyewear, such as described in the '113 Patent.

15. I have been working with virtual and augmented reality systems, including eyewear and other wearable devices for virtual and augmented reality systems. I have implemented aspects of virtual and augmented reality systems in practice and written several papers on them as part of my work in motion tracking and 3D interfaces, including the following:

Pfeil, K., Taranta, E., Kulshreshth, A., Wisniewski, P., and LaViola, J. "A Comparison of Eye-Head Coordination Between Virtual and Physical Realities", Proceedings of the 15th ACM Symposium on Applied Perception (SAP '18), Article 18: 7 pages, August 2018.

Kulshreshth, A. and LaViola, J. "Dynamic Stereoscopic 3D Parameter Adjustment for Enhanced Depth Discrimination", Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16), 177-187, May 2016.

Gupta, P., da Vitoria Lobo, N., and LaViola, J. "Markerless Tracking Using Polar Correlation of Camera Optical Flow", Proceedings of IEEE Virtual Reality 2010, 223-226, March 2010.

LaViola, J. "Input Devices", Wiley Encyclopedia of Computer Science and Engineering, B. Wah (ed.), Wiley, Vol.3, 1575-1584, January 2009.

LaViola, J., Forsberg, A., Huffman, J., and Bragdon, A. "The Influence of Head Tracking and Stereo on User Performance with Non-Isomorphic 3D Rotation", In the Proceedings of the 14th Eurographics Symposium on Virtual Environments, 111-118, May 2008.

16. I have also been teaching topics related to virtual and augmented reality systems to my students over the last 20 years. I have developed and taught courses related to 3D interaction and user interfaces for virtual and augmented reality systems. For example, I have taught the course “3D User Interfaces for Games and Virtual Reality” every year since 2008. Examples of courses on 3D user interfaces and virtual and augmented reality that I have taught at conferences include:

LaViola, J. and Keefe, D. “3D Spatial Interaction: Applications for Art, Design, and Science”, Course #1, Presented at ACM SIGGRAPH 2011, Vancouver, Canada, August 2011.

LaViola, J., Kruijff, E., Bowman, D., Poupyrev, I., and Stuerzlinger, W. "3D User Interfaces: Design, Implementation, Usability", Course #16, Presented at ACM CHI 2009, Boston, Massachusetts, April 2009.

Bowman, D., LaViola, J., Mine, M., and Poupyrev, I. “Advanced Topics in 3D User Interface Design”, Course #44, Presented at ACM SIGGRAPH 2001, Los Angeles, California, August 2001.

17. I am a named inventor on five U.S. patents. These patents are generally related to computer visualization, interfaces, and simulation, including for augmented reality systems.

18. I have served as an expert witness and technical consultant in litigation and *inter partes* review matters, including matters relating generally to user interaction and interfaces, augmented reality, and virtual reality. My litigation history and CV are provided as EX-1004.

19. Throughout my career I have received several best paper awards at top conferences including the ACM conference on Human Factors in Computing Systems (CHI) and the ACM Symposium on Spatial User Interfaces. I have been active in reviewing papers for respected journals and conferences including the IEEE Virtual Reality conference and the ACM CHI conference as well as IEEE Transactions on Visualization and Computer Graphics. I also served as the program chair for IEEE Virtual Reality 2013 and for the IEEE Symposium on 3D User Interfaces from 2010 to 2012. I am also a senior member of ACM and IEEE.

IV. LEGAL UNDERSTANDING

A. My Understanding of Claim Construction

20. I have been advised and understand that claim construction is a matter of law and that the final claim construction will ultimately be determined by the Patent Trial and Appeal Board (the “Board”). I have been advised and understand that patent claims are construed from the perspective of one of ordinary skill in the art at the time the claimed invention was made. I have further been advised and understand that, in an *inter partes* review, patent claims are to be construed

according to the methodology set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). In performing my analysis and rendering my opinions, I have interpreted claim terms by giving them the ordinary and customary meaning they would have to the POSITA reading the '113 patent as of March 15, 2013, and in light of its specification and file history.

B. A Person Having Ordinary Skill in the Art

21. I have been advised and understand that a POSITA is presumed to be aware of all pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity, not an automaton. With this understanding, a POSITA at the time of the invention claimed in the '113 patent would have been a person holding a B.S. degree and a Masters degree in Computer Science, Computer Engineering, Electrical Engineering, Physics, or an equivalent field, as well as one to two years of academic or industry experience in wearable electronic devices or comparable industry experience.

C. My Understanding of Obviousness

22. I have been advised and understand that a claimed invention is unpatentable if the differences between the invention 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 POSITA to which the subject matter pertains. This means that even

if all of the requirements of the claim cannot be found in a single prior art reference that would anticipate the claim, the claim can still be invalid.

23. It is my understanding that obviousness is a question of law based on underlying factual findings: (1) the scope and content of the prior art; (2) the differences between the claims and the prior art; (3) the level of skill in the art; and (4) objective considerations of non-obviousness. I understand that for a single reference or a combination of references to render the claimed invention obvious, a POSITA must have been able to arrive at the claims by altering or combining the applied references.

24. I also understand that prior art references can be combined under several different circumstances. For example, it is my understanding that one such circumstance is when a proposed combination of prior art references results in a system that represents a predictable variation, which is achieved using prior art elements according to their established functions.

25. I also understand that when considering the obviousness of a patent claim, one should consider whether a teaching, suggestion, or motivation to combine the references exists so as to avoid impermissibly applying hindsight when considering the prior art. I understand this test should not be rigidly applied, but that the test can be important to avoiding such hindsight.

V. THE '113 PATENT

A. Background of the '113 Patent

26. As shown in Fig. 5C below, the '113 Patent describes a wearable optics device 560 that includes a lens 601 and a dynamic eye tracking mechanism. (EX-1001, 7:35-8:39.) The lens can include “one or more lens material layers.” (EX-1001, 6:59-67.)

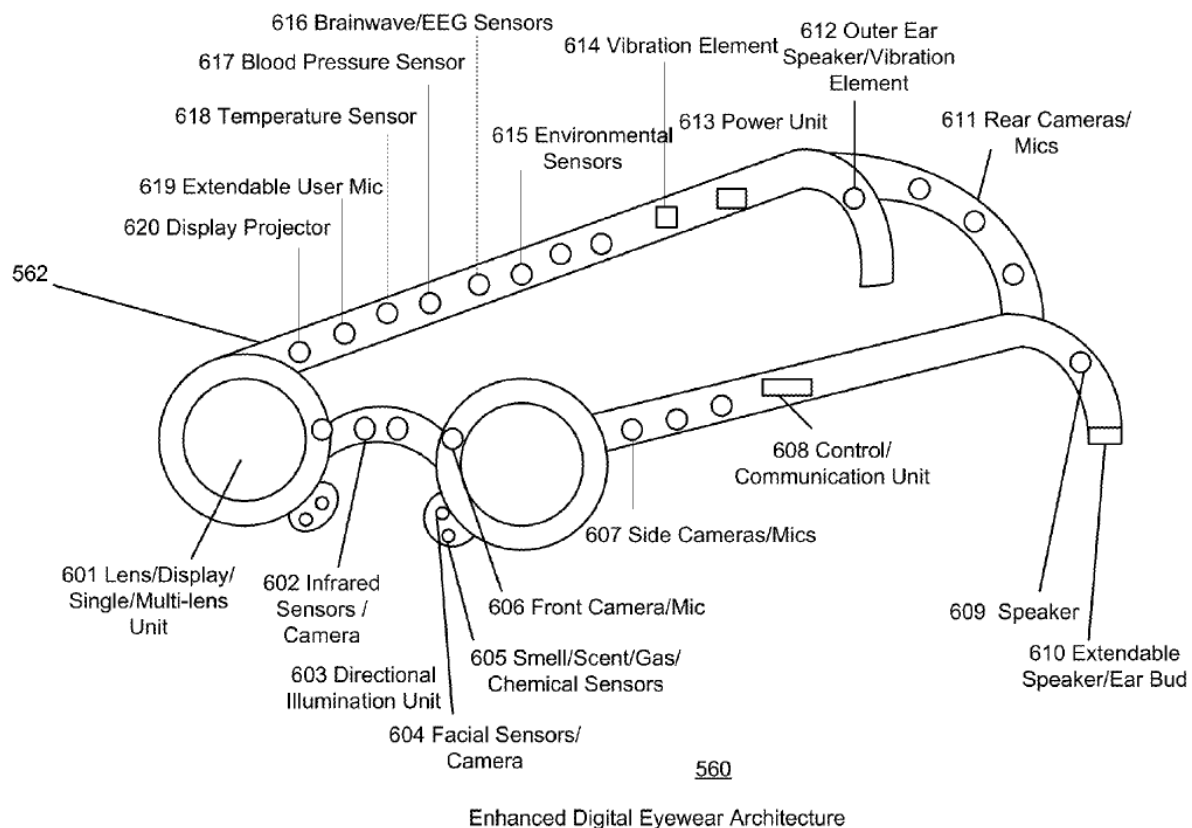


Figure 5C

(EX-1001, 7:35-8:12, Fig. 5C.)

27. According to the '113 Patent, “optical and perceptual parameters” can be “measured and used as inputs, controls, or feedback elements” to improve the

device. (EX-1001, 7:1-6.) The perceptual parameters are described as including: “optical expression, voice, brain wave, environmental, audio, video, navigational, augmented reality, algorithmic, spatial, cognitive, interpretive.” (EX-1001, 7:14-17.) The optical parameters are described as including: “ciliary, pupil, corneal, lens, iris, eye lid, retina measurements.” (EX-1001, 7:24-26.)

28. All of the challenged claims recite that the dynamic eye tracking mechanism utilizes “any of” certain optical parameter measurements. (EX-1001, 14:21-16:22.) The challenged claims also recite that an “optical/perceptual parameter based operating system” is “utilized.”¹ (EX-1001, 14:21-16:22.) The ’113 Patent does not use or define the claim term “optical/perceptual parameter based operating system.” Instead, the ’113 Patent refers to Fig. 19 as illustrating “an optical/perceptual operating system 1900 with the wearable optics device”:

¹ The challenged claims alternately refer to “an optical/perceptual parameter based operating system” and “the optical/perceptual based operating system.” These terms are understood to refer to the same element.

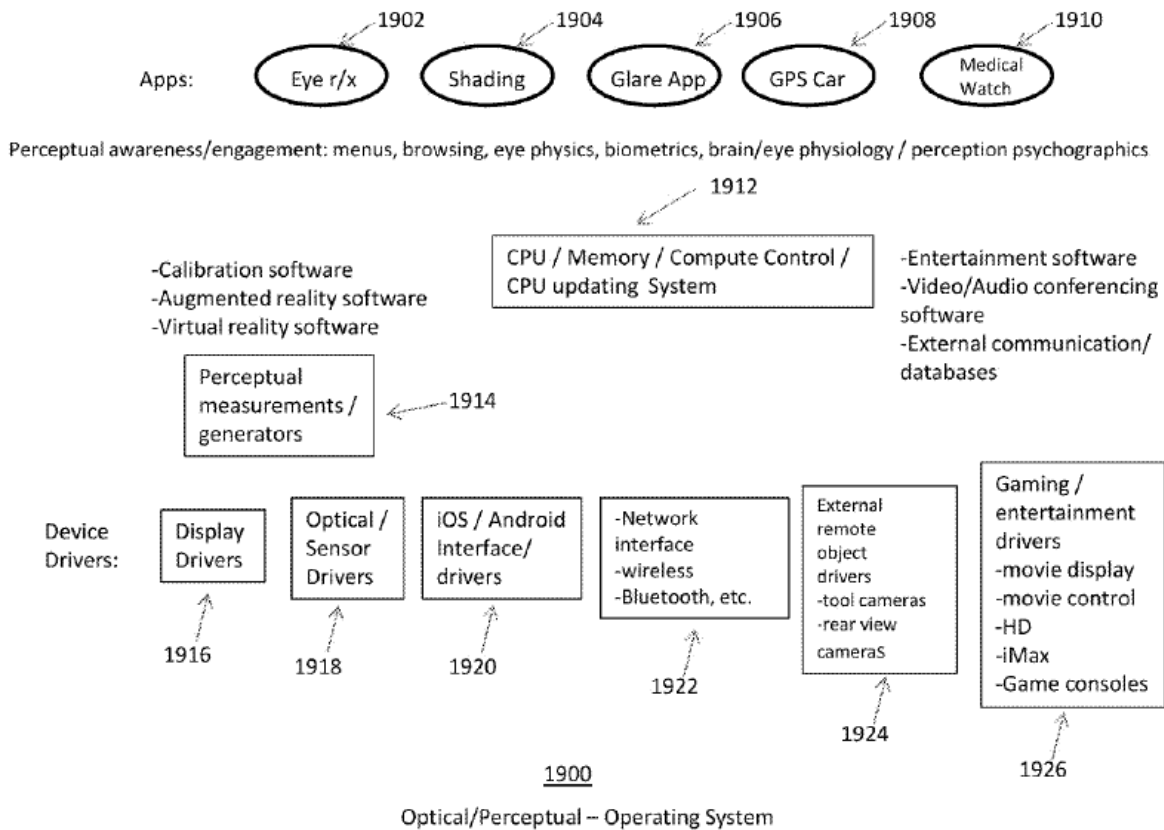


Figure 19

(EX-1001, 12:31-48, Fig. 19.)

B. Priority Date

29. The application (Appl. No. 13/841,141) that became the '113 Patent is a continuation-in-part of Appl. No. 13/739,929 (now U.S. Patent No. 9,010,929), and was filed on March 15, 2013.² The '113 Patent claims priority to a series of

² The cover page of the '113 Patent, under "Related U.S. Application Data," incorrectly identifies the '113 Patent as a "continuation" of Appl. No. 13/739,929.

applications dating to Oct. 7, 2005. (EX-1002, 224-25.) However, as shown in exhibits EX-1013 through EX-1018, Appl. No. 13/841,141 introduced and claimed new matter not found in any of the other applications in the chain of priority. (*See* EX-1013 through EX-1018 (applications to which the '113 Patent claims priority, as filed with the USPTO).)

30. None of the claims of the '113 Patent is supported by any of the applications filed prior to Appl. No. 13/841,141, which was filed on March 15, 2013 and introduced new matter. In drawing this conclusion, I reviewed Appl. No. 13/841,141, which matured into the '113 Patent, in comparison to the other applications to which it claims priority. These applications, as they were filed with the USPTO, are included as exhibits EX-1013 through EX-1018. In drawing the above conclusion, I also took into account the nature of the claims and the existing knowledge in the field; the complexity and predictability of the relevant

(EX-1001, Cover Page.) The '113 Patent is in fact a *continuation-in-part* of Appl. No. 13/739,929, as correctly identified in the '113 Patent specification under “CROSS-REFERENCE TO RELATED APPLICATION,” and in the Application Data Sheet as filed by the applicant, and as discussed herein. (EX-1001, 1:8-10; EX-1002, 224.)

technology; the extent and content of the prior art; and the maturity of the technology.

31. EX-1013 shows Appl. No. 13/841,141 as filed, and EX-1014 shows its parent, Appl. No. 13/739,929 (now U.S. Patent No. 9,010,929), as filed.³ As evident from a comparison of the two applications, Appl. No. 13/841,141 includes new matter that is not found in Appl. No. 13/739,929. As one example, Appl. No. 13/841,141 added new Figure 19, purporting to show an “Optical/Perceptual Operating System,” and new paragraphs [00105] and [00106], which describe Figure 19. (EX-1013.) These disclosures are nowhere to be found in Appl. No. 13/739,929. (EX-1014.) In fact, Appl. No. 13/739,929 says nothing whatsoever about the “optical/perceptual parameter based operating system” that appears in all challenged claims of the ’113 Patent.

32. In looking at the nature of the claims and the existing knowledge in the field, and taking into account the complexity and predictability of the relevant

³ Exhibits EX-1015 through EX-1018, showing the other applications in the priority chain as they were filed with the USPTO, appear substantively identical to Appl. No. 13/739,929. This is unsurprising, because Appl. No. 13/739,929 is a continuation or divisional of the applications in EX-1015 through EX-1018. (EX-1002, 224-25.)

technology, the extent and content of the prior art, and the maturity of the technology, I do not believe the term “optical/perceptual parameter based operating system” to be supported by any disclosure prior to the new matter that was introduced in Appl. No. 13/841,141, when it was filed on March 15, 2013. For example, I do not believe “optical/perceptual parameter based operating system” to be a term of art. A POSITA would not have been familiar with this term in March 2013. Instead, I believe “optical/perceptual parameter based operating system” to be a term that was created by the patent applicant. Only during prosecution of the ’113 Patent did the applicant explain what it meant by this term, by relying on new matter that was introduced in Appl. No. 13/841,141 when it was filed on March 15, 2013.

33. For example, in an Office Action response dated the applicant pointed to paragraphs 105 and 106 of the application—corresponding to col. 12, lines 31-48 of the issued ’113 Patent—as support for the optical/perceptual parameter based operating system. (EX-1002, 123-24.) Paragraphs 105 and 106, and the figure 19 to which they refer, were introduced in Appl. No. 13/841,141 when it was filed on March 15, 2013.

34. As another example, all challenged claims of the ’113 Patent recite a dynamic eye tracking mechanism that utilizes “optical parameter measurements,” which include “any of ciliary measurements, pupil measurements, corneal

measurements, eye lens measurements, iris measurements, eye lid measurements, retina measurements.” (EX-1001, 14:21-16:22.) In looking at the nature of the claims and the existing knowledge in the field, and taking into account the complexity and predictability of the relevant technology, the extent and content of the prior art, and the maturity of the technology, I do not believe the claimed dynamic eye tracking mechanism that utilizes these specific claimed optical parameter measurements is supported by any disclosure prior to the new matter that was introduced in Appl. No. 13/841,141 when it was filed on March 15, 2013. For example, I note that Appl. No. 13/841,141 introduced a paragraph [0078], which references a “dynamic eyetracking mechanism” and describes that “optical parameters can be utilized.” (EX-1013, 22.) Paragraph [0078] also states that the optical parameters include “ciliary, pupil, corneal, retina, lens, iris measurements.” (EX-1013, 22.) But neither paragraph [0078], nor any disclosure of the specific claimed optical parameter measurements, are anywhere to be found in Appl. No. 13/739,929, or in any of the other applications to which the ’113 Patent claims priority. (EX-1014 through EX-1018.) Nor would the POSITA find support for claimed dynamic eye tracking mechanism that utilizes these specific claimed optical parameter measurements anywhere else in the disclosures of those applications.

35. Accordingly, for the purposes of this Declaration, I have assumed a priority date of March 15, 2013 for the challenged claims.

C. Prosecution History Of The '113 Patent

36. The application that became the '113 Patent was allowed after being rejected over various prior art references. While the prosecution histories of the '113 Patent and its parents are lengthy, for the purposes of the Petition, the exchange between the Examiner and the applicant in 2013 is most relevant.

37. Specifically, in a Final Office Action dated November 25, 2013, the Examiner rejected the claims under § 102 and § 103, citing Osterhout (U.S. Patent Appl. Publ. No. 2011/0213664 (“Osterhout”) (EX-1005)). (EX-1002, 93-100.) The Examiner found that Osterhout disclosed the claimed optical/perceptual parameter based operating system. Rather than challenge this finding, the applicant in a response dated December 23, 2013, amended all independent claims to recite that the claimed dynamic eye tracking mechanism utilizes “any of” certain optical parameter measurements. (EX-1002, 72-80.) This amendment led to an allowance of the claims. (EX-1002, 20-28.)

38. Then, in the Examiner’s reasons for allowance, the Examiner expressly incorporated certain remarks made by the applicant in its December 2013 response. (EX-1002, 24-28, 78-79.) In those remarks, the applicant asserted that the cited references did not meet the specific optical parameter measurements that

the applicant added to the claims. (EX-1002, 78-79.) Thus, the Examiner allowed the claims based on the specific optical parameter measurements, thereby making clear that the remaining limitations of the claims, such as the claimed optical/perceptual parameter based operating system, were met by the prior art. As set forth in this Petition, however, the prior art teaches the claimed optical parameter measurements, as well as all remaining limitations of the challenged claims.

39. Based on my review of the challenged claims and the prior art, I believe the Examiner erred at least by overlooking express disclosure in Osterhout (*e.g.*, in paragraph 0301]) of the same optical parameter measurements that led to the allowance of the claims.

D. Claim Construction

40. As discussed above, I understand that, during an *inter partes* review, words in a claim are given their ordinary and customary meaning, which is the meaning understood by a POSITA at the time of the alleged invention after reading the entire patent. In performing my analysis and rendering my opinions, I have interpreted claim terms by giving them the ordinary and customary meaning they would have to the POSITA reading the '113 patent as of March 15, 2013, and in light of its specification and file history.

41. I understand that in co-pending litigation in the U.S. District Court for the District of Delaware, Patent Owner asserts that the Petitioner infringes claims 1 and 12 of the '113 Patent. I understand the Patent Owner and the Petitioner have exchanged briefing regarding proposed constructions of certain claim terms of the '113 Patent, summarized in the chart below:

Claim Term	Patent Owner's Proposed Construction	Petitioner's Proposed Construction
dynamic eye tracking mechanism	mechanism for dynamically tracking the characteristics of the eye, including, for example, ciliary, pupil, corneal, retina, lens, iris, or eye lid measurements, blinks, squints, gaze direction, or eye movement	mechanism for dynamically tracking the characteristics of the eye, including, for example, ciliary, pupil, corneal, retina, lens, iris, or eye lid measurements, blinks, squints, gaze direction, or eye movement
a lens	plain and ordinary meaning	plain and ordinary meaning ⁴
optical/perceptual parameter based operating system	plain and ordinary meaning	operating system, not including a conventional mobile operating system such as Android or iOS, in which optical parameters and perceptual parameters are measured and used as inputs, controls, or feedback elements

⁴ Petitioner previously took the position that “a lens” should be construed to mean “a transmissive optical device which focuses a light beam by refraction.”

42. I do not believe any claim construction is necessary for the purposes of the Petition. I believe the challenged claims are unpatentable under any reasonable interpretation of the claim language for the reasons set forth in this declaration.

VI. TECHNICAL ANALYSIS OF PRIOR ART

A. Ground 1: Claims 1-3 and 12-14 are Obvious in View of Osterhout

43. Osterhout teaches each and every limitation of the challenged claims, for the reasons set forth below. I understand the Patent Office allowed the challenged claims over Osterhout. (EX-1002, 25-28, 72-80, 91-100.) In my view, this represents an error by the Patent Office, for the reasons set forth below. For example, I understand that, during prosecution of the application that became the '113 Patent, the patent examiner rejected the claims as being anticipated by Osterhout, but that the applicant overcame the rejection by amending the claims to recite *wherein the dynamic eye tracking mechanism utilizes optical parameter measurements; wherein the optical parameter measurements include any of ciliary measurements, pupil measurements, corneal measurements, eye lens measurements, iris measurements, eye lid measurements, retina measurements*; and that the claims were allowed on the basis of that amendment. (EX-1002, 25-28, 72-80, 91-100.) However, this entire amendment is plainly taught by Osterhout. For example, as described in more detail below, paragraph [0301] of

Osterhout expressly discloses a dynamic eye tracking mechanism that utilizes optical parameter measurements, as in the claim amendment that led to the allowance of the claims. (EX-1005, [0301].) For instance, paragraph [0301] recites: “an *eye tracking facility* may use the *corneal reflection* and the *center of the pupil* as features to track over time.” (EX-1005, [0301] (emphasis added).) The Patent Office erred at least to the extent it overlooked this particular disclosure of Osterhout in its allowance of the challenged claims.

1. Summary of Osterhout

44. Osterhout is a U.S. patent application that was filed on Feb. 28, 2011 and published on Sept. 1, 2011. Osterhout is thus prior art to the ’113 Patent under at least 35 U.S.C. §§ 102(a), (b), and (e) based on the March 15, 2013 priority date of the challenged claims.

45. Osterhout discloses an “interactive head-mounted eyepiece worn by a user.” (EX-1005, [0019].) For example, an augmented reality eyepiece can have an optical assembly, with a see-through or translucent lens, that enables the wearer of the eyepiece to view the surrounding environment as well as a displayed image. (EX-1005, [0164], [0183].) In some embodiments, the lens can include one or more chromic portions, such as an electrochromic layer, and/or an anti-reflective layer, to adjust the display or improve visibility. (EX-1005, [0019], [0248].)

46. A projector of the optical assembly, which can include an LCoS display and a light source, can project the image light onto the lens. (EX-1005, [0164].) The eyepiece can be controlled by a processor with a memory and an operating system. (EX-1005, [0164].) Fig. 1 illustrates an embodiment of the eyepiece:

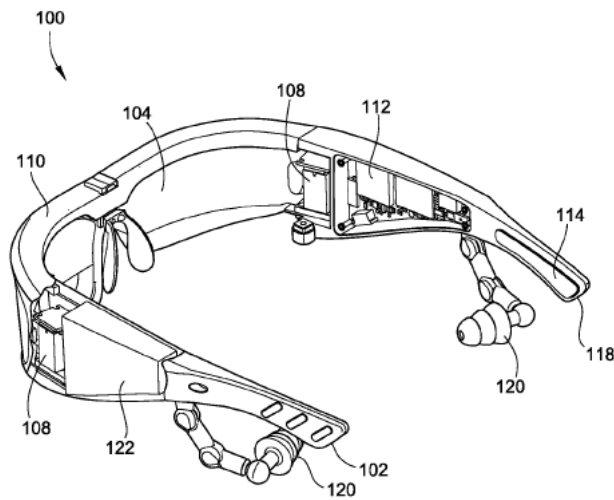


FIG. 1

(EX-1005, [0165], Fig. 1.)

47. Fig. 72 shows a block diagram of Osterhout's eyepiece system:

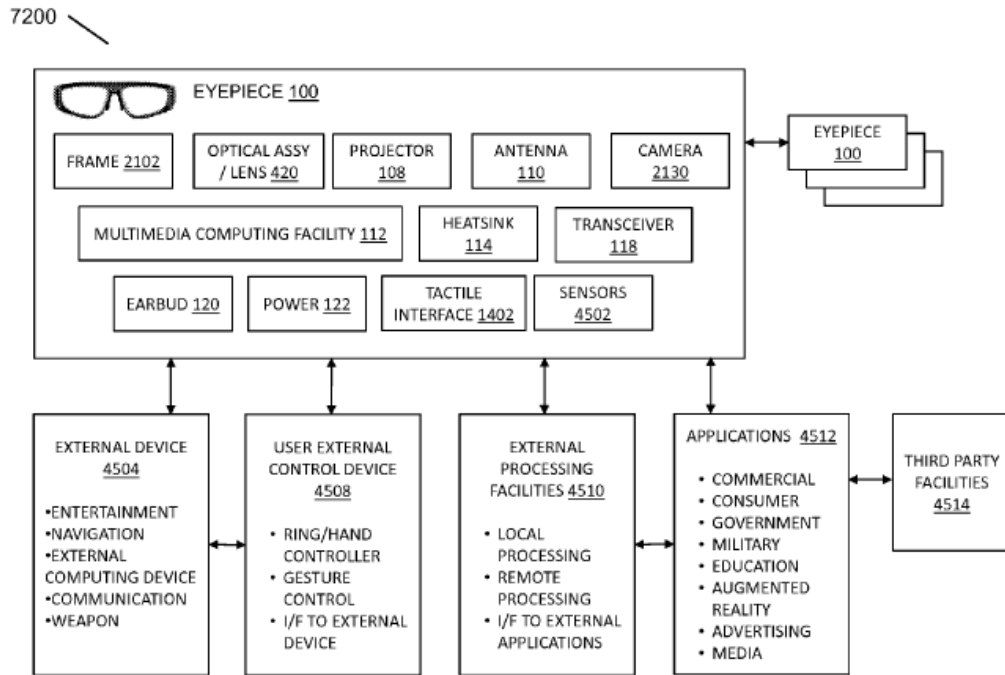


Fig. 72

(EX-1005, [0163], [0189], Fig. 72.)

48. As seen in the figure, the eyepiece can include various sensors (such as sensors 4502 and cameras 2130); can interface with applications 4512 (such as for consumer, augmented reality, and media), external devices 4504, and control devices 4508; and can communicate with other eyepieces 100. (EX-1005, [0189], Fig. 72.)

49. The eyepiece can include eye tracking devices for control. For example, the eyepiece can “determine where the user is gazing, or the motion of the user’s eye, by tracking the eye through reflected light off the user’s eye.” (EX-1005, [0301].) The eye tracking information can be used to correlate the user’s line of sight with the projected image (*e.g.*, to determine a point in the projected

image where the user is looking); and this information can be used in various control techniques. (EX-1005, [0301], [0304].) In some embodiments, commercially available retinal scanners can be used for eye tracking. (EX-1005, [0305].) In some embodiments, the eyepiece includes a camera that “views back to the wearer’s eye(s),” such that “eye movements or actions may be interpreted as command information.” (EX-1005, [0304].)

50. The eye tracking mechanism can make use of optical parameter measurements. For example, “an eye tracking facility may use the corneal reflection and the center of the pupil as features to track over time; use reflections from the front of the cornea and the back of the lens as features to track; image features from inside the eye, such as the retinal blood vessels, and follow these features as the eye rotates; and the like.” (EX-1005, [0301].) Other optical parameters, such as the electrical potential between the cornea and retina, can also be used. (EX-1005, [0301].) In some embodiments, a contact lens with embedded optical components can be used in conjunction with the eye tracking facility for measuring the motion of the user’s eye. (EX-1005, [0301].)

51. The eyepiece also includes head movement tracking, gesture recognition, voice recognition, and other features that use perceptual parameters such as voice, audio, video, and environmental parameters to control the eyepiece. (EX-1005, [0308]-[0311].) These features can be used in conjunction with the eye

tracking described above to activate and execute commands. (EX-1005, [0309].)

For example, a user of the eyepiece can use eye tracking to select an object in the display, and then perform a head motion (*e.g.*, tipping the head) to interact with the object. (EX-1005, [0309], [0311].) Other commands can include turning off the eyepiece projector, audio, camera, or sensors (*e.g.*, GPS); interacting with the display or the real world; or interacting with applications such as a web browser or an email application. (EX-1005, [0311].)

2. Claim 1

52. Osterhout meets each limitation of claim 1, as described below.

a. [Pre] *A wearable optics device comprising:*

53. The preamble is taught by Osterhout. Osterhout relates to an “augmented reality eyepiece.” (EX-1005, [0002].) For example, Osterhout discloses an “interactive head-mounted eyepiece worn by a user.” (EX-1005, [0019]) The eyepiece includes an “optical assembly through which the user views a surrounding environment and displayed content.” (EX-1005, [0011].) Fig. 1 illustrates an embodiment of an augmented reality eyepiece 100:

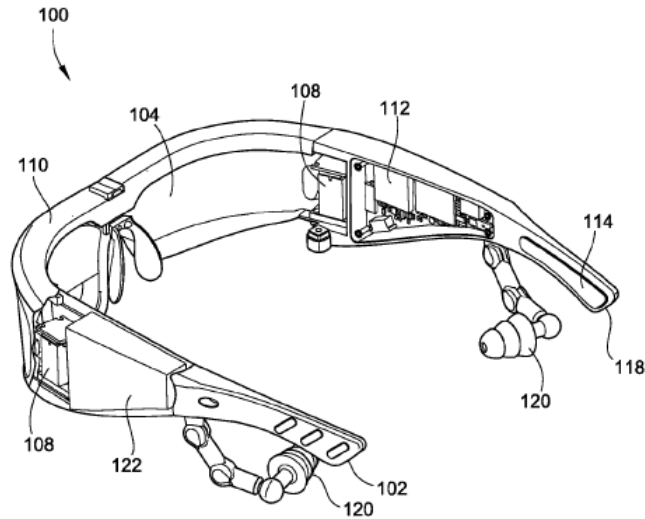


FIG. 1

(EX-1005, [0165], Fig. 1.)

b. [A] a lens; and

54. Osterhout meets this element. For example, Osterhout discloses that the augmented reality eyepiece can have a “see-through or translucent lens” which enables the wearer of the eyepiece to view the surrounding environment as well as a displayed image. (EX-1005, [0164].) Fig. 1 illustrates example lenses 104, which are part of eyepiece 100:

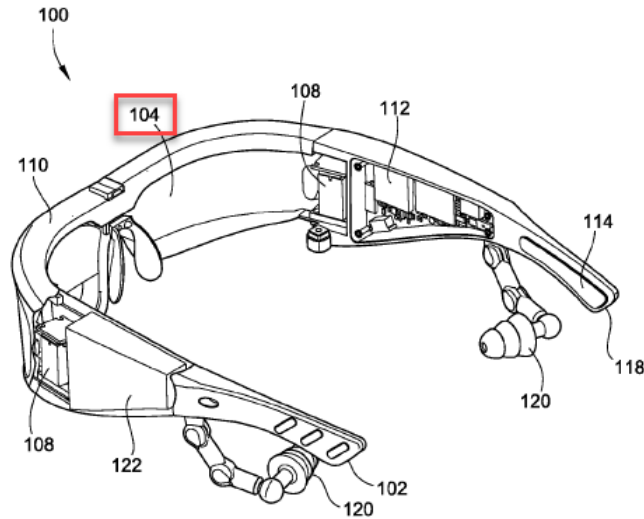


FIG. 1

(EX-1005, [0165], Fig. 1 (annotated))

55. As another example, Osterhout discloses that a “special contact lens may be provided to the user with an embedded optical component,” and that the eyepiece can use this contact lens in conjunction with an “eye tracking facility” for measuring the motion of the user’s eye. (EX-1005, [0301].)

56. In the co-pending litigation, the Petitioner initially proposed a construction of *lens* as “a transmissive optical device which focuses a light beam by refraction.” Osterhout meets the claimed lens according to this definition. For example, Osterhout discloses that “the eyepiece includes a see-through correction lens,” which may be “a prescription lens customized to the user’s corrective eyeglass prescription.” (EX-1005, [0032].) Similarly, the optical assembly described above includes a “corrective element that corrects the user’s view of the surrounding environment.” (EX-1005, [0183].) A POSITA would understand

these components to describe transmissive optical devices that focus light beams (e.g., directed to the user's eye) by refraction (e.g., to correct the user's view of the environment, as in corrective eyewear).

c. [B] *a dynamic eye tracking mechanism in communication with the lens;*

57. Osterhout meets this element as explained below.

(i) dynamic eye tracking mechanism

58. Osterhout discloses that “the glasses may be equipped with eye tracking devices for tracking movement of the user's eye, or preferably both eyes.” (EX-1005, [0305].) For example, Osterhout discloses an “eye tracking facility,” with which “the eyepiece may be able to determine where the user is gazing, or the motion of the user's eye, by tracking the eye through reflected light off the user's eye.” (EX-1005, [0301].) The eye tracking facility in Osterhout is an *eye tracking mechanism* that is *dynamic* at least because it tracks the motion of the eye. For instance, the eye tracking facility “may use the corneal reflection and the center of the pupil as features to track over time.” (EX-1005, [0301].) This is consistent with the '113 Patent's description that “the iris, retina[,] cornea, pupil, ciliary, and lens can all be utilized either singly or in combination to enable the dynamic eye tracking mechanism.” (EX-1001, 9:42-46.)

59. As another example, Osterhout discloses a “camera on the eyepiece that views back to the wearer's eye(s).” (EX-1005, [0304].) Using the camera,

“eye movements or actions may be interpreted as command information.” For instance, the camera can “correlate the viewing direction of the eye to a point on the display.” (EX-1005, [0304].) The eye movements can include, *e.g.*, “eye movements to the side, up and down, side to side,” or “through a sequence of positions.” (EX-1005, [0304].) The camera is an *eye tracking mechanism* that is *dynamic* at least because it is a mechanism (a camera) that tracks eye movements, like the eye tracking facility described above.

(ii) in communication with the lens

60. Osterhout describes that the dynamic eye tracking mechanism is in communication with the lens. For example, Osterhout describes that the dynamic eye tracking mechanism detects eye movements such as the eye gazing toward “the corner of the lens of the eyepiece,” or “through a certain portion of the lens.” (EX-1005, [0304].) The dynamic eye tracking mechanism is thus *in communication with the lens*, at least because the dynamic eye tracking mechanism detects an eye gaze that is directed toward a specific part of the lens (*e.g.*, the corner), or through a certain portion of the lens.

61. Moreover, because the lens is translucent, EX-1005 at [0164], the eye receives light rays that are transmitted via the lens. Those light rays are detected by the dynamic eye tracking mechanism—for example, by a “camera on the eyepiece that views back to the wearer’s eye.” (EX-1005, [0304].) Osterhout thus

teaches that the dynamic eye tracking mechanism may be in *optical* communication with the lens.

62. Further, Osterhout discloses that the dynamic eye tracking mechanism can “correlate the viewing direction of the eye to a point on the display,” and that the eyepiece can interpret commands based on that point on the display. (EX-1005, [0304].) Because the display is projected on the lens, EX-1005 at [0164], the dynamic eye tracking mechanism is thus further in communication with the lens at least by correlating the viewing direction to a point on the lens.

63. In another example in Osterhout, the eye tracking mechanism uses a “special contact lens,” described above, with an embedded optical component (such as a mirror or a magnetic field sensor) for measuring the motion of the eye. (EX-1005, [0301].) The eyepiece uses the contact lens to “track the motions of the eye.” (EX-1005, [0301].) The eye tracking mechanism is *in communication with the lens*, at least because the eye tracking mechanism is in communication with the embedded optical component of the contact lens to receive the measured motion of the eye and thus track the motion. (EX-1005, [0301].)

- d. [C] *wherein the dynamic eye tracking mechanism utilizes optical parameter measurements; wherein the optical parameter measurements include any of ciliary measurements, pupil measurements, corneal measurements, eye lens measurements, iris measurements, eye lid measurements, retina measurements;*

64. Osterhout meets this element. For example, Osterhout describes using optical components for “*measuring the motion of the eye.*” (EX-1005, [0301] (emphasis added).) By the plain language of the claim, which recites that the optical parameter measurements include “any of” the various measurements recited, this element is met if the optical parameter measurements taught by Osterhout include even one of those recited measurements. However, as described below, Osterhout teaches not just one, but *multiple* of the recited optical parameter measurements.

65. Osterhout describes that optical parameter measurements are utilized by the dynamic eye tracking mechanism to “determine where the user is gazing, or the motion of the user’s eye.” (EX-1005, [0301].) For example, Osterhout discloses that the dynamic eye tracking mechanism may use “the *corneal reflection* and the *center of the pupil* as features to track over time”; use “*reflections from the front of the cornea* and the back of the lens as features to track”; and “image features from inside the eye, such as the *retinal blood vessels*, and follow these features as the eye rotates.” (EX-1005, [0301] (emphasis added).) These features

meet multiple of the claimed optical parameter measurements. For example, tracking the center of the pupil meets a *pupil measurement* (*i.e.*, the measured center of the pupil); tracking the corneal reflection meets a *corneal measurement* (*i.e.*, the measured position of the cornea with respect to the reflection); and following the retinal blood vessels meets a *retina measurement* (*i.e.*, the measured position of the retinal blood vessels). (EX-1005, [0301].)

66. As another example, electrical potentials of the cornea and the retina can be “measured and monitored” with electrodes. (EX-1005, [0301].) For example, an electrical potential is measured for “a dipole ... with its positive pole at the cornea, and its negative pole at the retina.” (EX-1005, [0301].) These measurements of electrical potential of the cornea and the retina meet at least a *corneal measurement* and a *retina measurement*, respectively, in addition to the other corneal and retina measurements described above. The dynamic eye tracking mechanism can utilize these measurements to track eye movement. (EX-1005, [0301].)

67. In another example, Osterhout describes that the dynamic eye tracking mechanism can use a camera to determine eye movements or actions including “blinking, repetitive blinking, blink count, blink rate,” and “eye open-closed.” (EX-1005, [0304].) A POSITA would understand that blinking is the act of the eyelid closing and opening; and that detecting blinking using a camera includes

using the camera to measure a position of the eyelid (*e.g.*, measuring whether the eyelid is in an open position or a closed position). This meets the claimed *eye lid measurements*. The dynamic eye tracking mechanism utilizes the eyelid measurements to, *e.g.*, generate “command information.” (EX-1005, [0304].)

e. [D] *wherein an optical/perceptual parameter based operating system is utilized,*

68. Osterhout meets this element.⁵ For example, Osterhout discloses that a processor of the eyepiece includes an operating system. (EX-1005, [0164].)

69. A POSITA would understand the operating system of the eyepiece’s processor to meet the claimed optical/perceptual parameter based operating system. The operating system of Osterhout is based on optical parameters and further based on perceptual parameters.⁶ For example, the processor with the

⁵ In the co-pending litigation, the Petitioner and the Patent Owner have proposed competing constructions for “optical/perceptual parameter based operating system” for the purposes of the litigation. However, as explained herein, this element is met under either party’s proposed construction, or any reasonable interpretation of the claim language.

⁶ In the co-pending litigation, the Patent Owner takes the position that the claimed operating system may be based on either optical parameters or perceptual

operating system “handl[es] the content for display to the user,” and handles “sensor information from the sensor.” (EX-1005, [0045].)

70. To the extent Osterhout does not expressly disclose that it is the processor’s *operating system* that performs these tasks, it would have been obvious to a POSITA from Osterhout’s teachings. For example, handling input (*e.g.*, sensor information from the sensor) and output (*e.g.*, content for display to the user) are classic operating system functions. (EX-1019, 269 (“One of the main functions of an operating system is to control all the computer’s I/O (Input/Output) devices”).) The POSITA would have had a reasonable expectation of success in applying Osterhout’s operating system to perform handling content for display to the user, and handing sensor information from the sensor, at least because operating systems are a mature, commonly used, and well-understood type of software technology, and because I/O handling is a well-known operating system

parameters, and is not limited to requiring both types of parameters. (EX-1008, 11 (“There is no basis for requiring the operating system to be based on both ‘optical parameters and perceptual parameters.’”)(emphasis in original)(citing EX-1001, 8:17-18, 12:66-67).) However, as shown herein, the operating system of Osterhout is based on both optical and perceptual parameters, and thus meets this limitation even without the Patent Owner’s broad interpretation of the term.

function. (EX-1019, 269.) It would thus be obvious to the POSITA that, in a processor that includes an operating system, the operating system would perform those functions.

71. Osterhout further teaches that the operating system performs these tasks based on optical and perceptual parameters, as described below. The operating system is thus an *optical/perceptual parameter based operating system*. Moreover, the eyepiece *utilizes* this operating system as described below.

(ii) *Optical parameters*

72. As one example of utilizing optical parameters, Osterhout's processor "correlates the displayed content and the information from the sensor to indicate the eye's line-of-sight relative to the projected image, and uses the line-of-sight information relative to the projected image, plus a user command indication, to invoke an action." (EX-1005, [0045].) The line of sight information for the eye is "communicated to the processor as command instructions." (EX-1005, [0046].) Handling input (*e.g.*, line-of-sight input from the user's eye) and controlling processor actions are core operating system functions, so to the extent not expressly disclosed in Osterhout, it would have been obvious to the POSITA that those functions would be performed by the processor's operating system. (EX-1019, 269, 5 ("the job of the operating system is to provide for an orderly and controlled allocation of the processors, memories, and I/O devices among the

various programs competing for them.”).) The POSITA would have enjoyed a reasonable expectation of success in doing so for at least the reasons described above with respect to element [D].

73. As Osterhout explains, using the line-of-sight information to invoke an action is performed using an eye tracking mechanism, as described above for elements 1[B] and 1[C]. (EX-1005, [0301].) The line-of-sight information is used by the processor to “correlate the user’s line of sight with respect to the projected image,” and used by the processor in “control techniques.” (EX-1005, [0301].) For example, “eye movements or actions may be interpreted as command information.” (EX-1005, [0304].)

74. As described above, the eye tracking mechanism makes use of optical parameter measurements, including at least pupil measurements, corneal measurements, eyelid measurements, and retina measurements — four specific examples of optical parameter measurements specifically recited in claim 1. For example, “an eye tracking facility may use the corneal reflection and the center of the pupil as features to track over time; use reflections from the front of the cornea and the back of the lens as features to track; image features from inside the eye, such as the retinal blood vessels, and follow these features as the eye rotates; and the like.” (EX-1005, [0301].) Other optical parameters, such as electrical potential between the cornea and retina, can also be used. (EX-1005, [0301].) In some

embodiments, a contact lens with embedded optical components can be used in conjunction with the eye tracking facility for measuring the motion of the user's eye. (EX-1005, [0301].)

75. These optical parameter measurements are used by the Osterhout operating system to perform classic operating system functions. For example, the eyepiece "includes a user input interface ... to allow a user to control the device." (EX-1005, [0306].) "Inputs used to control the device" can include an eye tracking device, as described above. (EX-1005, [0306].) And as described above, the operating system of the eyepiece is utilized for the eye tracking device input.

76. Eye control can be used to activate and execute commands for the eyepiece. (EX-1005, [0309].) Commands can also be terminated through eye control. (EX-1005, [0309].) Similarly, the eyepiece can be controlled through a microphone, such as using voice recognition. (EX-1005, [0310].) The Osterhout operating system provides these controls, at least via optical parameters associated with the eye tracking mechanism as described above. Osterhout provides examples of commands that can be executed based on the optical parameters: turning on and off the eyepiece's projector, audio, camera, augmented reality projector, or GPS; interacting with the eyepiece's display through a user interface (*e.g.*, selecting displayed functions); performing actions using an embedded or external device; and controlling applications such as a web browser and an email

application. (EX-1005, [0311].) A POSITA would recognize these abilities as classic operating system functions, as described above.

77. Accordingly, the Osterhout operating system is based on optical parameters.

(iii) *Perceptual parameters*

78. The Osterhout operating system is further based on perceptual parameters. The '113 Patent describes that perceptual parameters include “optical expression, voice, brain wave, environmental, audio, video, navigational, augmented reality, algorithmic, spatial, cognitive, interpretive.” (EX-1001, 14:8-11.) Further, during prosecution, the patent applicant pointed to this specific language as support for the claimed parameters. (EX-1002, 114.)

79. Osterhout includes multiple examples in which perceptual parameters are used by the operating system to handle user input and execute processes. For example, the eyepiece includes head movement tracking, gesture recognition, voice recognition, and other features that use perceptual parameters such as voice, audio, video, and environmental parameters to control the eyepiece. (EX-1005, [0308]-[0311].) These features can be used in conjunction with the eye tracking described above to activate and execute commands. (EX-1005, [0309].) For example, a user of the eyepiece can use eye tracking to select an object in the display, and then perform a head motion (*e.g.*, tipping the head) to interact with the

object. (EX-1005, [0309], [0311].) Osterhout teaches that head movement tracking and gesture recognition is based on video and spatial input, and thus corresponds to at least the “video” and “spatial” examples of perceptual parameters provided in the ’113 Patent. (EX-1005, [0289]-[0300].) Other commands can include turning off the eyepiece projector, audio, camera, or sensors (*e.g.*, GPS); interacting with the display or the real world; or interacting with applications such as a web browser or an email application. (EX-1005, [0311].)

80. Similarly, the eyepiece can be controlled through a microphone, such as using voice recognition. (EX-1005, [0310].) Voice recognition corresponds to at least the “voice” example of perceptual parameters provided in the ’113 Patent. The Osterhout operating system provides these controls, at least via the perceptual parameters for the head motion control and voice recognition. Osterhout provides examples of such commands: turning on and off the eyepiece’s projector, audio, camera, augmented reality projector, or GPS; interacting with the eyepiece’s display through a user interface (*e.g.*, selecting displayed functions); performing actions using an embedded or external device; and controlling applications such as a web browser and an email application. (EX-1005, [0311].) A POSITA would recognize these abilities as classic operating system functions, as described above, and would have understood them to be performed by the operating system of Osterhout.

81. Accordingly, the Osterhout operating system is based on perceptual parameters, in addition to being based on optical parameters as described above.

(iv) *Disclosures of the '113 Patent*

82. The above teachings of Osterhout's operating system, and the eyepiece of Osterhout more generally, are consistent with the '113 Patent's description of the optical/perceptual parameter based operating system, which was endorsed by the patent applicant during prosecution of the '113 Patent. In response to a § 102 rejection, the patent applicant amended the claims to recite an "optical/perceptual parameter based operating system." (EX-1002, 118-26.) As support for its argument that the prior art did not meet the claimed optical/perceptual parameter based operating system, the patent applicant highlighted the following language in the specification, corresponding to column 12, lines 31-48 of the '113 Patent:

FIG. 19 illustrates an optical/perceptual operating system 1900 with the wearable optics device. As is seen a plurality of applications 1902-1910 interface with a processing system. The processing system includes a CPU, Memory, computer control and a CPU updating system 1912.

The applications include but are not limited to an eye prescription 1902, shading 1904, a glare application, 1906, GPS for navigation of a vehicle 1908 and a medical application 1910. The system would include perceptual measurement/generators 1914. These would include but are not limited to calibration software, augmented reality software, entertainment software, video/audio conferencing software and external communication/databases. The system would also include one or more device drivers. They include but are not limited to display

drivers 1916, optical/sensor drivers 1918, operating system drivers 1920, network drivers 1922, external remote object drivers 1924 and gaming/entertainment drivers 1926.

(EX-1002, 123-24.)

83. Indeed, the above description, together with the corresponding figure, is one of the only mentions of an optical/perceptual operating system anywhere in the '113 Patent.

84. Fig. 19 of '113 Patent, illustrating the optical/perceptual parameter based operating system, is as follows:

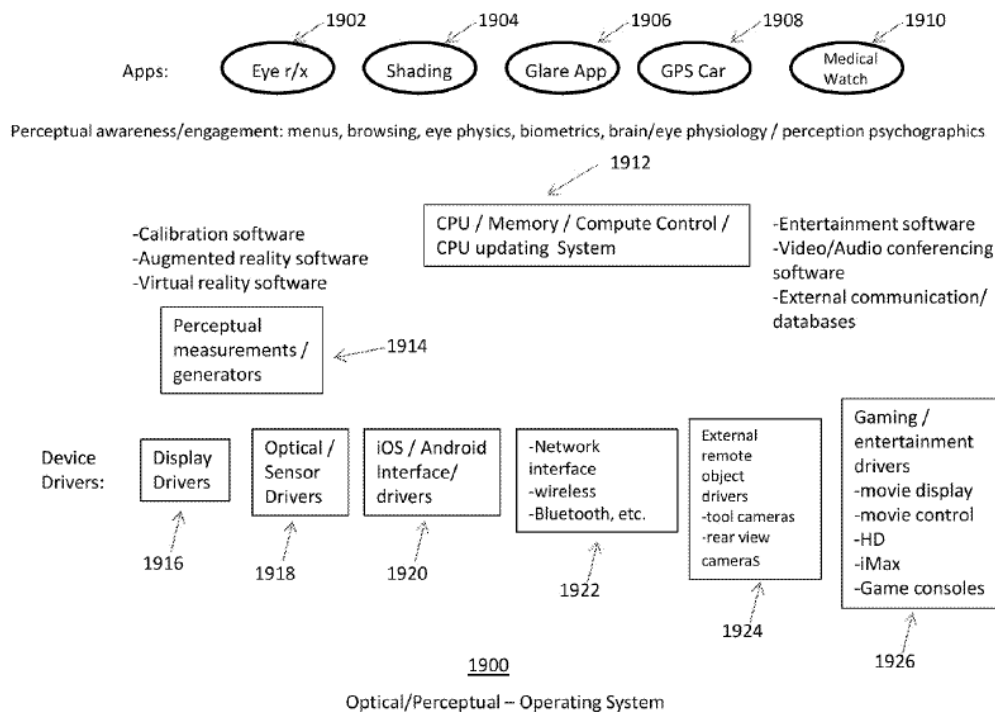


Figure 19

(EX-1001, Fig. 19.)

85. As discussed above, Fig. 72 of Osterhout shows Osterhout’s eyepiece 100 in a strikingly similar manner:

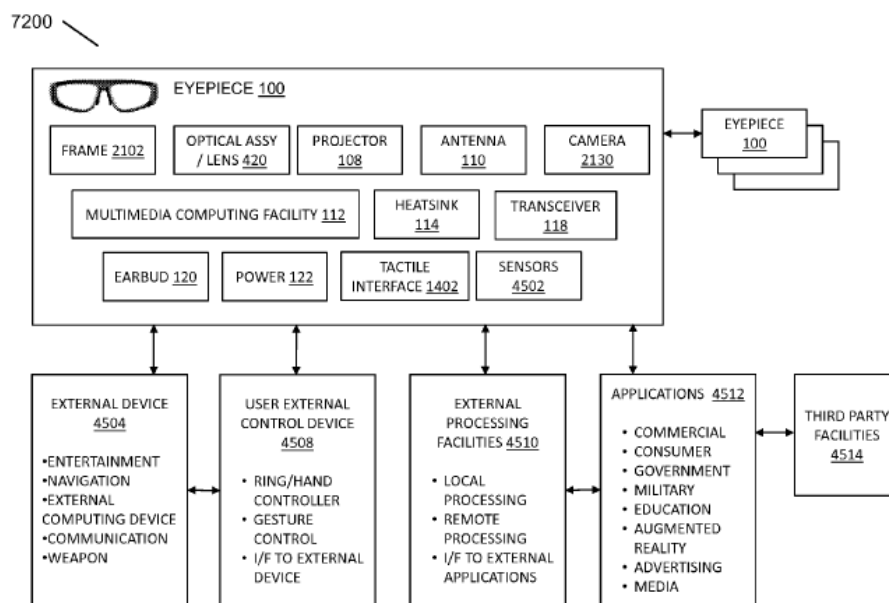


Fig. 72

(EX-1005, Fig. 72.)

86. As the patent applicant highlighted, the operating system shown in the ’113 Patent’s Fig. 19 features applications 1902-1910—such as “GPS for navigation of a vehicle 1908” and “medical application 1910”—that interface with a processing system. (EX-1001, 12:31-48; Fig. 19; EX-1002, 123-24.) The processing system includes basic computer components; a CPU, memory, computer control, and a CPU updating system. (EX-1001, 12:31-48; Fig. 19; EX-1002, 123-24.) The operating system includes “perceptual measurement/generators” that “include but are not limited to calibration software, augmented reality software, entertainment software, video/audio conferencing

software and external communication/databases.” (EX-1001, 12:31-48; Fig. 19; EX-1002, 123-24.) And the operating system uses drivers to interface with, *e.g.*, displays 1916; optical/sensors 1918; operating systems 1920; network interfaces 1922 (*e.g.*, wireless, Bluetooth); external remote objects 1924; and gaming/entertainment 1926. (EX-1001, 12:31-48; Fig. 19; EX-1002, 123-24.)

87. All of these computing features are found in Osterhout’s eyepiece, as described above and as shown in Fig. 72 of Osterhout. For example, Osterhout describes that features of the eyepiece include “applications for use 4512, control technologies and external control devices 4508, associated external devices 4504, software, networking capabilities, integrated sensors 4502, external processing facilities 4510, associated third party facilities 4514, and the like.” (EX-1005, [0189], Fig. 72.) Osterhout’s applications 4512 include, *e.g.*, GPS navigation applications (*e.g.*, NearestTube, Google Earth, Layar); and medical applications for monitoring a person’s “health and well-being.” (EX-1005, [0282], [0362]-[0363].) These correspond at least to the ’113 Patent’s GPS application 1908 and medical application 1910.

88. Osterhout also describes a processing system with a processor, memory, computer control (*e.g.*, by eye tracking as described above, or via other input devices such as a mouse), and updating capability (EX-1005, [0362], [0557],

[0573]-[0582].) These fundamental computer features correspond at least to the features of the '113 Patent's processing system 1912.

89. Osterhout also describes “calibration tables,” “augmented reality applications,” entertainment software (*e.g.*, “mobile on-line gaming” and “computer video games”), “video calling or video conference” software, and communication with external databases over a network (*e.g.*, a “database accessible over the Internet”). (EX-1005, [0190], [0223]-[0224], [0300], [0321]-[0322], [0352], [0389].) These correspond to the '113 Patent's examples of “perceptual measurement/generators” (*i.e.*, calibration software augmented reality software, entertainment software, video/audio conferencing software, and external communication/databases, respectively).

90. Osterhout also teaches interfacing with displays (*e.g.*, display optics as described above), sensors (*e.g.*, sensors 4502 and cameras 2130, and as described above), operating systems (*e.g.*, Windows Mobile, Linux, or Android installed on a “bio-phone”), networking interfaces (*e.g.*, WLAN, Bluetooth), external remote objects (*e.g.*, external computing device 4504), and “mobile on-line gaming” and “computer video games” (EX-1005, [0164], [0176], [0273], [0323], [0389], [0455], Fig. 72.) These correspond, respectively, to the '113 Patent's displays 1916; optical/sensors 1918; operating systems 1920; network interfaces 1922 (*e.g.*, wireless, Bluetooth); external remote objects 1924; and gaming/entertainment

1926. To the extent Patent Owner contends these interfaces require drivers—which are ordinary components of operating systems—Osterhout teaches at least a “display driver” that is used to control a display, corresponding to the ’113 Patent’s display drivers 1916. (EX-1005, [0273]; *see also* EX-1019, 289-290 (“current operating systems expect drivers to run in the kernel”).) And a POSITA would similarly understand that the operating system would similarly include drivers to interface with sensors, external remote objects, and other components.

91. In this declaration, I am not relying upon the ’113 Patent’s specification as prior art or comparing specifications of the ’113 Patent and Osterhout to establish unpatentability of claim 1. The term “optical/perceptual parameter based operating system” is not a term of art. Thus, what the term encompasses as informed by the ’113 Patent specification is relevant, and Osterhout provides a nearly identical disclosure of such an operating system.

92. Finally, in the co-pending litigation, the Petitioner proposed a construction of *optical/perceptual parameter based operating system* in which this operating system does not include a conventional mobile operating system such as Android or iOS; and in which optical parameters and perceptual parameters are measured and used as inputs controls, or feedback elements. Osterhout meets this limitation under this construction. For example, as described above, the operating system of Osterhout is not a conventional mobile operating system, at least because

such conventional mobile operating systems are not based on optical parameters and perceptual parameters, unlike the Osterhout operating system described above. Further, as described above, those parameters are measured (*e.g.*, by the dynamic eye tracking mechanism) and used as inputs, controls, or feedback elements (*e.g.*, as inputs for selecting interface elements or executing commands).

f. [E] *wherein the wearable optics device is controlled by the optical/perceptual based operating system.*

93. Osterhout meets this element as described above for claim 1[D].

3. Claim 2

94. Osterhout meets each limitation of claim 2, as described below.

a. [Pre] *The wearable optics system of claim 1,*

95. Osterhout meets the wearable optics system of claim 1 as described above for claim 1.

b. [A] *wherein the dynamic eye tracking is utilized to control the optical/perceptual based operating system.*

96. Osterhout meets this element as described above for claim 1[D]. For example, “a wearer may want to move an object to the right, and *through eye control* ... select the object”. (EX-1005, [0309].) A POSITA would understand this disclosure to teach using the dynamic eye tracking to select an object in a user interface of the optical/perceptual based operating system.

4. Claim 3

97. Osterhout meets each limitation of claim 3, as described below.

a. [Pre] *The wearable optics system of claim 1,*

98. Osterhout meets the wearable optics system of claim 1 as described above for claim 1.

b. [A] *wherein applications are utilized to control sensors and communication of the wearable optics device.*

99. Osterhout meets this element. For example, Osterhout discloses various software applications 4512 that can interface with the eyepiece 100, such as shown (in red) in Fig. 72:

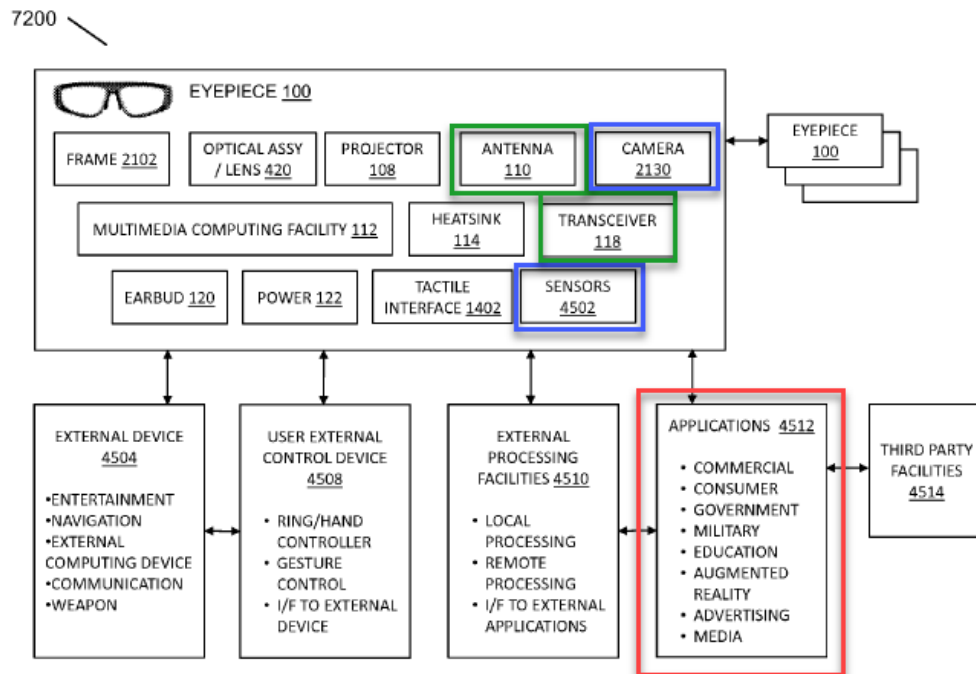


Fig. 72

(EX-1005, Fig. 72.)

100. As disclosed by Osterhout, and seen in Fig. 72, applications can include those for augmented reality and media applications, among others. (EX-1005, [0189], Fig. 72.) Eyepiece 100 can include sensors, such as cameras or optical sensors 2130 and integrated sensors 4502 (highlighted in blue above). (EX-1005, [0189], [0210], Fig. 72.) The cameras can include a forward facing camera that images what the wearer is looking and identifies the user's location or points of interest. (EX-1005, [0190].) Eyepiece 100 can also include devices for communication, including antenna 110 and radio transceiver 118 (highlighted in green above). (EX-1005, [0166].) Eyepiece 100 also communicates with external devices 4504, external control devices 4508, external processing facilities 4510, and other eyepieces 100. (EX-1005, [0189], Fig. 72.)

101. Osterhout teaches that applications 4512 are utilized to control sensors and communication of the eyepiece 100. For example, Osterhout describes that in some embodiments, a video calling or video conferencing application may control the cameras (such as a forward facing camera embedded in the eyepiece), a microphone, and communicate with other users of the application via a WiFi connection or a 3G or 4G calling network. (EX-1005, [0190], [0321]-[0337].) A POSITA would understand this video calling or video conferencing application to control sensors (camera, microphone) and communication (exchange of audio/video data over a network) of the eyepiece 100. Similarly, Osterhout

describes various additional applications, such as Yelp, Monocle, and Google Earth, that control the eyepiece's location sensors (*e.g.*, GPS sensors) to determine the user's location, and communicate with a database to provide location-based information to the user. (EX-1005, [0339]-[0341], [0362].)

5. Claim 12

102. Osterhout meets each limitation of claim 12, as described below.

a. [Pre] *A wearable optics device comprising:*

103. The preamble is taught by Osterhout as described above for claim 1[Pre].

b. [A] *a lens; and*

104. Osterhout meets this element as described above for claim 1[A].

c. [B] *a dynamic eye tracking mechanism in communication with the lens;*

105. Osterhout meets this element as described above for claim 1[B].

d. [C] *wherein the dynamic eye tracking mechanism utilizes optical parameter measurements; wherein the optical parameter measurements include any of ciliary measurements, pupil measurements, corneal measurements, eye lens measurements, iris measurements, eye lid measurements, retina measurements;*

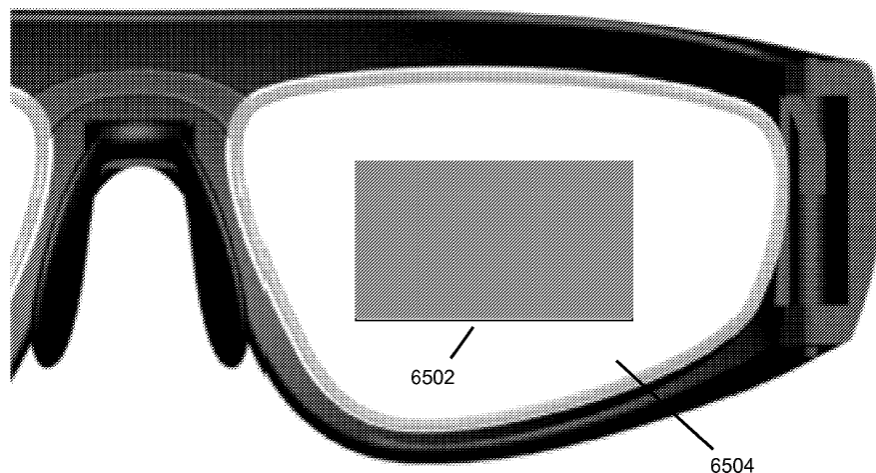
106. Osterhout meets this element as described above for claim 1[C].

- e. **[D] wherein an optical/perceptual parameter based operating system is utilized,**

107. Osterhout meets this element as described above for claim 1[D].

- f. **[E] wherein the lens includes a plurality of layers.**

108. Osterhout meets this element. For example, Osterhout discloses that “the optical assembly includes an *electrochromic layer* that provides a display characteristic adjustment”. (EX-1005, [0019] (emphasis added).) Similarly, the lens may include “integral chromic material” or a “chromic coating” to change the opacity of at least a portion of the lens. (EX-1005, [0193].) Fig. 65 illustrates an example, showing an electrochromic layer 6502 of the lens 6504:



(EX-1005, [0019], [0193], Fig. 65.)

109. A POSITA would understand the electrochromic layer, integral chromic material, and/or chromic coating to teach that *the lens includes a plurality of layers*. For example, as shown in Fig. 65 above, the lens 6504 includes a first

layer that includes a chromic portion 6502 (which may be an electrochromic layer); and at least a second layer that does not include the chromic portion 6502. (EX-1005, [0193], Fig. 65.) Further, Osterhout explains that there may be a “plurality” of such chromic portions on the lens, such as “large portions of the lens,” “sub-portions of the projected area,” and “programmable areas of the lens.” (EX-1005, [0193].) The dynamic eye tracking system is in communication with this lens as discussed above for claim 1.

110. Other lens layers are disclosed. For example, Osterhout discloses that a “300 nm deep absorbing and anti-reflective layer is added to the glasses,” in order to improve night vision capabilities. (EX-1005, [0248].) A POSITA would understand this anti-reflective layer to be added to the lens of the glasses, such that the lens includes a plurality of layers (*e.g.*, a first layer that includes the anti-reflective layer, and at least a second layer that does not). The POSITA would further understand that this anti-reflective layer could be added to a lens that includes a chromic layer as described above.

111. In addition, as described above for claim 1, a “special contact lens” may be provided to the user to track the motions of the eye. (EX-1005, [0301].) The contact lens can include an “embedded optical component,” such as a mirror or magnetic field sensor. (EX-1005, [0301].) The POSITA would understand this to teach a *plurality of layers*: for example, a first layer of the contact lens that

includes an embedded optical component, such as the mirror or the magnetic field sensor, and at least a second layer of the contact lens that does not include it. The dynamic eye tracking system is in communication with this lens as discussed above for claim 1: for example, the embedded optical component of the contact lens is used by the dynamic eye tracking system for “measuring the motion of the eye.” (EX-1005, [0301].)

6. Claim 13

112. Osterhout meets each limitation of claim 13, as described below.

a. [Pre] *The wearable optics system of claim 12,*

113. Osterhout meets the wearable optics system of claim 12 as described above for claim 12.

b. [A] *wherein the dynamic eye tracking is utilized to control the optical/perceptual based operating system.*

114. Osterhout meets this element as described above for claim 2[A].

7. Claim 14

115. Osterhout meets each limitation of claim 14, as described below.

a. [Pre] *The wearable optics system of claim 12,*

116. Osterhout meets the wearable optics system of claim 12 as described above for claim 12.

- b. [A] *wherein applications are utilized to control sensors and communication of the wearable optics device.*

117. Osterhout meets this element as described above for claim 3[A].

VII. MANN '526 IN VIEW OF VAISSIE RENDERS OBVIOUS CLAIMS 1-3 AND 12-14

A. Ground 2: Claims 1-3 and 12-14 are Obvious in View of Mann '526 and Vaissie

118. It is my view that Mann '526 in view of Vaissie teaches each and every limitation of the challenged claims, for the reasons set forth below. I understand that, during prosecution of the application that became the '113 Patent, Mann '526 was considered by the patent examiner. (EX-1002, 81.) In my view, the Patent Office erred in allowing the challenged claims over Mann '526, at least to the extent it failed to consider the teachings of Mann '526 in view of Vaissie as set forth below, and to apply those teachings to reject the challenged claims.

1. Summary of Mann '526

119. Mann '526 is a U.S. patent that was filed on Oct. 15, 1998 and issued on Oct. 23, 2001. Mann '526 is thus prior art to the '113 Patent under at least 35 U.S.C. §§ 102(a), (b), and (e).

120. Mann '526 discloses a wearable camera and viewfinder that is built into a wearable device, such as eyeglasses. (EX-1006, 3:16-18, 11:30-32.) Fig. 1

illustrates an embodiment, showing, *e.g.*, eyeglass frames 100, lenses 105, and cameras 110 and 120:

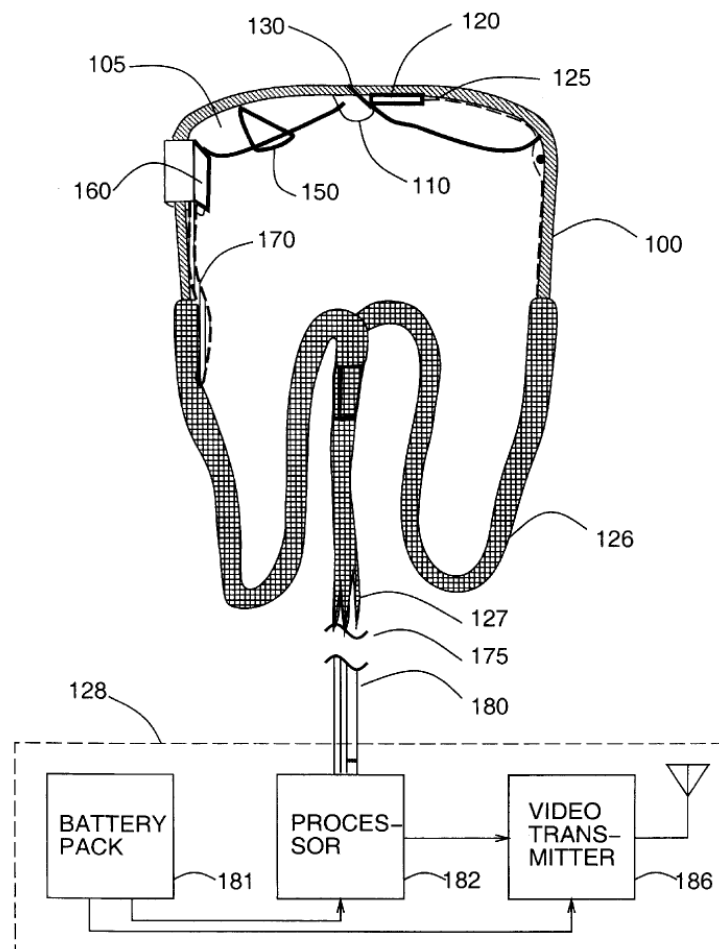


FIG. 1

(EX-1006, 11:30-32, Fig. 1.)

121. As shown in Fig. 1, the eyeglasses can be in communication via connection 180 with a processor 182, which may contain a computer, and preferably also a non-volatile storage device or network connection. (EX-1006, 12:25-31, Fig. 1.) The processor 182 can be powered by a battery pack 181, and

can provide output (*e.g.*, video output) via transmitter 186. (EX-1006, 12:25-35, Fig. 1.)

122. In some examples, the viewfinder can be concealed in the glasses frames, with “optics concealed in or behind the glass of the left lens.” (EX-1006, 9:35-37.) The viewfinder of the eyeglasses can include an electronic display, such as a computer monitor display, and be used to present the user with, *e.g.*, “information overlaid on top of his or her visual field of view such that the information is relevant to the imagery being viewed.” (EX-1006, 5:48-51, 12:39-44, 12:63-67.) The viewfinder can have an auto-focusing mechanism that is controlled by an “eye-tracking mechanism that causes the focus of the camera to be based on where the user is looking.” (EX-1006, 6:21-27.)

123. Processor 182 can include a vision analysis processor 183, an information processor 184, and a graphics synthesis processor 185. (EX-1006, 13:40-14:10, Fig. 1B) Fig. 1B illustrates:

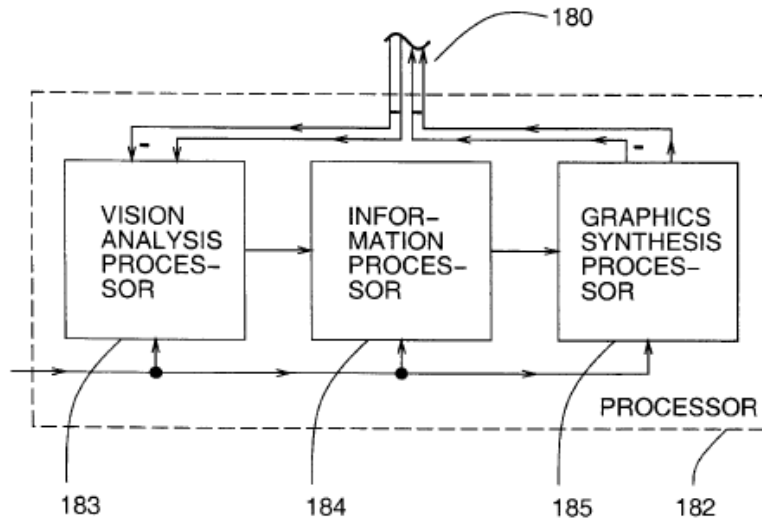


FIG. 1B

(EX-1006, Fig. 1B)

124. Processor 182 can perform various functions, such as head tracking and 3D object recognition. (EX-1006, 13:45-51.) Processor 182 can also provide video output to the viewfinder display, such as via transmitter 186. (EX-1006, 13:30-39.) For example, the processor 182 can take visual information, such as from cameras 110 and 120 of the eyeglasses, and determine “virtual objects” to present on the viewfinder based on that visual information. (EX-1006, 13:40-60.)

125. In some examples, a “computer graphics rendering” can be presented based on a 3D scene specified by processor 182. (EX-1006, 13:40-60.) The rendering can include virtual objects that correspond to real objects within the field of view. (EX-1006, 13:54-62.) Fig. 1C shows an example view on a display:

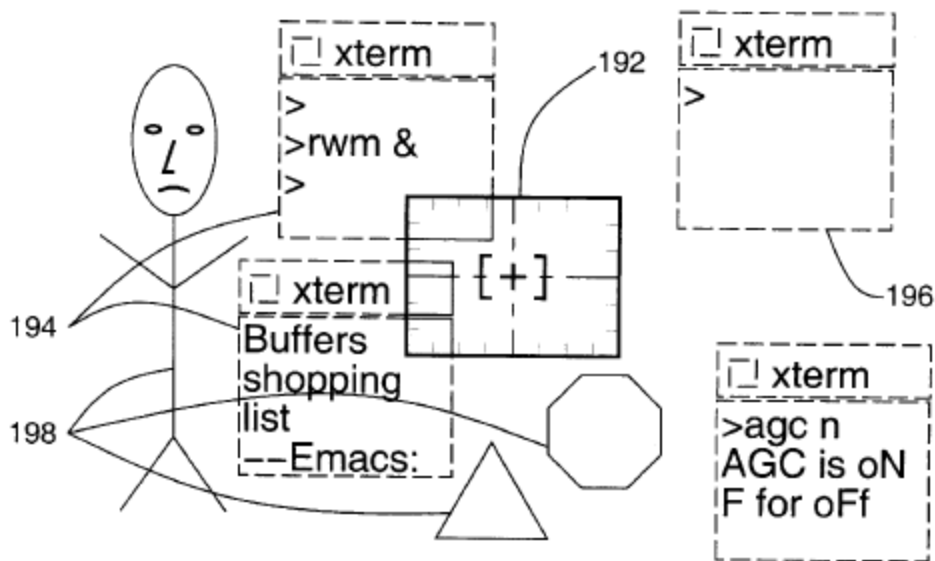


FIG. 1C

(EX-1006, 14:22-25, Fig. 1C)

126. In Fig. 1C, terminal windows (*e.g.*, xterm windows 194 and 196) are shown. (EX-1006, 14:22-25, Fig. 1C) The terminal windows may be windows of the “commonly-used X-windows graphical user interface.” (EX-1006, 14:22-25.) As the POSITA would recognize, X-windows is a windowing system application for the UNIX operating system, and is commonly distributed with and used with various other operating systems. (EX-1020, 485.) The terminal windows may “appear to hover in space above various real objects 198.” (EX-1006, 14:32-35.)

127. Mann ’526 discloses that head tracking and eye tracking can be used to interact with the viewfinder and the graphical user interface, such that “the viewfinder is the mouse/cursor: the wearer’s head is the mouse, and the center of the viewfinder is the cursor.” (EX-1006, 14:32-65.) Fig. 1D illustrates an example

motion of viewfinder reticle 192, controlled by head tracking and eye tracking (with the cursor visible in viewfinder reticle 192):

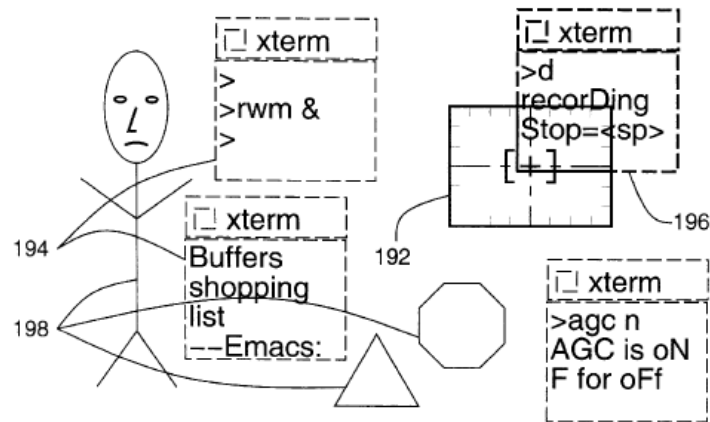


FIG. 1D

(EX-1006, 26:10-19, Figs. 1C, 1D)

128. The head tracking and eye tracking can be used together to position viewfinder reticle 192 over a particular terminal window 194, and activate the terminal window, such that commands can be entered in the terminal window. (EX-1006, 14:32-35, 14:55-15:13.) For instance, the user “selects window 196 by looking at it,” and then enters a command, such as to instruct a camera to start or stop recording. (EX-1006, 14:55-15:13.)

2. Summary of Vaissie

129. Vaissie is a U.S. patent that was filed on Dec. 23, 1999 and issued on Aug. 13, 2002. Vaissie is thus prior art to the '113 Patent under at least 35 U.S.C. §§ 102(a), (b), and (e).

130. Vaissie discloses using an eye tracker in a “head mounted display that has an integrated eye-tracking function.” (EX-1007, 1:56-58.) To perform eye tracking, a light source (*e.g.*, one or more near-infrared LEDs) illuminates the cornea of the eye via a beam splitter. (EX-1007, 3:16-31.) A camera (*e.g.*, a CCD camera) detects a reflected light image reflected in the cornea. (EX-1007, 3:16-31.) This provides an image of the eye to a computer, which processes the image to identify the location of pupil 42 and thus the user’s sight direction. (EX-1007, 3:39-46, Fig. 4.) For example, with respect to Fig. 7b below, the computer measures a pupil center 72 and a corneal reflection barycenter 74, and determines the sight direction based on the vector PH based on the pupil center and the corneal reflection barycenter:

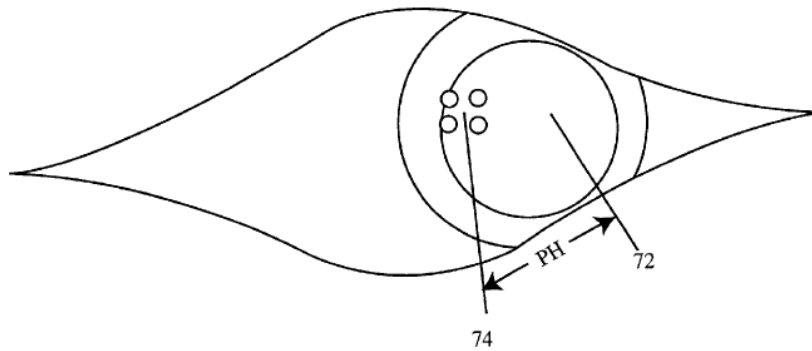


Figure 7b

(EX-1007, 3:59-4:3, Fig. 7b.)

3. Claim 1

131. Mann '526 in view of Vaissie meets each limitation of claim 1, as described below.

a. [Pre] *A wearable optics device comprising:*

132. The preamble is taught by Mann '526 in view of Vaissie. For example, Mann '526 discloses a “wearable camera and viewfinder” that is “built into eyeglass frames 100, typically containing two eyeglass lenses 105.” (EX-1006, 3:16-18, 11:30-32.) Fig. 1 illustrates an example:

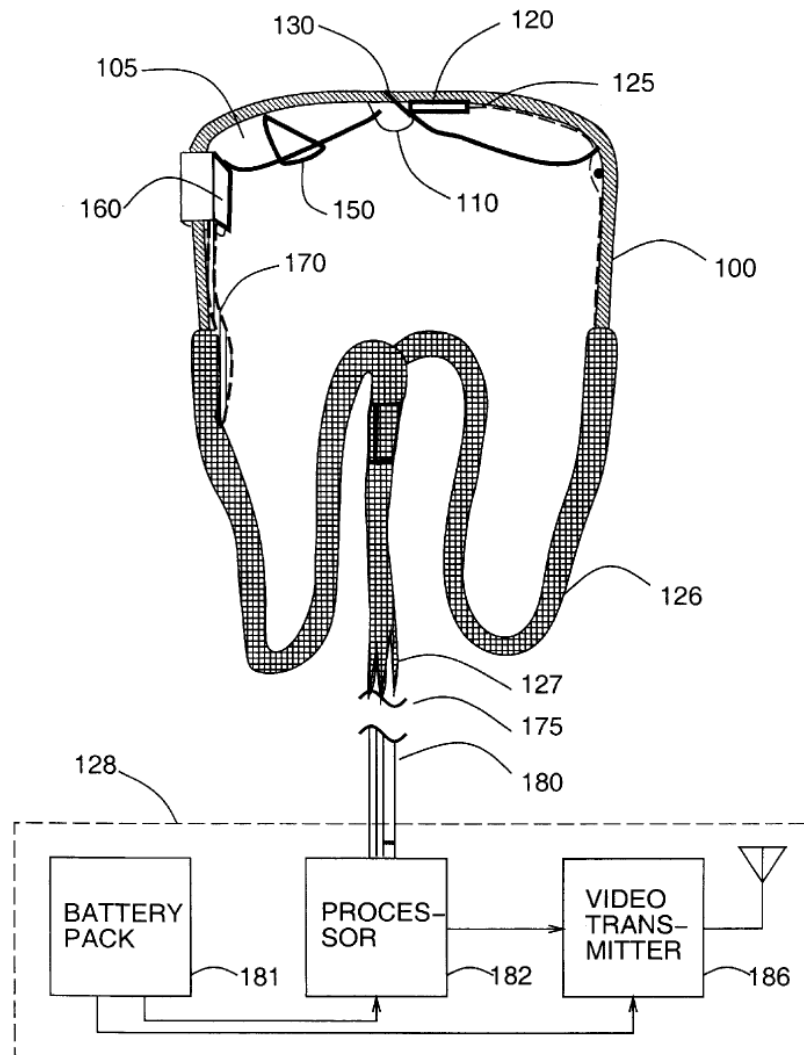
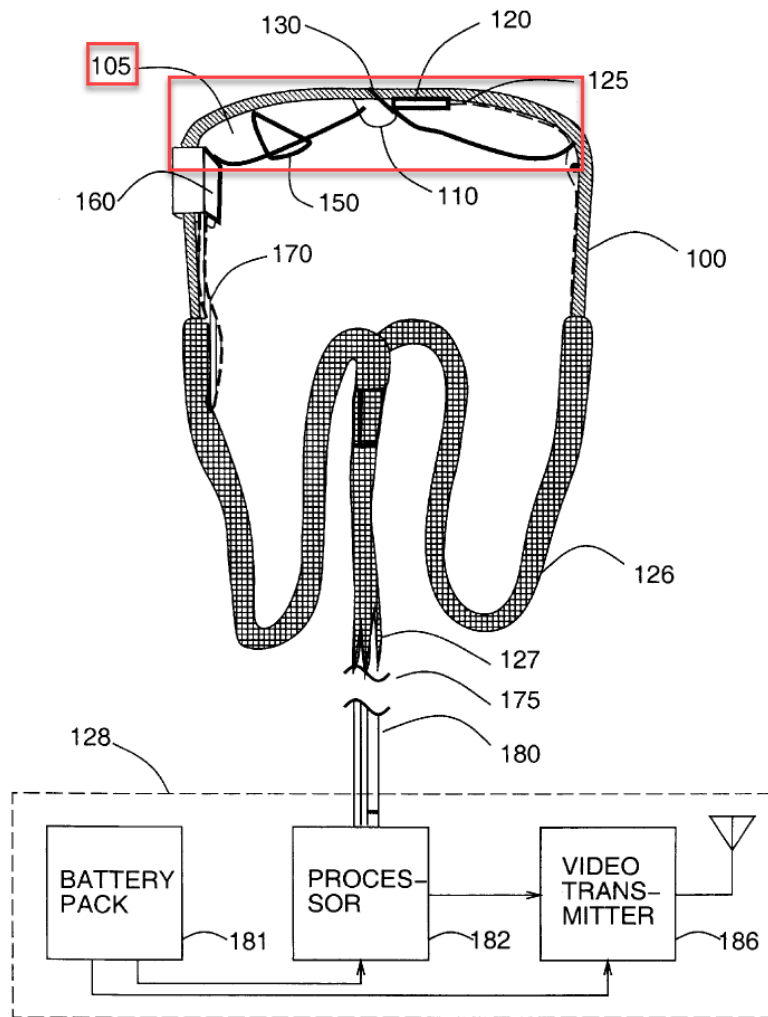


FIG. 1

(EX-1005, 11:30-32, Fig. 1.)

b. [A] a lens; and

133. Mann '526 in view of Vaissie meets this element. For example, Mann '526 discloses a “wearable camera and viewfinder” that is “built into eyeglass frames 100, typically containing two eyeglass lenses 105.” (EX-1006, 3:16-18, 11:30-32.) Fig. 1 illustrates an example:



(EX-1005, 11:30-32, Fig. 1 (annotated))

c. [B] *a dynamic eye tracking mechanism in communication with the lens;*

134. Mann '526 in view of Vaissie meets this element. For example, Mann '526 discloses a viewfinder with a focusing mechanism that is “controlled by an automatic focusing mechanism of a camera system, and in which the apparatus comprises an *eye-tracking mechanism* that causes the focus of the camera to be

based on where the user is looking”. (EX-1006, 6:21-26 (emphasis added).) Mann ’526 also discloses that the eye tracking mechanism can be used to control a cursor position in a “reality window manager,” such as shown in Fig. 1D (with the cursor visible in 192):

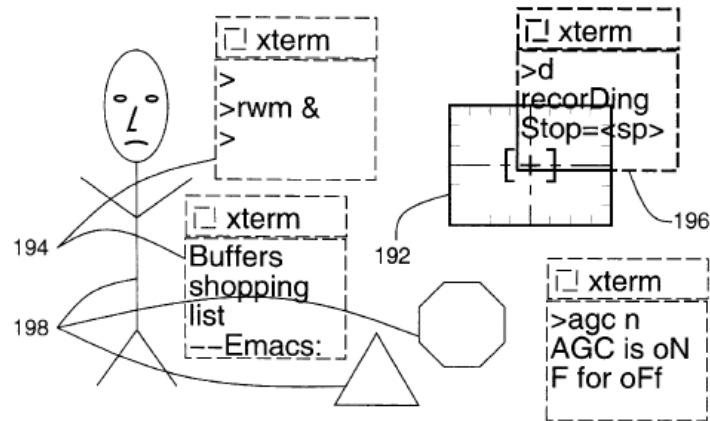
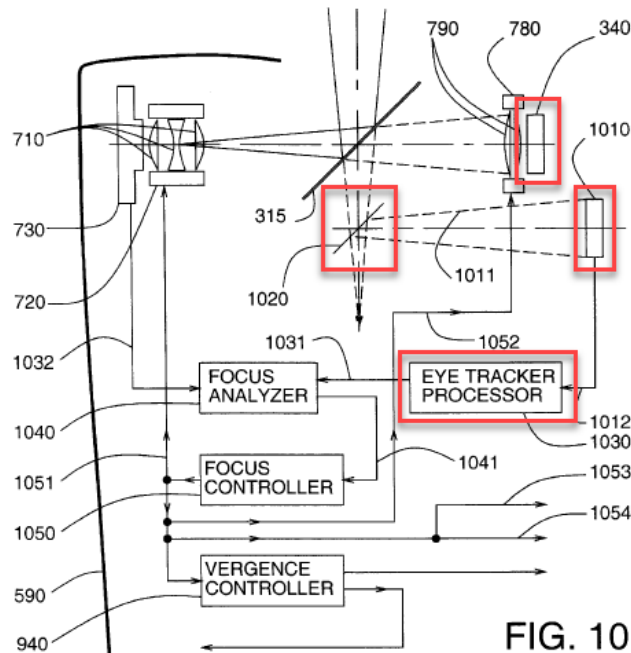


FIG. 1D

(EX-1006, 26:10-19, Figs. 1C, 1D)

135. Fig. 10 illustrates an example of the eye-tracking mechanism:



(EX-1006, 24:66-25:32, Fig. 10 (annotated))

136. Fig. 10 shows a left-eye portion of Mann '526's wearable camera system, in which the camera focus and vergence are driven by the output of the eye tracking mechanism. (EX-1006, 24:66-25:1, Fig. 10.) The eyetracker 1010 includes a camera and infrared light sources. (EX-1006, 25:1-4, Fig. 10.) The eyetracker 1010 illuminates the eye (*e.g.*, via the infrared light sources); and observes (*e.g.*, via the camera) the eye via light rays reflected in beamsplitter 1020. (EX-1006, 25:1-7, Fig. 10.) The eyetracker 1010 thus "reports the direction of eye gaze," via a signal 1012 provided to an eye tracker processor 1030. (EX-1006, 25:7-11, Fig. 10.) The eye tracker processor 1030 converts the eye gaze direction into X and Y coordinates, corresponding to the screen coordinates of a viewfinder screen 340. (EX-1006, 25:7-11, Fig. 10.) The viewfinder 340 is visible to the user

via reflection in mirror 315. (EX-1006, 25:5-7, Fig. 10.) The X and Y coordinates indicate where on the viewfinder screen 340 the user is looking. (EX-1006, 25:11-13, Fig. 10.)

137. The eye tracking mechanism is *dynamic* at least because it tracks the “direction of eye gaze” as the user’s eye moves; and causes “movement of the cursor” (such as shown in Figs. 1C and 1D) and/or an adjustment of focus by a servo mechanism 720, in accordance with the tracked eye movement. (EX-1006, 24:66-25:32, 26:10-19, Fig. 10.)

138. The dynamic eye tracking mechanism is *in communication with the lens* at least because the eye tracking mechanism is in optical communication with the lens, *e.g.*, by the eye tracking mechanism receiving light rays from the lens. For example, the camera of the eye tracking mechanism 1010 captures an image of the eye by capturing light rays transmitted by the lens and reflected in the eye. These light rays are shown, for example, in Fig. 3, in which rays 311 and 321, after being transmitted by the lens, “pass through the apparatus and enter directly into the eye without being deflected by two-sided mirror 315.” (EX-1006, 18:21-26, Fig. 3.) The two-sided mirror 315 of Fig. 3 is also shown in the example of the eye tracking mechanism in Fig. 10 above.

specifies, on a component-by-component basis, how this modification would be made. (EX-1006, 18:62-19:15, Fig. 3, Fig. 4, Fig. 10.) In this configuration, because “only a portion of the rays” from the lens are reflected by the beamsplitter, as shown with respect to light rays 310 in Fig. 4 below, remaining light rays are transmitted to the eye tracking mechanism from the lens via the beamsplitter, such that the eye tracking mechanism is in optical communication with the lens, in addition to the optical communication described above. (EX-1006, 18:62-19:21, Fig. 4, Fig. 10.)

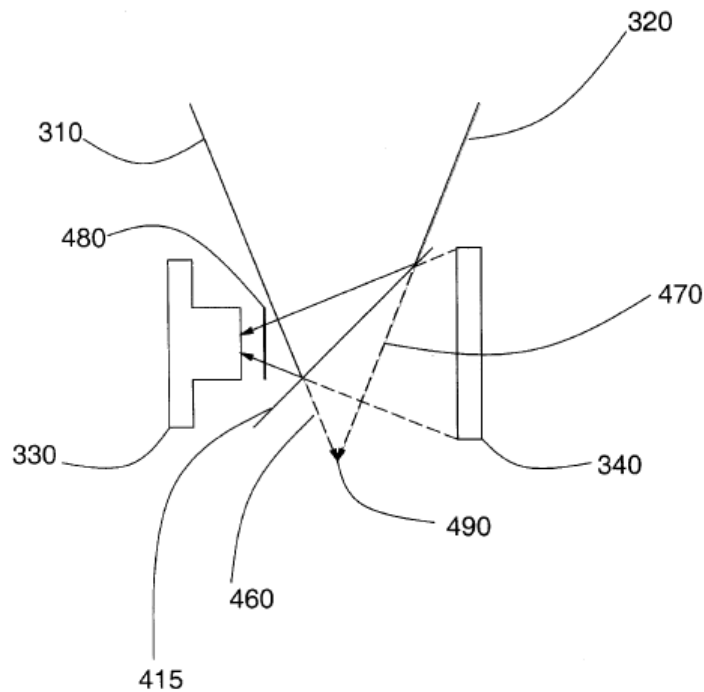


FIG. 4

(EX-1006, Fig. 4.)

- d. [C] *wherein the dynamic eye tracking mechanism utilizes optical parameter measurements; wherein the optical parameter measurements include any of ciliary measurements, pupil measurements, corneal measurements, eye lens measurements, iris measurements, eye lid measurements, retina measurements;*

140. Mann '526 in view of Vaissie meets this element.

(i) Mann '526

141. Mann '526 teaches this element even without Vaissie. For example, as described above for element [B], the eye tracker in Mann '526 “observes the eyeball” using a camera and an infrared light source and uses this to determine the “direction of eye gaze.” The POSITA would understand this to describe a popular technique for determining a gaze direction using a camera and a light source: by measuring a location of the pupil of the eye (which moves according to the movement of the eye gaze) and comparing that measured pupil location to the location of a reflection of the light source, typically an infrared light source, in the cornea of the eye (which does not move with the movement of the eye gaze). This well-known eye tracking technique thus meets at least the claimed *pupil measurements* and *corneal measurements*.

142. The details of this well-known eye tracking technique were likely omitted from Mann '526 deliberately, because the author of that reference understood that the POSITA would be familiar with the technique, and would

understand that the technique could be practiced with the eyewear of Mann '526. For example, the POSITA would recognize that the eye tracking mechanism includes the camera and infrared light source known to be common to this eye tracking technique.

(ii) Mann '526 in combination with Vaissie

143. To the extent that Mann '526 alone does not teach this limitation, it is taught by Mann '526 in combination with Vaissie. Vaissie describes techniques for performing eye tracking in a “head mounted display that has an integrated eye-tracking function,” such as the eyewear described in Mann '526. (EX-1007, 1:56-58.) Vaissie explains that, as in Mann '526, a light source (*e.g.*, one or more near-infrared LEDs 9) illuminates the cornea of the eye via a beam splitter. (EX-1007, 3:16-31.) In Vaissie, also as in Mann '526, a camera (*e.g.*, a CCD camera 11.) detects a reflected light (*e.g.*, visible light) image reflected in the cornea. (EX-1007, 3:16-31.) This provides an image of the eye to a computer 10, which processes the image to identify the location of pupil 42 and thus the user's sight direction. (EX-1007, 3:39-46, Fig. 4.)

144. Vaissie explains a process for how the image is processed to determine the user's eye gaze direction. Fig. 7a below represents “an image of the pupil, cornea and iris of a user's eye,” with reflections of the light source (*e.g.*, 4 LEDs), when the user gazes straight ahead:

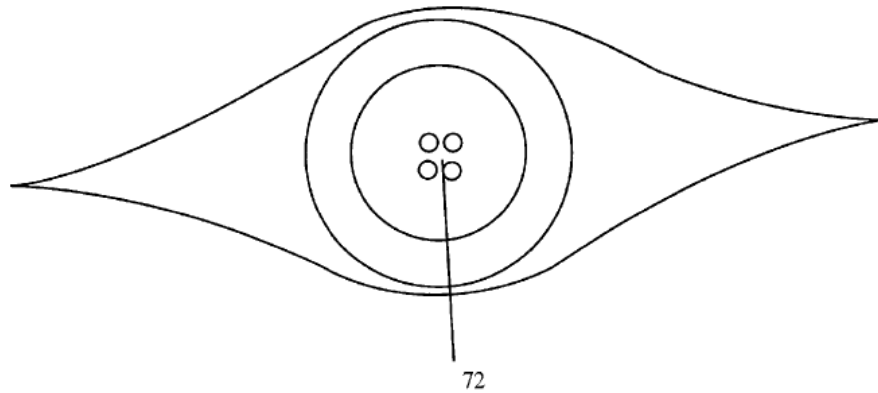


Figure 7a

(EX-1007, 3:59-61, Fig. 7a.)

145. When the user is gazing off axis, “the reflections of the 4 LEDs on an image of the pupil, cornea and iris of the user’s eye” are as represented in Fig. 7b:

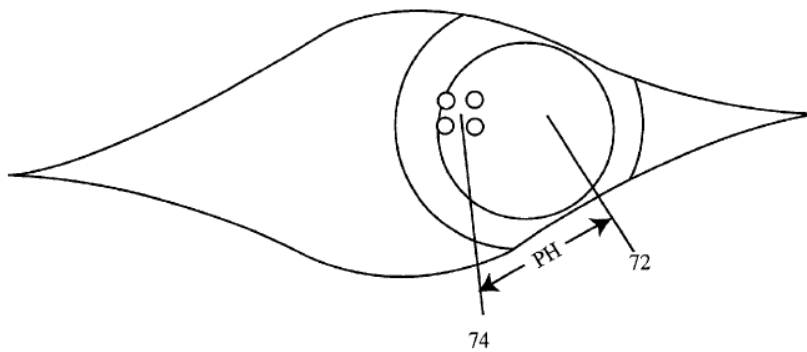


Figure 7b

(EX-1007, 3:61-64, Fig. 7b.)

146. Vaissie explains that the “location of the LEDs when the eye rotates” is computed by measuring the “location of the center 72, of the entrance pupil,” and measuring the “barycenter of the images of the LEDs,” which are reflected in the cornea. (EX-1007, 3:64-4:3, Fig. 7b.) A vector PH from the center of the

entrance pupil 72 to the barycenter of the cornea reflections 74 is then measured, as shown in Fig. 7b, and used to “determine the sight direction with respect to the axis of the reference point.” (EX-1007, 3:64-4:3, Fig. 7b.)

147. Mann ’526 in view of Vaissie thus teaches that the dynamic eye tracking mechanism utilizes *optical parameter measurements*; and that the optical parameter measurements include at least *pupil measurements* (e.g., the center of entrance pupil 72) and *corneal measurements* (e.g., the barycenter of the cornea reflections 74), as recited in the claim. As explained in Vaissie, these optical parameter measurements are used to measure vector PH, from which the user’s eye gaze direction can be determined.

**(1) Motivation to Combine Mann ’526
and Vaissie with Reasonable
Expectation of Success**

148. To the extent that Mann ’526 alone does not teach a POSITA how to practice this limitation, the POSITA would have been motivated to combine Mann ’526 and Vaissie to meet the claim limitations.

149. First, as described above, Mann ’526 does not expressly disclose how to perform eye tracking using its own dynamic eye tracking mechanism. For example, while Mann ’526 discloses that an eye tracking mechanism includes a camera and infrared light sources, that the eye tracking mechanism “illuminates and observes the eyeball,” and that the eye tracking mechanism “reports the

direction of eye gaze,” Mann ’526 does not expressly disclose how the direction of the eye gaze is determined. (EX-1006, 24:66-25:31, Fig. 10.) So, to the extent Mann ’526 alone does not teach this process to the POSITA, the POSITA would have been motivated to identify a reference that explains how to use Mann ’526’s eye tracking mechanism to perform eye tracking (*e.g.*, report the direction of eye gaze).

150. Second, Vaissie expressly suggests an environment for its eye tracking technique: a “head mounted display that has an integrated eye-tracking function,” just like the head-mounted display in Mann ’526. (EX-1007, 1:56-58.) Vaissie explains that, compared to eye tracking devices that are “not useful for head mounted displays,” implementing Vaissie’s eye tracking in head-mounted devices can advantageously allow “physically challenged people” to interact with such devices. (EX-1007, 1:40-53.) Vaissie also describes additional advantages, for example: enhancing local images, correcting for depth perception difficulties, and increased resolution of visual displays. (EX-1007, 1:45-53.) The POSITA would have been motivated to combine Vaissie’s eye tracking with the head-mounted device of Mann ’526 to realize these advantages.

151. Third, the eye tracking technique described in Vaissie utilizes components analogous to those already found in Mann ’526’s eyewear. For example, Vaissie’s light source 9—with “at least one, but preferably four, near

infrared LEDs” that emit light toward the cornea of the eye—is analogous to the “infrared light sources” of the eye tracker 1010 in Mann ’526, which “illuminates ... the eyeball” via light rays 1011. (EX-1007, 3:1-5, 3:16-31; EX-1006, 24:66-25:4, Fig. 10.) Vaissie’s CCD camera 11, which images the cornea, is analogous to Mann ’526’s camera that “observes the eyeball” and can include a CCD image sensor. (EX-1007, 3:16-31; EX-1006, 7:2-4, 24:66-25:4, Fig. 10.) And Vaissie discloses using a beam splitter 5 to deliver light from the light source to the eye — analogous to beam splitter 1020 of Mann ’526. (EX-1007, 3:16-31; EX-1006, 24:66-25:4, Fig. 10.) Thus, the combination of Vaissie and Mann ’526 would have been predictable and provided a reasonable expectation of success.

e. [D] *wherein an optical/perceptual parameter based operating system is utilized,*

152. Mann ’526 in view of Vaissie meets this element as described below.

(i) Operating System

153. Mann ’526 in view of Vaissie teaches an operating system. For example, Mann ’526 discloses that processor 182, which can include a computer, can present a “computer graphics rendering” based on a 3D scene. (EX-1006, 13:40-60.) The rendering can include virtual objects that correspond to real objects within the field of view. (EX-1006, 13:54-62.) Fig. 1C shows an example view on a display:

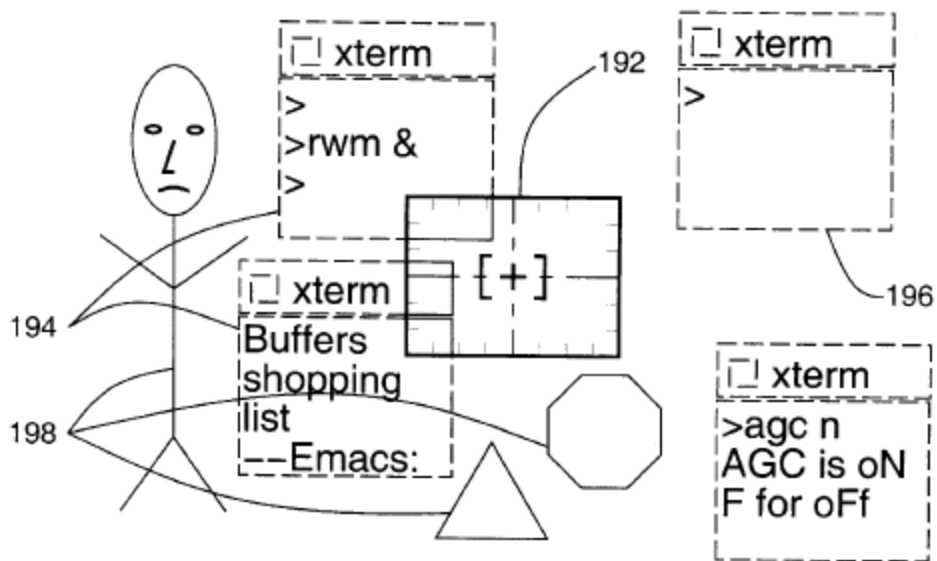


FIG. 1C

(EX-1006, 14:22-25, Fig. 1C)

154. Visible in Fig. 1C are terminal windows, which may be windows of the “commonly-used X-windows graphical user interface.” (EX-1006, 14:22-25.) As a POSITA would recognize, X-windows is a windowing system application for the popular UNIX operating system, initially released in 1984, and was commonly distributed with and used with various other operating systems by the 2013 priority date of the ’113 Patent. (EX-1020, 485 (Prentice-Hall, Inc. 6th ed. 2013).) As the POSITA would further recognize, many computers running the UNIX operating system run X-windows as their standard windowing system. (EX-1019, 356.) The POSITA would thus recognize Mann ’526’s xterm windows as belonging to such a windowing system.

155. The POSITA would understand that X-windows, and other windowing systems, such as disclosed in Mann '526, are ubiquitous features of operating systems. In some operating system examples, a windowing system (such as X-windows) can include a client process executed by the operating system. (EX-1019, 356.) In some operating system examples, such as Microsoft Windows, a windowing system is part of the operating system kernel. (EX-1019, 357.) As the POSITA would understand, a component that runs in the operating system kernel, like the windowing system in Microsoft Windows, is part of that operating system. (EX-1019, 3 (“Everything running in kernel mode is clearly part of the operating system.”).)

156. The POSITA would thus understand Mann '526 to teach an *operating system*, such as may execute on processor 182—at least by Mann '526's disclosure of X-windows and xterm terminal windows. (EX-1006, 14:21-27.) Moreover, as Mann '526 discloses, terminal windows can be used to provide commands to processes executing on processor 182. For example, Mann '526 discloses that a terminal window “can accept commands.” (EX-1006, 14:42-45.) Further, a terminal window can have “programs running in it.” (EX-1006, 14:42-45.) For example, Mann '526 illustrates a example of a well-known text editor program, Emacs, running in an xterm window. (EX-1006, 14:22-25, Fig. 1C.) A terminal window can also provide a command-line interface for inputting and executing

commands from a user. (EX-1019, 360.) Fig. 1D of Mann '526 shows several such examples in xterm windows 194 and 196. (EX-1006, Fig. 1D.) As the POSITA would recognize, managing processes executing on a processor, such as processor 182, is a function performed by an operating system.

157. To the extent not expressly disclosed by Mann '526, a POSITA would understand Mann '526 in view of Vaissie to teach an operating system. The POSITA would have found it obvious to include an operating system, and would have had a reasonable expectation of success in doing so, for the reasons described below.

158. Mann '526 discloses a computer system of sufficient complexity that an operating system would be a logical inclusion. (EX-1019, 5 (“the operating system is there to manage all the pieces of a complex system.”).) For example, Mann '526's computer system includes various components: inputs (*e.g.*, cameras 110 and 120, and eye tracking and head tracking inputs, as described above); outputs (*e.g.*, video transmitter 186, display 160); a processor (*e.g.*, processor 182), which may itself include multiple processors (*e.g.*, vision analysis processor 183, information processor 184, graphics synthesis processor 185); a power source (*e.g.*, battery pack 181); a storage device; and a network connection. (EX-1006, 11:1-14:10, Fig. 1.) These components introduce various complexities, including how

to allocate these components among various programs executing via the processor 182.

159. The POSITA would understand that managing the above components of Mann '526's computer system, such as by allocating components and resources of the computer system among processes of processor 182, is a task best suited to an operating system. Indeed, this is a primary purpose of operating systems. (EX-1019, 5 ("the job of the operating system is to provide for an orderly and controlled allocation of the processors, memories, and I/O devices among the various programs competing for them").)

160. By the 2013 priority date of the '113 Patent, operating systems were a relatively mature and well understood type of software, such that the POSITA would be familiar with their usage, and would be able to incorporate an operating system into a computer system like that of Mann '526 with a reasonable expectation of success and without undue experimentation.

(ii) Optical/Perceptual Parameter Based Operating System

161. Mann '526 in view of Vaissie further teaches that the operating system is an optical/perceptual parameter based operating system. Mann '526 teaches that the operating system is based on optical parameters and perceptual parameters. For example, Mann '526 discloses that head tracking and eye tracking can be used to interact with the viewfinder and the graphical user interface, such

that “the viewfinder is the mouse/cursor: the wearer’s head is the mouse, and the center of the viewfinder is the cursor.” (EX-1006, 14:32-65.) Fig. 1D illustrates an example motion of viewfinder reticle 192, controlled by head tracking and eye tracking (with the cursor visible in viewfinder reticle 192):

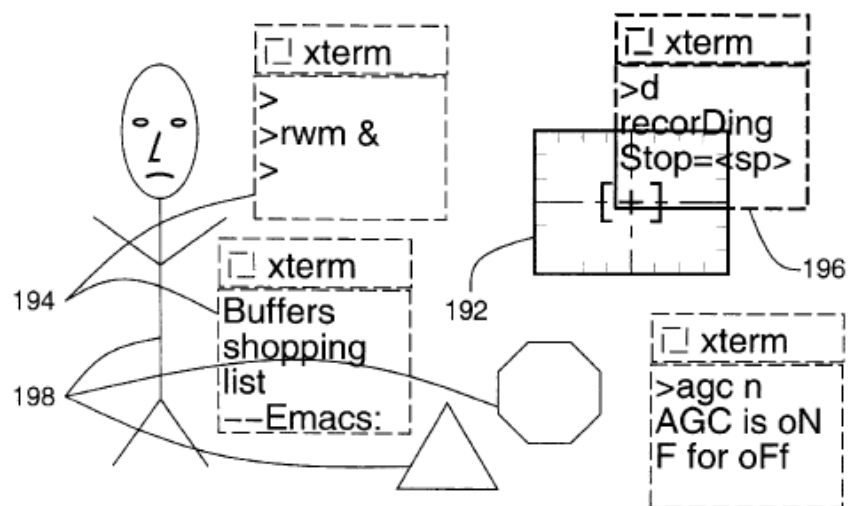


FIG. 1D

(EX-1006, 26:10-19, Figs. 1C, 1D)

162. As described above with respect to element [C], the eye tracker in Mann '526 in view of Vaissie utilizes optical parameter measurements, at least because, as described above, the eye tracker uses *pupil measurements* and *corneal measurements* to determine the direction of eye gaze. The operating system uses these optical parameter measurements to determine the coordinates of the cursor, which is in turn used to select and activate terminal windows for controlling processes of the eyewear. (EX-1006, 14:32-65.) Handling input (*e.g.*, line-of-sight

information for the user's eye) and controlling processor actions are core operating system functions, so the POSITA would understand them to be performed by the processor's operating system. (EX-1019, 269 ("One of the main functions of an operating system is to control all the computer's I/O (Input/Output) devices"); EX-1019, 5 ("the job of the operating system is to provide for an orderly and controlled allocation of the processors, memories, and I/O devices among the various programs competing for them").) The Mann '526 operating system is *optical parameter based* at least in that it utilizes the optical parameter measurements to execute these core functions.

163. Similarly, as disclosed by Mann '526, the cursor and terminal window activation is also controlled by head tracking. (EX-1006, 14:32-65.) For example, a user "makes [a] window active by head movement up and to the right." (EX-1006, 14:45-50.)

164. As Mann '526 discloses, the head tracker is based on camera output, utilizing at least *video* parameters of the camera to "orient[] the head (and hence the camera) that the cursor may be positioned." (EX-1006, 14:45-50.) For example, "video outputs from cameras 110 and 120 pass through wiring harness 180 into vision analysis processor 183," which uses this video data for head tracking. (EX-1006, 13:43-46.) The head tracking determines the orientation of the head "based on the visual location of objects in the field of view of camera

110.” (EX-1006, 13:46-49.) That is, the orientation of the head is based on the video output from the camera.

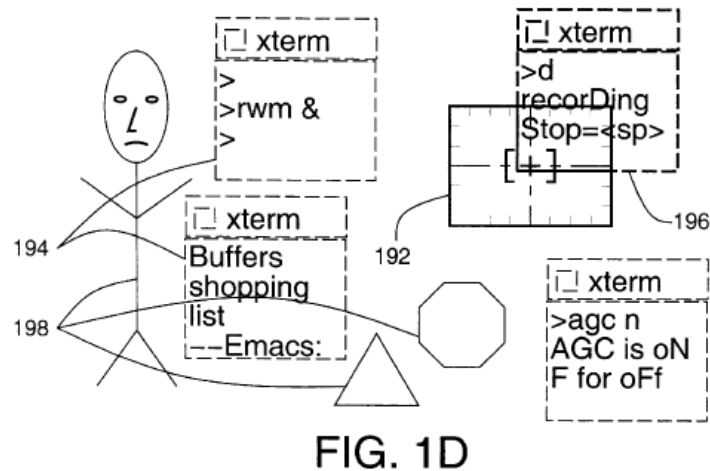
165. The video parameters used by the head tracking are perceptual parameters at least because the ’113 Patent identifies “video” as a specific example of perceptual parameters. (EX-1001, 14:8-11.) In addition, the ’113 Patent identifies “environmental” and “spatial” as examples of perceptual parameters. The head tracking of Mann ’526 is described by these parameters as well. For example, the camera output on which the head tracking is based captures *environmental* parameters (*e.g.*, from the environment of the user, as captured by the camera); and the head tracking is based further on *spatial* parameters describing spatial relationships between the “objects in the field of view.” (EX-1006, 13:46-49.) Further, the head tracking output, which indicates the “yaw, pitch, and roll” of the head, and which is utilized by the operating system, can itself be described as a *spatial* parameter, at least because yaw, pitch, and roll describe the spatial orientation of the head. (EX-1006, 13:46-49.)

166. The Mann ’526 operating system is thus *perceptual parameter based* at least in that it utilizes the perceptual parameters of the camera-based head tracking system to execute core operating system functions, as described above.

f. [E] *wherein the wearable optics device is controlled by the optical/perceptual based operating system.*

167. Mann '526 in view of Vaissie meets this element at least as described above for element [D]. For example, the eyewear is controlled by the optical/perceptual parameter based operating system at least in that the optical/perceptual parameter based operating system is used to control process execution (*e.g.*, starting and stopping a camera of the eyewear), such as via terminal windows that may be activated via eye tracking and head tracking. (EX-1006, 14:32-35, 14:55-15:13.)

168. As an example, as shown in Fig. 1D below, a user can use a terminal window of the operating system to enter a command, such as to instruct a camera process to start or stop recording. (EX-1006, 14:55-15:13.) For instance, in Fig. 1D, the “recorDing Stop” command is executed by the operating system to pause the camera from recording. (EX-1006, 14:55-15:36.) The POSITA would understand this to include providing a command (*e.g.*, “Stop”) to a process executing on processor 182 and controlling a camera of the wearable optics device. (EX-1006, 14:66-15:36.)



(EX-1006, Fig. 1D)

4. Claim 2

169. Mann '526 in view of Vaissie meets each limitation of claim 2, as described below.

a. [Pre] *The wearable optics system of claim 1,*

170. Mann '526 in view of Vaissie meets the wearable optics system of claim 1 as described above for claim 1.

b. [A] *wherein the dynamic eye tracking is utilized to control the optical/perceptual based operating system.*

171. Mann '526 in view of Vaissie meets this element as described above for claim 1[E].

5. Claim 3

172. Mann '526 in view of Vaissie meets each limitation of claim 3, as described below.

a. [Pre] *The wearable optics system of claim 1,*

173. Mann '526 in view of Vaissie meets the wearable optics system of claim 1 as described above for claim 1.

b. [A] *wherein applications are utilized to control sensors and communication of the wearable optics device.*

174. Mann '526 in view of Vaissie meets this element as described above for claim 1[D]. For example, as described above, Mann '526 discloses that sensors (*e.g.*, cameras) of the eyeglasses can be controlled by using a terminal window of a window manager application (*e.g.*, X-windows) to provide a command to a sensor (*e.g.*, to command the camera to start or stop recording). (EX-1006, 4:55-15:13.) Mann '526 thus teaches that applications are utilized to control *sensors* of the wearable optics device. In addition, as Mann '526 discloses, camera recordings are transmitted by transmitter 186. (EX-1006, 15:31-36.) Mann '526 thus also teaches that applications are utilized to control *communication* of the wearable optics device, at least by using a terminal window to control the camera (and thus the transmission of camera recordings) as described above.

6. Claim 12

175. Mann '526 in view of Vaissie meets each limitation of claim 12, as described below.

a. [Pre] *A wearable optics device comprising:*

176. The preamble is taught by Mann '526 in view of Vaissie as described above for claim 1[Pre].

b. [A] *a lens; and*

177. Mann '526 in view of Vaissie meets this element as described above for claim 1[A].

c. [B] *a dynamic eye tracking mechanism in communication with the lens;*

178. Mann '526 in view of Vaissie meets this element as described above for claim 1[B].

d. [C] *wherein the dynamic eye tracking mechanism utilizes optical parameter measurements; wherein the optical parameter measurements include any of ciliary measurements, pupil measurements, corneal measurements, eye lens measurements, iris measurements, eye lid measurements, retina measurements;*

179. Mann '526 in view of Vaissie meets this element as described above for claim 1[C].

e. **[D] *wherein an optical/perceptual parameter based operating system is utilized,***

180. Mann '526 in view of Vaissie meets this element as described above for claim 1[D].

f. **[E] *wherein the lens includes a plurality of layers.***

181. Mann '526 in view of Vaissie meets this element. For example, Mann '526 discloses that a beamsplitter, such as described with respect to claim 1, can be “embedded in one or both glass lenses of the eyeglasses.” (EX-1006, 20:22-24.) The beamsplitters “may be integrated into the lenses in such a manner to have the appearance of ordinary lenses in ordinary bifocal eyeglasses.” (EX-1006, 20:29-31.) In addition, beamsplitters can be “implemented as a metallisation within a lens of the eyeglasses.” (EX-1006, 22:55-61.) Further, beamsplitters and diverging lens 250 “may be embedded within the eyeglass lens ... so that the embedded elements may appear to be a feature of bifocal eyeglasses.” (EX-1006, 22:55-61.) Mann '526 thus teaches that *the lens includes a plurality of layers* (e.g., a metallization layer with the lens, and/or a layer comprising one or more beamsplitters embedded within the lens).

7. Claim 13

182. Mann '526 in view of Vaissie meets each limitation of claim 13, as described below.

a. [Pre] *The wearable optics system of claim 12,*

183. Mann '526 in view of Vaissie meets the wearable optics system of claim 12 as described above for claim 12.

b. [A] *wherein the dynamic eye tracking is utilized to control the optical/perceptual based operating system.*

184. Mann '526 in view of Vaissie meets this element as described above for claim 2[A].

8. Claim 14

185. Mann '526 in view of Vaissie meets each limitation of claim 14, as described below.

a. [Pre] *The wearable optics system of claim 12,*

186. Mann '526 in view of Vaissie meets the wearable optics system of claim 12 as described above for claim 12.

b. [A] *wherein applications are utilized to control sensors and communication of the wearable optics device.*

187. Mann '526 in view of Vaissie meets this element as described above for claim 3[A].

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and that these statements were made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code.

Executed the 19th of January, 2023 in Oviedo, Florida.

Respectfully submitted,



Joseph J. LaViola Jr., Ph.D.