UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LUXOTTICA OF AMERICA INC.,
Petitioner,

v.

E-VISION OPTICS, LLC,
Patent Owner.

Case IPR2024-01069
Patent 10,613,355

DECLARATION OF JOHN FELAND IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 10,613,355

Luxottica Ex. 1002
IPR Petition USP 10,613,355

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I, John Feland, Ph.D., declare as follows:

1. I am making this declaration at the request of Luxottica of America Inc. ("Luxottica"). I have been retained by Luxottica as a technical expert in this matter.

2. I am being compensated for my work on this matter and I am being reimbursed at cost for my expenses. My compensation in no way depends upon the outcome of this proceeding. I do not own any stock in Luxottica and, to my knowledge, I have no financial interest in Luxottica.

3. In preparation for this declaration, I have considered the following materials:

Exhibit	Description
1001	U.S. Patent 10,613,355
1002	Declaration of John Feland
1003	File History of U.S. Patent 10,613,355
1004	U.S. Patent Pub. 2005/0248719 (Howell-719)
1005	Sikonowiz, Walter, DESIGNING AND CREATING PRINTED CIRCUITS (Hayden Book Co., 1981)
1006	U.S. Patent 6,733,130 (Blum-130)
1007	U.S. Patent Pub. 2006/0023158 (Howell-158)
1008	U.S. Patent 3,612,744 (Thomas)
1009	U.S. Patent 5,606,743 (Vogt)
1010	U.S. Patent 4,290,052 (Eichelberger)
1011	U.S. Patent 2,915,598 (Brunton)

Exhibit	Description
1012	Declaration of Sylvia D. Hall-Ellis
1013	Declaration of Rachel J. Watters
1014	U.S. Patent 4,053,789
1015	U.S. Patent Pub. 2006/0238513
1016	JP S58-113913 (Hattori-913)
1017	U.S. Patent 5,373,109
1018	U.S. Patent 6,857,741
1019	Harper, Charles, ed., HANDBOOK OF MATERIALS AND PROCESSES FOR ELECTRONICS (McGraw-Hill, 1970): Chapter 5, Licari, J.J. & Brands, E.R., *Coatings for Electronics* [Ex. A to Ex. 1013 (Watters Declaration)]
1020	Curriculum vitae of John Feland
1021	IPC-2221A
1022	U.S. Patent 5,796,183
1023	U.S. Patent Pub. 2003/0076306
1024	U.S. Patent 4,601,206
1025	U.S. Patent 5,916,181
1026	WO 2005/093550
1027	WO 2005/103863
1028	U.S. Patent Pub. 2005/0154330
1029	EP 1575250
1030	McGraw-Hill Concise Encyclopedia of Science & Technology (1994)

Exhibit	Description
1031	Steer, Michael, MICROWAVE AND RF DESIGN: RADIO SYSTEMS, (NC State University)

4. I have also relied on my education, training, and experience, and my knowledge of pertinent literature in the field of the '355 patent.

I. EXPERIENCE AND QUALIFICATIONS

5. My experience and qualifications are summarized in my *curriculum vitae*, a copy of which is provided as Exhibit 1020.

6. I have over 30 years of experience in mechanical engineering, electromechanical engineering, and mechatronics. I graduated from the Massachusetts Institute of Technology with a bachelor of science degree in mechanical engineering in 1994. After graduating from MIT, I attended Stanford University, where I received an M.S. in 1996 and then a Ph.D. in 2005, both also in mechanical engineering. Although my degrees were in mechanical engineering, I completed coursework and research involving electronic circuitry, electromechanical engineering, and mechatronics.

7. Beginning in June 1996, I worked as a mechatronic design engineer for IDEO Product Development. From March 1997 to April 1999, I worked for the National Air Intelligence Center as a Program Manager, Defense Intelligence Systems, managing mission requirements and software development for an $18

billion missile warning satellite program. From April to July 1999, I served as Director, Measurement and Signals Intelligence Systems, for the Joint Analysis Center, supervising classified intelligence support for Operation Allied Force in Kosovo.

8. From August 1999 to July 2001, I was an Assistant Professor of Engineering Mechanics for the United States Air Force Academy. In that time, I launched the Academy's first mechatronics course. From 2002 to 2004, I worked as a design strategy consultant for Trusted Nomad, taught at Stanford, and worked as Senior Mechanical Engineer for Symyx Technologies, developing MEMS industrial sensors.

9. From December 2004 to August 2008, I worked at Synaptics. While at Synaptics, I designed and built several mobile devices and mobile-device accessories. The team I managed retrofitted or designed from scratch hundreds of capacitive touch interfaces for multiple consumer electronic devices. Through this work, I gained deep experience with manufacturing electronic assemblies and integrating them into a wide array of consumer electronics. This work also provided me with significant experience in the path to mass production, including how to deliver technological improvements that could be mass produced, as we recommended these prototypes as potential product features for customers. My work at Synaptics included architecting the Onyx, a working multitouch-controlled

mobile phone prototype, which gained international recognition in 2006, winning the Red Dot Design Concept Award months ahead of Apple's 2007 launch of the iPhone.

10. Also at Synaptics, I both developed and evaluated gesture interactions on multiple consumer devices, including audits of the then-nascent iPhone interface and attempts by competitors to leverage Synaptics's touch technology to compete in the market. This included work on designing improved capacitive touch switches for integration into consumer electronics.

11. After Synaptics, I was Chief Technologist at SK Telecom Americas from September 2008 to September 2009. While at SK Telecom Americas, I evaluated several user experience designs across a range of interfaces, including voice, touch, and gesture. From October 2009 to September 2011, I held positions at Stanford, including Executive Director of the Global Design Innovation course that connects graduate students with corporate partners, as well as Consulting Assistant Professor in the Design Group of the Mechanical Engineering department. In 2012, I served as Distinguished Lecturer at Cogswell Polytechnical College, teaching courses in robotics and entrepreneurship.

12. After leaving SK Telecom in September 2009, I founded Argus Insights, a consulting firm that I have run for nearly 15 years. Some of my projects have included analyzing what UX aspects are driving adoption in autonomous

vehicles and designing UX for industrial cutting tools to lower training requirements and increase operator effectiveness.

13. I am currently a Principal Strategist at CableLabs, a non-profit think tank for the broadband industry. I pursue a mixture of quantitative and qualitative research on consumer behaviors and preferences. I also coach innovation teams and work extensively in artificial intelligence strategy. From April 2017 to September 2018, I served as forum chair and moderator for the IoT (Internet of Things) Forum in Silicon Valley. Since August 2018, I have also taught engineering at the Nueva School.

14. As shown in my CV, I have authored or co-authored over 30 publications, most of which relate to engineering or design. I am a named inventor on at least six issued patents, including patents on technology involving capacitive touch sensing.

II. APPLICABLE LEGAL STANDARDS

15. I have been asked to provide my opinion as to whether the claims of U.S. Patent. No. 10,613,355 ("the '355 patent") would have been obvious to a person of ordinary skill in the art at the time of the alleged invention, in view of the prior art.

16. I am an engineer by training and profession. The opinions I am expressing in this report involve the application of my training and technical

knowledge and experience to the evaluation of certain prior art with respect to the ’355 patent.

17. Although I have been involved as a technical expert in patent matters before, I am not an expert in patent law. Therefore, attorneys from Knobbe, Martens, Olson & Bear have provided me with guidance as to the applicable patent law in this matter. The paragraphs below express my understanding of how I must apply current principles related to patent validity to my analysis.

A. Relevant Timeframe

18. I understand that the earliest claimed priority date of the ’355 patent is May 4, 2007, and I have been instructed to assume for the purposes of my opinions that this is the invention date for the ’355 patent.

B. Claim Construction

19. It is my understanding that in determining whether a patent claim is anticipated by or obvious in view of the prior art, the Patent and Trademark Office construes the claim by giving the claim terms their plain and ordinary meaning, as they would have been understood by a person of ordinary skill in the art at the time of the invention in view of the intrinsic record (patent claims, patent specification, and file history). For the purposes of this review, and to the extent necessary, I have interpreted each claim term in accordance with its plain and ordinary meaning as it

would have been understood by a person of ordinary skill in the art at the time of the invention, in view of the intrinsic record.

20. I understand that a patent and its prosecution history are considered "intrinsic evidence" and are the most important sources for interpreting claim language in a patent. I also understand that in reading the claim, I must not import limitations from the specification into the claim terms; in other words, I must not narrow the scope of the claim terms by implicitly adding disclosed limitations that have no express basis in the claims. The prosecution history of related patents and applications can also be relevant.

21. I understand that sources extrinsic to a patent and its prosecution history (such as dictionary definitions and technical publications) may also be used to help interpret the claim language, but that such extrinsic sources cannot be used to contradict the unambiguous meaning of the claim language that is evident from the intrinsic evidence.

22. Unless expressly stated herein, I have applied the plain and ordinary meaning of the claim terms, which I understand is the meaning that a person of ordinary skill in the art would have given to terms at the time of the claimed invention based on a review of the intrinsic evidence.

C. Obviousness

23. It is my understanding that a claim is "obvious" if the claimed subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time of the alleged invention. I understand that an obviousness analysis involves a number of considerations. I understand that the following factors must be evaluated to determine whether a claim would have been obvious: (i) the scope and content of the prior art; (ii) the differences, if any, between each claim of the '355 patent and the prior art; (iii) the level of ordinary skill in the art at the time of the claimed invention; and (iv) additional considerations, if any, that indicate that the invention was obvious or not obvious. I understand that these "additional considerations" are often referred to as "secondary considerations" or "objective indicia" of non-obviousness or obviousness.

24. I also understand that the frame of reference when evaluating obviousness is what a hypothetical person of ordinary skill in the pertinent art would have known at the time of the claimed invention. I understand that the hypothetical person of ordinary skill is presumed to have knowledge of all pertinent prior art references.

25. I understand that a prior art reference may be a pertinent prior art reference (or "analogous art") if it is in the same field of endeavor as the patent or if it is pertinent to the problem that the inventors were trying to solve. I understand that

a reference is reasonably pertinent if it logically would have commended itself to an inventor's attention in considering the problem at hand. If a reference relates to the same problem as the claimed invention, I understand that supports use of the reference as prior art in an obviousness analysis. Here, all of the references relied on in my obviousness analysis below are in the same field of endeavor as the '355 patent, e.g., eyewear and/or consumer electronics. The references are also pertinent to a particular problem the inventor was focused on, e.g., adding electronics to eyewear or sealing eyewear electronics to resist moisture.

26. It is my understanding that the law recognizes several rationales for combining references or modifying a reference to show obviousness of claimed subject matter. Some of these rationales include:

- combining prior art elements according to known methods to yield predictable results;
- simple substitution of one known element for another to obtain predictable results;
- a predictable use of prior art elements according to their established functions;
- using known techniques to improve similar devices (methods, or products) in the same way;

- applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
- choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success (in which case a claim would have been obvious to try);
- known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to one of ordinary skill in the art; and
- some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

27. I understand that "secondary considerations" must be considered as part of the obviousness analysis when present. I further understand that the secondary considerations may include: (1) a long-felt but unmet need in the prior art that was satisfied by the claimed invention; (2) the failure of others; (3) skepticism by experts; (4) commercial success of a product covered by the patent; (5) unexpected results achieved by the claimed invention; (6) industry praise of the claimed invention; (7) deliberate copying of the invention; and (8) teaching away by others. I also understand that evidence of the independent and nearly simultaneous "invention" of

the claimed subject matter by others is a secondary consideration supporting an obviousness determination and may support a conclusion that a claimed invention was within the knowledge of a person of ordinary skill as of the time of the claimed invention. I am not aware of any evidence of secondary considerations that would suggest that the claims of the ’355 patent would have been nonobvious at the time of the claimed invention.

28. I understand that when assessing obviousness, using hindsight is impermissible; that is, what is known today or what was learned from the teachings of the patent should not be considered. The patent should not be used as a road map for selecting and combining items of prior art. Rather, obviousness must be considered from the perspective of a person of ordinary skill at the time the alleged invention was made. (See paragraph 18 for discussion of invention date.)

29. I also understand that an obviousness analysis must consider the invention as a whole, as opposed to just a part or element of the invention. I understand this “as a whole” assessment to require showing that one of ordinary skill in the art at the time of invention, confronted by the same problems as the inventor and with no knowledge of the claimed invention, would have selected the elements from the prior art and combined them in the claimed manner.

III. PERSON OF ORDINARY SKILL IN THE ART

30. It is my understanding that when interpreting the claims of the ’355 patent and evaluating whether a claim would have been obvious, I must do so based on the perspective of a person of ordinary skill in the art (POSITA) at the time of invention. (See paragraph 18 for discussion of invention date.)

31. I understand that in determining the level of ordinary skill in the art, several factors are considered. Those factors may include: (i) the type of problems encountered in the art; (ii) prior art solutions to those problems; (iii) the rapidity with which innovations are made; (iv) the sophistication of the technology; and (v) the educational level of active workers in the field. A person of ordinary skill in the art must have the capability of understanding the scientific and engineering principles applicable to the pertinent art.

32. Based on my review of the specification and claims of the ’355 patent, it is my opinion that a person of ordinary skill in the art would have had a minimum of a bachelor’s degree in mechanical or manufacturing engineering; mechatronics; electrical engineering plus coursework in mechanical engineering, manufacturing engineering, or mechatronics; or a similar technical degree. A POSITA would have also had at least 2 years of experience designing consumer electronics, such as eyewear with electronics. Additional work experience could serve as a substitute for a formal degree and vice versa. However, my opinions do not turn on this specific

definition of the level of ordinary skill. The claims would been obvious from the perspective of a skilled artisan under any reasonable definition.

33. My conclusions below that the claims of the ’355 patent would have been obvious would remain the same even if the invention date, field of endeavor, or level of ordinary skill were slightly different.

34. I am able to make this assessment because in the 2000s, I was familiar with design and operation principles common in the mechanical, manufacturing, and mechatronic domains as they relate to the design, specification, and manufacturing of consumer electronic components. I, and the engineers that I worked with during the 2000s, had the requisite knowledge to make and use eyewear as described in the claims of the ’355 patent. Specifically I worked on and supervised the design and integration of hundreds of capacitive-touch-enabled prototypes of consumer electronics products, developed intellectual property on novel capacitive touch interfaces including capacitive touch switches, and was issued patents related to the design and integration of capacitive touch switches into consumer electronics products. Because I have worked with and supervised designers, engineers, and software developers, I know very well what their capabilities were in the 2000s, how they would interpret and understand the claims of the ’355 patent, and how they would understand the disclosures in the prior art discussed herein. Additionally, I have been a professor of mechanical engineering undergraduate and graduate

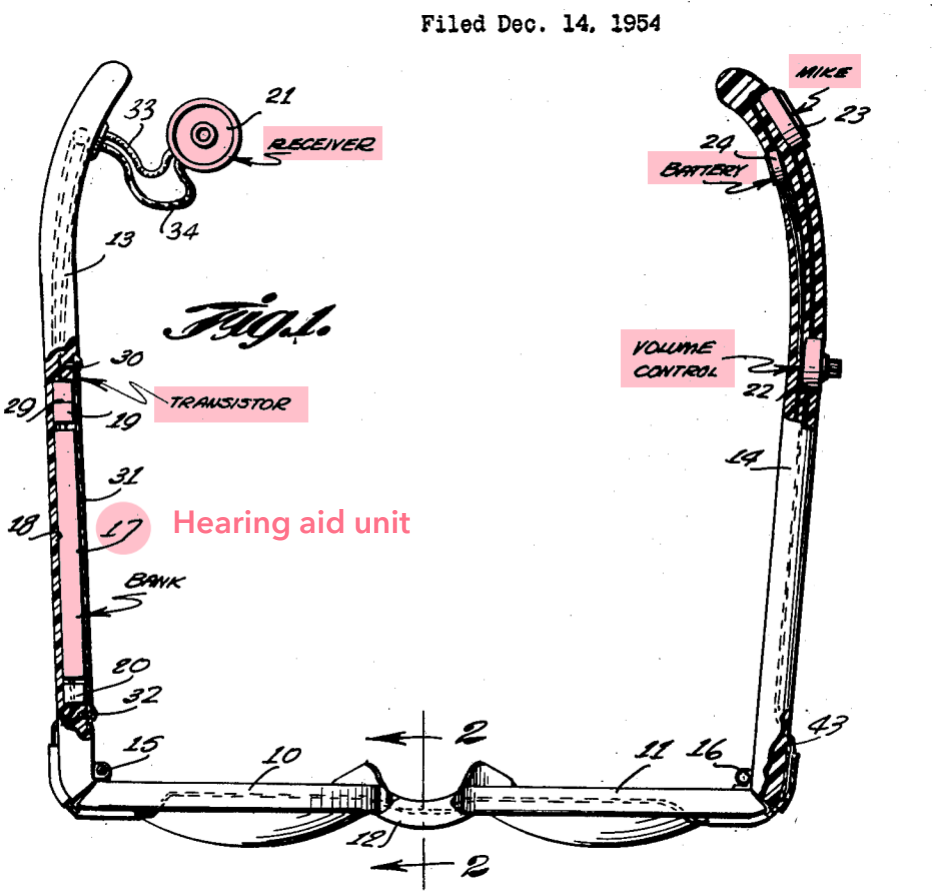
programs where I developed novel curriculum that integrated mechatronic course content within existing mechanical engineering curriculums. As of May 2007, I had been an assistant professor at the United States Air Force Academy, as well as a graduate teaching assistant at Stanford University within the departments of Engineering Mechanics and Mechanical Engineering respectively.

IV. TECHNOLOGY BACKGROUND AND OVERVIEW OF THE PRIOR ART

A. [1950s] Brunton: eyewear with embedded hearing-aid electronics

35. U.S. Patent 2,915,598 was filed in 1954. I will refer to this patent as "**Brunton**," and I understand it is Exhibit 1011. Brunton discloses combining a hearing aid with glasses, with electronics for the hearing aid embedded in the temples, as shown below in figure 1 (highlighting and annotations added):

[*continued on next page*]



Unit 17 included electronics for the hearing aid, "such as resistors, transistors, and capacitors." *Id.* 3:51–52. Wires embedded in the spectacle frame connected the hearing aid unit to other components like the receiver, volume control, and microphone. *Id.* 4:2–9; *see also id.* col.4, figs. 1–7.

B. [1980s] Widespread usage of printed circuit boards (PCBs) and integrated circuits

36. Printed circuit boards (PCBs) and integrated circuits were invented in the mid-twentieth century. Due to advances in miniaturization and lower manufacturing costs, PCBs and integrated circuits were ubiquitous by the 1980s.

This allowed for cheaper and more powerful consumer electronics, such as personal computers, video game consoles, and portable music players. Since the 1980s, PCBs have advanced to include multilayer geometries that allowed for components to be placed on both sides of the board, electrically connected by traces within layers and conductive vias between layers, further advancing the shrinking of PCBs and the products that contained them. New substrates such as Kapton allowed for flexible circuits that enabled more organic product geometrics than traditional, large flat PCBs.

37. By the 1980s, due to their small size, reliability, and relatively low cost, it was increasingly common to integrate integrated circuits into consumer electronics. In particular, it was increasingly common to integrate microprocessors into consumer electronics. These powerful integrated circuits brought significant computational power, packing thousands of transistors or more into a small form factor; by the end of 1980s, some microprocessors contained a million transistors or more. Microprocessors are able to execute program instructions. This ability, combined with their small size and relatively low cost, led microprocessors to become popular controllers for consumer electronics by the 1980s. Integrated circuits, including microprocessors, are mounted on a PCB. Mounting on a PCB is standard because PCBs permit manufacturing and assembly to be automated, which typically makes mass-producing PCB-based circuits cheaper and faster than

alternative methods of producing circuits. Other methods, such as wirewrapping or breadboarding, required each contact to and from the many-pinned integrated circuit (e.g., microprocessor) to be effectively made by hand, driving the cost of scale manufacturing to be outside of what is feasible for consumer electronics. To functionally integrate into an end consumer product, microprocessors typically rely on and interact with components external to the processor, such as power supplies, timing chips, displays, and sensors. Many of these components perform optimally in concert with the microprocessor if they are similarly disposed on the same PCB. As microprocessor manufacturing processes continued to shrink, the demand for smaller circuit board designs also spawned the creation of surface mount components, where passive components, such as resistors and capacitors, shifted from larger components (roughly the size of a large ant) with metal leads that pushed through holes on the PCB to smaller, leadless packages the size of a gnat that were soldered directly to pads on top of the PCB surface.

38. By May 2007, producers of consumer electronics had robust supply chains at their disposal for designing, specifying, and manufacturing at scale small PCBs filled with tiny components for integration into their products, including handheld consumer electronics. At every step of manufacturing, multiple vendors were able to provide services and components in a standardized way—from a design

standpoint, a given service or component from one vendor could be easily swapped out for that of another vendor.

C. [1981] Sikonowiz

39. The reference DESIGNING AND CREATING PRINTED CIRCUITS published in 1981. I will refer to this reference as "**Sikonowiz**," and I understand it is Exhibit 1005. Sikonowiz focuses on designing and manufacturing PCBs.[1] Chapter 9 covers final assembly and devotes an entire section to the step of "Conformal Coating." *Id.* at 122, 135. "The purpose of a conformal coating is to cover a printed-circuit assembly and protect it from environmental hazards such as moisture, dirt, and chemicals." *Id.* at 135–36. "Of these, moisture protection is probably of the greatest general significance." *Id.* at 136.

40. Sikonowiz explains that the conformal coatings "are rarely thicker than 0.005 in." and "can be as thin as 250 angstroms." *Id.* "Ideally, a conformal coating covers not only the circuit board but the components mounted on it as well." *Id.* "Conformal coatings may be applied by a variety of methods including vacuum

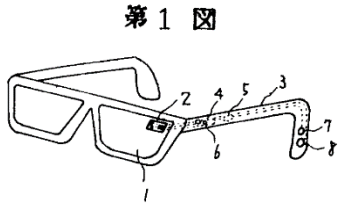
[1] It is common to use *printed circuit board* or *PCB* in two senses: sometimes to refer to the board by itself and sometimes to refer to the board plus mounted components. I will use the term in both senses in this declaration. Some authors use the term *printed circuit assembly* or *PCA* for the second sense (board plus mounted components), in which case they may use *printed circuit board* or *PCB* to refer only to the board without components. I may use *printed circuit assembly* at times, but I will also use *printed circuit board* and *PCB* to refer to the board plus mounted components.

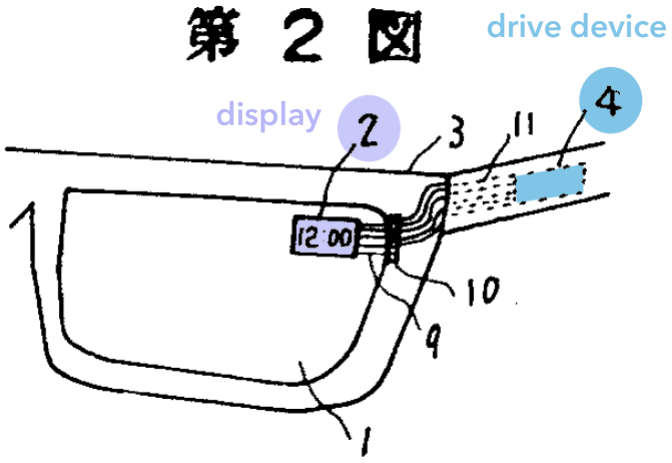
deposition, dipping, or spraying." *Id.* "For printed-circuit applications, the most important coatings are epoxy, parylene, acrylic, polyurethane, and silicone." *Id.* Epoxies and polyurethane resins in particular provide "excellent resistance to chemicals and humidity." *Id.* at 137. Epoxy, acrylic, polyurethane, and silicone coatings "are dipped or sprayed." *Id.*

41. Sikonowiz further teaches that liquid conformal coatings such as epoxy, acrylic, polyurethane, and silicone "cure into hard, protective films." *Id.* at 136. Accessing the underlying electronics, such as for repairs, requires removal of the coating. For example, "epoxy resin is so impervious" that "it cannot be chemically stripped"; rather, "it must be burned away." *Id.* Removing a silicone coating "requires that the film be cut away." *Id.* at 137.

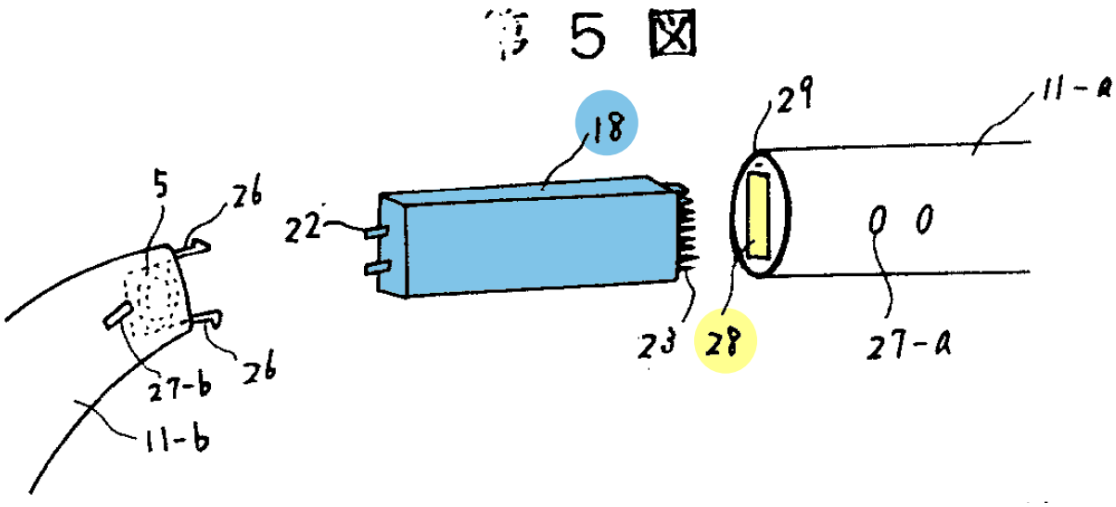
D. [1983] Hattori-913

42. Japanese patent publication JP S58-113913 published in 1983. I will refer to this reference as "**Hattori-913**," and I understand it is Exhibit 1016. (Hattori-913 discloses a pair of glasses with a liquid crystal display:





Ex. 1016 figs. 1, 2. The drive device 4 could be implemented as an integrated circuit 18 embedded within a hollow 28 in the temple:



Id. at 68, fig 5. Hattori-913's device includes a switch to turn power on and off and control the display. *Id.* at 68 (e.g., reference numerals 6, 27a, 27b). The switch can be a touch switch. *Id.*

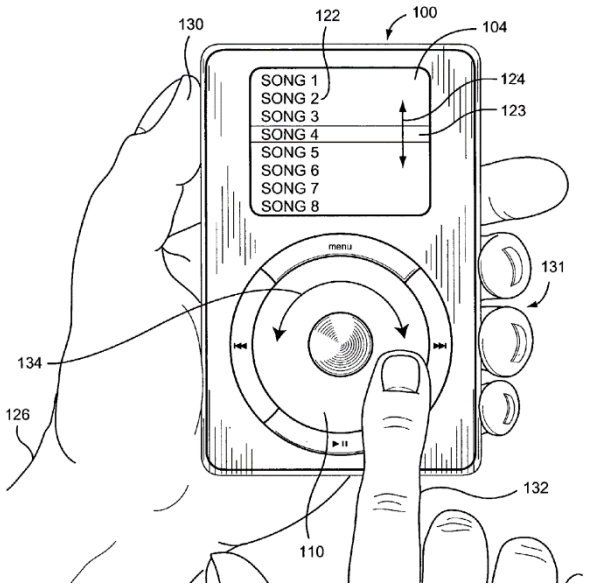
E. [1970s–2000s] Well-known usage of capacitive touch switches

43. In parallel with the developments in PCBs and integrated circuits I describe above, developments were occurring with capacitive touch switches, accelerometers, and gyroscopes, including their inclusion in consumer electronics.

44. Touch switches responsive to the operator's capacitance date at least as far back as the 1970s. As just a few examples, the following were all directed to capacitive touch switches:

- U.S. Patent 4,053,789, titled "Touch Actuated System Responsive to a Combination of Resistance and Capacitance" (issued 1977), Ex. 1014;
- U.S. Patent 4,290,052, titled "Capacitive Touch Entry Apparatus Having High Degree of Personal Safety" (issued 1981), Ex. 1010 (discussed below as **Eichelberger**);
- U.S. Patent 5,796,183, titled "Capacitive Responsive Electronic Switching Circuit" (issued 1998), Ex. 1022; and
- U.S. Patent Pub. 2006/0238513, titled "Touch Sensitive Control Panel" (filed 2004, published 2006), Ex. 1015.

45. By the 1990s, capacitive touch switches were well known, and by the early 2000s, many consumer electronics featured capacitive touch switches. For example, they were included in home appliances such as blenders. E.g., Ex. 1015 ¶¶ 1–3, 27, 34–35, figs. 1, 2, 4. As disclosed in a 2003 patent publication, handheld electronic devices such as Apple's iPod also relied on capacitive touch sensing:



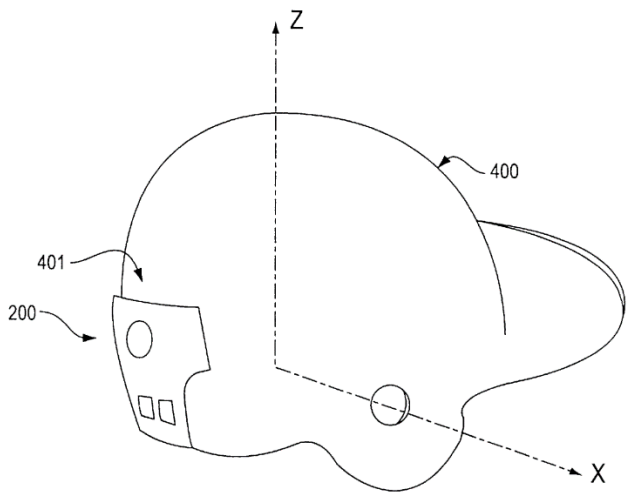
Ex. 1023 (U.S. Patent Pub. 2003/0076306) fig. 3A & ¶¶ 11–14, 47–48, 52, 61, claim 36. By May 2007, the iPod and other handheld or wearable consumer electronic products, similar in scope and scale to eyewear, had already integrated capacitive touch interfaces into assemblies that were moisture resistant.

F. [1990s–2000s] Well-known usage of accelerometers and gyroscopes in consumer electronics

46. For decades before the assumed invention date of the '355 patent, accelerometers and gyroscopes had been used to detect and measure motion. For

example, U.S. Patent 4,601,206 issued in 1986 and describes an "accelerometer system" comprising accelerometers and gyroscopes for use in vehicles. Ex. 1024.

47. Using accelerometers and gyroscopes to detect human motion in wearables was known in the 1990s. For example, U.S. Patent 5,916,181 was filed in 1997 and issued in 1999. Ex. 1025. Titled "Head gear for detecting head motion and providing an indication of head movement," the patent describes a device 200 that can be attached to a batting helmet for batting practice:



Id. fig. 4. The patent describes embodiments using gyroscopes or a combination of gyroscopes and accelerometers to detect angular motion around multiple axes (such as X and Z shown in figure 4). *Id.* at 5:54–6:9.

48. By the early 2000s, consumer electronics frequently used a gyroscope or accelerometer to detect motion. For example, patent publications in 2005 disclose: using an accelerometer to detect motion in a handheld tablet (e.g., to rotate the display), Ex. 1026 (WO 2005/093550) ¶¶ 49–51; using accelerometers and one or

more gyroscopes to detect and distinguish tilt and translation in a "mobile phone," a "watch," or "any other device capable of being held or worn by a user," Ex. 1027 (WO 2005/103863) at 5:7–13, 7:12–24, 10:1–18; using an accelerometer embedded in a wrist watch to detect the user's motion, Ex. 1028 (U.S. Patent Pub. 2005/0154330) ¶ 25; and mounting an integrated-circuit accelerometer on a circuit board to detect tilt in a telephone and optimize speakerphone performance, Ex. 1029 (EP 1575250) ¶ 18.

G. [2003] IPC-2221A

49. IPC is a non-profit global trade association for the electronics industry. It is widely recognized as a leading source for industry standards, including standards relating to printed circuit boards. In May 2003, IPC published standard IPC-2221 Revision A (**IPC-2221A**), titled "Generic Standard on Printed Board Design." IPC-2221A establishes generic requirements for the design of printed boards and other forms of component mounting or interconnecting structures. I understand IPC-2221A is Exhibit 1021.

50. IPC published IPC-2221A in May 2003, and I can confirm that, as of May 2003, IPC-2221A had been disseminated or otherwise been made available to such an extent that persons interested and ordinarily skilled in the art could locate it with reasonable efforts. Indeed, as a published standard, IPC-2221A was worked on, commented on, and reviewed by many electronics-industry professionals no later

than 2003. IPC-2221A is an update to the original standard, IPC-2221, published in 1998. Not only would these documents have been available to a POSITA, but manufacturers in the supply chain would have taken IPC standards into account when designing components for consumer electronic products.

51. Section 4.5.2.1 of IPC-2221A reads in part:

> **4.5.2.1 Conformal Coating Types and Thickness** Conformal coating may be any one of the types indicated. The thickness of the conformal coating **shall** be as follows for the type specified, when measured on a flat unencumbered surface:
>
> | | |
> |---|---|
> | Type AR - Acrylic Resin | 0.03-0.13 mm [0.00118 in-0.00512 in] |
> | Type ER - Epoxy Resin | 0.03-0.13 mm [0.00118 in-0.00512 in] |
> | Type UR - Urethane Resin | 0.03-0.13 mm [0.00118 in-0.00512 in] |
> | Type SR - Silicone Resin | 0.05-0.21 mm [0.00197 in-0.00828 in] |
> | Type XY - Paraxylylene Resin | 0.01-0.05 mm [0.000394 in-0.00197 in] |
>
> There are three primary chemical categories in use for conformal coating materials: silicone elastomers, organics, and parylene. All three types provide various levels of protection from solvents, moisture, corrosion, arcing, and other environmental factors that can jeopardize the circuit's operational performance (see Table 4-7). Many surface mount technologies cannot perform adequately without the use of a conformal coating due to the tight spacing of leads and land traces.

Ex. 1021 at 25.

52. Table 4-7 sets forth properties of these coatings:

Table 4-7 Conformal Coating Functionality

Type	Advantages	Disadvantages
Silicone elastomers	Resistant to extreme temperature cycling. Good intermittent solvent splash resistance. Low modulus, easily removed, flexible. Works well over most solder resists and no clean fluxes. Easily reworked.	Low mechanical abrasion resistance. Half the dielectric strength of organics. Can impair solderability after coating.
Organics	High dielectric strength. Excellent mechanical abrasion resistance. Excellent solvent resistance. Excellent moisture resistance.	Can only be used to 125 °C [257 °F]. Difficulty of rework varies. Coefficient of thermal expansion needs to be matched. Required compatibility check with solder resist. Required compatibility check with flux chemistry.
Parylene	Extremely high dielectric strength. Excellent conformability around parts. Excellent penetration of polymer. Excellent moisture/chemical resistance.	High raw material cost. Applied in a vacuum chamber (batch process). Masking seals must be air-tight. Thin film leakage difficult to visually detect.

Id. at 26.

H. [2004] Blum-130

53. U.S. Patent 6,733,130 issued in 2004. I will refer to this patent as "**Blum-130**," and I understand it is Exhibit 1006. Blum-130 discloses glasses with "electro-active lenses" whose optical power could change electronically. Ex. 1006 Abstract, 7:34–8:57.

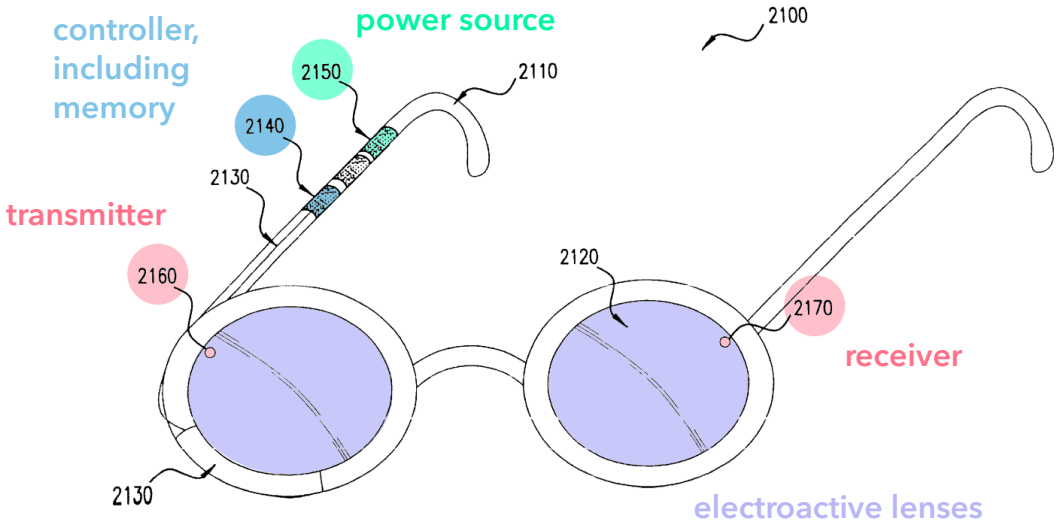


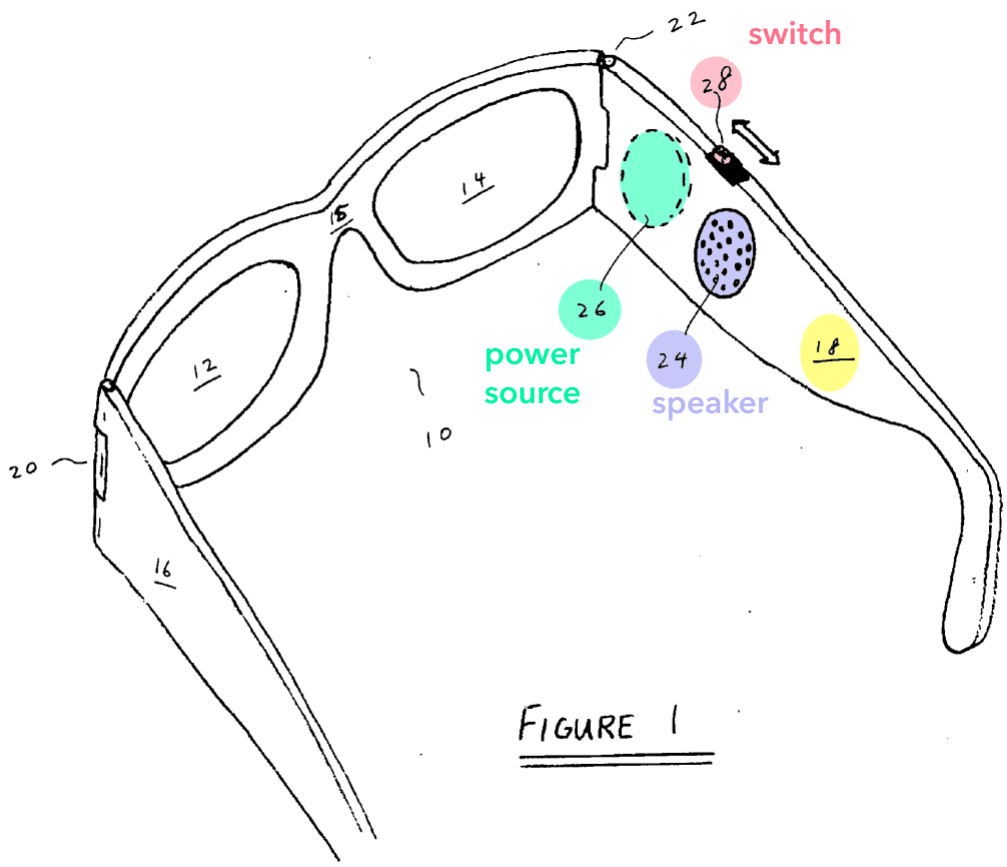
FIG.21

54. In the embodiment of figure 21, "frames 2110 contain electro-active lenses 2120 that are connected by connecting wires 2130 to controller 2140 (integrated circuit) and power source 2150." Ex. 1006 at 30:1–3. Blum-130 discloses a controller that includes a microprocessor, memory, and a port for input and output. *Id.* at 3:46–48, 6:22–26. The eyewear includes a transmitter and a receiver for a rangefinder, attached to the lenses (as shown above) or "embedded in frame 2110." *Id.* at 30:3–10. The rangefinder can be used to switch the settings of the lenses. *Id.* at 30:29–37. The rangefinder can use radio-frequency waves or microwaves and thus involve an antenna. *Id.* at 30:15–18; *id.* 29:54–57 ("Another version of the switch contains a small microwave or radio-frequency short-range transmitter which sends a signal regarding switch position to a tiny receiver antenna mounted conformably on the spectacle frames."). The rangefinder can be used in combination with a microgyroscope to detect head tilt. *Id.* at 30:59–60. Blum-130 also discloses using an accelerometer to detect head motion, and it further discloses combining a gyroscope with a manual switch. *Id.* at 30:38–58.

I. [2005] Howell-719

55. U.S. Patent Pub. 2005/0248719 published in 2005. I will refer to this patent publication as "**Howell-719**," and I understand it is Exhibit 1004. Howell-719

was published in 2005 and discloses eyewear with a built-in audio player, such as a radio:



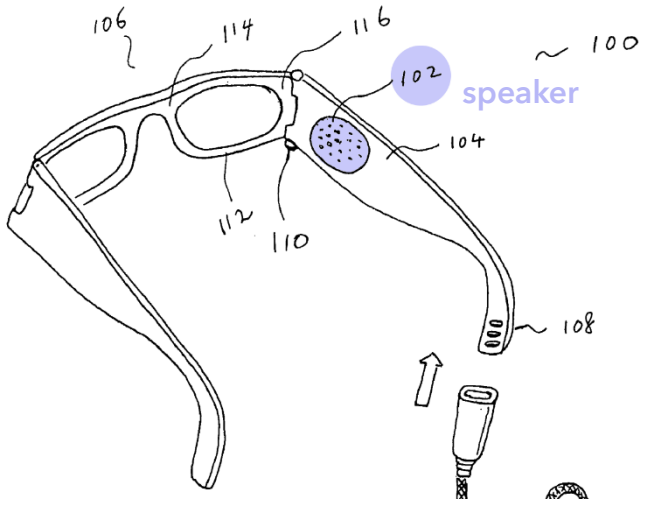
Ex. 1004 fig. 1.

56. The radio includes a speaker, and the electronics for the radio can reside on a printed circuit board "in one of the temples of the glasses." Ex. 1004 ¶ 50. In an embodiment not illustrated above, the glasses include a capacitive touch switch, where "changing the capacitance," such as "by placing one's finger over a metallic pad," turns the switch on and off. *Id.* ¶ 82.

57. The glasses also include a power source embedded in the temple, along with a processor, memory, antenna, and transceiver. *E.g.*, *id.* ¶¶ 28, 50–58, 67, 99.

J. [2006] Howell-158

58. U.S. Patent Pub. 2006/0023158 published in 2006. I will refer to this patent publication as "**Howell-158**," and I understand that it is Exhibit 1007. Howell-158 discloses an eyewear system very similar to that of Howell-719:



Ex. 1007 fig. 1 (excerpt). The glasses include an embedded printed circuit board to control a speaker, which can be part of, for example, a radio or MP3 player. *Id.* ¶¶ 51, 65, 69, 95, 130. The glasses include an antenna and transceiver circuits for receiving and transmitting signals wirelessly. *Id.* ¶¶ 113–16. They can also include an accelerometer to detect motion and sense when the glasses are being worn. *Id.* ¶ 163.

V. OVERVIEW OF THE '355 PATENT

59. The '355 patent discloses an "electronic module 202" in a temple of a frame 102 to control electroactive lenses, such as electroactive lens 104:

FIG. 2

Ex. 1001 at 7:51–9:27.

60. Figure 6 of the '355 patent shows an electroactive lens:

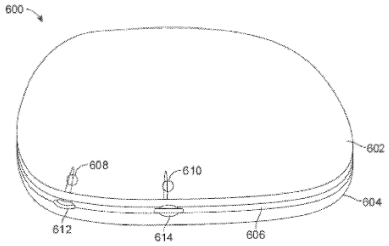


FIG. 6

The lens has a top substrate 602 and a bottom substrate 604. Ex. 1001 at 11:1–3. Electrical leads 608 and 610 in between the substrates provide power to the lenses, and conductive materials 612 and 614 are placed on top of the leads. *Id.* at 11:9–36.

61. These conductive materials 612 and 614 make contact with conductors 708 and 710 in a frame:

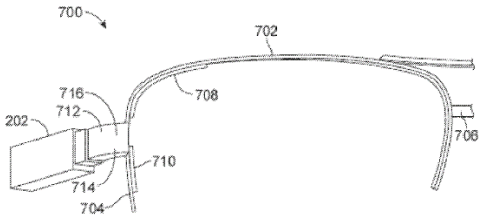


FIG. 7

Id. at 11:59–63. Further conducting members 712 and 714 connect the electronic module 202 to the conductors 708 and 710 and thereby link the electronic module to the leads in the electroactive lens.

62. Because moisture may cause "a temporary electrical short circuit across the rimlock (e.g., between metal components 712 and 714)," the '355 patent describes applying electrically insulating grease to the mating surfaces of rimlock components 712 and 714:

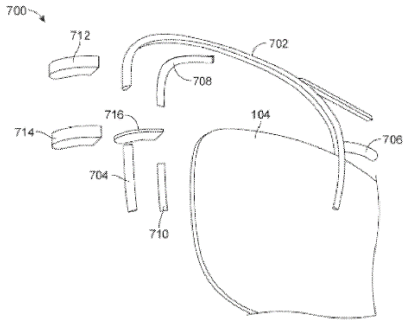


FIG. 8

Id. at 13:19–21, 14:11–16.

63. The ’355 patent briefly mentions capacitive touch switches toward the end of the Detailed Description. The ’355 patent does not describe any novel capacitive touch switches, does not explain how to make a capacitive touch switch, does not describe the components of a capacitive touch switch, and does not identify any capacitive touch switch especially suited for eyewear. The ’355 patent thus assumes a person ordinary skill in the art understands capacitive touch switches well and would recognize they are broadly and easily usable in eyewear.

64. Similarly, the ’355 patent briefly discusses conformal layers toward the end of the specification. Again, the ’355 patent does not describe any novel conformal layers. Rather, the ’355 patent explains that “coating may comprise *any suitable material*, such as a brushed, spray or dip applied acrylic, urethane, silicone, or epoxy.” *Id.* at 27:8–10 (emphasis added). As Sikonowiz shows, such coatings were well known. And by stating that “[t]he coating may comprise any suitable material,” the ’355 patent assumes a person ordinary skill in the art understands conformal coatings well and would recognize they are broadly and easily usable in eyewear.

VI. GROUND 1: HOWELL-719 AND SIKONOWIZ RENDER CLAIMS 1 AND 3–13 OBVIOUS

A. Claim 1

1. Preamble and 1[a]: eyewear system comprising an eyewear frame

65. The preamble and element 1[a] recite: "An eyewear system comprising: an eyewear frame."[2] Howell-719 discloses an eyewear system comprising an eyewear frame:

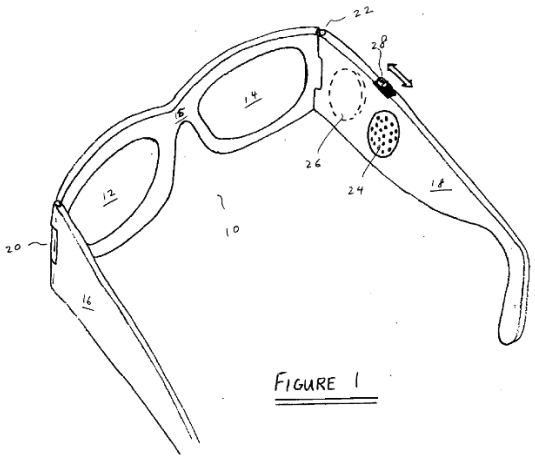
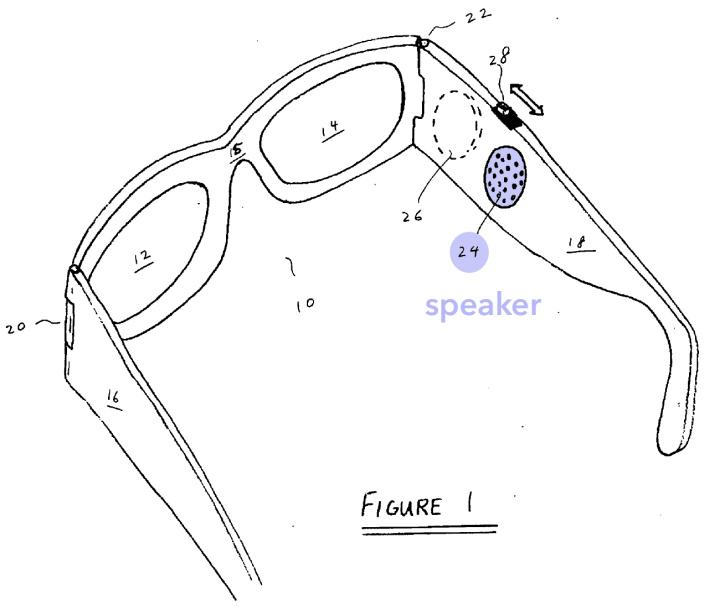


Figure 1 shows "a pair of glasses 10," and Howell-719 discusses "the frames of the glasses." Ex. 1004 ¶¶ 27–29.

[2] I understand that an annotated copy of the claims with numbering (e.g., 1[a], 1[b], etc.) appears in the petition after the exhibit list.

2. 1[b]: electronics assembly

66. Element 1[b] recites: "an electronics assembly comprising electronic components configured to control an electrical functional member." Howell-719 discloses this element. Howell-719's eyewear system has built-in audio:



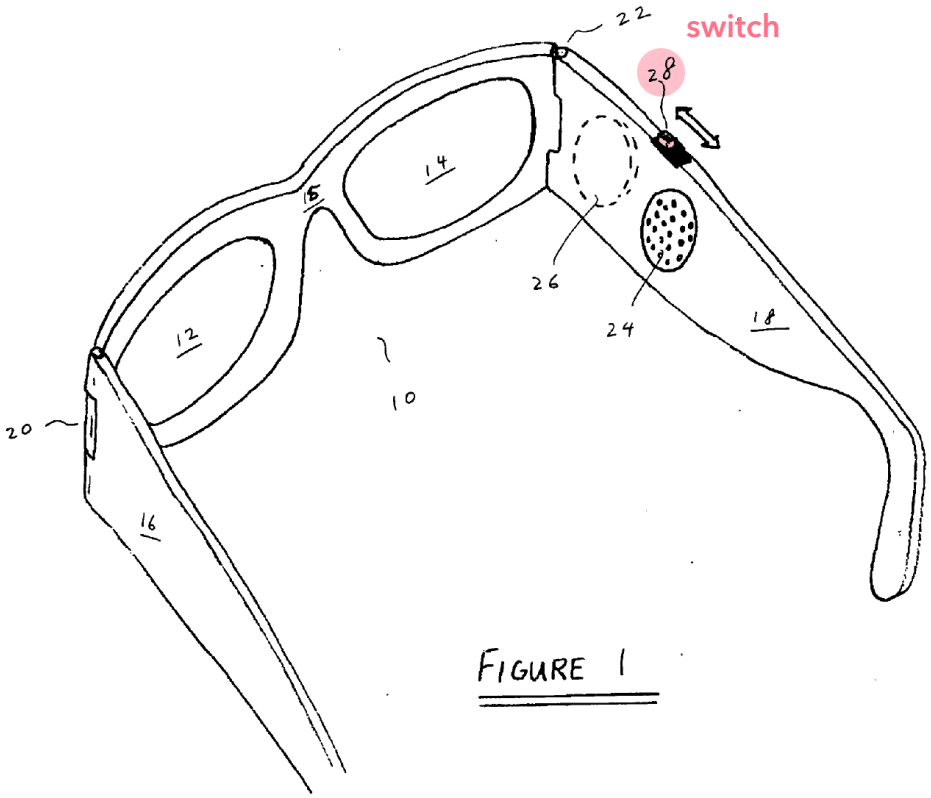
Ex. 1004 ¶¶ 27, 50, fig. 1.

67. The audio system can be a radio or audio player that includes a speaker, which is an electrical functional member. *Id.* ¶¶ 50, 67. The system also includes an electronics assembly comprising electronic components configured to control the speaker. For example: "All the electronics for the radio are at least partially embedded in the glasses." *Id.* ¶ 50. The "electronics can be on a printed circuit board, and the board is in one of the temples of the glasses." *Id.*; *see also id.* ¶¶ 64, 97. These electronic components can include a data bus, a processor, and a storage

device. *Id.* ¶ 67. The processor works with these other components to control operation of the player. *Id.*

3. 1[c]: capacitive touch switch

68. Element 1[c] recites: "a capacitive touch switch coupled to at least one electronic component in the electronics assembly." Howell-719's glasses include a switch. *E.g.*, Ex. 1004 ¶ 28. Figure 1 illustrates an example:



69. While the switch illustrated in figure 1 appears to operate at least partially by mechanical force, Howell-719 also discloses that the switch can be a capacitive touch switch. "The switch can be activated depending on electrical

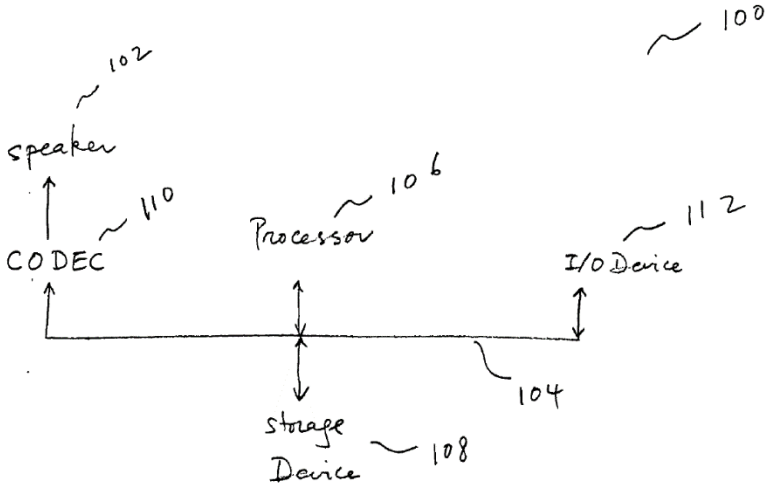
forces," including where "the electrical force depends on capacitive effect." *Id.* ¶ 82. "By changing the capacitance," such as "by placing one's finger over a metallic pad," one turns the switch on and off. *Id.*

70. The switch "can be used to turn the speaker on, or to tune the frequency of a radio." *Id.* ¶ 74. The switch is therefore operably coupled to the audio electronics that control the speaker. Indeed, to function as a switch for the audio system, the switch must be coupled to at least one electronic component in the electronics assembly discussed above for element 1[b]. Moreover, Howell-719 discloses: "All of the electronic components can be self-contained inside the temple" and "can be coupled to a printed circuit board." Ex. 1004 ¶ 97. Since a capacitive touch switch is an electronic component, Howell-719 discloses the capacitive touch switch can be self-contained inside the temple and coupled via a printed circuit board to the electronic components that control the speaker. In this manner as well, the capacitive touch switch is coupled to at least one electronic component in the electronics assembly.

4. 1[d]: at least one electrical connective element

71. Element 1[d] recites: "at least one electrical connective element electrically connected to the electronic assembly and the electrical functional

member." Figure 3 of Howell-719 shows multiple electronic components connected to the speaker:



Id. fig. 3. As discussed for element 1[b] above, Howell-719 discloses mounting the electronics for controlling the speaker on a printed circuit board. See § VI.A.2. The following would be basic common knowledge to a POSITA: Printed circuit boards have conductive traces on their layers electrically connecting electronic components mounted on the board to each other, and they have conductive leads or connectors to electrically connect the mounted electronics to off-board electronic components. See, e.g., Ex. 1030 at 1498–99 (PCBs have conductors on one or more sides). For example, batteries are often mounted off board and electrically connected to a PCB to supply power the PCB needs to operate. Howell-719 states that all electronic components "can be coupled to a printed circuit board." Ex. 1004 ¶ 97. Howell-719

thus discloses an electrical connective element electrically connected to the electronic assembly and speaker. *Id.*

5. 1[e] and 1[f]: conformal layer that is moisture proof and seals electrical connections

72. Elements 1[e] and 1[f] recite: "a conformal layer over the electronic assembly to seal the electronic components; wherein the conformal layer is moisture proof and seals electrical connections of the electronic component." Claim 9 recites the "eyewear system of claim 1, wherein the conformal layer is a conformal coating," so the conformal layer of claim 1 can be a conformal coating. The '355 patent states: "The coating may comprise *any suitable material*, such as a brushed, spray or dip applied acrylic, urethane, silicone, or epoxy." Ex. 1001 at 27:8–10 (emphasis added).

73. As discussed for element 1[b] above, Howell-719 discloses mounting the electronics for controlling the speaker on a printed circuit board. See § VI.A.2. Sikonowiz discloses applying a conformal coating as a well-known step of final PCB assembly. Ex. 1005 at 135–37. Sikonowiz discloses: the "purpose of a conformal coating is to cover a printed-circuit assembly and protect it from environmental hazards such as moisture, dirt, and chemicals." *Id.* at 135–36. "Of these, moisture protection is probably of the greatest general significance." *Id.* at 136. "Ideally, a conformal coating covers not only the circuit board but the components mounted on it as well." *Id.* "Conformal coatings may be applied by a variety of methods including vacuum deposition, dipping, or spraying." *Id.* "For printed-circuit

applications, the most important coatings are epoxy, parylene, acrylic, polyurethane, and silicone." *Id.* Epoxies and polyurethane resins in particular provide "excellent resistance to chemicals and humidity." *Id.* at 137. Sikonowiz thus discloses a conformal layer over the PCB to seal the mounted electronic components, where the conformal layer is moisture proof and seals electrical connections, such as conductive traces on the PCB, between the mounted components. The conformal layer also seals electrical connections between the PCB itself and mounted components.

74. It would have been obvious to a POSITA that Howell-719's PCB could have a conformal coating as described in Sikonowiz. A POSITA would have been motivated to apply the conformal coating of Sikonowiz to a PCB like that in Howell-719 to prevent moisture and contaminants from affecting the PCB's electronics. Indeed, compared to PCBs in the 1980s, by the early 2000s, PCBs had generally become smaller and typically utilized more surface mount components. As IPC-2221A documents, a POSITA would have recognized that, "due to the tight spacing of leads and land traces," "[m]any surface mount technologies cannot perform adequately without the use of a conformal coating." Ex. 1021 at 25. This principle known to a POSITA would have provided further motivation to apply a conformal coating as taught in Sikonowiz to Howell-719. Because conformal coatings were commonplace with PCBs as early as the 1980s and continuing into the 2000s (see

IPC-2221A), a POSITA would have had a reasonable expectation of success in applying Sikonowiz's teachings to Howell-719. For example, applying a conformal coating as Sikonowiz teaches would represent using a known technique (conformal coating) with a known device ready for improvement (uncoated PCB); and the result would have been predictable because decades of experience would have told a POSITA that the coated PCB would accomplish its intended function with the added benefit of keeping moisture and contaminants from interfering with the electronics.

6. 1[g]–1[i]: conformal layer disposed in an enclosure and electronic assembly enclosed in a temple

75. Elements 1[g]–1[i] recite: "wherein the conformal layer is disposed in an enclosure of the eyewear frame; wherein the eyewear frame comprises a temple; and wherein the electronic assembly is enclosed in the temple."

76. Howell-719 discloses that the PCB with the electronics for the radio or audio player "is in one of the temples of the glasses." Ex. 1004 ¶ 50. Indeed: "All of the electronic components can be self-contained inside the temple of the glasses. The components can be coupled to a printed circuit board." *Id.* ¶ 97. Because the conformal layer Sikonowiz teaches is a coating of the PCB, the conformal layer would also be enclosed in the temple.

77. Howell-719 and Sikonowiz therefore disclose elements 1[g]–1[i] and together render them obvious.

7. Further remarks on claim 1

78. In summary, Howell-719 discloses glasses with temples, a PCB embedded in a temple with electronics to control a speaker of a radio or audio player, and a capacitive touch switch to control the speaker and tune the radio. Howell-719 discloses all elements of claim 1 except for those relating to the conformal layer (1[e]–1[g]). Sikonowiz discloses applying a conformal coating to any PCB. It would have been obvious to a POSITA to improve Howell-719's PCB by applying a conformal coating as Sikonowiz teaches. The coating would be moisture proof and seal the electronic components and electrical connections of the PCB. Applying Sikonowiz's coating would thus satisfy the remaining elements of claim 1. Because applying Sikonowiz to Howell-719 represents using a known technique to a known device ready for improvement with known beneficial results, claim 1 would have been obvious.

B. Claim 3

79. Claim 3 depends from claim 1 and further recites: "wherein the electrical functional member includes at least one of an electro-active lens, … , an audio output function, a microphone function, … , a transmitter function, … , and an active 3D function." Howell-719's speaker outputs audio and thus includes an audio output function. Howell-719 also discloses that the embedded electronics can control: a microphone for receiving user audio input (microphone function),

Ex. 1004 ¶ 102; and a transceiver that wirelessly transmits user inputs (transmitter function), *id.* ¶ 15. Claim 3 would have been obvious.

C. Claim 4

80. Claim 4 depends from claim 1 and further recites "wherein the at least one electrical connective element is a conductive compressible member or a multi-conductor cable." Multi-conductor cables were known for decades before the '355 patent, going back at least to the 1970s. See, for example, Thomas (Ex. 1008, U.S. Patent 3,612,744), directed to a "flexible multiple flat conductor electric cable" and issued in 1971 (Ex. 1008, Abstract), or U.S. Patent 5,373,109, directed to "flat, flexible, multiple conductor electrical cables" and issued in 1994 (Ex. 1017 at 1:5–6). Indeed, multi-conductor cables were used in eyewear before the '355 patent. For example, Hattori-913 discloses eyewear using a "zebra" connector (i.e., Fujipoly's branded ZEBRA elastomeric connector). Ex. 1016 at 68. As another example, Vogt (Ex. 1009, U.S. Patent 5,606,743), which issued in 1997, discloses eyewear with "[m]ultiple conductors 32, which may comprise a flexible strip circuit," extending

through frame 14, as well as a "single wire or *multi-wire conductor* 28" (Ex. 1009 at 4:34–39 (emphasis added)):

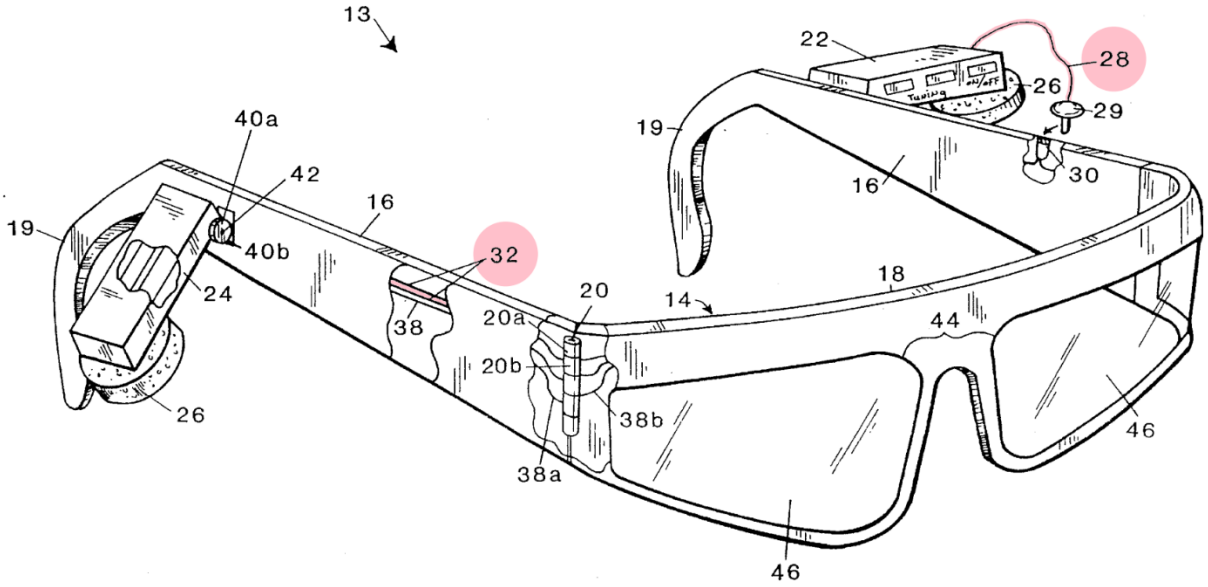


FIG. 2

81. Moreover, U.S. Patent 6,857,741, which is directed to eyewear with electroactive lenses and which issued in 2005, uses "multi-conductor wire 3720" (Ex. 1018 at 50:27):

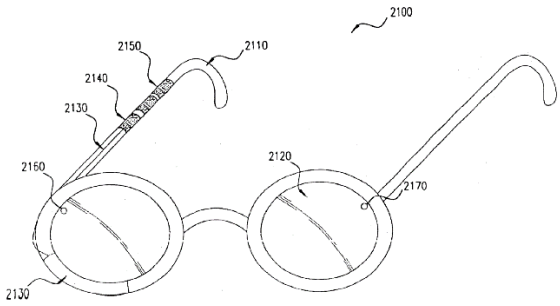


FIG.21

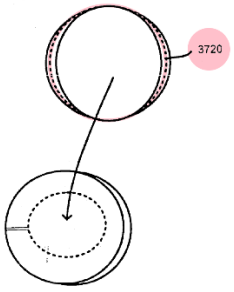


Figure 37e

82. By the mid-2000s, a POSITA would be very familiar with multi-conductor cables as part of the POSITA's basic background knowledge and would

readily identify them as a commonplace and advantageous design option for connecting electronic components. Such cables include flat, flexible varieties that would be a beneficial design choice for connecting components within an eyewear temple, which is a structure expected to rotate, with very limited internal space to accommodate components. A flexible cable makes it easier to assemble components within the temple, address differences in manufacturing tolerances, rework failed components, and distribute the electronics assembly and electrical functional member recited in claim 1 to the most appropriate locations of the eyewear rather than requiring a monolithic PCB. Since Howell-719 discloses embedding electronic components in the temple, a person of ordinary skill in the art would have identified a flat, flexible multi-conductor cable as an advantageous option among a limited number of well-known suitable choices for connecting the components in the temple. Consequently, claim 4 would have been obvious.

D. Claim 5

83. Claim 5 depends from claim 1 and further recites "wherein the electronic assembly comprises a micro-processor." As discussed for element 1[b], Howell-719 discloses an electronic assembly including a processor. See § VI.A.2. Howell-719 states the processor "can be a micro-processor." Ex. 1004 ¶ 67. Howell-719's eyewear is designed to be worn and has limited internal space, so Howell-

719's microprocessor would be an advantageous design choice because it would be lightweight and compact. Claim 5 would have been obvious.

E. Claim 6

84. Claim 6 depends from claim 1 and further recites "wherein the enclosure comprises at least one of an outer casing of the electronic assembly or a cavity of the eyewear frame." As discussed for elements 1[g]–1[i], Howell-719 discloses a PCB embedded in the temple. See § VI.A.6. Howell-719 states "a temple of the eyeglass frame can have an opening, cavity or container to hold or encompass the different embodiments of components." Ex. 1004 ¶ 108. Claim 6 would have been obvious.

F. Claim 7

85. Claim 7 depends from claim 1 and further recites "wherein the conformal layer comprises at least one of an encasing layer or an encapsulating layer." Sikonowiz explains that liquid conformal coatings such as epoxy, acrylic, polyurethane, and silicone "cure into hard, protective films." Ex. 1005 at 136. Accessing the underlying electronics, such as for repairs, requires removal of the coating. For example, "epoxy resin is so impervious" that "it cannot be chemically stripped"; rather, "it must be burned away." *Id.* Removing a silicone coating "requires that the film be cut away." *Id.* at 137. Sikonowiz thus discloses conformal

coatings that encase the coated electronics in a hard, protective film. Claim 7 would have been obvious.

G. Claim 8

86. Claim 8 depends from claim 1 and further recites "wherein the conformal layer protects the electronic components from external environmental damage." Sikonowiz explains that the conformal coating protects the printed-circuit assembly from "environmental hazards such as moisture, dirt, and chemicals." Ex. 1005 at 135–36. Claim 8 would have been obvious.

H. Claim 9

87. Claim 9 depends from claim 1 and further recites "wherein the conformal layer is a conformal coating." The conformal layer used for claim 1 is a conformal coating. See § VI.A.5. Claim 9 would have been obvious.

I. Claim 10

88. Claim 10 depends from claim 9 and further recites "wherein a thickness of the conformal coating is less than 1 mm." Sikonowiz explains that the conformal coatings "are rarely thicker than 0.005 in." and "can be as thin as 250 angstroms." Ex. 1005 at 136. A coating 0.005 inches thick is less than 0.2 millimeters thick. Claim 10 would have been obvious.

J. Claim 11

89. Claim 11 depends from claim 9 and further recites "wherein the conformal coating comprises at least one of an acrylic, urethane, silicone, or epoxy." Sikonowiz discloses that "the most important coatings are epoxy, parylene, acrylic, polyurethane, and silicone." Ex. 1005 at 136. As IPC-2221A shows, these coating materials taught by Sikonowiz were still the recommended materials for conformal coatings in the early 2000s. IPC-2221A thus reinforces that a POSITA would have combined Sikonowiz's teachings with Howell-719. Claim 11 would have been obvious.

K. Claim 12

90. Claim 12 depends from claim 11 and further recites "wherein the conformal coating is brush applied, spray applied, or dip applied." Sikonowiz discloses: "Conformal coatings may be applied by a variety of methods including vacuum deposition, dipping, or spraying." Ex. 1005 at 136. Epoxy, acrylic, polyurethane, and silicone coatings "are dipped or sprayed." *Id.* Claim 12 would have been obvious.

L. Claim 13

1. Preamble

91. Claim 13's preamble recites: "A method of manufacturing an eyewear system." Howell-719 discloses an eyewear system and its construction. *See, e.g.*, Ex. 1004 fig. 1, ¶¶ 27–107. See also § VI.A.1.

2. 13[a]–13[b]: disposing electronic components on a capacitive touch switch and connecting the components to form an electronic assembly

92. Elements 13[a]–13[b] recite: "disposing a plurality of electronic components on a capacitive touch switch; connecting the plurality of electronic components via electrical connections to form an electronic assembly."

93. Howell-719 discloses mounting all its electronic components on a printed circuit board, including the capacitive touch switch and electronic components such as a data bus, processor, and storage device. Ex. 1004 ¶ 97; see §§ VI.A.2, VI.A.3.

94. The '355 patent explains that these other electronic components are considered "disposed on" the capacitive touch switch. The '355 patent describes an example in which a PCB is coupled to "electrical connectors that may have been reflow soldered to the capacitive touch switch." Ex. 1001 at 27:40–42. "In this manner, an electronic assembly may be created, wherein each additional electronic component may connect to another electronic component or components." *Id.* at

27:42–45. "*Each of these additional electronic components may be considered to be disposed on the capacitive touch switch*." *Id.* at 27:45–47 (emphasis added). By mounting the capacitive touch switch and all its other electronic components on a PCB, Howell-719 disposes a plurality of electronic components on the capacitive touch switch and electrically connects those components to form an electronic assembly.

3. 13[c]: depositing a conformal layer

95. Element 13[c] recites: "depositing a conformal layer over at least a portion of the electronic assembly and at least a portion of the capacitive touch switch." For the same reasons discussed for claim 1, *see* § VI.A.5, Sikonowiz motivates depositing a conformal coating over Howell-719's PCB, including the electronic components mounted on the board, and a POSITA would have had a reasonable expectation of succeeding in doing so. As discussed for elements 13[a]–13[b], the electronic components mounted on the PCB include the capacitive touch switch.

4. 13[d] coupling the assembly and switch with the conformal layer to an enclosure

96. Element 13[d] recites: "coupling the electronic assembly and the capacitive touch switch with the conformal layer to an enclosure of an eyewear frame." As discussed above for claim 1 and below for claim 14 (Grounds 4 and 5), Howell-719 discloses that all electronics, including the capacitive touch switch, can

be embedded in a cavity within a temple.[3] See § VI.A.6; see below § IX.A.2. According to the ’355 patent, such electronics are coupled to the enclosure that the cavity and temple form. As the ’355 patent states: “[T]he enclosure may comprise . . . the cavity of a temple of electronic eyewear. The step of coupling the capacitive touch switch to the enclosure may comprise any suitable method, including pressure fitting the two components.” Ex. 1001 at 28:7–12.

VII. GROUND 2: HOWELL-719, SIKONOWIZ, THOMAS, AND VOGT RENDER CLAIM 4 OBVIOUS

97. Claim 4 covers claim 1 “wherein the at least one electrical connective element is a conductive compressible member or a multi-conductor cable.” As discussed under Ground 1, the Thomas and Vogt references show that a POSITA would have immediately identified flat, flexible multi-conductor cables as a commonplace option for connecting electronic components that would be naturally suitable to use with Howell-719, which discloses connecting components within a temple. See § VI.C.

98. The limitation added by claim 4 would have alternatively been obvious in view of Thomas and Vogt (Ground 2). Thomas discloses a “flexible multiple flat conductor electric cable.” Ex. 1008 Abstract. The cable comprises multiple

[3] Indeed, a capacitive touch switch performs better in an enclosure, so even without Howell-719’s disclosure, it would have been obvious to a POSITA to put the switch and electronics assembly in an enclosure in the temple.

"individual strip conductors 18 which extend parallel to one another, at spaced intervals along the length of the cable 10." *Id.* at 5:65–66. The cable's thickness can be as small as 0.013 inches, and its construction permits various embodiments to "be sharply folded upon themselves with fold curvature radii of less than the cable thickness." *Id.* at 3:14–17.

99. Vogt discloses using a cable like Thomas's in eyewear. Vogt discloses eyewear with "[m]ultiple conductors 32, which may comprise a flexible strip circuit," extending through frame 14, as well as a "single wire or *multi-wire conductor* 28" (Ex. 1009 at 4:34–39 (emphasis added)):

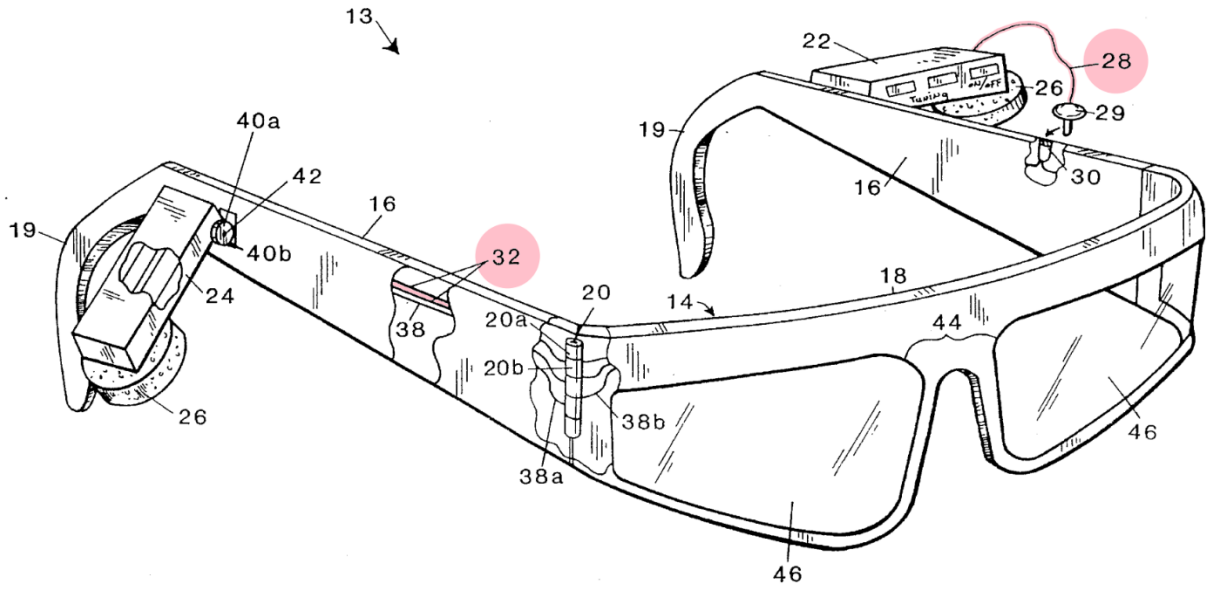


FIG. 2

100. A POSITA would consider the flexible multi-conductor cables described in Thomas and Vogt a natural choice for connecting components within an eyewear temple. A flexible cable makes it easier to assemble components within

the temple, address differences in manufacturing tolerances, rework failed components, and distribute the electronics assembly and electrical functional member recited in claim 1 to the most appropriate locations of the eyewear rather than requiring a monolithic PCB. Because Howell-719 discloses embedding electronic components in the temple, using Thomas's cable in Howell-719's glasses as illustrated in Vogt would have merely involved identifying an advantageous option among a limited number of well-known suitable choices for connecting the components in the temple with predictable results. Additionally, combining Howell-719 with the teaching of both Thomas and Vogt (e.g., Thomas as illustrated in Vogt) would have merely involved applying a known technique to a similar device in the same way with predictable results. A POSITA would have had a reasonable expectation of success because the cable would be used precisely for its well-known purpose and Vogt itself illustrates use of such a cable in eyewear.

101. Claim 4 therefore would have been obvious in view of Howell-719 and Sikonowiz plus Thomas and Vogt.

VIII. GROUND 3: HOWELL-719, SIKONOWIZ, AND EICHELBERGER RENDER CLAIM 13 OBVIOUS

102. Claim 13 requires disposing electronic components on the capacitive touch switch. In Ground 1, I discussed Howell-719's capacitive touch switch, as well as Howell-719's disclosure of coupling all electronic components to a printed circuit board. As the '355 patent's specification confirms, this coupling falls within the

broad meaning of components "disposed on" the capacitive touch switch. See § VI.L.2 (e.g., ¶ 94).

103. In Ground 3, I alternatively rely on a combination of Howell-719 with Eichelberger, which discloses in detail a capacitive touch switch that can be used as the capacitive touch switch that Howell-719 discusses generally.

A. Preamble

104. Claim 13's preamble recites: "A method of manufacturing an eyewear system." Howell-719 discloses an eyewear system and its construction. *See, e.g.*, Ex. 1004 fig. 1, ¶¶ 27–107. See also §§ VI.A.1, VI.L.1.

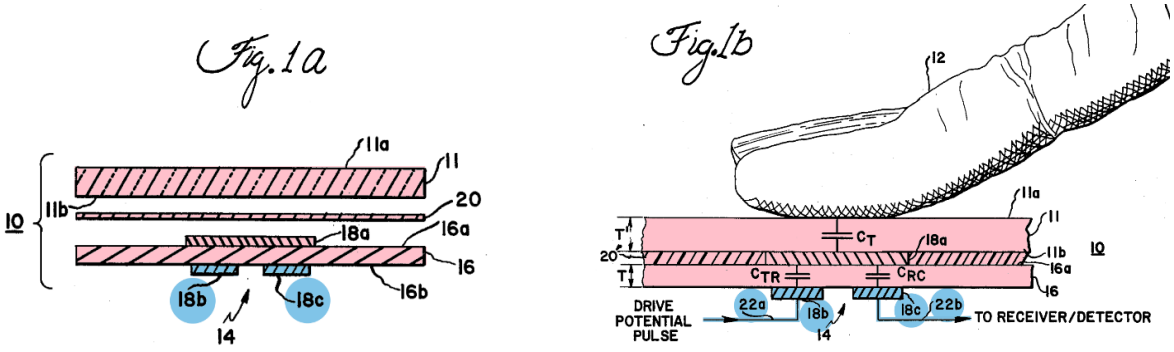
B. 13[a]: disposing electronic components on a capacitive touch switch

105. Element 13[a] recites: "disposing a plurality of electronic components on a capacitive touch switch." According to the '355 patent, capacitive touch switches include "any sensor that may utilize an electrical field to detect, for instance, the presence of a human finger or other conducting object to activate a switch." Ex. 1001 at 26:18–21.

106. The '355 patent explains that the electronic components can be "electrical connectors" disposed directly on a surface of the switch, such as through reflow soldering. *Id.* at 27:22–28. But as I discuss for Ground 1, when such directly soldered connectors are coupled to other electrical connectors that are in turn coupled to printed circuit boards, the additional connectors and PCBs are *also*

considered by the '355 patent to be disposed "on" the switch even though they are not attached directly to the switch. See § VI.L.2, e.g., ¶ 94. According to the '355 patent: by coupling a PCB to an electrical connector that is in turn coupled to another connector soldered to the switch, "an electronic assembly may be created, wherein each additional electronic component may connect to another electronic component or components." Ex. 1001 at 27:42–45. "Each of these additional electronic components may be considered to be disposed on the capacitive touch switch." *Id.* at 27:45–47.

107. Eichelberger discloses a capacitive touch switch on which multiple electronic components are disposed.



The capacitive touch switch includes a double-sided printed circuit board 16 on which electrodes 18b and 18c are fabricated. Ex. 1010 at 3:20–23, 3:43–47, 3:54–57. Eichelberger thus discloses disposing a plurality of electronic components on a capacitive touch switch. *See* Ex. 1001 at 27:22–28 (electrical connectors soldered to

the capacitive touch switch are electronic components "disposed on" the switch's surface).

108. Additionally, Eichelberger's electrodes are coupled to additional circuitry and electronic components (including the components the switch controls). *E.g.*, Ex. 1010 at 4:3–4, 4:26–34. According to the '355 patent, these additional electronic components are "considered to be disposed on the capacitive touch switch." Ex. 1001 at 27:45–47.

109. A POSITA would have been motivated to combine Howell-719 with Eichelberger because Howell-719 discloses using a capacitive touch switch to control or tune the audio electronics in its glasses. Moreover, Howell-719 discloses mounting electronic components, such as a data bus, processor, and storage device, on a printed circuit board. Ex. 1004 ¶¶ 50, 67. A POSITA would have been motivated to use Eichelberger's capacitive touch switch in Howell-719's glasses because using a switch with a double-sided printed circuit board and the ability to mount electronics directly thereon would facilitate efficient use of space. Indeed, Eichelberger teaches that the double-sided PCB provides a "further advantage" of allowing "electronic components, of either the passive or active types, to be installed directly upon the appropriate portions of the double-sided printed circuit board," which facilitates efficient use of space. Ex. 1010 at 3:53–57. Such efficiency is

important in designing eyewear with embedded electronics because the space for the electronics is limited.

110. Incorporating Eichelberger's capacitive touch switch into Howell-719's glasses involves nothing more than identifying a long-known example of the genus of switches (capacitive touch switches) that Howell-719 discloses and using that specific example according to its fundamental purpose of detecting capacitance levels to trigger a switch in functionality.

111. Because using Eichelberger's capacitive touch switch in exactly the way Howell-719 contemplates using a capacitive touch switch would lead to the predictable result of using capacitance to control or tune the audio electronics in Howell-719's glasses, a POSITA would have a reasonable expectation of success. Eichelberger thus discloses element 13[a] and it would have been obvious to combine Eichelberger with Howell-719.

112. Limitation13[a] would have thus been obvious.

C. 13[b]: connecting the components to form an electronic assembly

113. Element 13[b] recites: "connecting the plurality of electronic components via electrical connections to form an electronic assembly." Eichelberger discloses that the electrodes 18b and 18c are "interconnected by conductive leads fabricated as a portion of the PC board, as is well known to the art." Ex. 1010 at 3:50–53. Additionally, conductive leads or traces on the PCB would likewise

connect Howell-719's electronic components (e.g., data bus, processor, and storage device) to form an electronic assembly.

D. 13[c]: depositing a conformal layer

114. Element 13[c] recites: "depositing a conformal layer over at least a portion of the electronic assembly and at least a portion of the capacitive touch switch." For the same reasons discussed in Ground 1, *see* §§ VI.A.5, VI.L.3, Sikonowiz motivates depositing a conformal coating over a PCB like that in the combination of Howell-719 and Eichelberger, including the electronic components mounted on the board, and a POSITA would have had a reasonable expectation of succeeding in doing so. The conformal coating would cover the electronic assembly and at least the PCB portion of Eichelberger's capacitive touch switch, protecting them from, e.g., moisture and other contaminants.

E. 13[d] coupling the assembly and switch with the conformal layer to an enclosure

115. Element 13[d] recites: "coupling the electronic assembly and the capacitive touch switch with the conformal layer to an enclosure of an eyewear frame." See the discussion in Ground 1. See § VI.L.4.

IX. GROUNDS 4 AND 5: HOWELL-719, SIKONOWIZ, AND HOWELL-158 OR BLUM-130 RENDER CLAIMS 14–21 OBVIOUS

116. To avoid repetition, I will discuss Grounds 4 and 5 in parallel. In Ground 4, Howell-158 supplies an accelerometer for purposes of element 14[b]. In Ground 5, Blum-130 supplies both an accelerometer and a gyroscope for purposes of element 14[b]. Except for that one aspect of element 14[b], the analysis for claims 14–21 is the same for Grounds 4 and 5.

A. Claim 14

1. Preamble and 14[a]: eyewear comprising a frame with a temple

117. The preamble and element 14[a] recite: "Eyewear comprising: an eyewear frame comprising a temple." Howell-719 discloses these elements. *See, e.g.*, Ex. 1004 fig. 1. See also §§ VI.A.1, VI.A.6.

2. 14[b]: electronic components in a temple cavity

118. Element 14[b] recites: "a plurality of electronic components disposed within a cavity formed in the temple, the plurality of electronic components comprising (i) at least one of a processor or a controller, iii) [sic] a memory, (iii) a power source, (iv) an antenna, (v) at least one of a transmitter or a receiver, and (vi) at least one of an accelerometer or a gyroscope."

119. According to Howell-719, "All of the electronic components can be self-contained inside the temple of the glasses." Ex. 1004 ¶ 97. And "a temple of the eyeglass frame can have an opening, cavity or container to hold or encompass the

different embodiments of components." *Id.* ¶ 108. Howell-719 discloses at least the following electronic components:

(i) a "processor 106, which can be a microprocessor or controller," *id.* ¶ 67;

(ii) a storage device that can be or include, for example, "a flash memory device," "a Read-Only Memory (ROM)," and "a RAM" or random access memory, *id.* ¶ 67, claim 13;

(iii) "a power source," such as a battery (in figure 1, reference numeral 26, embedded in the temple), *id.* ¶¶ 28, 36, fig. 1, claim 15;

(iv) a radio, *e.g.*, *id.* ¶¶ 40, 50–62, claim 12; and

(v) a variety of receivers and transmitters, including:

a. radio receivers like an FM receiver, *e.g.*, *id.* ¶¶ 50–62, claim 12;

b. a WiFi or WiMax receiver, *id.* ¶ 55 ("information is transmitted to the glasses through a Wi-Fi network, or a WiMax network"); and

c. a "wireless transceiver," *id.* ¶ 99, claims 17, 20, and a microphone, *e.g.*, *id.* ¶ 102, claim 15.

120. By disclosing a radio, Howell-719 discloses an antenna. Any radio has an antenna. See Ex. 1030 at 116 ("**Antenna (electromagnetism)** A portion of a radio system especially designed to couple electromagnetic energy between free space and transmission lines."); Ex. 1031 at 2 ("An RF signal is a signal that is coherently

generated, radiated by a transmit antenna, propagated through air or space, collected by a receive antenna, and then amplified and information extracted."), at 14 & fig. 1-8 (reproduced below) ("Figure 1-8: A simple transmitter …"; diagram showing "Antenna"), at 22 ("In a receiver system, information is translated by a metallic antenna from the propagating photons to moving charges in a conductor.").

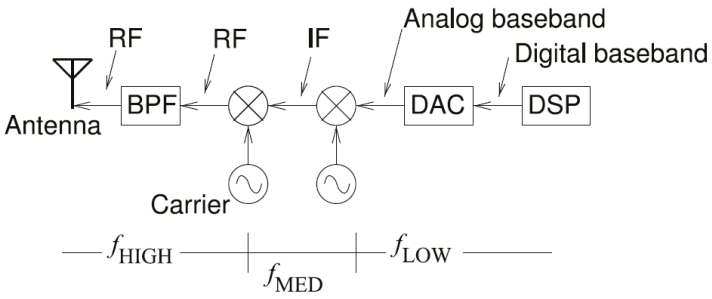


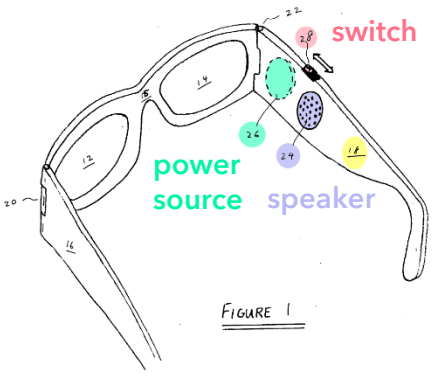
Figure 1-8: A simple transmitter with low, f_{LOW}, medium, f_{MED}, and high frequency, f_{HIGH}, sections. The mixers can be idealized as multipliers, shown as circles with crosses, that boost the frequency of the input baseband or IF signal by the frequency of the carrier.

"An antenna interfaces circuits with free-space[,] with a transmit antenna converting a guided wave signal on a transmission line to an electromagnetic (EM) wave propagating in free space, while a receive antenna is a transducer that converts a free-space EM wave to a guided wave on a transmission line and eventually to a receiver circuit." *Id.* at 129. Since WiFi, WiMAX, and other wireless transmissions involve EM waves received and transmitted by antennas, Howell-719's disclosure of WiFi, WiMAX, and wireless receivers and transmitters also discloses an antenna.

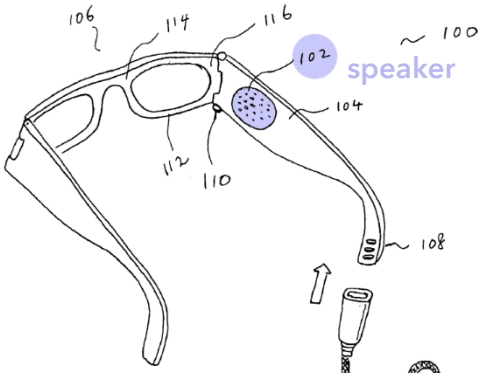
121. Howell-719 thus discloses all the electronic components recited in element 14[b] apart from "an accelerometer or a gyroscope." In **Ground 4**, Howell-158 supplies an accelerometer. In **Ground 5**, Blum-130 supplies both an accelerometer and a gyroscope.

a. Ground 4: + Howell-158

122. Howell-158 discloses glasses very similar to those of Howell-719.



Howell-719 fig. 1



Howell-158 fig. 1 (excerpt)

123. Like those of Howell-719, Howell-158's glasses include a speaker and, in a temple cavity, a processor, memory, power source such as a battery, antenna, receiver, and transmitter. *E.g.*, Ex. 1007 ¶¶ 49, 95, 99, 113, 159, 185, claim 26.

124. Furthermore, the glasses can include an accelerometer to detect whether a user is wearing the glasses. *Id.* ¶ 163. Due to the close similarity between Howell-719 and Howell-158, it would have been obvious to a POSITA to incorporate Howell-158's accelerometer into Howell-719's glasses. Howell-719's glasses would benefit from the ability to detect when a user is wearing the glasses. Indeed, Howell-719 describes an embodiment using a magnetic or Hall effect sensor to detect when the temple "is in its extended position" such that the glasses are "ready to be worn." Ex. 1004 ¶ 81. Detecting this state can activate the switch to turn on the audio. *Id.*

Howell-719's glasses would therefore benefit from Howell-158's accelerometer-based "being worn" detector.

125. By the mid-2000s, accelerometers were widely used in consumer electronics to detect motion and tilt. For example, Nintendo launched its Wii console in 2006, and the Wii controllers (such as the Wii Remote in 2006) relied on accelerometers to detect motion. Incorporating Howell-158's accelerometer-based "being worn" detector thus represents using a simple substitution of one known alternative (accelerometer-based "being worn" detector) for another, similar component (magnetic-based "ready to be worn" detector) with predictable results. Howell-158's disclosure of the accelerometer-based detector in glasses highly similar to those of Howell-719 demonstrates a POSITA would have a reasonable expectation of success.

126. In Ground 4, element 14[b] would therefore have been obvious.

b. Ground 5: + Blum-130

127. Blum-130 likewise discloses glasses similar in many respects to those of Howell-719.

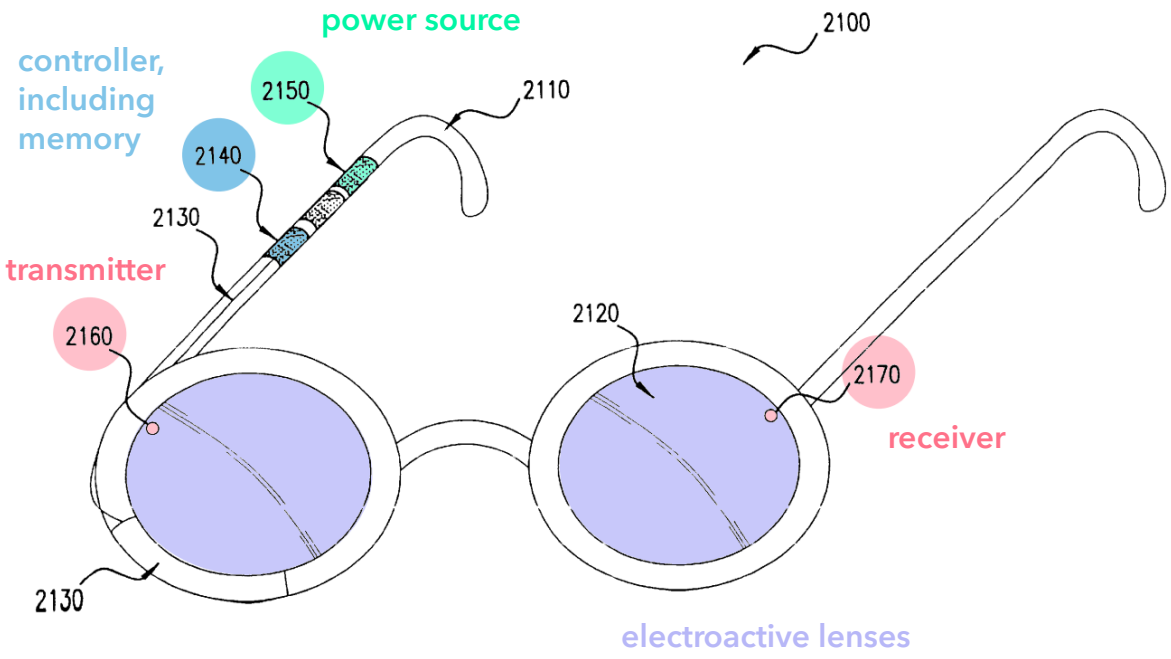


FIG.21

128. Like in Howell-719, Blum-130's glasses include, embedded in a temple, a processor, memory, power source, antenna, rangefinder receiver, and rangefinder transmitter. *E.g.*, Ex. 1006 at 3:46–48 ("controller" can be processor), 30:2–3 ("controller 2140" and "power source 2150"), 30:3–10 (rangefinder receiver 2170 and transmitter 2160 can be "embedded in frame 2110"), 29:55–57 (receiver as antenna).

129. Furthermore, "a tiny micro-gyroscope or micro-accelerometer in the temple" controls a switch, allowing the user to use a head movement to change the functionality of the glasses. *Id.* at 30:39–45. In "another exemplary embodiment, a combination of a rangefinder and a microgyroscope" controls the switch. *Id.* at 30:59–60.

130. Howell-719 describes that the user may operate switches to control audio while wearing the glasses. Ex. 1004 ¶ 93. Since the user might not be able to see the switches, Howell-719 describes using different tactile cues (rough versus smooth surface or different heights) to allow the user to distinguish between switches. Incorporating Blum-130's accelerometer- or gyroscope-based switch controls into Howell-719 represents using a simple substitution of one known alternative (accelerometer/gyroscope-based motion detector allowing for head movement to activate switch) for a component (physical switches) serving the same purpose (allowing the user to activate switch to control functionality while the user is wearing the glasses and cannot see the switches). Blum-130's disclosure of the accelerometer/gyroscope-based switch in glasses highly similar to those of Howell-719 demonstrates a POSITA would have a reasonable expectation of success.

131. In Ground 5 as well, element 14[b] would have been obvious.

3. 14[c]: conformal coating

132. Element 14[c] recites: "a conformal coating, deposited over at least a portion of the plurality of electronic components, to protect the plurality of electronic components." As discussed for claim 1, Howell-719 explains that electronic components for controlling the speaker can reside on a printed circuit board, and Sikonowiz discloses a conformal coating deposited to protect components mounted on a printed circuit board. See §§ VI.A.2, VI.A.5.

4. 14[d]: capacitive touch switch

133. Finally, element 14[d] recites: "a capacitive touch switch operably coupled to an electronic component in the plurality of electronic components." As discussed in claim 1, Howell-719 discloses a capacitive touch switch operably coupled to the speaker to control the speaker and thus discloses element 14[d]; additionally, Howell-719 renders obvious a capacitive touch switch operably coupled to the processor controlling the speaker and to the power source for the speaker. § VI.A.3.

134. On both Ground 4 and Ground 5, claim 14 would have been obvious.

B. Claim 15

135. Claim 15 depends from claim 14 and further recites: "wherein the conformal coating exposes an electrical contact of the electronics assembly." For a printed circuit board to function, it typically is connected to off-board components.

This connection is often accomplished via a connector strip on the edge of the board. Since conformal coating materials are often insulators, a POSITA would therefore understand that edge connector strips should be left uncoated to permit electrical contact with off-board components. Indeed, HANDBOOK OF MATERIALS AND PROCESSES FOR ELECTRONICS, published in 1970, documents this principle: "In the assembly and processing of electronic components, resists or maskants may be needed to 'stop off' certain areas from conformal coating or solder. For example, in the conformal coating of printed-circuit boards, the edge connector strip should be left uncoated to allow electric contact with an edge connector." Ex. 1019 at 5-11 (chapter 5, p. 11). This principle would have been immediately apparent to a POSITA. Accordingly, claim 15 would have been obvious.

C. Claims 16 and 17

136. Claim 16 depends from claim 14 and further recites: "wherein the conformal coating has a thickness of less than 1 mm." Claim 17 also depends from claim 14 and further recites: "wherein the conformal coating has a thickness of less than 0.5 mm." As explained for claim 10, Sikonowiz discloses conformal coatings whose thickness is less than 0.2 millimeters and even as small as 250 angstroms. Ex. 1005 at 136; *see* § VI.I. IPC-2221A mandates coatings no thicker than 0.21 mm. Ex. 1021 at 25. A POSITA would therefore have been motivated to apply

Sikonowiz's teachings of coatings thinner than 0.5 mm. Claims 16 and 17 would have been obvious.

D. Claim 18

137. Claim 18 depends from claim 14 and further recites: "wherein the electronic component is disposed on a surface of the capacitive touch switch." Howell-719 discloses that all electronic components can be put on a printed circuit board within a temple. Ex. 1004 ¶ 97. A POSITA would readily understand from the '355 patent that either the printed circuit board itself, or an electrical connector between the switch and printed circuit board, can serve as the "electronic component" recited in the claim. As the '355 patent explains: "[E]lectronic components may be disposed on a surface of the capacitive touch switch. For instance, electrical connectors may be disposed on the surface (e.g. using reflow soldering)." Ex. 1001 at 27:23–26. Within the meaning of the '355 patent, the printed circuit board, or the electrical connector between the board and switch, would be disposed on a surface of the connected capacitive touch switch. Claim 18 would have been obvious.

E. Claim 19

138. Claim 19 depends from claim 14 and further recites: "wherein the conformal coating protects a portion of the capacitive touch switch." Howell-719 discloses: "All of the electronic components can be self-contained inside the temple

of the glasses. The components can be coupled to a printed circuit board." Ex. 1004 ¶ 97. And Sikonowiz states: "Ideally, a conformal coating covers not only the circuit board but the components mounted on it as well." Ex. 1005 at 136. Additionally, a POSITA would understand that a conformal coating would protect a portion of the capacitive touch switch from, for example, environmental hazards such as moisture, dirt, and chemicals." Ex. 1005 at 135–36. It would have therefore been obvious to mount the capacitive touch switch on a PCB and apply a conformal coating to both the board and the switch. Claim 19 would have been obvious.

F. Claim 20

139. Claim 20 depends from claim 14 and further recites: "wherein the capacitive touch switch is fit to the cavity in the temple." Again, Howell-719 discloses: "All of the electronic components can be self-contained inside the temple of the glasses." Ex. 1004 ¶ 97. That includes the capacitive touch switch that Howell-719 discloses. *See* claim 18. Howell-719 thus discloses a capacitive touch switch fit to the temple cavity. *Id.* Claim 20 would have been obvious.

G. Claim 21

140. Claim 21 depends from claim 14 and further recites: "wherein the capacitive touch switch is electrically connected to an electronic component disposed on the eyewear frame." Claim 21 is obvious for multiple reasons.

141. First, Howell-719 discloses the capacitive touch switch as an option for a switch that controls the speaker or tunes the frequency of the radio. Howell-719 describes embodiments where the speaker is partially embedded in the frame. *E.g.*, Ex. 1004 ¶ 49, claim 1. It would therefore be obvious for the capacitive touch switch to be connected to a speaker disposed on the eyewear frame.

142. Alternatively, Howell-719 discloses LEDs "arranged as an array on the outside surface of one of the temples." *Id.* ¶ 95. These LEDs light up in sync with audio from the speaker. *Id.* Since the capacitive touch switch controls the speaker, it would have been obvious to a POSITA to electrically connect the switch to the LEDs.

143. Claim 21 would have been obvious.

X. GROUND 6: BLUM-130, HOWELL-719, AND SIKONOWIZ RENDER CLAIMS 1–21 OBVIOUS

A. Claim 1

1. Preamble and 1[a]: eyewear system comprising an eyewear frame

144. The preamble and element 1[a] recite: "An eyewear system comprising: an eyewear frame." Blum-130 discloses an eyewear system comprising an eyewear frame:

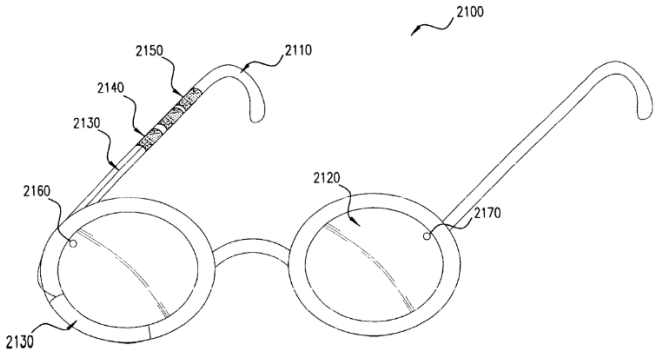


FIG.21

Figure 21 shows "electro-active eyewear 2100" with "frames 2110." Ex. 1006 at 29:66–30:1.

2. 1[b]: electronics assembly

145. Element 1[b] recites: "an electronics assembly comprising electronic components configured to control an electrical functional member." Blum-130 discloses this element:

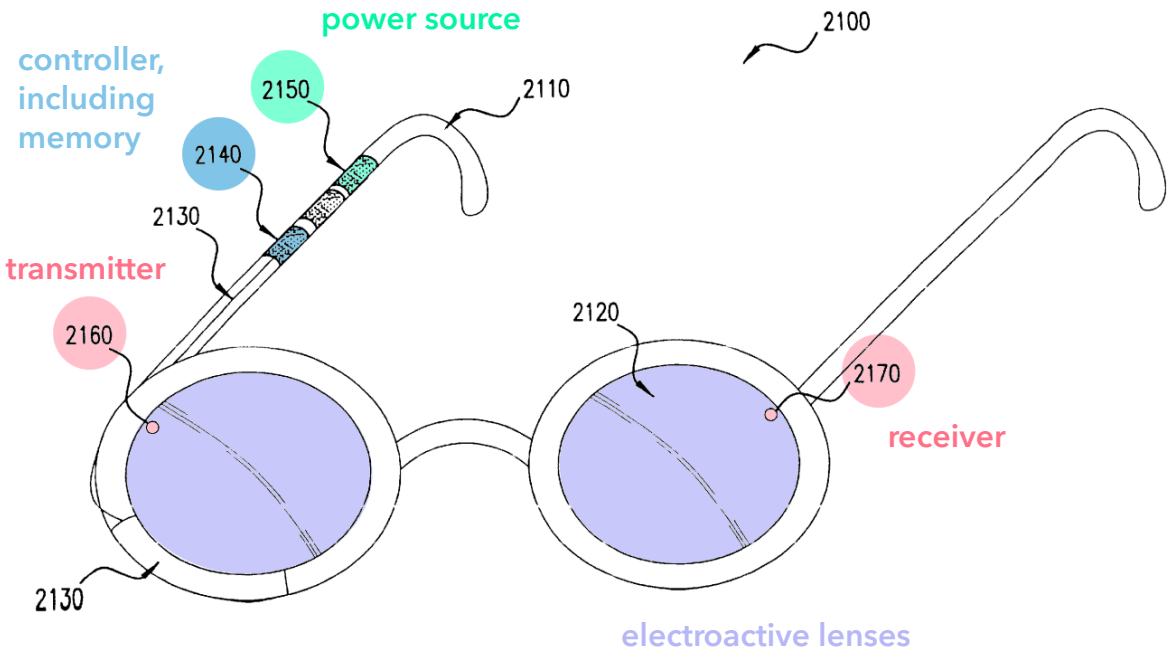


FIG.21

146. In the embodiment of figure 21, "frames 2110 contain electro-active lenses 2120 that are connected by connecting wires 2130 to controller 2140 (integrated circuit) and power source 2150." Ex. 1006 at 30:1–3. Blum-130 discloses a controller that includes a microprocessor, memory, and a port for input and output. *Id.* at 3:46–48, 6:22–26. Blum-130 thus discloses an assembly of electronic

components configured to control an electro-active lens, which is an electrical functional member.

3. 1[c]: capacitive touch switch

147. Element 1[c] recites: "a capacitive touch switch coupled to at least one electronic component in the electronics assembly." Blum-130 discloses several options for a switch to control the electroactive lenses, including combining sensors and a manual switch to allow for a mixture of automated and manual inputs to control the electroactive lenses. Ex. 1006 cols.28–30. As discussed in Ground 1, Howell-719 discloses a capacitive touch switch satisfying element 1[c]. See § VI.A.3.

148. A POSITA would have been motivated to use such a capacitive touch switch with Blum-130's glasses. A person needing Blum-130's electro-active lenses would be expected to require frequent switching operations to change the lenses' focal distance as the person looked at objects at different distances. Manual switches relying on mechanical movement to close a circuit are susceptible to wear, fatigue, and loosening, which, over the course of repeated switching operations, can lead to eventual failure. Capacitive touch switches do not rely on mechanical movement, eliminating this source of failure. Additionally, using a capacitive touch switch permits the glasses to have a switch without a protruding button that would disrupt the typical smooth, slim profile of glasses. It also avoids Blum-130's inconvenient alternative of needing to carry a second device that remotely controls the lenses. See

Ex. 1006 at 29:49–51. A capacitive touch switch would therefore have been an attractive, advantageous choice for a switch in eyewear in the early 2000s, when glasses were often marketed as fashion accessories.

149. Incorporating Howell-719's capacitive touch switch into Blum-130 would constitute a simple substitution or addition of a specific known type of switch (Howell-719's capacitive touch switch) for or to a genus of switches disclosed in Blum-130 (manual switch). Capacitive touch switches had been known for decades. By May 2007, products like the Apple iPod already integrated capacitive touch interfaces into assemblies that were moisture resistant for handheld or wearable consumer electronic products, similar in scope and scale to eyewear—and Howell-719 expressly discloses using a capacitive touch switch in eyewear. The '355 patent does not purport to identify any novel capacitive touch switch. Moreover, the '355 patent discloses no structural or design details of any capacitive touch switch. A POSITA would therefore have a reasonable expectation of success incorporating Howell-719's capacitive touch switch into Blum-130's glasses in accordance with claim 1. Element 1[c] would have been obvious.

4. 1[d]: at least one electrical connective element

150. Element 1[d] recites: "at least one electrical connective element electrically connected to the electronic assembly and the electrical functional

member." Blum-130 explains: "connecting wires 2130" connect the integrated-circuit controller 2140 to the electroactive lenses 2120. Ex. 1006 at 30:1–3.

5. 1[e] and 1[f]: conformal layer that is moisture proof and seals electrical connections

151. Elements 1[e] and 1[f] recite: "a conformal layer over the electronic assembly to seal the electronic components; wherein the conformal layer is moisture proof and seals electrical connections of the electronic component." As discussed for Ground 1, the conformal layer can be a conformal coating. See § VI.A.5. As also discussed for Ground 1, Howell-719 discloses mounting any electronic components on a printed circuit board, and Sikonowiz explains the well-known PCB assembly step of applying a conformal coating to prevent moisture from damaging the PCB and mounted electronics, where the coating is moisture proof and seals electrical connections and otherwise satisfies elements 1[e] and 1[f]. See § VI.A.5; Ex. 1004 ¶ 97. Moreover, Blum-130's controller can include a microprocessor, memory, and input/output port and can be an integrated circuit. Ex. 1006 at 3:46–49, 6:22–47, 29:5–6, 30:3.

152. It would have been immediately obvious to a POSITA to mount Blum-130's integrated-circuit electronic components on a printed circuit board (as Howell-719 teaches) and apply a conformal coating satisfying elements 1[e] and 1[f] (as Sikonowiz teaches). A POSITA would have been motivated to mount Blum-130's components on a PCB (as Howell-719 teaches) because doing so makes

manufacturing and assembly cheaper and faster. And a POSITA would have been motivated to apply a conformal coating (as Sikonowiz teaches) because doing so protects the electronics from moisture and contaminants. Combining these aspects of Blum-130, Howell-719, and Sikonowiz would have constituted nothing more than arranging well-known elements in a time-tested manner, with each element performing the same function it had been known to perform for decades and resulting in exactly what a POSITA would expect from that arrangement. Indeed, a POSITA would have reasonably expected to succeed in combining these teachings because, by the mid-2000s, it had been commonplace for decades to mount integrated circuits to printed circuit boards and to apply conformal coatings to printed circuit boards to protect them and their mounted components from moisture and contaminants. Elements 1[e] and 1[f] would have been obvious.

6. 1[g]–1[i]: conformal layer disposed in an enclosure and electronic assembly enclosed in a temple

153. Elements 1[g]–1[i] recite: "wherein the conformal layer is disposed in an enclosure of the eyewear frame; wherein the eyewear frame comprises a temple; and wherein the electronic assembly is enclosed in the temple."

154. Like Howell-719 teaches for its electronic components, Blum-130 discloses that the integrated-circuit controller and its electronic assembly can be housed inside the frame, such as in a temple as illustrated in figure 21. Ex. 1006 at 12:44–46, fig. 21. Therefore, for the same reasons as discussed for Ground 1, the

conformal coating resulting from combining Blum-130, Howell-719, and Sikonowiz would satisfy elements 1[g]–1[i] and render them obvious. See § VI.A.6.

7. Further remarks on claim 1

155. In summary, Blum-130 discloses glasses with temples, an integrated circuit embedded in a temple with electronics to control electroactive lenses, and a combination of a manual switch and sensors to activate different settings for the lenses. Blum-130 thus expressly discloses all elements of claim 1 except for those relating to the capacitive touch switch (1[c]) and the conformal layer (1[e]–1[g]). Howell-719 discloses a capacitive touch switch, which would be obvious to incorporate as a simple substitution of known alternatives with the same function. Howell-719 also discloses putting the electronic components on a PCB, and Sikonowiz discloses applying a conformal coating to any PCB. It would have been obvious to improve Blum-130's system by putting the integrated circuit on a PCB as Howell-719 teaches and applying a conformal coating as Sikonowiz teaches. The coating would be moisture proof and seal the electronic components and electrical connections of the PCB. Based on the disclosures of Blum-130 and Howell-719 of embedding their respective integrated circuit and PCB and other electronics in a temple, the coated PCB would be embedded in the temple. Incorporating these teachings of Howell-719 and Sikonowiz would thus satisfy the remaining elements of claim 1. Because applying Sikonowiz represents using a known technique to a

known device ready for improvement with known beneficial results, claim 1 would have been obvious.

B. Claims 2 and 3

156. Claim 2 depends from claim 1 and further recites: "wherein the electrical functional member comprises a lens." Claim 3 also depends from claim 1 and further recites: "wherein the electrical functional member includes at least one of an electro-active lens, [other options] … , and an active 3D function." The electrical functional member discussed for claim 1 was an electroactive lens. Claims 2 and 3 would have been obvious.

C. Claim 4

157. Claim 4 depends from claim 1 and further recites "wherein the at least one electrical connective element is a conductive compressible member or a multi-conductor cable." Blum-130 discloses that the electroactive lenses are connected to the controller "via a network of conductive wires." Ex. 1006 at 4:19–21; also *id.* at 30:1–3. In addition, Blum-130 discloses embedding the integrated-circuit controller in the temple. *E.g.*, *id.* at 12:44–46, fig. 21. Accordingly, for the reasons discussed for Ground 1, *see* § VI.C, a POSITA would have identified a flat, flexible multi-conductor cable as an advantageous option among a limited number of well-known suitable choices for connecting the components in the temple. Claim 4 would have been obvious.

D. Claim 5

158. Claim 5 depends from claim 1 and further recites "wherein the electronic assembly comprises a micro-processor." As discussed for element 1[b], Blum-130 discloses an electronic assembly including a microprocessor. See § X.A.2; Ex. 1006 at 3:46–49. Claim 5 would have been obvious.

E. Claim 6

159. Claim 6 depends from claim 1 and further recites "wherein the enclosure comprises at least one of an outer casing of the electronic assembly or a cavity of the eyewear frame." See the discussion of claim 6 in Ground 1 and elements 1[g]–1[i] in Ground 6. See §§ VI.E, X.A.6. Claim 6 would have been obvious.

F. Claims 7–12

160. Claims 7–12 depend from claim 1 and further recite limitations relating to the conformal layer. See the discussion in Ground 1, which applies here. See §§ VI.F–VI.K. These claims would have been obvious.

G. Claim 13

1. Preamble

161. Claim 13's preamble recites: "A method of manufacturing an eyewear system." Blum-130 discloses an eyewear system and its construction. *See, e.g.*, Ex. 1006 fig. 21; *see also* § X.A.1.

2. 13[a]–13[b]: disposing electronic components on a capacitive touch switch and connecting the components to form an electronic assembly

162. Elements 13[a]–13[b] recite: "disposing a plurality of electronic components on a capacitive touch switch; connecting the plurality of electronic components via electrical connections to form an electronic assembly." For the reasons discussed for claim 1, it would have been obvious to incorporate Howell-719's capacitive touch switch into Blum-130 and to mount Blum-130's integrated-circuit electronic components on a printed circuit board, where they would be electrically connected to form an electronic assembly. See §§ X.A.3, X.A.5. Moreover, for the same reasons discussed for claim 13 in Ground 1, it would have been obvious to electrically connect Howell-719's capacitive touch switch to the same printed circuit board. See § VI.L.2. Within the meaning of the '355 patent, Blum-130's electronic components would thus be disposed on the capacitive touch switch. See § VI.L.2 (e.g., ¶ 94). Elements 13[a]–13[b] would have been obvious.

3. 13[c]: depositing a conformal layer

163. Element 13[c] recites: "depositing a conformal layer over at least a portion of the electronic assembly and at least a portion of the capacitive touch switch." For the same reasons discussed for claim 1, *see* § X.A.5, Sikonowiz motivates depositing a conformal coating over the PCB discussed for elements

13[a]–13[b], including the electronic components mounted on the board, and a POSITA would have had a reasonable expectation of succeeding in doing so.

4. 13[d] coupling the assembly and switch with the conformal layer to an enclosure

164. Element 13[d] recites: "coupling the electronic assembly and the capacitive touch switch with the conformal layer to an enclosure of an eyewear frame." As discussed above for claim 1, the electronics, including the capacitive touch switch, discussed for elements 13[a]–13[c] would be embedded within a temple. See § VI.A.6. Within the meaning of the '355 patent, such electronics are coupled to the enclosure that cavity and temple form. See § VI.L.4.

H. Claim 14

1. Preamble and 14[a]: eyewear comprising a frame with a temple

165. The preamble and element 14[a] recite: "Eyewear comprising: an eyewear frame comprising a temple." Blum-130 discloses these elements. *See, e.g.*, Ex. 1006 fig. 21; *see also* §§ X.A.1, X.A.6.

2. 14[b]: electronic components in a temple cavity

166. Element 14[b] recites: "a plurality of electronic components disposed within a cavity formed in the temple, the plurality of electronic components comprising (i) at least one of a processor or a controller, iii) [sic] a memory, (iii) a power source, (iv) an antenna, (v) at least one of a transmitter or a receiver, and (vi)

at least one of an accelerometer or a gyroscope." Blum-130's figure 21 shows several of these components:

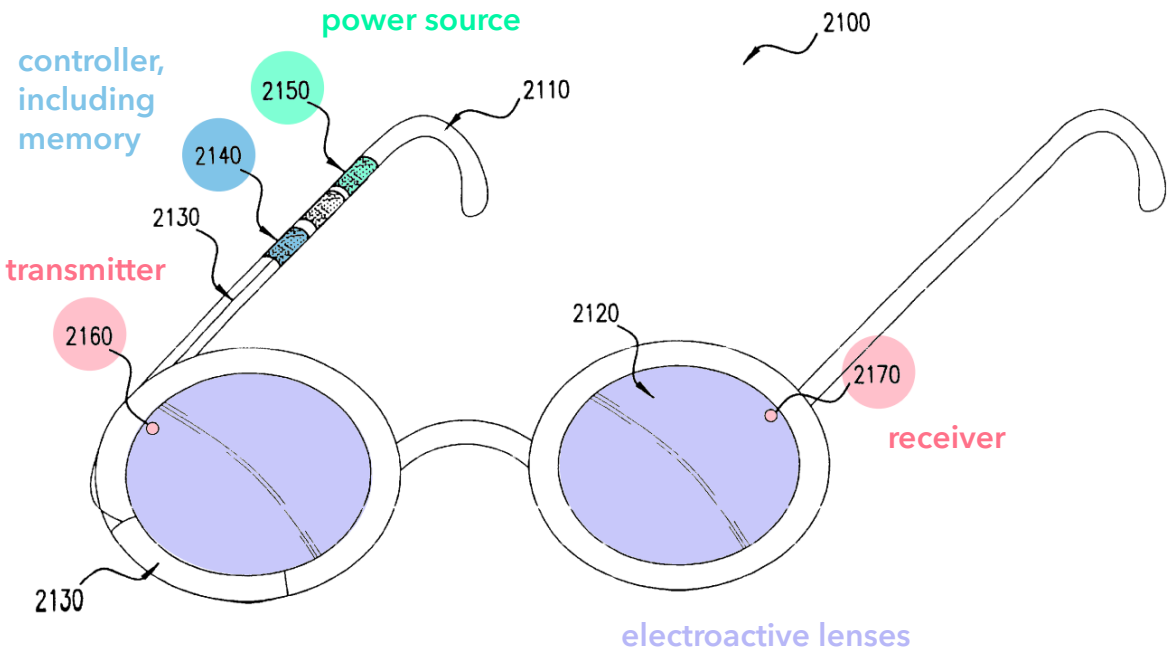


FIG.21

Blum-130 discloses at least the following electronic components embedded in a temple:

(i) a controller, e.g., "controller 2140," Ex. 1006 at 30:2–3;

(ii) a memory, *e.g.*, *id.* at 3:46–49, 6:22–47, 14:34;

(iii) a power source, e.g., "power source 2150," *id.* at 30:2–3;

(iv) receivers and transmitters, including rangefinder receiver 2170 and transmitter 2160, *e.g.*, *id.* at 30:3–10 (can be "embedded in frame 2110"); and

(v) "a tiny micro-gyroscope or micro-accelerometer in the temple," *id.* at 30:39–45; *see also id.* at 30:59–60.

167. Blum-130 discloses the rangefinder can utilize "radio-frequency waves," *id.* at 30:15–17, which requires an antenna. See paragraph 120 above. Additionally, Blum-130 discloses "a tiny receiver antenna mounted conformably on the spectacle frames." *Id.* at 29:55–57. In either case, a POSITA would be motivated to embed the antenna inside the temple to protect it from damage and to simplify manufacturing. As Howell-719 teaches, embedding components in a temple cavity "[a]dvantageously" creates "minimal impact on the design of the end product" and avoids both "tedious wiring" and "other changes or complications to the eyeglass frames." Ex. 1004 ¶ 108; *also id.* ¶ 97.

3. 14[c]: conformal coating

168. Element 14[c] recites: "a conformal coating, deposited over at least a portion of the plurality of electronic components, to protect the plurality of electronic components." See §§ X.A.2, X.A.5.

4. 14[d]: capacitive touch switch

169. Element 14[d] recites: "a capacitive touch switch operably coupled to an electronic component in the plurality of electronic components." See § X.A.3.

I. Claims 15–20

170. Claims 15–20 depend from claim 14 and further recite limitations related to the conformal coating or capacitive touch switch. See the discussion of these claims in Grounds 4 and 5. The discussion of these claims in Grounds 4 and 5 applies equally to the combination of Blum-130, Howell-719, and Sikonowiz: exposing an electrical contact as recited in claim 15 would have been obvious based on a POSITA's background knowledge; Sikonowiz discloses conformal coatings satisfying the thickness limitations of claims 16 and 17; Howell-719 discloses the capacitive-touch-switch limitations of claims 18 and 20; and Sikonowiz's disclosure of conformal coatings covering mounted components combines with Howell-719's disclosure of mounting a capacitive touch switch to a PCB to render claim 19 obvious. See §§ IX.A–IX.G.

J. Claim 21

171. Claim 21 depends from claim 14 and further recites: "wherein the capacitive touch switch is electrically connected to an electronic component disposed on the eyewear frame." Blum-130 discloses "thin film solar cell arrays can be attached to the surface of the frames." Ex. 1006 at 28:27–28. These solar cell arrays are a power source. *Id.* at 28:31–33. Because the capacitive touch switch requires a power source, it would have been obvious to electrically connect the switch to the solar cell arrays. Additionally, since the capacitive touch switch

controls the electroactive lenses, the switch is electrically connected to the lenses. Claim 21 would have been obvious.

XI. GROUND 7: BLUM-130, EICHELBERGER, AND SIKONOWIZ RENDER CLAIMS 13, 14, AND 18 OBVIOUS

172. Ground 7 is similar to Ground 6. In Ground 7, I alternatively rely on Eichelberger for a capacitive touch switch.

A. Claim 13

1. Preamble

173. Claim 13's preamble recites: "A method of manufacturing an eyewear system." See Ground 6, Claim 13. See § X.G.1.

2. 13[a]: disposing electronic components on a capacitive touch switch

174. Element 13[a] recites: "disposing a plurality of electronic components on a capacitive touch switch."

175. As discussed in Ground 3, Eichelberger discloses a capacitive touch switch with multiple electronic components disposed thereon. See § VIII.B.

176. For the same reasons I discuss in Ground 3 with respect to combining Eichelberger with Howell-719, a POSITA would have been motivated to use Eichelberger's capacitive touch switch with Blum-130's glasses and would have reasonably expected to succeed. *Id.* For example, the efficient use of space that Eichelberger's double-sided PCB affords and the common use of capacitive touch

switches in consumer electronics would have motivated a POSITA to combine Blum-130 with Eichelberger. *See id.*

177. Incorporating Eichelberger's capacitive touch switch would also constitute a simple substitution or addition of a specific known type of switch (capacitive touch switch) for or to a genus of switches disclosed in Blum-130 (manual switch). Capacitive touch switches had been known for decades. Considering the prevalence of capacitive touch switches in consumer electronics, including in glasses as disclosed in Howell-719, a POSITA would have a reasonable expectation of success.

178. Blum-130 and Eichelberger therefore render element 13[a] obvious.

3. 13[b]: connecting the components to form an electronic assembly

179. Element 13[b] recites: "connecting the plurality of electronic components via electrical connections to form an electronic assembly." Eichelberger discloses that the electrodes 18b and 18c are "interconnected by conductive leads fabricated as a portion of the PC board, as is well known to the art." Ex. 1010 at 3:50–53. A POSITA would readily understand that in the alternative combinations, conductive leads or traces on the PCB could likewise connect Blum-130's electronic components to form an electronic assembly.

4. 13[c]: depositing a conformal layer

180. Element 13[c] recites: "depositing a conformal layer over at least a portion of the electronic assembly and at least a portion of the capacitive touch switch." For the same reasons discussed in Ground 6, *see* § X.G.3, Sikonowiz motivates depositing a conformal coating over the PCB discussed for elements 13[a]–13[b], including the electronic components mounted on the board, and a POSITA would have had a reasonable expectation of succeeding in doing so.

5. 13[d] coupling the assembly and switch with the conformal layer to an enclosure

181. Element 13[d] recites: "coupling the electronic assembly and the capacitive touch switch with the conformal layer to an enclosure of an eyewear frame." See the discussion in Ground 6. See § X.G.4.

B. Claim 14

182. For Ground 7, the analysis of claim 14 is identical to that of claim 14 for Ground 6, except with Eichelberger's capacitive touch switch taking the place of Howell-719's. See § X.H. For the reasons discussed for claim 13 in Ground 7, it would have been obvious to incorporate Eichelberger's capacitive touch switch into Blum-130's glasses. See § XI.A.2.

C. Claim 18

183. Claim 18 depends from claim 14 and further recites: "wherein the electronic component is disposed on a surface of the capacitive touch switch." For

the reasons discussed for claim 13, Blum-130 and Eichelberger render obvious coupling an electronic component to Eichelberger's capacitive touch switch and disposing that component on one side of Eichelberger's printed circuit board. See § XI.A.2.

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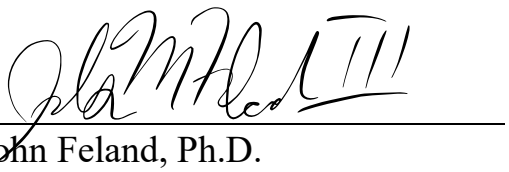
XII. CONCLUSION

For the foregoing reasons, it is my opinion that the claims of the ’355 patent would have been obvious in view of the prior art discussed above and the knowledge of one of ordinary skill in the art at the time of the alleged invention.

I reserve the right to supplement my opinions in the future to respond to any arguments or positions that the patent owner may raise, taking account of new information as it becomes available to me.

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 further that these statements were made with the 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.

June 14, 2024



John Feland, Ph.D.