

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.;
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioner,

v.

OURARING, INC.,
Patent Owner.

IPR2025-00147
U.S. Patent No. 11,188,124

DECLARATION OF DR. PATRICK MERCIER

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I. INTRODUCTION

1. I, Patrick Mercier, Ph.D., submit this Declaration on behalf of Patent Owner Ouraring, Inc. (“Patent Owner” or “Oura”). I have been retained by counsel for Oura to offer my independent technical opinion as to the validity of the U.S. Patent No. 11,181,124 (“’124 Patent”).

2. I have been asked to review the Declaration of Dr. Brian Anthony and provide any opinions I have in response. As part of my analyses, I have reviewed the ’124 Patent, its file history, all references cited by Dr. Anthony in his Declaration, as well as testimony and exhibits from various individuals, to assess the validity of the ’124 Patent in light of the same.

3. I am being compensated at my usual consulting rate of \$650 per hour, as well as reimbursed for any reasonable expenses I incur in the course of my consultation in this matter. No part of my compensation is conditioned upon the outcome of this or any related proceeding.

II. BACKGROUND

A. Overview of Qualifications and Experience

4. My educational background, professional experience, and a list of my publications are set forth in my curriculum vitae, attached to this Declaration as Exhibit A.

5. As discussed in more detail below, I have particular expertise in the

subject matter discussed in the '124 Patent as I am the co-founder and co-director of the Center for Wearable Sensors at the University of California San Diego (“UCSD”).

6. I received my B.Sc. degree in Electrical and Computer Engineering in 2006 from the University of Alberta. I received my S.M. in 2008, and my Ph.D. in Electrical Engineering in 2012, both from the Massachusetts Institute of Technology.

7. In 2012, after receiving my Ph.D., I joined UCSD as an Assistant Professor, and I became a Full Professor in 2023 and Vice Chair of the Electrical and Computer Engineering department in 2024. My professional experience includes three main components: research, teaching, and service to the scientific community.

B. Research and Development

8. My research relates to the design of energy-efficient microsystems, including the design of RF circuits, power converters, and sensor interfaces for miniaturized systems. My research has involved the development of wearable sensors, low-power wireless sensing systems, and power management integrated circuits. My research has been and/or is being incorporated for use in retinal prosthetics, saliva sensing, and wearable microneedle platforms.

9. I currently lead an approximately 20-person group undertaking high-

impact research spanning multiple domains, from near-zero-power integrated circuits, power management, energy harvesting, neural interfaces, wearable physiochemical sensors, RFICs and RF systems, and beyond.

10. As noted above, I am the co-founder and co-director of the Center for Wearable Sensors at UCSD, which includes over 20 faculty across four engineering departments within UCSD, the School of Medicine, and the Arts and Humanities Department (Department of Visual Arts). The purpose of the Center is to bring together top UCSD faculty, students, and researchers with complementary expertise in areas such as sensors, low-power circuits, materials, electrochemistry, bioengineering, wireless network technologies, preventive medicine, and life sciences to create an environment that fosters the acceleration of research and system development.

11. I am also the Site Director for the Power Management Integration Center (“PMIC”), a National Science Foundation Industry University Collaborative Research Center that is a partnership between UCSD and Dartmouth College. The mission of the PMIC is to target innovations that support higher efficiency, smaller size, and reduced cost by considering system reliability, robustness, and performance in a diverse range of industry sectors and applications spanning consumer, industrial, and automotive electronics. My work with both the Center for Wearable Sensors and the PMIC includes hardware design for wearable, wireless,

and power management systems.

12. My research has resulted in over 200 peer-reviewed publications, including 30 ISSCC papers, 33 JSSC papers, and several papers in high-impact journals such as *Science*, *Nature Biotechnology*, *Nature Biomedical Engineering*, *Nature Electronics*, *Nature Communications*, *Advanced Science*, and *Energy and Environmental Science*. Some of the articles I have published on the topic of wearables and power management include, for example:

- E. De La Paz, N.H. Maganti, A. Trifonov, I. Jeerapan, K. Mahato, L. Yin, T. Sonsa-ard, N. Ma, W. Jung, R. Burns, A. Zarrinpar, J. Wang, P.P. Mercier, “A Self-Powered Ingestible Wireless Biosensing System for Real-Time in Situ Monitoring of Gastrointestinal Tract Metabolites,” *Nature Communications*, Vol. 13, 7405, Dec. 2022.
- F. Tehrani, H. Teymourian, B. Wuerstle, J. Kavner, R. Patel, A. Furmidge, R. Aghavali, H. Hosseini-Toudeshki, C. Brown, F. Zhang, K. Mahato, Z. Li, A. Barfidokht, L. Yin, P. Warren, N. Huang, Z. Patel, P.P. Mercier & J. Wang, “An Integrated Wearable Microneedle Array for the Continuous Monitoring of Multiple Biomarkers in Interstitial Fluid,” *Nature Biomedical Engineering*, May 2022.
- J. Tian, P. Mercier, C. Paolini, “Ultra Low-Power, Wearable, Accelerated Shallow-Learning Fall Detection for Elderly At-Risk Persons,” *Smart Health*, Vol. 33, Sept. 2024.
- A. Akinin, J.M. Ford, J. Wu, C. Kim, H.D. Thacker, P.P. Mercier, G. Cauwenberghs, “An Optically Addressed Nanowire-Based Retinal Prosthesis with Wireless Stimulation Waveform Control and Charge Telemetry,” *IEEE Journal of Solid-State Circuits*, Vol. 56, No. 11, pp. 3263-73, Nov. 2021.
- P.P. Mercier, J. Wang, “Why Sweat Will Power Your Next Wearable,” *IEEE Spectrum*, Jun. 2020 (Cover article).

- A. Abdulslam, P.P. Mercier, “A Symmetric Modified Multilevel Ladder PMIC for Battery-Connected Applications,” *IEEE Journal of Solid-State Circuits*, Vol. 55, No. 3, pp. 767-80, Mar. 2020. (CICC Special Issue).
- J. Warchall, P. Theilmann, Y. Ouyang, H. Garudadri, P. Mercier, “Robust Biopotential Acquisition Via a Distributed Multi-Channel FM-ADC,” *IEEE Transactions on Biomedical Circuits and Systems*, Vol. 13, No. 6, pp. 1229-42, Dec. 2019.
- J. Park, P.P. Mercier, “A Sub-10pJ/bit 5Mbps Magnetic Human Body Communication Transceiver,” *IEEE Journal of Solid-State Circuits*, Vol. 54, No. 11, pp. 3031-42, Nov. 2019.
- J. Kim, J.R. Sempionatto, S. Imani, M.C. Hartel, A. Barfidokht, G. Tang, A.S. Campbell, P.P. Mercier, J. Wang, “Simultaneous Monitoring of Interstitial Fluid and Sweat Using a Single Flexible Wearable Iontophoretic-Biosensor Platform,” *Advanced Science*, 5, 1800880, Aug. 2018.
- J. Park, H. Garudadri, P.P. Mercier, “Channel Modeling of Miniaturized Battery-Powered Capacitive Human Body Communication Systems,” *IEEE Transactions on Biomedical Engineering*, Vol. 64, No. 2, pp. 452-62, Feb. 2017.
- S. Imani, A.J. Bhandodkar, A.M.V. Mohan, R. Kumar, S. Yu, J. Wang, P.P. Mercier, “A Wearable Chemical-Electrophysiological Hybrid Biosensing System for Real-Time Health and Fitness Monitoring,” *Nature Communications*, Vol. 7, May 2016.

13. I have also published chapters and edited books in the area of wearable and implantable medical monitors and power management. For example, I was co-editor of books entitled “Power Management Integrated Circuits,” “Ultra-Low-Power Short-Range Radios,” and “High-Density Integrated Electrocardiac Neural Interfaces,” and also authored a chapter titled “Low-Power Integrated Circuits for Wearable Electrophysiology” in the book titled “Wearable Sensors – Fundamentals,

Implementation and Applications 2nd Edition.”

14. Beyond my scientific articles and publications, I am also a named inventor on 24 U.S. patents, including several directed to power circuits and systems.

C. Teaching Experience

15. At UCSD, I have taught the following courses:

- Digital Integrated Circuits, ECE 165 (2013-2015, 2017-2025): a course that discusses fundamentals of transistor-based implementations of Boolean logic functions, then expands towards design of various combinational and sequential logic circuits. The final project involves the design of a high-speed, yet low-power digital arithmetic circuit for use in microprocessors.
- Biomedical Integrated Circuits and Systems, ECE 203 (2013-2025): a course of my own design that covers the basics of low-power integrated circuit design, including topics on pulse oximetry, instrumentation amplifiers, wearable medical devices, and more.
- VLSI Digital System Algorithms and Architectures (2014-2016): this is the graduate version of ECE 165 that includes advanced topics on microprocessor design.

16. These and the other courses I teach include a number of subjects that bear on the technology in this case. For example, in ECE 203 we discuss how pulse oximeters work, and discuss methods to develop low-power and low-noise optical readout technologies. Beyond this specific example, much of ECE 203 is focused on how to minimize power in both analog and digital circuits, while meeting performance (e.g., noise for analog, clock frequency/throughput for digital) targets. We discuss concepts like duty-cycling, power gating, power-saving modes, dynamic voltage and frequency scaling (and thus dynamic power scaling), and so on.

17. I have received a number of awards recognizing my teaching. For example, in 2016 I received the UCSD Academic Senate Distinguished Teaching Award, which is awarded yearly to five distinguished teachers across all departments at UCSD. In 2023, I received the Teacher of the Year Award from the Jacobs School of Engineering at UCSD, which is selected by ballot of UCSD students.

18. Beyond my teaching at UCSD, I have taught tutorials as part of engineering organization conferences. For example, I taught a tutorial entitled “Interface Circuits for Wearable and Implantable Sensing Systems” at the IEEE International Solid-State Circuits Society. I also presented a tutorial entitled “Power Management for the Internet-of-Things” at the IEEE Custom Integrated Circuits Conference (CICC) and gave a keynote presentation entitled “Energy-Efficient Power Management Circuits for IoT and Wearable Devices” at the IEEE Sensor Interfaces Meeting. As part of these presentations, I dive into circuit design techniques that can deliver low-power operation.

D. Service to the Scientific Community

19. My most time-consuming role related to UCSD service is the directorship of the Center for Wearable Sensors and the Power Management Integration Center, covered earlier.

20. Beyond UCSD, I have been an Associate Editor with IEEE Solid-State Circuits Letters (2017-2023), IEEE Transactions on Biomedical Circuits & Systems

(2013-2023), and IEEE Transactions on VLSI (2015-2017). I have been a Guest Editor with IEEE Open Journal of the Solid-State Circuits Society (OJ-SSCS) Special Issue on Low-Power RF Circuits and Systems (2023), and IEEE Journal of Solid-State Circuits Special Issue on the 2018 International Solid-State Circuits Conference (ISSCC) (2018). I have chaired numerous committees for international conferences including, for example, as the Executive Committee member – Demo Chair – IEEE International Solid-State Circuits Conference (ISSCC) (2022-present), Technical Program Co-Chair – IEEE Sensor Interfaces Meeting (2022-2024), Subcommittee Chair – Power Management – IEEE Custom Integrated Circuits Conference (CICC) (2021-2023), Technical Program Committee member – IEEE VLSI Circuits Symposium (2018-2022), International Technical Program Committee member – IEEE International Solid-State Circuits Conference (ISSCC) Technology Directions subcommittee (2017-2022), and Technical Program Committee member – IEEE Custom Integrated Circuits Conference (CICC) (2017-2023). I am also a peer reviewer for numerous journals including, for example, IEEE *Journal of Solid-State Circuits* (JSSC), IEEE *Transactions on Circuits and Systems I* (T-CAS I), IEEE *Transactions on Circuits and Systems II* (T-CAS II), IEEE *Transactions on Microwave Theory and Techniques* (T-MTT), IEEE *Sensors Journal*, IEEE *Transaction on Power Electronics*, *Journal of Low Power Electronics and Applications* (JLPEA), *IET Circuits, Devices & Systems*, *IEEE International*

Conference on Ultra-Wideband (ICUWB), IEEE Transactions on Biomedical Circuits & Systems (TBioCAS), IEEE Transactions on Biomedical Engineering (TBME), IEEE International Conference on Circuits and Systems (ISCAS), IEEE Biomedical Circuits and Systems Conference (BioCAS), IEEE Journal of Emerging and Selected Topics in Power Electronics, and IEEE Transactions on Industrial Electronics.

E. Materials Considered

21. In reaching the opinions that I express in this Declaration, I have considered and relied upon my education, knowledge of the relevant field, and experience. I have also reviewed and considered the materials cited in this Declaration, as well as my study of relevant materials, including the '124 Patent and its file history.

III. LEGAL PRINCIPLES

22. I am not a patent attorney, nor am I an expert in patent law. In reaching the opinions set forth here in this Declaration, I have applied the following legal principles, which have been explained to me by counsel for Oura.

A. The Person of Ordinary Skill in the Art

23. Counsel has informed me that the '124 Patent (including each claim) and the prior art is interpreted from the perspective of the person of ordinary skill in the art ("POSITA"), which I understand is a hypothetical person considered to have

the skill level and knowledge of a particular field related to an alleged invention claimed in a patent. Counsel has also informed me that this hypothetically skilled person is presumed to have before him or her all of the relevant prior art. I further understand that this “hypothetical person” can be more than one person or a team of people of different disciplines.

24. Counsel has informed me that factors that are relevant and germane in determining the knowledge base of a POSITA include: (1) the type of problems encountered in the art; (2) the solutions to those problems disclosed in the prior art; (3) the speed of innovation in the field; (4) the sophistication of the technology; and (5) the educational level of active workers in the field engaged in innovation.

25. Counsel for Oura has informed me that the “time of the invention” for the ’124 Patent is the date that the inventors filed their earliest patent application to which the ’124 Patent claims priority. I understand that the ’124 Patent claims priority to a provisional application filed November 29, 2013.

26. I understand that Dr. Anthony contends that for the ’124 Patent, a POSITA would have had:

at least a four-year degree in electrical engineering, mechanical engineering, biomedical engineering, optical engineering, or related field of study, or equivalent experience, and at least two years’ experience in academia or industry studying or developing physiological monitoring devices such as non-invasive biosensors. A POSITA would have also been familiar with, for

example, sensor system design and signal processing including inertial and other motion sensor system design, signal processing, and human-machine interfaces.

Ex-1002 at ¶ 29.

27. I generally agree with Dr. Anthony's proposed definition of a POSITA with respect to the '124 Patent and will apply his definition throughout my testimony.

28. As of the time of the invention, I had at least the level of knowledge and skill possessed by a POSITA in the relevant the field. For example, as noted above, I am the co-founder and co-director of the Center for Wearable Sensors and have extensive experience in areas such as sensors, low-power circuits, materials, electrochemistry, and bioengineering. I also had extensive experience in power-management systems specifically for hardware designs for wearable devices. My relevant experience is also based on my teaching and supervising of graduate students. In my analysis of the claims and the prior art, I have viewed them from the point of view of a POSITA.

B. Claim Construction

29. I understand that the claims in the '124 Patent are to be given their ordinary and customary meaning by a POSITA in view of the context in which they appear, including the claims, the patent disclosure, and the file history of the patent. The claim terms are to be interpreted from the perspective of those in the art at the

time of filing. I am informed that there may be exceptions to the general rule of claim interpretation if the patentee, either in the patent or its file history, has expressly or impliedly defined a term or phrase used in the claims or has expressly disavowed the claim scope that would otherwise be encompassed by the ordinary and customary meaning of the terms.

C. Anticipation

30. I understand that, to anticipate a claim, a single qualifying prior art reference must disclose, expressly or inherently, all of the elements of the asserted claim. I understand that a reference expressly discloses a claim limitation when a POSITA, reading the reference, would understand that it discloses the limitation. I understand that a prior art reference inherently discloses a particular claim element if, even though not expressly described, that element would necessarily be present in the prior art reference. I understand, however, that inherency, however, cannot be shown by mere likelihood or probabilities. My understanding is that Petitioner does not contend any claims of the '124 Patent are anticipated by prior art.

31. I understand that to analyze a claim for anticipation requires two steps. First, the claims should be construed and second, the construed terms compared to the identified prior art references to determine if all elements are expressly or inherently present in the prior art reference.

D. Obviousness

32. Counsel has informed me that a claim may be invalid as obvious if the differences between a prior art reference and the claimed invention are such that the claimed invention would have been obvious to a POSITA in view of his or her general knowledge, or in combination with other prior art references that a POSITA would be motivated to combine with the original prior art reference. I understand, however, that a patent claim may not be shown to be obvious through hindsight reconstruction of the invention from elements disclosed in the prior art.

33. Counsel has informed me that, to guard against hindsight reconstruction of an invention, certain factors must be analyzed to determine if a claim is obvious: (1) the scope and content of the prior art; (2) the level of ordinary skill in the art; (3) the difference between the prior art and the claims at issue; and (4) objective evidence of secondary considerations if offered by the patent owner.

34. I understand from counsel that, in analyzing obviousness, the prior art must be considered “as a whole.” Inventions typically are new combinations of existing principles or features, and the “as a whole” instruction prevents evaluation of the invention part by part. Accordingly, it is my understanding that an obviousness assessment cannot break an invention into its component parts (A+B+C), then find a prior art reference containing A, another containing B, and another containing C, and on that basis alone declare the invention obvious. I understand that this is an

impermissible form of hindsight reasoning, using the invention as a roadmap to find its prior art components, which would discount the value of combining various existing features or principles in a new way to achieve a new result—often the very definition of invention.

35. I also understand that obviousness requires a patent challenger to make two distinct showings: (i) that a POSITA would have been motivated to combine prior art references or to modify the prior art in a manner that yields and enables the claimed invention, and (ii) that the POSITA would have had a reasonable expectation of success in doing so.

36. I have been informed, by counsel, that the motivation to combine references, or to modify the prior art, may be found in many different places and forms, including common knowledge or understanding of those skilled in the art, the prior art as a whole, any need or problem in the field, common sense, and the inferences, judgments, and ordinary creativity of a POSITA in the field. However, I also understand that the reasonable expectation of success must be founded in the prior art. Finally, neither the motivation to combine nor the reasonable expectation of success can result from the disclosure of the challenged patent.

37. I have also been informed that the reasonable expectation of success requirement for obviousness does not necessitate an absolute certainty for success and allows for some degree of unpredictability in the art so long as there was a

reasonable probability of success. However, I understand that there is no reasonable expectation of success where the prior art gave no indication of which parameters were critical nor direction as to which of many possible choices is likely to be successful, and instead only gave general guidance as to the particular form of the invention or how to achieve it. I also understand that reports which demonstrate POSITAs using the prior art met with failure provide strong evidence that there was no reasonable expectation of success. Similarly, if a POSITA would have viewed the reference as describing teachings that were contrary to the patented invention, i.e., the reference taught away from it, a strong inference exists that the reference does not provide a reasonable expectation of success to render the invention obvious.

38. Counsel has informed me that one of the factual inquiries when determining the obviousness of a patent is to consider objective evidence related to the issue of obviousness, sometimes called “secondary considerations of non-obviousness” or “objective indicia of non-obviousness.” I understand that such evidence can often be probative of the issues of obviousness. Such objective indicia of non-obviousness can include:

- a. commercial success of the products and processes covered by the invention;
- b. copying of the invention by others in the field;
- c. praise of the invention by others skilled in the art;

- d. long-felt and unmet need in the art that was satisfied by the invention of the patent;
- e. failure of others to achieve the results of the invention;
- f. expression of disbelief of skepticism by those skilled in the art upon learning of the invention; and
- g. unexpected results achieved by the invention.

39. I understand that there must be a nexus between the patented invention and the evidence of secondary considerations. I further understand that there is a presumption of such a nexus if the claims of the patent are coextensive with a product or products that are the subject of the secondary considerations evidence. I further understand that in order for a claim to be coextensive with a product, one must look at the claim as a whole and not just the new claimed feature. In addition, the claimed invention should not be merely a subcomponent of the products sold but should encompass the entire apparatus.

IV. OVERVIEW OF THE '124 PATENT

A. Specification

40. The '124 Patent, titled "Wearable Computing Device," issued on November 30, 2021, and has an earliest priority date of November 29, 2013. Ex-1001. The '124 Patent lists three inventors: Curt C. von Badinski, Michael J. Strasser, and Peter Miles Twiss. Ex-1001.

41. The '124 Patent relates to a “wearable fitness monitor . . . which is suitable for prolonged usage with accurate results.” Ex-1001 at 6:17-20. Wearable electronics can “help monitor activity within the wearer’s body.” Ex-1001 at 1:30-31. “However, many current wearable electronics are bulky and can be intrusive or interfere with a person’s daily life.” Ex-1001 at 1:31-33. Consequently, “conventional wearable fitness monitors such as clip-on devices, wristbands, or watch-[type] monitors still often suffer from inaccuracy mainly because they lack constant and consistent ways to read from the body areas they aim to monitor.” Ex-1001 at 6:52-56.

This invention overcomes the disadvantages of the prior art by providing a wearable computing device (WCD) in the shape of a ring. The wearable computing device can be worn for extended periods of time and can take many measurements and perform various functions because of its form factor and position on the finger of a user.

Ex-1001 at 1:39-44.

42. In particular, the patent describes “a smart ring . . . having a U-shape interior storing component’s including a curved battery, . . . a semi-flexible PCB . . . a motion sensor . . . a memory . . . a transceiver . . . a temperature sensor, . . . a processor . . . and a potting material . . . [that] is substantially transparent to visible light, infrared light, and/or ultraviolet light. Ex-1001, Abstract. Fig. 6 shows an

exploded view of one embodiment of the invention:

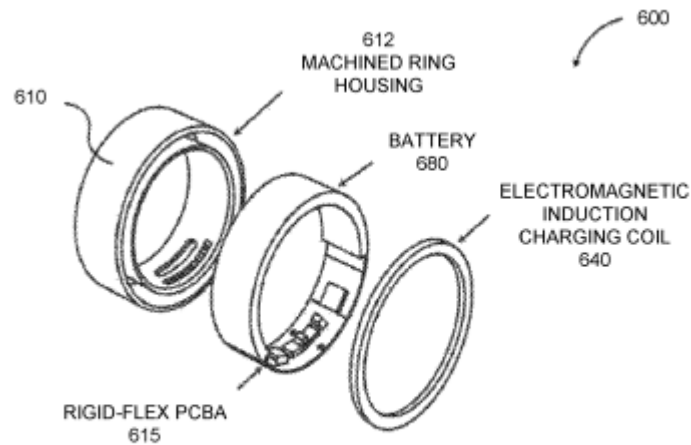


FIG. 6

Ex-1001 at Fig. 6.

43. As shown in Fig. 6, a curved battery 680 and printed circuit board 615 are shaped and configured to fit within ring housing 612. The ring is also equipped with sensors that enable the ring to “function as a sleep monitor, a heart rate sensor, a cardiac monitor[,] a body temperature detector, or the like.” Ex-1001, 6:67-7:1. Examples of such sensors are shown below in Fig. 3B.

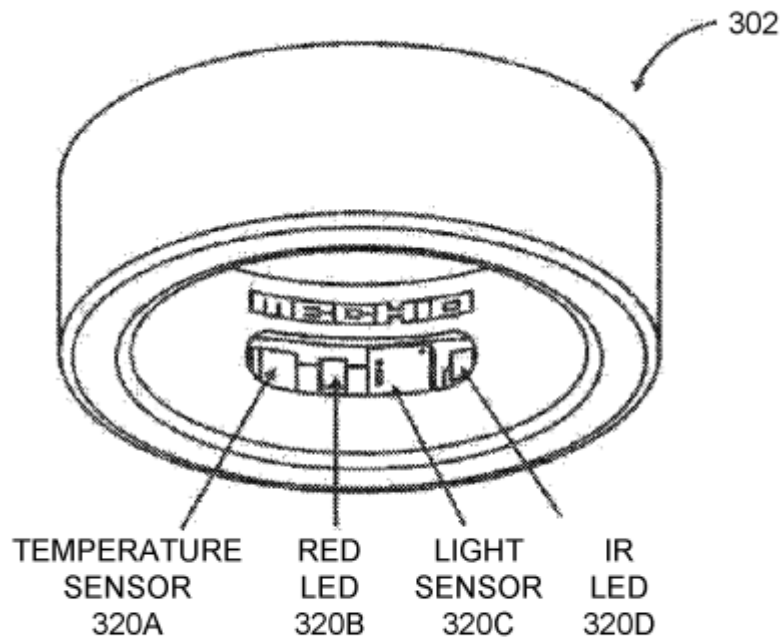
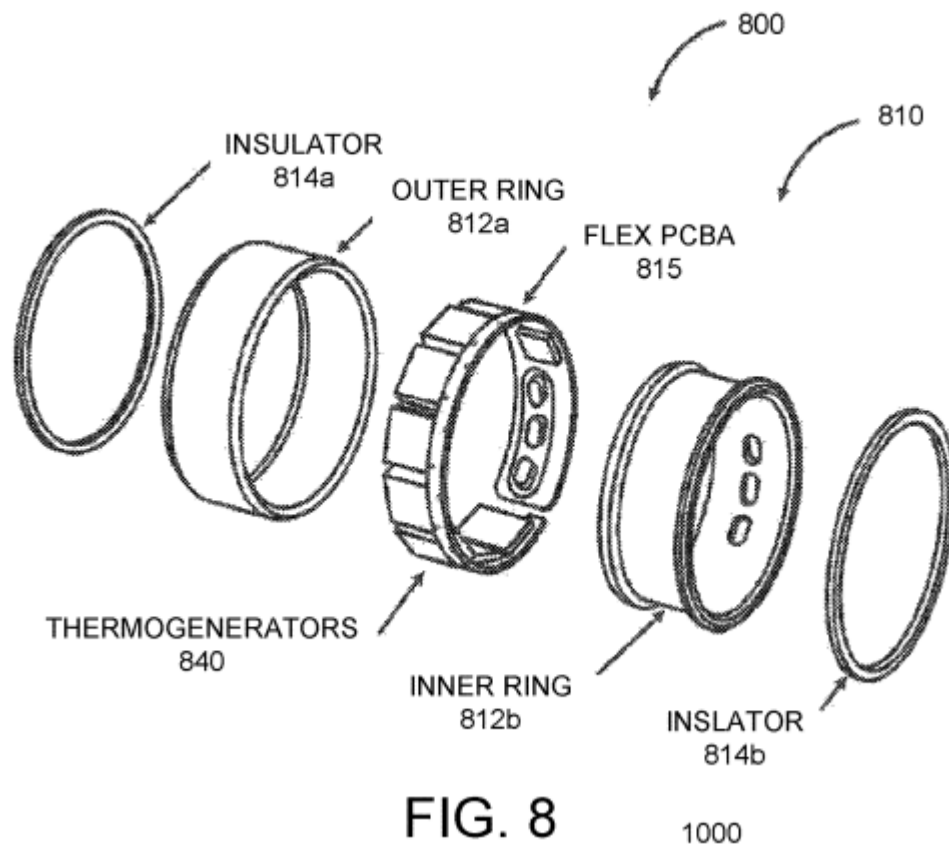


FIG. 3B

Ex-1001 at Fig. 3B.

44. Sensors 320A-320D “are directly related to biological sign monitoring [and] can be configured and positioned in a way that is close to the skin (e.g., facing the interior window 130 of the WCD 110).” Ex-1001 at 8:42-44. A motion sensor (not shown) may also be used to detect an “activity level” of the wearer and whether the wearer is sleeping or engaged in exercise. Ex-1001 at 9:15-21 (“In some embodiments, the WCD 110 can utilize the accelerometer to measure the activity level (e.g., arm movement) in conjunction with the measured heart rate to determine if the user is walking horizontally, running, swimming, or climbing stairs. Other activities can be identified by the WCD 110 may include biking or sleeping.”).

45. Significant to the claims discussed herein, the '124 Patent discloses an interior enclosure portion coupled to an exterior enclosure structure to form a housing for accommodating the battery, circuit board, and sensors. These enclosures are shown below in Fig. 8 as elements 812a (outer ring) and 812b (inner ring).



Ex-1001 at Fig. 8.

46. Fig. 11 below shows a cross section of one embodiment of the ring having a housing 1310 comprising internal potting or encapsulant 1314 and external housing 1312. Ex-1001 at 15:62-66. A space 1320 is formed and occupied by battery 1330 and printed circuit board 1340. Ex-1001 at 16:3-7.

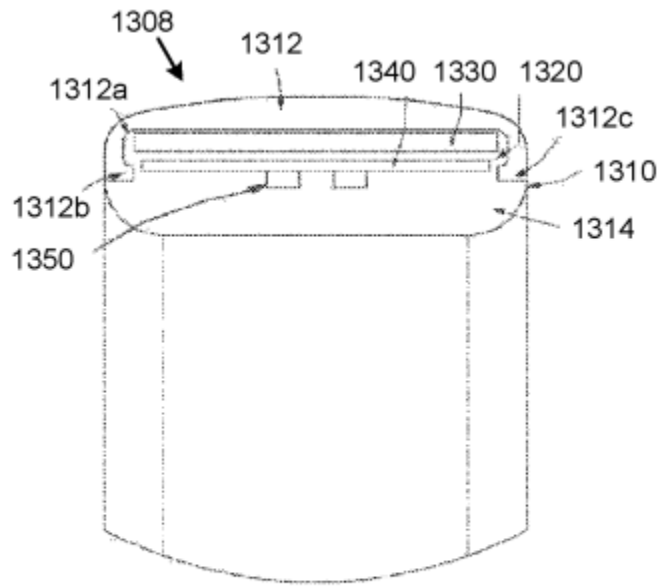


FIG. 11

Ex-1001 at Fig. 11.

B. Prosecution History

1. Application No. 17/013,348

47. For over a year, the United States Patent and Trademark Office (USPTO) examined the application that issued as the '124 Patent. Ex-1004. The application claimed priority through a continuation and two divisional applications to Application No. 14/556,062, filed November 29, 2014, which later issued as U.S. Patent No. 9,582,034. The '124 Patent further claims priority to Provisional Application Nos. 62/006,835, filed June 2, 2014, and 61/910,201 filed November 29, 2013. Ex-1004 at 2.

2. Application No. 16/224,686

48. The prosecution history of related U.S. Application No. 16/224,686, which issued as U.S. Patent No. 10,768,666 (Ex-2007), is relevant as it involved the USPTO's consideration of U.S. Patent Application Publication No. US 2013/0106603 to Weast (Ex-2006). Weast is significant because its disclosure regarding a wrist-worn athletic device with a curved battery and flexible PCB (e.g., Weast at Fig. 6) is substantially identical to the disclosure relied upon by Petitioner from Mestas (Ex-1010 at Fig. 6) in the present proceeding.

49. During the examination of the '686 application, the Examiner issued an Office Action (Ex-2008) rejecting then-pending claims as obvious over Vescovi (U.S. Patent Application Publication No. 2015/0277559, Ex-2120) in view of Weast. The Examiner specifically asserted that it would have been obvious to modify Vescovi's disclosed ring-like device to use Weast's taught "curved battery" because it "would increase the overall functionality of the device by providing the user with a battery shape to fit the shape of the ring itself, thereby more efficiently using the space inside the ring" Ex-2008 at 4.

50. In response to this rejection (Ex-2010), the Applicant for the '686 application argued that the Examiner's proposed combination was improper. This argument hinged on the distinction commonly understood in the art relating to wearable devices. Generally, a "ring" is understood as an ornament or device worn

on a finger; Merriam-Webster defines a ring as “a circlet usually of precious metal worn especially on the finger.” Ex-2009. This is distinct from circumferential items designed for other body parts, such as Weast’s device, which was a “bracelet.” A “bracelet” is defined by Merriam-Webster as “an ornamental band or chain worn around the wrist,” while a “necklace” is described as “an ornament worn around the neck.” *Id.* Finally, “band” is defined as “a strip serving to join or hold things together,” “a thin flat encircling strip,” or “a narrow strip serving chiefly as declaration.” *Id.*

Leveraging this distinction, the Applicant contended:

However, as the Applicants’ claims are directed to a ring, and the device of Weast is directed to a bracelet, the two devices are not capable of being combined in the manner suggested by the Office. Specifically, a battery for a bracelet, curved or otherwise, would not be of a dimension to be fitted within the confines of a cavity of a ring. Nor is there any teaching within Weast as to how such a battery can be re-configured to do so. Consequently, even if the two references of Vescovi and Weast could be combined, there is no likelihood that the Applicants’ claimed invention would thereby be successfully derived.

Ex-2010 at 3.

51. Following these arguments, the Examiner withdrew the rejection over Vescovi in view of Weast and issued a Notice of Allowance for the ’686 application Ex-2011. I agree with the Examiner. This history demonstrates that the USPTO, when presented with art substantially similar to Mestas (*i.e.*, Weast) teaching a

curved battery in a bracelet, was persuaded that it was not obvious to apply such a battery to a ring form factor due to dimensional incompatibilities and lack of enabling teachings for reconfiguration. The substantive implications of this prior examination will be discussed further in Section VII in relation to the specific grounds of unpatentability asserted by Petitioner.

V. CLAIM CONSTRUCTION

52. As stated above in Section III regarding legal principals of patent law, I have been informed by counsel that the first step in a validity analysis is properly construing the terms of the asserted patent claims.

53. Petitioner's expert, Dr. Anthony, states in his Declaration that he does not believe that any claim term in the '124 Patent requires explicit construction to resolve the issues presented in this Petition. Ex-1002 at ¶ 163.

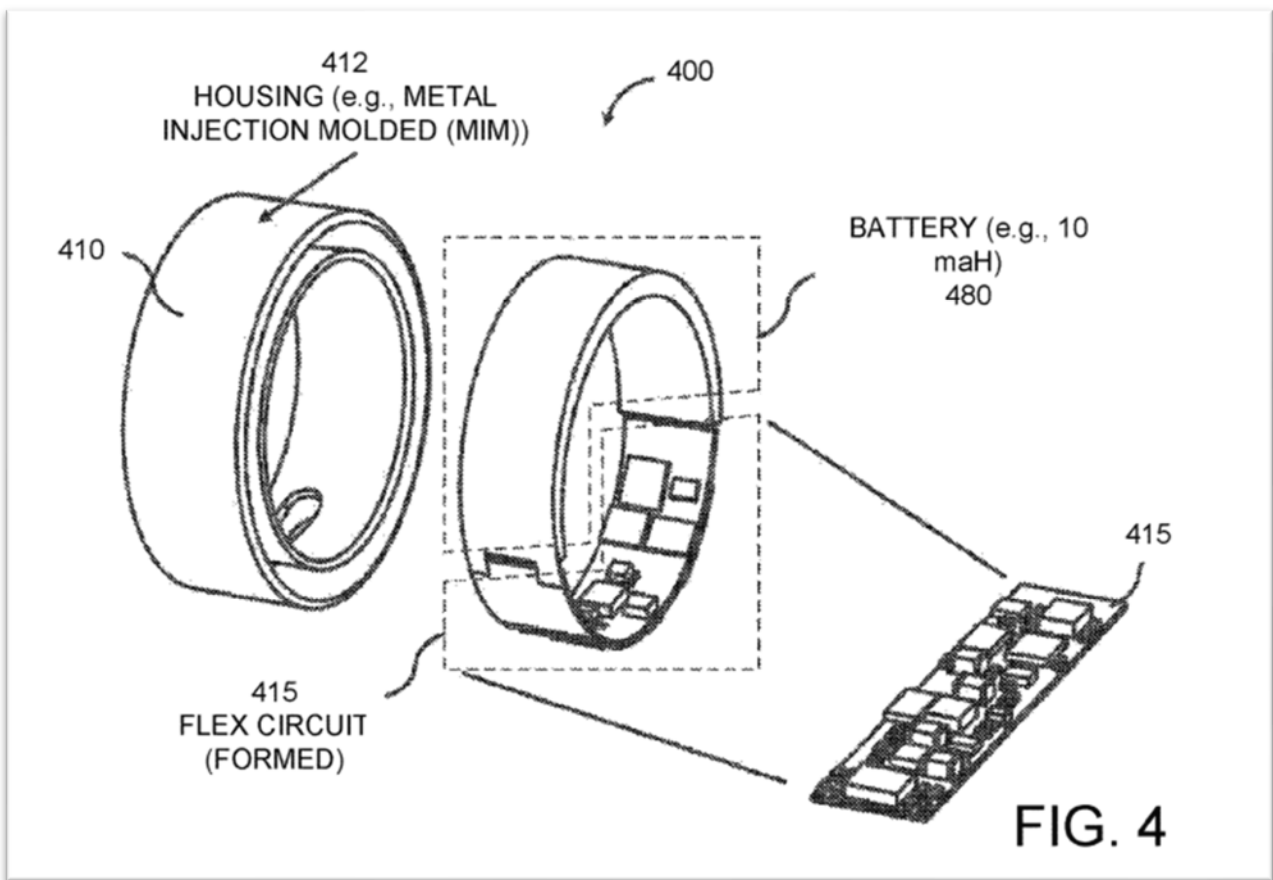
54. While many terms may be understood by a POSITA according to their plain and ordinary meaning, the term "wearable computing device configured to be worn around a finger of a wearer" as used in the challenged claims has become a point of discussion relevant to the Board's analysis in its Institution Decision. IPR2025-00147, Paper 11 at 10-12. Therefore, clarification on this term is warranted.

55. A POSITA at the time of the invention (November 29, 2013) would understand "wearable computing device configured to be worn around a finger of a

wearer” as used in claims 1 and 14 (Ex-1001 at 33:38, 35:38-39) to refer to a finger-worn ring wearable computer device. The prosecution history of the ’124 Patent, and prosecution history of related applications, confirms this. Thus, it is my opinion that the term “wearable computing device configured to be worn around a finger of a wearer” as used in the claims—including the preamble—is limited to a finger-worn ring wearable computer device.

56. This understanding is firmly rooted in the ’124 Patent’s own disclosure. The Summary of the Invention explicitly states: “This invention overcomes the disadvantages of the prior art by providing a wearable computing device (“WCD”) in the shape of a ring. The wearable computing device can be worn for extended periods of time and can take many measurements and perform various functions because of its form factor and position on the finger of a user.” Ex-1001 at 1:39-44.

57. The specification further details this finger-centric design, noting, for example, “It is recognized by the present disclosure that a human being’s finger can come in various different sizes and so should the WCD 410.” Ex-1001, 12:64-66.



Ex-1001 at Fig. 4.

58. As shown below, the illustrative embodiments throughout the '124 Patent consistently depict and describe a device worn on the finger.



FIG. 9B

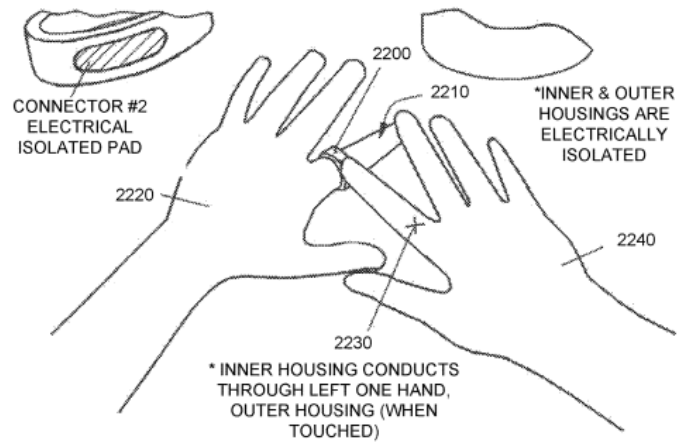


FIG. 17A

Ex-1001, Fig. 9B, Fig. 17A.

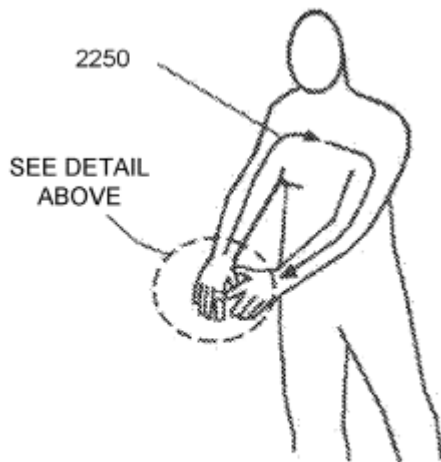


FIG. 17B

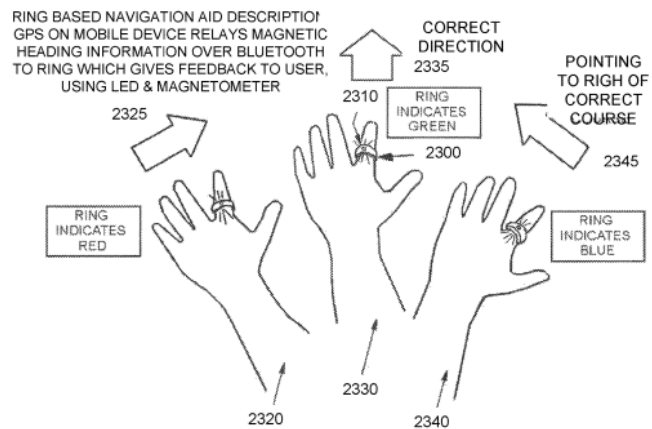


FIG. 18A

Ex-1001 at Fig. 17B, Fig. 18A.

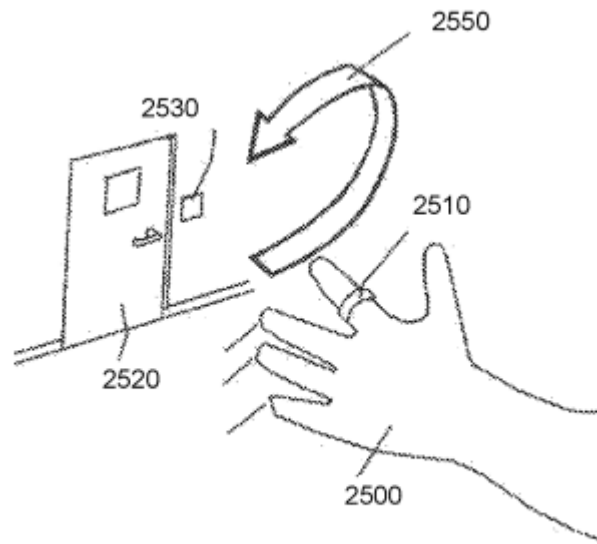


FIG. 20

Ex-1001 at Fig. 20.

59. While the '124 Patent broadly discusses the general applicability of WCD technology to other form factors (*e.g.*, Ex-1001, at 6:22-30 and 33:57), in light of the claims, specification, and prosecution history, it is clear that such disclosure does not support construing the term “wearable computing device configured to be worn around a finger of a wearer” more broadly than a finger-worn ring wearable computer device.

60. Patent Owner expressed this understanding when distinguishing the prior art during the prosecution of related U.S. Patent 10,139,859 (“’859 Patent”). The Examiner initially rejected claims over prior art references Raghunath and Ajagbe. Ex-2014, 447-453. As detailed in those references, Raghunath discloses a “rechargeable wrist watch system” (Ex-2004 at Fig. 1, ¶ 22) and Ajagbe discloses a

device “configured to be worn around the wrist of a user.” Ex-2005 at Abstract. In response to these rejections, Applicant amended the claims to consistently recite a “ring” form factor and argued that these references failed to disclose a device configured as a ring with the claimed internal components:

1. (Currently Amended) A system, comprising:
a wearable ring computing device, the ring computing device including a housing, the housing having an interior bounding member and an exterior bounding member, the interior bounding member and the exterior bounding member being configured for being coupled together to form a waterproof cavity there between;

Ex-2014, 478

61. Specifically, Applicant argued that Raghunath and Ajagbe were not directed to a wearable computing device configured as a ring and did not disclose the claimed components within such a ring structure.

Raghunath is not directed to a wearable computing device, in a first instance, and is certainly not directed to a wearable computing device that is configured as a ring. As such Raghunath neither discloses a ring, nor discloses a ring having the claimed components, including a curved battery, a sensory module, and a flexible printed circuit board. Further,

Ex-2014, 472-473

62. The Examiner was persuaded by these arguments based on the “ring” distinction, leading to the allowance of the claims. Ex-2014 at 497, 506. This prosecution history reinforces that the term “ring” in the claims was understood and

argued to mean a finger-worn device, distinguishing it from other wearable form factors like those disclosed in Raghunath and Ajagbe.

63. Moreover, during prosecution of another related family member, U.S. Patent No. 10,768,666 patent, the examiner rejected the pending claims over Vescovi in view of Weast, arguing that it would be obvious to apply the curved battery disclosed in Weast and Mestas to the ring of Vescovi:

The claimed battery being curved is not specifically disclosed by Vescovi. Weast teaches a wearable electronic device that is curved and utilizes a curved battery (Weast: paragraph 422). Modifying Vescovi to use a curved battery would increase the overall functionality of the device by providing the user with a battery shape to fit the shape of the ring itself, thereby more efficiently using the space inside the ring. Therefore it would have been obvious to one of ordinary skill in the art to modify Vescovi according to Weast.

Ex-2008, at 4.

64. Oura responded that Weast's battery was inapplicable to a ring and not a proper basis for the Office's obviousness rejection:

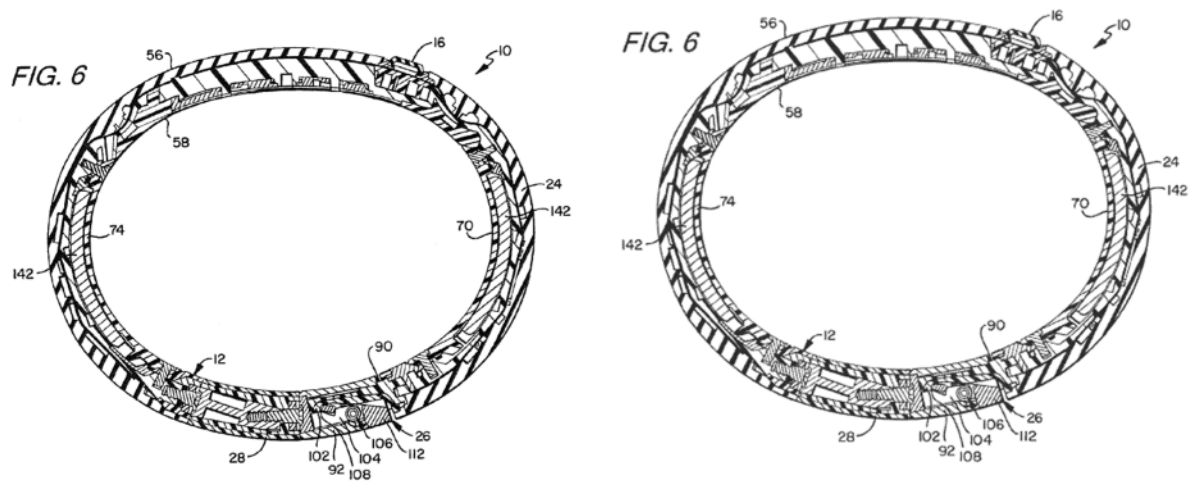
As acknowledged by the Office, Vescovi is further deficient for failing to teach a curved battery, a flexible printed circuit board, and the functionality of remotely unlocking a computing device. The Office, therefore, relies on Weast for the teaching of a curved battery.

However, as the Applicants' claims are directed to a ring, and the device of Weast is directed to a bracelet, the two devices are not capable of being combined in the manner suggested by the Office. ***Specifically, a battery for a bracelet, curved or otherwise, would not be of a dimension to be fitted within the confines of a cavity of a ring. Nor is there any teaching within Weast as to how such a battery can be re-configured to do so.***

Consequently, even if the two references of Vescovi and Weast could be combined, there is no likelihood that the Applicants' claimed invention would thereby be successfully derived. Consequently, a *prima facie* case for obviousness has not been established, and this rejection may be withdrawn.

Ex-2010 at 3. In response to this argument the examiner withdrew the rejection and allowed the claims. Ex-2011 (Notice of Allowance). I agree with the examiner's decision.

65. Notably, Weast's figures are identical to Mestas's and disclose the same battery 142 relied on by Petitioner in Mestas:



Ex-2006 at Fig. 6; Ex-1010 at Fig.6.

66. Petitioner’s attempt to broaden the term “wearable computing device configured to be worn around a finger of a wearer” to encompass disclosures like Yuen’s vague reference to “toe band” (Ex-1006 at 24:35-40) by citing a general statement in the ’124 Patent—that a WCD could take other forms like a “wrist band” (Ex-1001 at 6:25-30)—is unpersuasive in view of the foregoing prosecution history. The ’124 Patent’s disclosure does not support construing the term “wearable computing device configured to be worn around a finger of a wearer” more broadly than a finger ring.

67. Dr. Anthony fails to account for this prosecution history in his declaration. Specifically, while Dr. Anthony presents a discussion of finger and toe anatomy in an apparent effort to equate Yuen’s “toe band” with the claimed “ring computing device,” this line of reasoning entirely overlooks how the ’124 Patent and related patent’s prosecution history decisively defined and limited the claimed

“wearable computing device configured to be worn around a finger of a wearer” to a finger-worn device to secure allowance of the claims. The anatomical comparisons Dr. Anthony draws are therefore irrelevant to the proper construction of “wearable computing device configured to be worn around a finger of a wearer” in the context of the ’124 Patent and related patent, as the distinctions made during prosecution to overcome prior art specifically narrowed its scope to a device for a finger. *E.g.*, Ex-1002, ¶¶274, 307, 322.

68. The distinction made during prosecution aligns with the common understanding of various terms in the art relating to wearable devices. Merriam-Webster defines a ring as “a circlet usually of precious metal worn especially on the finger.” Ex-2009. This is distinct from circumferential items designed for other body parts, such as “bracelets” or “bands” for the wrist, or “necklaces” for the neck. A “bracelet” is defined by Merriam-Webster as “an ornamental band or chain worn around the wrist,” and a “necklace” is described as “an ornament worn around the neck.” *Id.* Finally, “band” is defined as “a strip serving to join or hold things together,” “a thin flat encircling strip,” or “a narrow strip serving chiefly as declaration.” *Id.*

69. Prior art documents also reflect these distinctions: for example, Ajagbe describes its wrist-worn device as a “SOLAR BRACELET”, and Mestas details a “wearable device assembly” often configured as a wristband for athletic monitoring, explicitly stating it is “configured for wearing around a user’s wrist.” Ex-1010 at ¶

0152. Yuen also describes its biometric monitoring devices as being secured with a “band” for use on the “arm, wrist, leg and/or ankle.” Ex-1006 at 12:50-52. Even when discussing a “finger-ring”, prior art like Schröder uses this specific terminology to denote its function and placement. Ex-1007 at 2:62-63. Thus, based on the common nomenclature and the explicit language of the ’124 Patent specification, the term “wearable computing device configured to be worn around a finger of a wearer” in the claims clearly refers to a finger ring device.

70. Therefore, a POSITA would understand the claimed “wearable computing device configured to be worn around a finger of a wearer” to be a finger ring device, and this understanding is applied throughout my subsequent analysis.

VI. TECHNOLOGY BACKGROUND

A. State of Wearable Ring Devices up to 2013

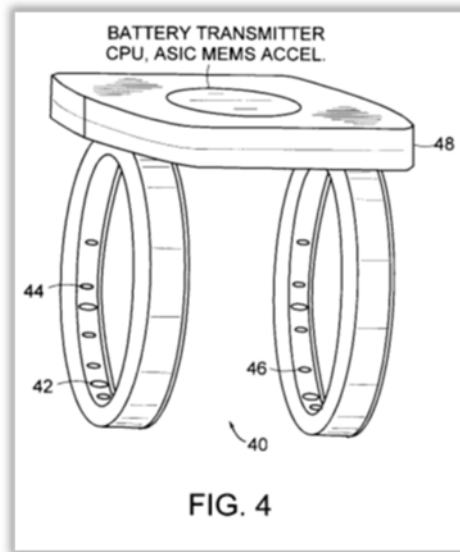
71. In 2013, there were no commercially available smart rings. I know because in 2012-2013 timeframe, I was establishing the Center of Wearable Sensors at UCSD, and thus I am familiar with the state of the art at the time of the invention of the ’124 Patent.

72. The lack of commercially available smart rings in 2013 is not surprising. Prior to the ’124 Patent, no one had managed to construct a wearable smart ring that people would actually want to wear continuously. Continuous wear is critical to measure certain characteristics related to cardiac health or sleep. Despite

the known goals of comfort and compactness in a ring design, prior designs located components outside of the ring housing, formed a large protrusion above the finger, and generally failed to teach a POSITA how to arrange the components within a housing (like Vescovi).

73. A team of researchers at MIT performed the first significant research into designing and constructing a wearable smart ring. Professor Asada, who I have personally met, and his team filed for patents, constructed prototypes, and published articles about their work.

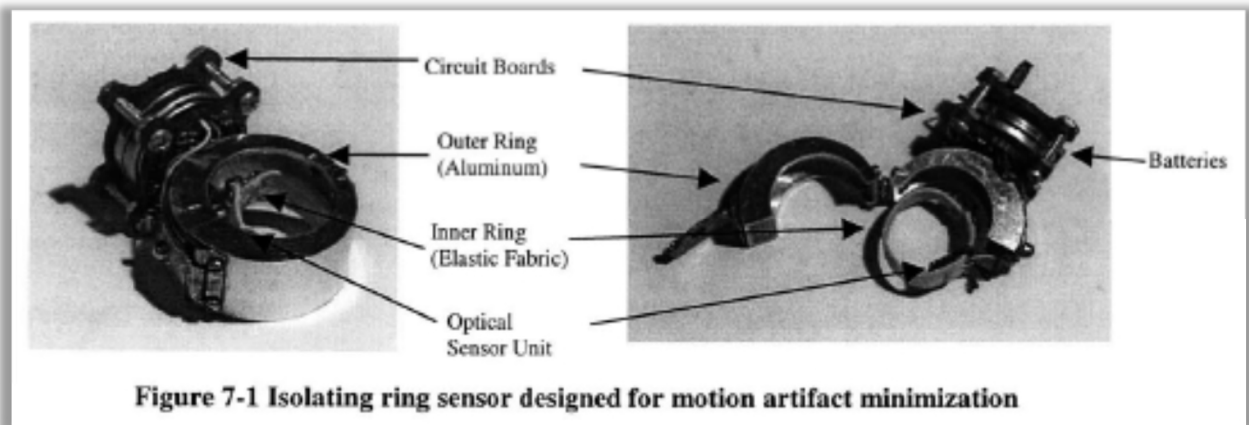
74. In 1997, Asada filed for a patent and recognized the advantage of health monitoring using a finger ring: “The finger ring sensor may be worn by the patient at all times, hence the health status is monitored 24 hours a day.” Ex-2025 at 1:56-58. The implementation of the finger ring taught mounting the battery, CPU, and other components on top of the ring:



Ex-2025 at Fig. 4.

75. Three years later in 2000, MIT graduate student Rhee published his dissertation on a wearable ring and noted “it is important that the ambulatory monitoring devices should be easy to wear in everyday life. Such long-term, ambulatory devices must be compact, lightweight, and comfortable to wear at all times.” Ex-1035 at 9-10.

76. The two prototypes—of which the top one I have personally held and inspected—shown in the dissertation stacked components on top of the ring:



Ex-1035 at 68.

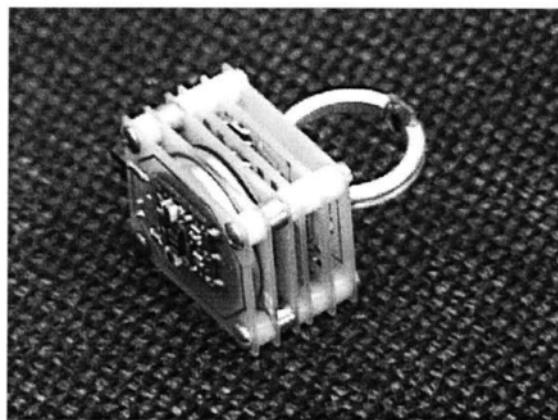
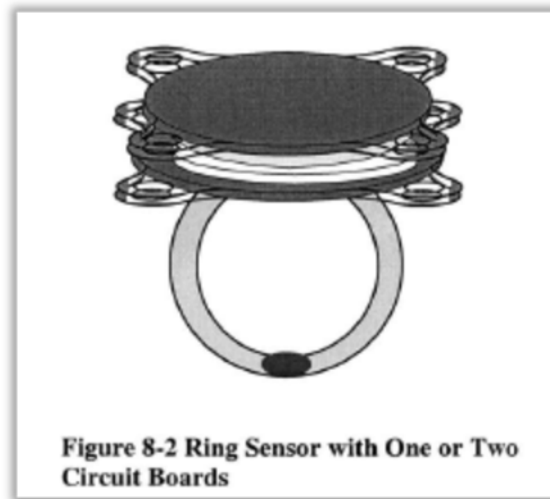


Figure 8-1 First Prototype Ring Sensor

Ex-1035 at 75.

77. Rhee acknowledged that “the size of the first prototype, as shown in Figure 8-1, was too large to be of use in real life.” Ex-1035 at 74. Rhee’s proposed solution sought to reduce the number of circuit boards, but continued the practice of mounting components on top of the ring:



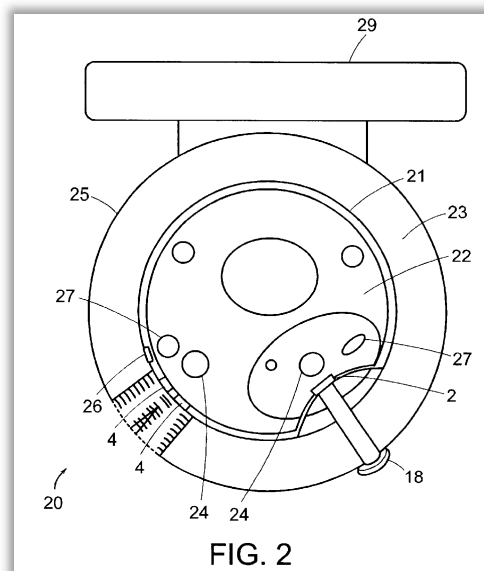
Ex-1035 at 75; Ex-1035 at 74 (“Therefore, the final ring must be compact and light enough so that the person who wears it does not feel its presence. In the initial effort, we plan to consolidate all the circuit elements on to a small, multi-layer printed circuit board (Figure 8-2).”).

78. In an IEEE article published in 2003, Asada again acknowledged that the ring is “ideal for long term measurements.” Ex-1037 at 3. Asada again acknowledged that “comfort” and “compactness” were keys to making a useable wearable finger ring. Ex-1037 at 1-2. In terms of comfort and compactness, Asada’s prototype changed little in the three years since the Rhee dissertation—again mounting the circuit board and battery on top of the ring:



Ex-1037 at 7.

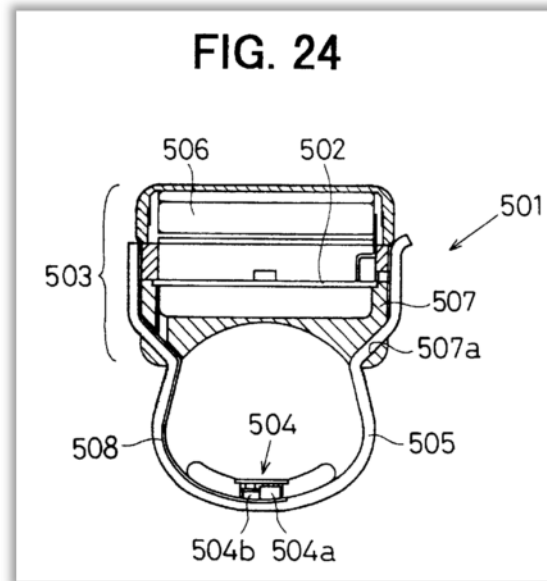
79. U.S. Patent No. 6,699,199 issued to Asada in 2004. Ex-1034. The preferred embodiment of that patent similarly teaches locating “circuit module 29 containing battery 12, processor 6, and transmitter 8” outside base ring 23 which includes sensor band 21. Ex-1034 at 3:18-19.



Ex-1034. at Fig. 2.

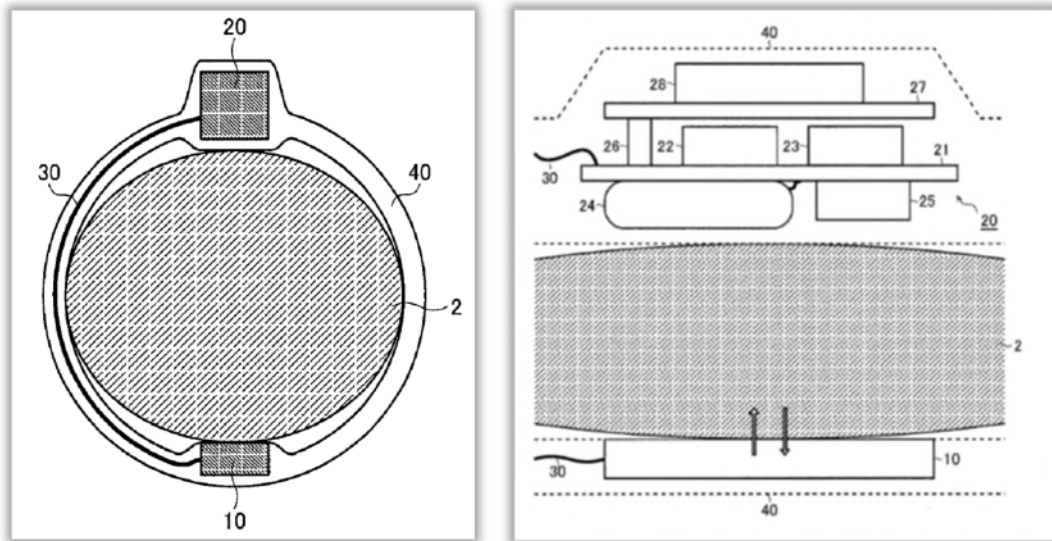
80. Other researchers followed Asada’s design choices. U.S. Patent No.

6,608,562 issued in 2003 to Kimura. Ex-1028. Kimura followed Asada's arrangement of externally mounting components to the ring body above the finger:



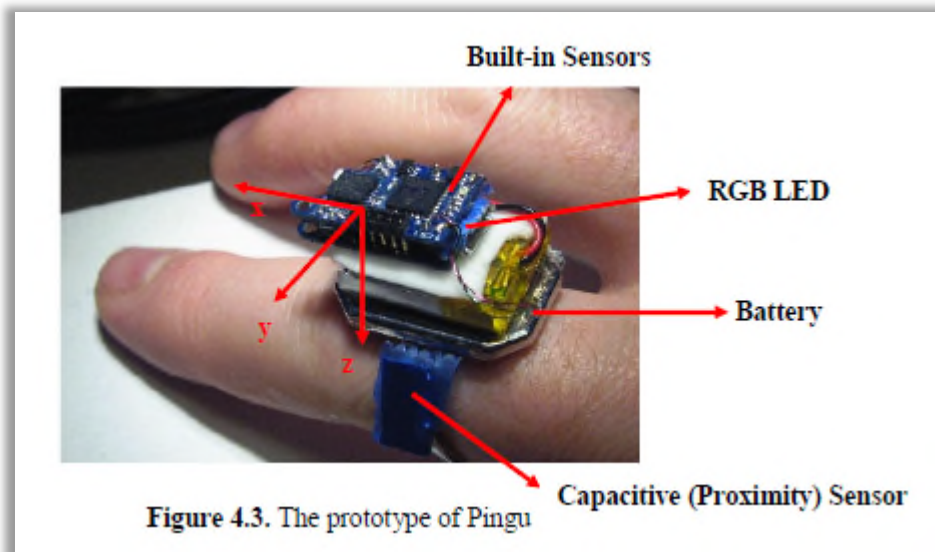
Ex-1028 at Fig. 24. Like Asada, Kimura shows the battery 506 and circuit 502 mounted on top of the ring and the light detector 504 at the bottom of the finger. Ex-1028 at 14:55-67.

81. In 2012, about ten years after Asada's design, Niwa (Ex-1005) again kept the same basic design taught by Asada. Niwa stacked its circuit and battery 20 at the top of the ring and mounted the light sensor 10 at the bottom of the finger.



Ex-1005 at Fig. 22; Ex-1005 at Fig. 29.

82. Another effort in 2012 showed those skilled in the art were still “stacking” circuit boards and batteries on top of the ring:

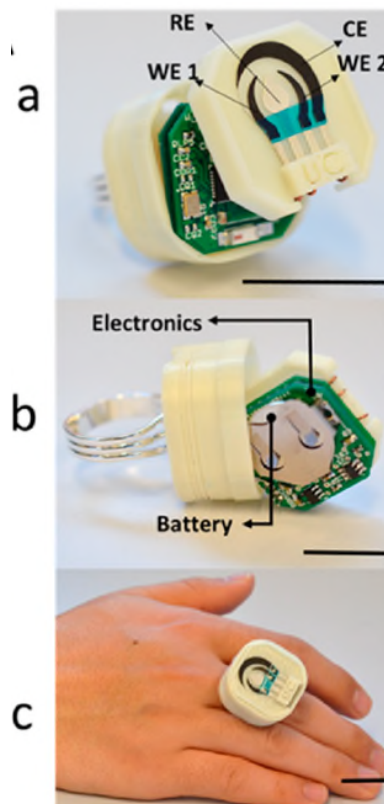


Ex-2032.

83. Indeed, in 2012-2013 timeframe when I was establishing the Center of

Wearable Sensors at UCSD, I considered building a finger-worn wearable smart ring device. However, my colleagues and I also looked to stacking the components external to the ring given a number of constraints, including power requirements needed for the finger-worn wearable smart rings.

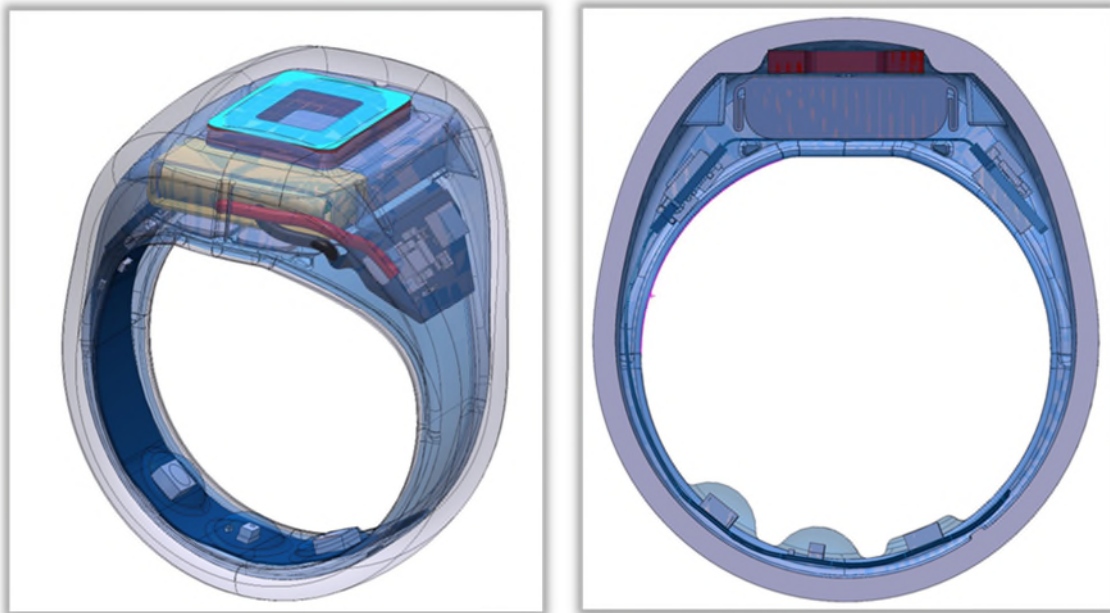
84. The Center of Wearable Sensors eventually built a smart ring that, as shown below, placed all the components, including battery and printed circuit board, above the ring, similar to all the prior art in the field of smart rings:



Ex-2149 (Published 2017).

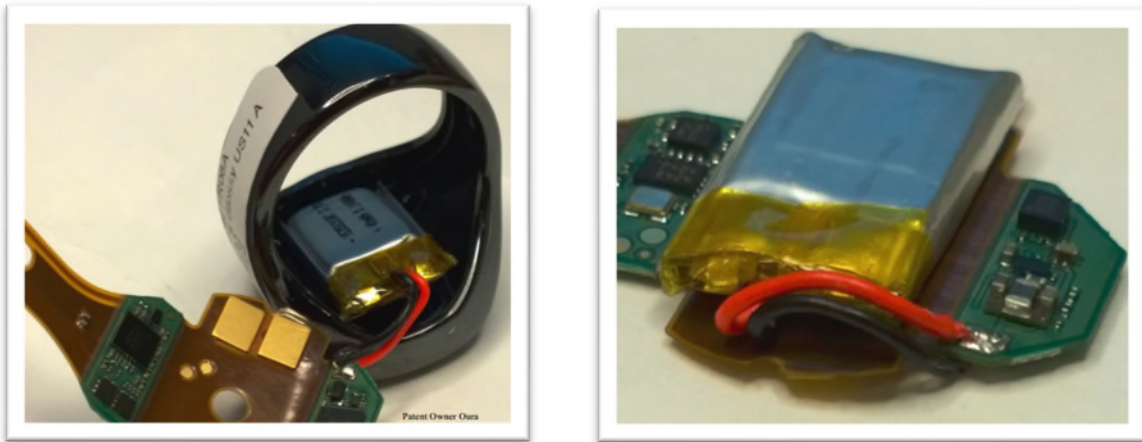
85. Even after the priority date of the '124 Patent, Oura's first-generation ring released in 2015, released prior to Oura's use and acquisition of the '124 Patent,

used a Superbowl ring-type design, with the battery and other components mounted on top of the ring¹, as all of the prior art prototypes in the smart ring area did.



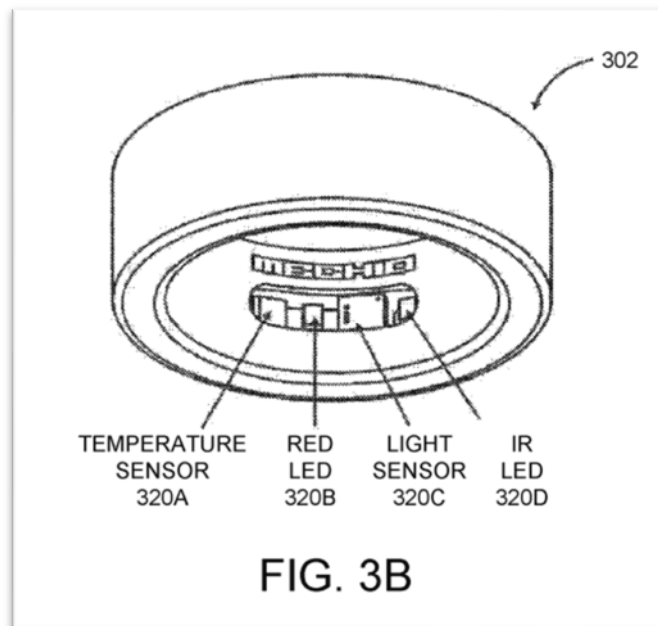
Ex-2033.

¹ I understand that the inventors of the '124 Patent were initially part of another company called Motiv that launched the Motiv Ring. Ex-2047. I further understand that Oura subsequently acquired Motiv and its patented technology.



Ex-2148.

86. In sum, nothing similar to the design implemented in the '124 Patent had ever been seen before.



Ex-1001, Fig. 3B.

B. Dr. Anthony Misrepresents the State of Wearable Ring Devices up to 2013

87. While reviewing Dr. Anthony's section title "Wearable Electronic Devices Were Known" (Ex-1002 ¶¶ 42-146), I noticed discrepancies, a few of which I note below.

1. Dr. Anthony's Example Li-Po Batteries Are Unsuitable for Use in a '124 Claimed Finger Ring Device

88. Dr. Anthony alleges that in 2013, lithium-polymer (Li-Po) batteries and solid-state batteries "offered high energy density while being flexible and lightweight, making them ideal for integration into, small irregular enclosures, such as the curved interior of a finger ring." Ex-1002 at ¶53. I disagree.

89. Dr. Anthony listed a number of example Li-Po batteries that he claimed would "provide sufficient power for devices . . . even in miniaturized applications like finger rings" and "that were feasible for use in small wearable devices like finger rings." Ex-1002 at ¶¶94-95.

90. Dr. Anthony first points to Ketabdar (Ex-1017 at 503) as having such a battery. The Ketabdar reference discloses two images of its device, one aspirational, and one that was actually built. Ex-1017 at 503 ("In our first prototype the battery is located **under the sensory platform (see Figure 2)** although in the final version it will be augmented at the ring band (Figure 1)"). Dr. Anthony uses Figure 1's aspirational drawing as support that Li-Po battery integration into a device

was possible. But Dr. Anthony conceded that, to his knowledge, the aspirational device was never actually built, let alone prior to 2013. Ex-1002 at ¶¶94; See Ex-2150 at 53:7-58:13. Contrary to Dr. Anthony's representation of Ketabdar, what Ketabdar actually discloses is also superbowl-style ring with the battery and other large components sitting atop the ring device, as in all of the prior art smart ring designs disclosed prior to the '124 Patent.

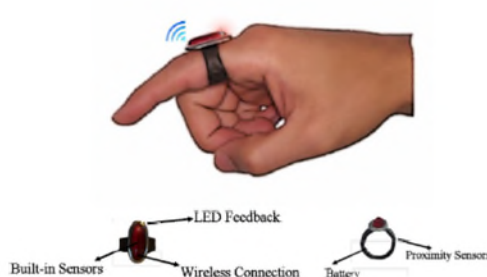


Figure 1. The *Pingu* design concept.

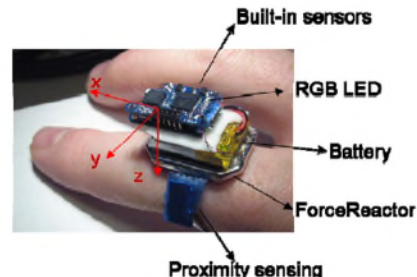


Figure 2. The *Pingu* prototype.

Ex-1017, Figs. 1, 2.

91. Dieffenderfer (Ex-1018) is also listed as support for Li-Po Battery integration into a finger ring device. Ex-1002 at ¶¶95. Dieffenderfer's device and battery are massive and rigid, and are in line with what would reasonably go into a wrist-worn device circa 2013. Such a design is not suitable for use or integration into a '124 Patent claimed finger ring device.

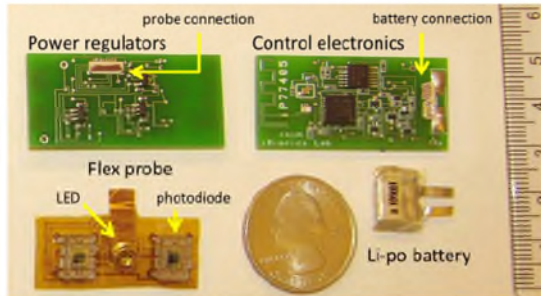


Fig. 3. Flexible probe (bottom-left) and rigid electronics board (front and back shown together at the top). The probe and the Li-Po battery are connected to the electronics board through FFC connectors.

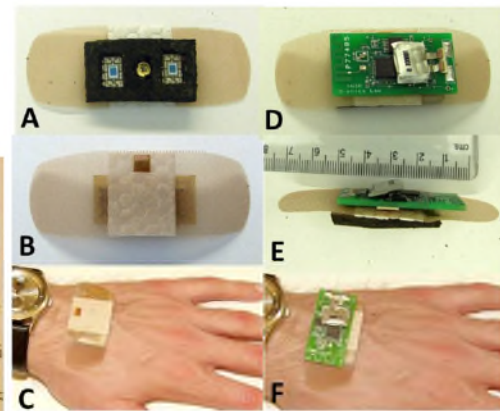


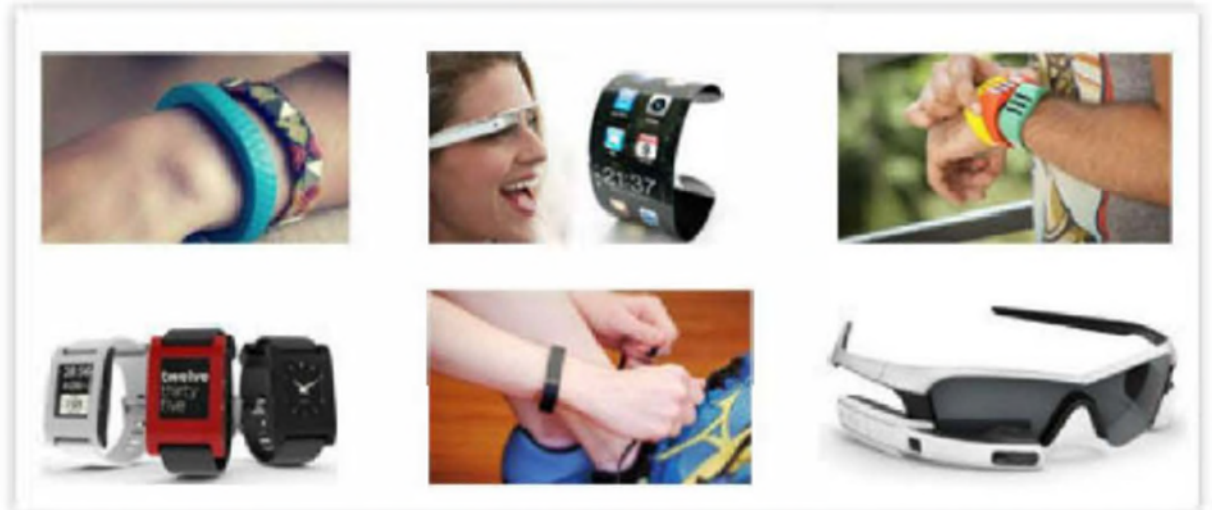
Fig. 4. Flexible probe is sandwiched between a bandage and foam cushion (A). The connection for the board is extended through a small slit on the backside of the bandage (B). The electronics board connection can be seen in D (top view) and E (side view). The bandaged fNIRS system before (C) and after (F) circuit connection.

Ex-1018. Figs. 3, 4.

92. Dr. Anthony also discusses batteries disclosed on GMB Power's website (Ex-1021) to allege that suitable Li-Po batteries for finger rings were on sale at the time of filing of the '124 Patent. Ex-1002, ¶196. Dr. Anthony is again wrong and misrepresents GMBPow. First, the GMB batteries were designed for larger applications like wrist watches and smart glasses, as described by their own marketing material shown in the image below:

Main Application of Curved Lithium Polymer Battery:

i-watches, sports bracelets and wrist straps, etc.



Ex-1021 at 5.

93. The ITC recently analyzed the GMBPow batteries and determined that a POSITA would not have a reasonable expectation of success to use the GMBPow batteries in finger rings. Ex-2122 at 93 (“As shown above, GMBPow advertised its batteries for use with ‘i-watches, sports bracelets, and wrist straps,’” and “[s]uch devices, designed for wrist-worn accessories, are larger in size, and accommodate larger batteries relative to finger-worn ring devices.”). The ITC also observed that “respondents’ argument is that it would have been obvious to use the curved battery of GMBPow . . . not that it would be obvious to modify what is disclosed in GMBPow and then incorporate it in [ring based references]. In addition, Respondents provide no evidence supporting how GMBPow would be modified or what ‘capital equipment investment’ would be required to use it in Niwa.” *Id.* at 93-

94.

94. Dr. Anthony offers a similar flawed proposition here that a POSITA would simply use GMBPow battery as-is for finger-worn smart rings: “The website included specifications and pictures of the various curved batteries, demonstrating their feasibility for use in small wearable devices such as smart finger rings.” Ex-1002, ¶¶96. But Dr. Anthony also fails to account for various considerations such as battery packaging and power constraints that would lead a POSITA away from considering batteries such as GMBPow that are adapted for larger devices.

95. Indeed, the inventors of the ’124 patent recently testified at the ITC that they looked at GMBPow in their early development stage, including visiting their facility, but quickly concluded that GMBPow batteries were unsuitable for use in finger ring. Ex-2024 at 190:11-192:9. For example, the inventors testified that the dimensions of the GMBPow battery alone (shown below) without accounting for the packaging that surrounds the battery (to allow expansion and retraction of the battery) and the housing shells (internal and external) would make the device too wide and thick, and not suitable for a finger-worn ring. *Id.* at 192:10-25.

Specifications:

TYPE	Thickness	Width	length	Rated Capacity	Nominal Voltage	Charge current	Charge time	Discharge current
	(mm)	(mm)	(mm)	(mAh)	(V)	(mA)	(H)	(mA)
201021	2.0	10	21	25	3.7	0.2C	5~8H	0.2C
201024	2.0	10	24	28	3.7	0.2C	5~8H	0.2C
201030	2.0	10	30	41	3.7	0.2C	5~8H	0.2C
202580	2.0	25	80	270	3.7	0.2C	5~8H	0.2C
205080	2.0	50	80	550	3.7	0.2C	5~8H	0.2C
252090	2.5	20	90	260	3.7	0.2C	5~8H	0.2C
252270	2.5	22	70	320	3.7	0.2C	5~8H	0.2C
254045	2.5	40	45	300	3.7	0.2C	5~8H	0.2C
233045	2.3	30	45	200	3.7	0.2C	5~8H	0.2C
233070	2.3	30	70	370	3.7	0.2C	5~8H	0.2C
242269	2.5	22	60	340	3.7	0.2C	5~8H	0.2C
251343	2.5	13	43	85	3.7	0.2C	5~8H	0.2C

Ex-1021 at 6.

96. The inventors' testimony is consistent with my experience with batteries. Indeed, unlike coin or button cells, flexible or curved batteries include flexible packaging materials such as aluminum laminated films that house the electrodes and electrolyte. Ex-2026. Thus, once the battery packaging is added to a battery such as GMBPow and then placed within a housing (e.g., external housing shell and internal potting), the resulting device would have dimensions that are not suitable for a finger-worn ring.

97. In addition to the size, Dr. Anthony also fails to account for any power

requirements and the capacity of the proposed GMBPow battery. Dr. Anthony proposes a grab bag of functionalities that a POSITA would allegedly just throw into the proposed ring. Ex-1002, ¶210 (Dr. Anthony suggesting that a POSITA would include “sensors such as accelerometers and gyroscopes in wearable electronic devices, including finger rings, to sense physical perturbations”); *Id.* at ¶¶214-217 (Dr. Anthony additionally suggesting incorporating Bluetooth communication module); *Id.*, ¶¶221-223 (Dr. Anthony adding in temperature sensor). But Dr. Anthony is silent on the power requirements of any such components and whether the GMBPow battery would have been able to meet the power demands of these components.

98. In my opinion, the GMBPow battery alone could not meet such demands. This is confirmed by the inventors who testified that the discharge rate of such batteries was unsuitable for the health monitoring ring:

[T]he discharge current is pretty small. If you take .2 times 25, that gives you maybe 5 milliamps of discharge that you could have. We had at times 120-milliamp spikes in our design for being able to run like the [PPG] and the Bluetooth most of the time, the Bluetooth would run about 12 to 15 milliamps if you’re continuously transmitting. And then the PPG sensor was probably on the order of tens of milliamp if your battery is only capable of discharging 5 milliamps, then usually the repercussions are that your voltage rail drops and then it doesn’t work, so you start resetting things.

Ex-2024 at 193:1-194:13.

99. Dr. Anthony’s conclusory statement that a POSITA would simply take the batteries such as GMBPow configured for larger electronics without considering many of the engineering challenges that a POSITA would need to navigate is completely unsupported. The inventors, however, tackled these engineering challenges by taking paths that would not have been obvious to a POSITA. Ex-2024 at 195:3-197:11. For example, the inventors were forced to subsidize a battery manufacturing plant and experiment with various battery technologies to create a curved battery that can be used for finger-worn wearable rings. *Id.* at 197:2-12. Dr. Anthony admitted in his deposition that such efforts on the battery design would be beyond the skill of a POSITA. Ex-2021, 315:18-19 (“They’re not going to design an LED or a battery from scratch.”). This is especially true when a POSITA is faced with an obvious alternative that is readily available and used in all prior art to date—flat coin cell batteries.

2. Solid-State Batteries Were Unsuitable for Use in a ’124 Patent Claimed Finger Ring Device

100. Dr. Anthony alternatively argues that “solid-state batteries [are] well suited for compact, durable wearables.” Ex-1002 at ¶97. To the extent that Dr. Anthony is arguing that solid state batteries are also suitable for a ’124 Patent claimed finger ring device, I disagree.

101. I am not aware of the existence of curved solid-state batteries in 2013. Dr. Anthony only cites to Ribero's research which discloses an extremely thin (4.9 μm thick) sputtered solid state battery. Ex-1016 at 2234. The Ribero reference does not disclose peak currents for its battery, but does disclose charging the battery in nano-Amp units—much too small to run any practical finger ring device.

102. Although Dr. Anthony did not mention any, commercially ready thin-film solid-state microbatteries were available in 2013. For example, ST Microelectronics released the EnFilm product line in 2010, a series of rechargeable solid state lithium thin film batteries. The EnFilm batteries were not intended for a finger ring sized wearable device. Instead, they were designed for larger devices that require low peak current like smart cards, and RF ID tags. Ex-2140.

Features

- All solid-state
- Ultra thin
- Fast recharge
- Long cycle life
- RoHS compliant
- UL file number: MH47669

Applications

Device is intended to be used in following applications:

- Sensors and sensor networks
- Smart card
- RF ID tags
- Energy storage for energy harvesting devices
- Non implantable medical applications
- Backup power

Description

The EFL700A39 is a thin film rechargeable lithium battery. The battery has a LiCoO_2 cathode, LiPON ceramic electrolyte and a lithium anode. This device has a footprint of 25.4 x 25.4 mm.



Table 1. Device summary

Capacity	0.7 mAh
V_{nominal}	3.9 V
V_{op}	3.6 to 4.2 V
R_{int}	100 ohm
I_p	10 mA
Dimension	25.4 x 25.4 mm
Thickness	200 μm

Ex-2140 (Showing a peak current of 10 mA).

103. Commercially available thin-film solid-state microbatteries had a peak power too low for a '124 Patent claimed finger ring device. For instance, the EFL700A39 battery's peak current of 10mA was also too low to run the '124 Patent finger ring's printed circuit board, movement sensors, temperature sensors, short range communication module, memory and processor. As one example, Texas Instruments released a Bluetooth low energy communication module (a short range communication module) in June 2012. Ex-2141. The peak RX current was 17.9 mA and the peak TX current was 18.2 mA. Ex-2141 at 1. Dr. Anthony has not shown suitable commercially available solid-state battery.

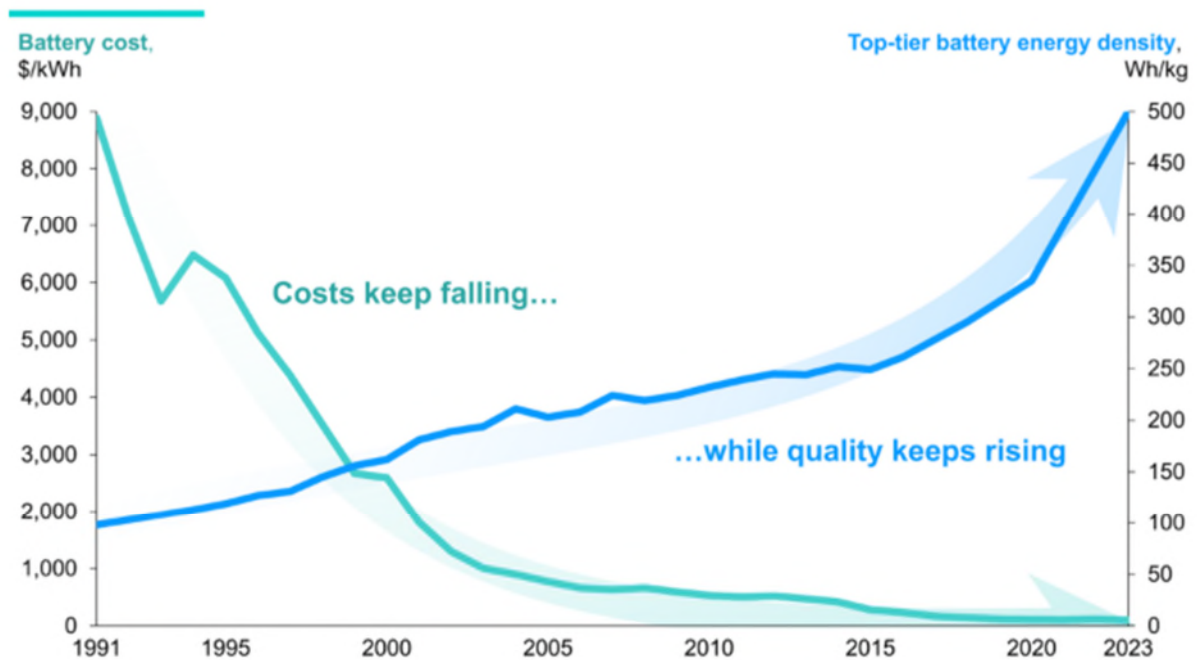
3. Battery Miniaturization was a Slow Process And the Evidence Suggests that Batteries Available on the Market Could Not be Adopted into a '124 Patent Claimed Finger Ring Device

104. I find Dr. Anthony's claim that "battery miniaturization, driven by advancements in high-energy density and flexibility battery technologies, was standard" to be vague. Ex-1002 at ¶53. While battery miniaturization research was a focus in the years leading up to 2013, the pace of miniaturization was slow.

105. For instance, in June 13, 2013, Berkely Lab published an article about the slow state of battery research. Ex-2142 ("Unfortunately, there is no Moore's Law for batteries. The amount of power they can store has increased at a plodding five percent a year. As a result, conventional batteries are becoming the largest and heaviest component of all things mobile and electronic.").

106. This is backed up by data showing that battery density (blue line in the plot below) did not start rapidly improving until well after 2015.

Exhibit 2: Battery cost and energy density since 1990



Source: Ziegler and Trancik (2021) before 2018 (end of data), BNEF *Long-Term Electric Vehicle Outlook* (2023) since 2018, BNEF *Lithium-Ion Battery Price Survey* (2023) for 2015-2023, RMI analysis.

Ex-2138 at Fig 2 (Using Pre-2018 Data from Ex-2139)

107. It is not clear to me that any battery provider could have made rapid improvements to existing batteries to work in a '124 Patent claimed finger ring device. In fact, the named inventor of the '124 Patent (Curt von Badinski), recently testified under oath that during the development leading up the invention, he initially looked at flat and coin-type batteries. Ex-2024, 182:3-12; 187:3-4 (“I looked at button cell batteries, which are what you use in hearing aids.”). He even considered “taking flat standard batteries and just bending them.” 187:8-9. He researched flexible cells, but testified “we weren’t able to actually validate that any of the

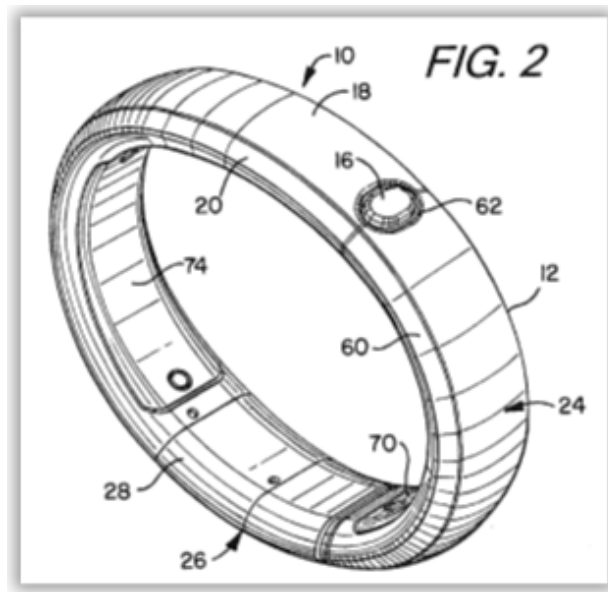
flexible cells that were available would work for us.” *Id.*, 187:23-25. He also could not find any commercially available curved battery appropriate for the invention. *Id.*, 188:8-10 (“There were curved cells, but . . . to my recollection, there weren’t any that would be [dropped in] for our application.”). In other words, taking an existing large curved battery and simply scaling it down, all while meeting the challenging needs of a small smart ring, was not within the skillset of an ordinary artisan circa 2013.

C. The Prior Art Relied on by Petitioner.

1. Mestas

108. U.S. Patent Publication No. 20140244009 (“Mestas”) discloses a wearable device of a much larger form factor that is not constructed to be worn as a ring: “In addition, the wearable athletic device may be worn in a variety of locations on a user’s body including on a user’s chest (e.g., a chest strap), around a user’s wrist, around a user’s arm, on a user’s head, on a user’s ankle or thigh, and the like.” Ex-1010 at ¶ 0143.

109. Mestas preferred embodiment is as a wristband, as shown in Fig. 2 below:



Ex-1010, Fig. 2, ¶ 0152 (“As further shown in FIGS. 2-6, the wearable device assembly 10 is annular or generally circular in shape and, in this illustrative example, is configured for wearing around a user’s wrist.”).

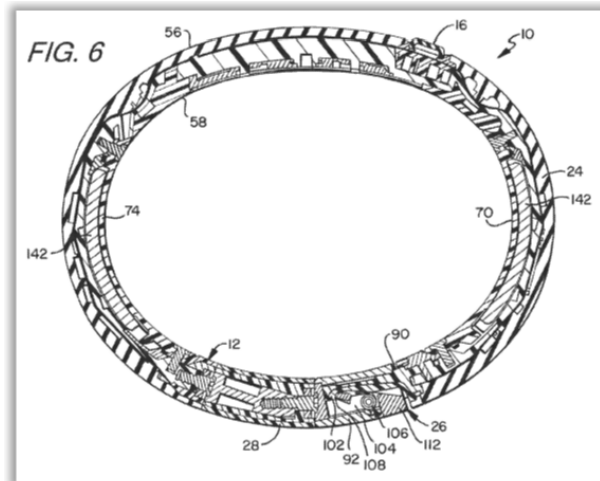
110. During prosecution of the ’666 Patent, the examiner rejected the pending claims over Vescovi in view of Weast, arguing that it would be obvious to apply the curved battery disclosed in Weast and Mestas to the ring of Vescovi²:

The claimed battery being curved is not specifically disclosed by Vescovi. Weast teaches a wearable electronic device that is curved and

² In a later-filed application in the same family, the examiner stated that Vescovi (Ex-2120) was the “closest prior art” when allowing similar claims. Ex-2011 (Reasons for Allowance). This application issued as U.S. Patent No. 11,868,178 (“the ’178 Patent”), which is the subject of a request for Post Grant Review filed by Petitioner.

utilizes a curved battery (Weast: paragraph 422). Modifying Vescovi to use a curved battery would increase the overall functionality of the device by providing the user with a battery shape to fit the shape of the ring itself, thereby more efficiently using the space inside the ring. Therefore it would have been obvious to one of ordinary skill in the art to modify Vescovi according to Weast.

Ex-2008, at 4. Weast's figures are identical to Mestas's and disclose the same battery 142 relied on by Petitioner in Mestas:



Ex-2006 at Fig. 6.

111. Oura responded that Weast's battery was inapplicable to a ring and not a proper basis for the Office's obviousness rejection:

As acknowledged by the Office, Vescovi is further deficient for failing to teach a curved battery, a flexible printed circuit board, and the functionality of remotely unlocking a computing device. The Office, therefore, relies on Weast for the teaching of a curved battery.

However, as the Applicants' claims are directed to a ring, and the device of Weast is directed to a bracelet, the two devices are not capable of being combined in the manner suggested by the Office. ***Specifically, a battery for a bracelet, curved or otherwise, would not be of a dimension to be fitted within the confines of a cavity of a ring. Nor is there any teaching within Weast as to how such a battery can be re-configured to do so.***

Consequently, even if the two references of Vescovi and Weast could be combined, there is no likelihood that the Applicants' claimed invention would thereby be successfully derived. Consequently, a *prima facie* case for obviousness has not been established, and this rejection may be withdrawn.

Ex-2010 at 3. In response to this argument the examiner withdrew the rejection and allowed the claims. Ex-2011 (Notice of Allowance). I agree with the examiner.

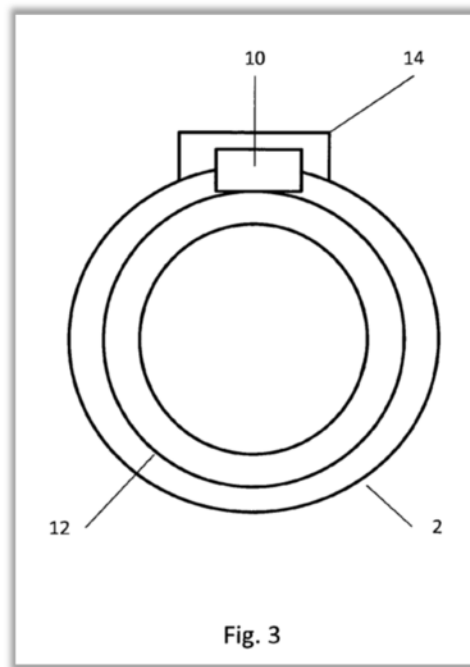
112. In the Final Written Decision for related proceeding PGR2024-00030 (EX-2151) on the related 11,868,178 Patent, the Board found that "the record supports . . . that Mestas's batteries are much too large to fit within a ring form factor, and 'Mestas's batteries, layout and other components . . . would have to be scaled down 5 to 10 times to be appropriately sized for a finger worn ring.'" Ex-2151 at 38-39; *see also* Ex-2153 at 36-37 (Final Written Decision in related proceeding PGR2024-00039 holding the same). The Board also found that miniaturization of

the battery would not have been trivial to implement based on Dr. Anthony's admission that it would not have been within the level of skill of a POSITA to design a smaller version of Mestas's battery. Ex-2151 at 39. I again agree with the Board.

2. Schröder

113. U.S. Patent No. 10,303,867 ("Schröder") does not relate to monitoring health or fitness. Instead, Schröder describes an "external secure unit" for the purpose of authenticating a user. Ex-1007, Abstract ("[S]ecurity-relevant data necessary for executing the application program in the communication device are stored in the external unit . . ."). Schröder attempts to improve upon the existing "smart card" and RFID devices, which have poor range. Ex-1007 at 4:63-5:9. Schröder employs an antenna coil in the ring to achieve this purpose. Ex-1007 at 5:12-13. ("For solving these problems, the invention therefore proposes integrating into the external secure unit 2, e.g., the finger ring 2, an antenna coil 8 . . .").

114. Schröder's disclosure of a ring structure is rudimentary, nonspecific, and completely lacks the claimed arrangement of components and disclosure of the '124 Patent. The only electronic component shown in the figures of Schröder is chip module 10, which protrudes beyond the surface of the ring housing, making it accessible via a hinged cover 14. Ex-1007, Fig. 3, 9:1-3 ("The chip module 10 is arranged in particular replaceably in the finger-ring 2.").



Ex-1007 at Fig. 3.

115. While petitioner argues that Schröder teaches a chip module within the ring structure without a hinged cover in Fig. 4, there are no actual teachings within Schröder of how to accomplish this, nor is such an arrangement described in the claims of Schröder. It would be a difficult and non-obvious task for a POSITA circa 2013 to accomplish this, especially in view of all of the prior art that places the components in a stacked arrangement at the top of the ring.

116. In the Final Written Decision for related proceedings, the Board found that while “Schröder[’s inlay] describes some aspects of a printed circuit board, Petitioner has not demonstrated that a person having ordinary skill in the art would have understood Schröder’s inlay 12 or carrier foil to be a ‘printed circuit board.’”

Ex-2151 at 32. *See also* Ex-2153 at 28 (Final Written Decision for related proceeding

PGR2024-00039 holding the same). The Board reached that conclusion partially because Schröder “does not describe how, if at all, the components are connected on its carrier foil.” Ex-2151 at 33. Dr. Anthony’s testimony regarding the nature of the inlay in this proceeding is less detailed than his testimony in PGR2024-00030—he offers no additional evidence or testimony in this proceeding. *See* IPR2025-00147, Ex-1002 at ¶ 156; PGR2024-00030, Ex-1002 at ¶¶ 90-92, 137, 171.

117. In contrast, the ’124 Patent provides significant details and teachings, including multiple engineering drawings disclosing exactly how to arrange components within the circumferential internal volume of a finger-worn ring—because it was not obvious at the time how to accomplish this.

118. Additionally, none of the embodiments depicted in the figures of Schröder include a battery or a sensor, because its focus is an improved antenna. Ex-1007 at 5:12-14. Schröder’s specification does suggest that a “further embodiment example” has a battery, which is “connected to” a chip module 10. Ex-1007 at 11:48-49. However, Schröder does not disclose where the battery might be located, nor does it disclose that the chip module is mounted to a printed circuit board. Rather, Schröder discloses that the chip module 10 is connected to an antenna coil 8 that is located on the inlay 12. Ex-1007 at 8:57-58 (“The inlay 12 serves as a carrier for at least one antenna coil 8.”); Ex-1007 at 8:63-66 (“The chip module 10 is electroconductively connected by means of electroconductive contacts to the at least

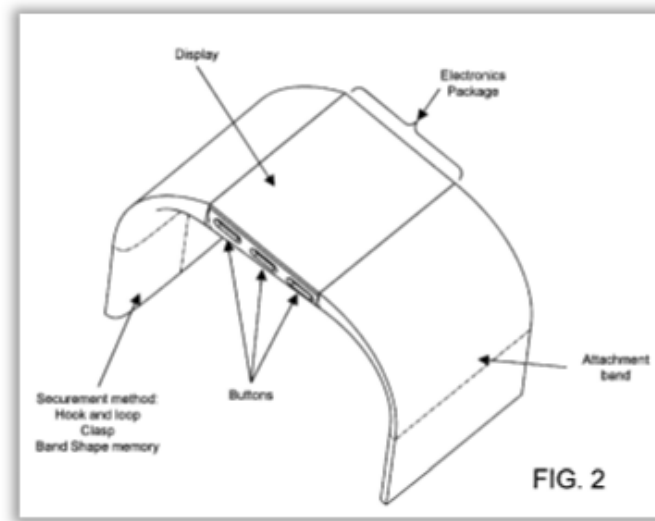
one antenna coil 8 which is located on the inlay 12.”).

119. Schröder also discloses an embodiment using a “biometric sensor” for authentication purposes. Ex-1007 at 9:54-56 (“In a further embodiment example of the invention, the external secure unit 2 has a biometric sensor. This enables the user of the external secure unit 2 to authenticate himself.”). But Schröder does not disclose using this biometric sensor to monitor any health parameters, nor does Schröder teach where or how such sensors would be integrated into any of the disclosed embodiments. Like the battery, the biometric sensor is not depicted in any figure, but “can be arranged on the chip module 10 or it can be arranged in the finger-ring 2 separately from the chip module 10 e.g., on a separate circuit foil.” Ex-1007, 9:60-62. This again is in stark contrast to the ’124 Patent, which teaches and discloses in great detail how sensors are arranged within the finger ring device.

120. Schröder teaches scanning the ring wearer’s vein pattern and comparing it to a stored pattern for authentication. Ex-1007, 10:42-45 (“The user of the finger-ring 2 authenticates himself by means of the biometric data stored in the finger-ring 2. The terminal compares the biometric data received from the finger-ring 2, e.g. the data of finger veins, with the data stored in a background system and authorizes e.g. a transaction in dependence on the comparison.”). Schröder does not, however, teach how to actually accomplish this within the confines of a finger ring device.

3. Yuen

121. Like Mestas, U.S. Patent No. 8,954,135 (“Yuen”) discloses a wearable device but does not contemplate a device in the form factor of a ring: “The biometric monitoring device is adapted (for example, includes a size and a shape) to be worn or carried on the body of a user (for example, arm, wrist, leg and/or ankle).” Ex-1006 at 12:50-52. The device of Yuen is shown below in Fig. 2:



122. The device utilizes an attachment band with an appropriate fastener to secure the device to a user’s arm or wrist. Ex-1006 at 12:53-55 (“[T]he device may be a wrist-worn or arm-mounted accessory such as a watch or bracelet. (See, for example, FIGS. 2-13.”).

123. Furthermore, as detailed in Section V (Claim Construction) of this declaration, Yuen’s teachings consistently emphasize adaptable and flexible bands, often for larger appendages, which directly teaches away from the ’124 Patent’s

typically more rigid, compact, and circumferentially complete ring structure designed for a finger. Yuen describes its device attaching via mechanisms such as “hooks and loops (e.g., Velcro), a clasp, and/or a band having memory of its shape (e.g. through the use of for example, a spring metal band, elastic band, a “rubber” band, and/or a watch-like band)” Ex-1006 at 2:13-17.

124. Notably, Yuen’s primary wrist-worn embodiment features a “generally flat back” for its electronics housing, “matching the generally flat profile of an average wrist (much like the flat back of a typical watch housing).” Ex-1002 at ¶167. This characteristic flat portion for the main electronics, designed for placement on a broader surface like the wrist, further highlights the fundamental structural differences between Yuen’s disclosed wearable devices and the continuously curved, integrated “ring computing device” of the ’124 Patent. Such a design is not readily adaptable to the distinct form factor of a finger-worn ring that must house all its components within a consistently curved and compact structure.

VII. THE CHALLENGED CLAIMS ARE NOT OBVIOUS

A. Ground 1: Claims 1-2, 4-5, 8-11, 14, 16, and 18-19 are patentable over Mestas in view of Schröder.

125. In Ground 1, Petitioner alleges that Claims 1-2, 4-5, 8-11, 14, 16, and 18-19 are obvious over Mestas in view of Schröder. I disagree for several reasons.

1. A POSITA Would Not Have Been Motivated to Combine Mestas and Schröder and Would Have Lacked a Reasonable Expectation of Success.

126. Petitioner argues that Mestas and Schröder are analogous art, both directed to wearable biometric sensing devices with similar structural components. Petitioner asserts a POSITA would be motivated to combine Mestas’s athletic monitoring functionalities (e.g., accelerometer, curved battery, flexible PCB) with Schröder’s finger-ring form factor to create a more compact and comfortable device, ensure a tighter fit for better sensor readings, and enhance functionality.

127. Mestas describes a wrist-worn (or other large body part) “wearable athletic device” focused on comprehensive athletic performance monitoring. Ex-1010 at ¶143. In contrast, Schröder primarily discloses a “finger-ring” as an “external secure unit” for authentication and secure transactions using RFID/NFC and biometric vein pattern recognition (Ex-1007 at Abstract, 3:61-63, 9:54-10:4). Schröder’s focus is security and discrete event interaction, not continuous physiological health monitoring. A POSITA would not view these as “the same type of devices” to be simply merged.

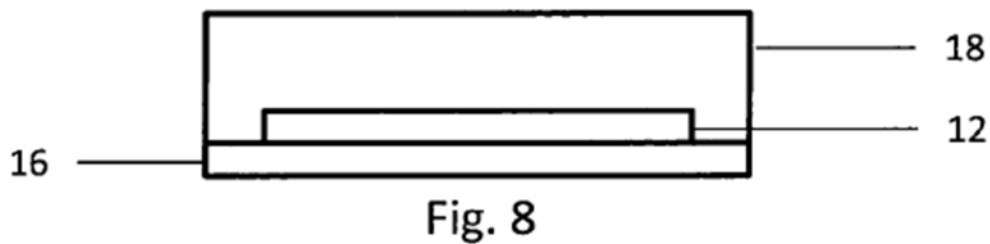
128. Schröder’s primary embodiment features an externally accessible, replaceable chip module 10 (Ex-1007 at Fig. 3, 9:1-3), prioritizing modularity for its security functions. This teaches away from integrating Mestas’s extensive internal components (large battery, complex PCB for physiological monitoring) into a

sealed, compact ring. Mestas emphasizes the need for larger form factors to accommodate more power and components (Ex-1010 at ¶154, 203), contrary to the miniaturization required for Schröder's ring.

129. Dr Anthony attempts to rationalize that Mestas' disclosure of "the interior facing side of a wearable device . . . may be ribbed to improve traction and prevent slippage" (Ex-1010, ¶152) "would have further motivated a POSITA to consider placing the device on the finger to improve traction and prevent slippage. Ex-1002, ¶169. But Mestas's ribbing to prevent slippage teaches away from a combination with Schröder. Ex-1002 at ¶169. Mestas already provides a POSITA with a solution to slippage using ribbing, and so a POSITA would not need to look outside of Mestas to solve this problem. Ex-1010 at ¶169. Further, in my experience designing wearables, the skin around the finger is much more sensitive than the wrist or arm area. A POSITA knowledgeable in wearables would avoid using Mestas for a ring because it teaches using ribbing to increase traction, which would be uncomfortable for a user, and would make it difficult to slip the ring on and off. Ex-1010 at ¶169. Dr. Anthony's own source teaches away from ribbing on a finger ring. Ex-1014 at 6. ("All of our rings are made with the Comfort Fit feature. The inside of the ring (against the skin) is rounded for comfort.").

130. Adapting Mestas's components (curved battery, multi-functional PCB, many microchips) designed for a wristband into Schröder's rudimentary ring

structure also presents technical challenges. Mestas's battery and PCB would require non-trivial scaling. Schröder's ring provides minimal internal space, primarily for a thin "inlay 12" as an antenna carrier (Ex-1007 at 8:57-58, 12:28-32), which is approximately 100 μm thick. *See also*, Ex-2122 at 101. It does not suggest the internal volume or structural support needed for Mestas-style components; even if they could be miniaturized, there are no teachings as to how to arrange such components on inlay 12 in Schröder. While placing a small RFID/NFC-style chip and an antenna coil on Schröder's inlay is reasonably within the skillset of a POSITA circa 2013, placing a large spine member as taught by Mestas, or arranging a curved battery (*See* Section VI.B (showing suitable batteries available in 2013 were large)), a power management module (*see e.g.* Ex-2143 at 49 (showing a footprint of 2.1 x 2.1 mm and a height of .625 mm), a communication module (*see e.g.* Ex-2141 at 29 (showing a footprint of 6.1 x 6.1 mm and a height of 1 mm)) and a printed circuit board with sensors, a processor, and memory, within an internal space occupied by inlay is not, and is why all prior-art rings located their chips and boards in a stacked arrangement on top of the ring. A POSITA would not have a reasonable expectation of success in merging these two references into a compact '124 Patent claimed finger ring device.



Ex-1007 at Fig. 8

131. The ordinary person is not skilled in component design and would not have the skill to “miniaturize” the components of Mestas. For example, Dr. Anthony agrees that battery design was beyond the skill of the ordinary person. Ex-2021 at 315:18-19 (“They’re not going to design an LED or a battery from scratch.”). He also admitted that the miniaturization process to which he referred could take “years.” *Id.* at 455:6-8. It is a contradiction to suggest that a multi-year technological development effort for miniaturization somehow renders the complex task of fundamentally re-engineering and scaling down a device like Mestas’s—designed for a wrist—into a finger ring a trivial exercise for a POSITA. Such a position overlooks the substantial, non-trivial inventive effort required to overcome the inherent challenges of power, space, and functionality in different form factors.

132. At his deposition, Dr. Anthony testified that the POSITA would not need to miniaturize the battery, because they would contact vendors for an appropriate battery. Ex-2021 at 317:18-22 (miniaturizing “would not be necessary”); *Id.* at 318:2-4 (“They would identify the battery they needed, a curved battery with

the appropriate energy density, and secure it appropriately.”). Dr. Anthony, however, did not know the specifications of the battery he proposed be used in his Schröder-Mestas combination, nor did he know or research what batteries were available in 2013:

Q. Have you in your work on this case attempted to find whether there was a battery available in 2013 that was appropriate to fit in Schröder as you’ve proposed?

A. I did not find it necessary to do that, no.

Ex-2021 at 321:5-10.

133. As explained in Section VI, I see no evidence in the record that curved batteries of an appropriate size and specification were available in 2013 to power the Schröder-Mestas combination, and I am not aware of any. The named inventor of the ’124 Patent (Curt von Badinski), in fact, recently testified under oath that during the development leading up the invention, he initially looked at flat and coin-type batteries. Ex-2024, 182:3-12; 187:3-4 (“I looked at button cell batteries, which are what you use in hearing aids.”). He even considered “taking flat standard batteries and just bending them.” 187:8-9. He researched flexible cells but testified “we weren’t able to actually validate that any of the flexible cells that were available would work for us.” *Id.*, 187:23-25. He also could not find any commercially available curved battery appropriate for the invention. *Id.*, 188:8-10 (“There were curved cells, but . . . to my recollection, there weren’t any that would be [dropped

in] for our application.”).

134. With respect to Mestas-sized wrist worn batteries, he testified “There was no way it would work”:

Q. Could a curved cell for a wrist wearable work for a ring form factor?

A. If the ring was very, very, very big, but for our application, the sizes of the other wearables that were out there were nowhere near where we needed them to be. Capacity was great, but the size was just massive. ***There was no way it would work.***

Ex-2024 at 188:11-17.

135. He also testified he could not find a curved battery with the appropriate size and specifications so eventually they had a flat battery made and just bent it. Ex-2024 at 188:18-189:11. The battery companies he talked to “passed on the opportunity” because it would take too much effort:

A. . . . Most of those vendors, if not all of them, passed on the opportunity. I think a lot of the feedback that we had was the technology to make it as small as we required would be a lot of lift, and a lot of them just didn’t want to take on the challenge.

Ex-2024 at 189:12-190:3.

136. Mestas is further evidence of that curved batteries were not available for finger-sized devices. While Mestas does use curved batteries, it gives an exhaustive list of body locations where its device could be located. The finger is not mentioned, and all of the locations would be wrist-sized or greater. Ex-1010 at ¶ 143 (“the wearable athletic device may be worn in a variety of locations on a user’s body

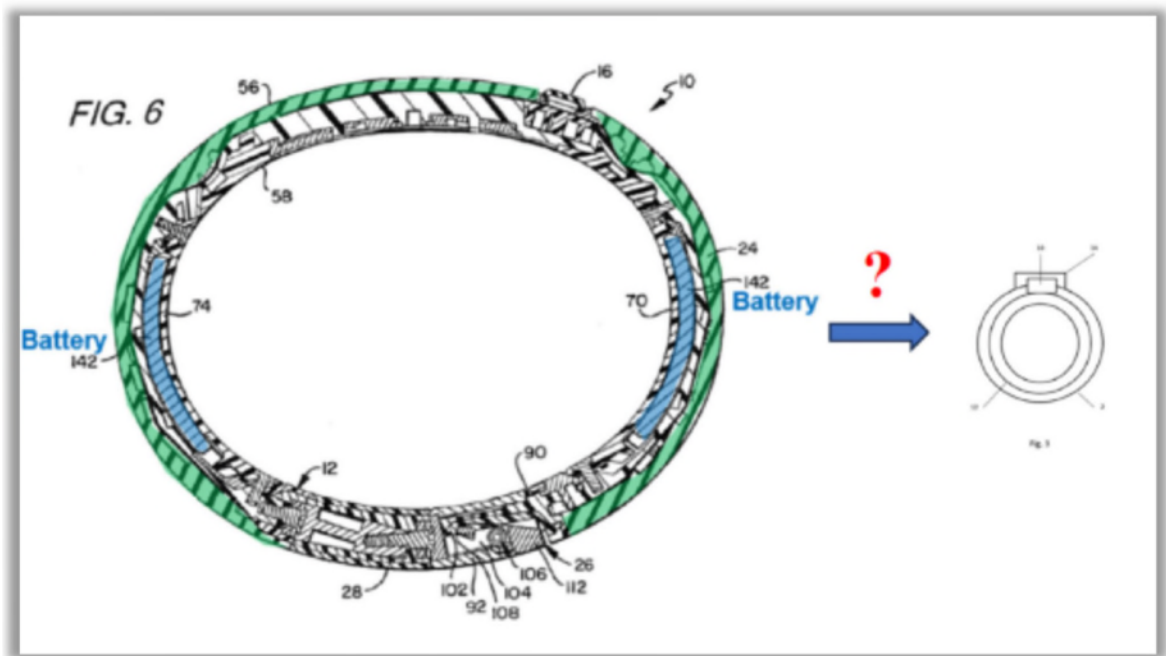
including on a user's chest (e.g., a chest strap), around a user's wrist, around a user's arm, on a user's head, on a user's ankle or thigh, and the like.”).

137. But Dr. Anthony did not take any of these issues into account when he suggested a skilled artisan would simply “identify the battery they needed, a curved battery with the appropriate energy density, and secure it appropriately.” Ex-2021 at 318:2-4.

138. The power requirements of Schröder and Mestas would also be different, given that Mestas is constantly monitoring health conditions and features active wireless communications – both of which require substantial amounts of both peak and average power draws, while Schröder only takes vein pattern images in a security validation event, and communicates via NFC or RFID, which are backscatter systems that can be 1,000x lower power than active communications such as Bluetooth, for example. Ex-2152 at 2 (“It can be seen that backscatter systems are at least 1000 times more energy efficient than corresponding radios.”). Given the typically low power requirements of Schröder's intended RFID and NFC applications, and its description of the battery as optional, a POSITA would not be motivated to combine the references or have a reasonable expectation of success in doing so. Indeed, as Dr. Anthony admits, Mestas's battery would have to be reduced in size on the magnitude of 5-10 times from its current size to fit in a ring of Schröder. Ex-2021 at 313:12. But with the reduction of size, a skilled artisan would

also expect a significant decrease in battery capacity at minimum by approximately the same magnitude (i.e., 5-10x decrease). And Dr. Anthony appears to agree. Ex-2021 at 325:10-326:5. Yet Dr. Anthony offers no explanation or rationale of why a skilled artisan would have any reasonable expectation of success in powering all the components of Schröder, including the additional components that Dr. Anthony proposes to include in Schröder given the significant reduction in battery capacity.

139. In the Final Written Decision for related proceeding PGR2024-00030 (EX-2151) on the related 11,868,178 Patent, the Board found that “the record supports . . . that Mestas’s batteries are much too large to fit within a ring form factor, and Mestas’s batteries, layout and other components . . . would have to be scaled down 5 to 10 times to be appropriately sized for a finger worn ring.” Ex-2151 at 38-39. The Board also found that miniaturization of the battery would not have been trivial to implement based on Dr. Anthony’s admission that it would not have been within the level of skill of a POSITA to design a smaller version of Mestas’s battery. Ex-2151 at 39.



Ex-1010 Fig. 6; Ex-1007 Fig. 4.

140. Dr. Anthony also neglects to address the fact that unlike coin or button cells, flexible or curved batteries include flexible packaging materials such as aluminum laminated films that house the electrodes and electrolyte. Ex-2026. Thus even if the battery itself could be miniaturized—and there is no evidence in the record that such miniaturized batteries with the required power requirements existed—a curved cell would have required a POSITA to separately address the issue of battery packaging that also requires real estate which is already limited when designing a finger-worn wearable ring device. Given that all of the development in finger ring wearables up to the '124 Patent had used “coin” type batteries, the ordinary person would look to that type of battery.

141. Given the state of the prior art, I do not believe the ordinary person would attempt to have a curved battery custom made for this application because such batteries were not used in finger worn rings. Like the world leading MIT researcher Asada, and prior art all the way up to and beyond 2013 (e.g., Niwa in 2010 (Ex-1005), Ketabdar in 2012 (Ex-1017), Oura's own Generation 1 ring in 2015 (Ex-2034; Ex-2148), and my own colleague's work within the UCSD Center for Wearable Sensors in 2017 (Ex-2149) that all designed super-bowl-type rings, the ordinary artisan (the definition as put forward by Dr. Anthony) would find the smallest coin-sized battery they could and construct the ring by mounting it and other components on top of the ring in a large protrusion.

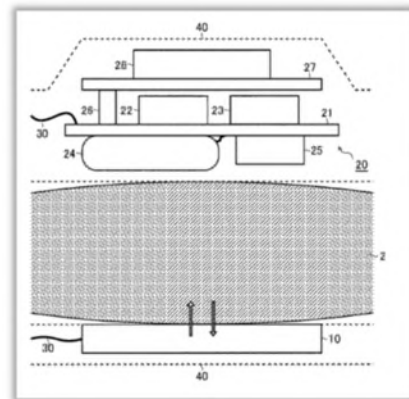
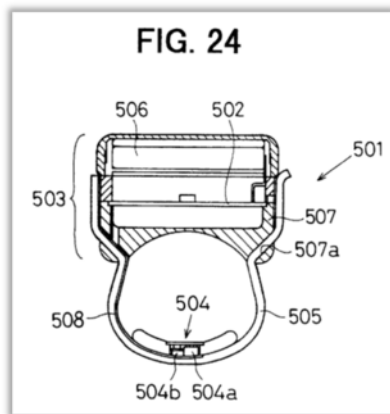
142. Moreover, Dr. Anthony's assertion that "design incentives and market forces" would motivate the combination is conclusory. Ex-1002, ¶168. There is no specific evidence presented that market forces in 2013 suggested combining the specific features of a Mestas wristband, and a Schröder security ring to create the '124 Patent claimed finger ring device. In fact, as set forth further below in Section VIII, secondary considerations of non-obviousness suggest otherwise. Petitioner improperly uses the '124 Patent's claimed invention as a roadmap to piece together disparate elements from the prior art.

143. Petitioner's desire for a "more compact and comfortable form" (Pet. at 19) is again derived via hindsight from the '124 Patent's solution, not from a clear

teaching or suggestion in Mestas or Schröder to combine their specific, disparate features for physiological monitoring in a ring. Instead, the ordinary artisan would apply the teachings of the wearable ring prior art to date as I described in Section VI. When deciding where to locate the power management module in Schröder, the POSITA would apply these teachings:



Figure 8-1 First Prototype Ring Sensor



Ex-1037 at 7; Ex-1035 at 75; Ex-1028 at Fig. 24; Ex-1005 at Fig. 29.

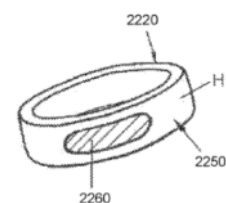
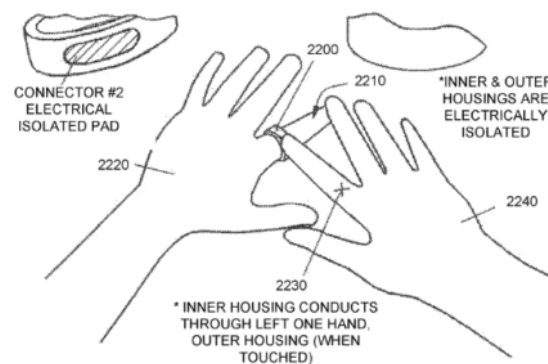
144. A POSITA would not have been motivated to combine the athletic monitoring system of Mestas with the security-focused finger-ring of Schröder in the manner proposed, nor would they have had a reasonable expectation of

successfully integrating Mestas's complex, power-intensive components into Schröder's slim ring form factor to arrive at the claimed invention.

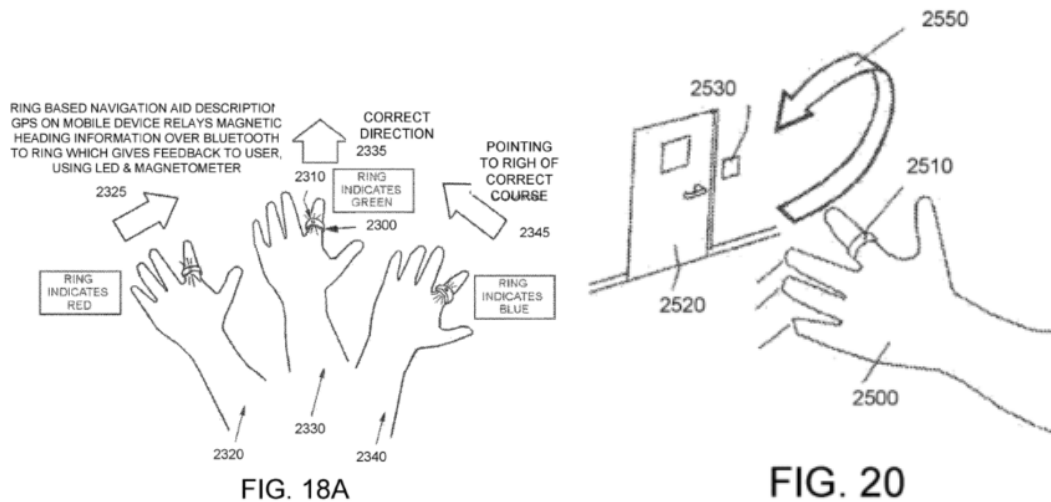
2. The Mestas-Schröder combination does not disclose or suggest limitations 1[pre] and 14[pre].

145. Limitation 1[pre] and 14[pre] of the '124 Patent requires: "a wearable computing device configured to be worn around the finger of a wearer." Ex-1001 at 33:39-40, 35:38-39.

146. Moreover, as shown below, the illustrative embodiments throughout the '124 Patent consistently depict and describe a device worn on the finger.



Ex-1001 at Fig. 9b, 17A-C.



Ex-1001 at Fig. 18A, 20.

147. Petitioner asserts Mestas teaches a wearable electronic device and Schröder teaches a device in a finger-ring configuration. (Pet. at 21-22; Ex-1002 at ¶¶184-185).

148. Mestas is a wrist-worn or other large body part athletic device (Ex-1010 at ¶143), and is not configured as a finger ring. Petitioner and Dr. Anthony admit that Mestas does not disclose a finger-ring. Pet. at 22; Ex-1002 at ¶ 185. In Section IV.B.2, I discuss the Patent Office’s withdrawal of an action based on Weast (Ex-2006), which is substantially identical to the disclosure relied upon by Petitioner from Mestas, based on applicant’s arguments that it is not proper to apply Mestas’s teaching to a finger ring device. Schröder, while disclosing a “finger-ring” (Ex-1007 at 3:61-63), describes it as an “external secure unit” for authentication (Ex-1007 at Abstract). It does not teach a “wearable computing device” with the comprehensive

physiological monitoring capabilities and integrated componentry of the '124 Patent.

149. The combination of Mestas's non-ring athletic device with Schröder's security-focused ring fails to disclose or suggest a "wearable computing device configured to be worn around a finger of a wearer" as claimed for the purpose of physiological monitoring.

3. The Mestas-Schröder combination does not disclose or suggest limitations 1[a] and 14[a].

150. Claim 1[a] requires "an external housing having an outer surface, an interior surface and sidewalls, wherein the interior surface and the sidewalls are characterized by approximately a C-shaped cross section and define an interior space, and wherein the interior space is configured to retain a plurality of components" Ex-1001 at 33:41-46. Claim 14[a] requires "an external housing having an outer surface forming an exterior wall of the wearable computing device, an interior surface and sidewalls, wherein the external housing is characterized by approximately a C-shaped cross section and define an interior space, and wherein the interior space is configured store a plurality of components." Ex-1001 at 35:40-56.

151. Claims 1 and 14 proceed to recite a list of components that are placed in the defined interior space: 1[b]/14[b]—a curved rechargeable battery; 1[c]/14[c]—a printed circuit board; 1[d]/14[d]—one or more sensors; 1[e]/14[e]—a memory; 1[f]/14[f]—a short-range communication sensor; 1[g]/14[g]—a

temperature sensor; 1[h]/14[h]— a processor; and 1[i]—potting material. Ex-1001.

152. By way of example, the following '124 Patent figures show the components above in the '124 Patent's finger ring internal space: Fig. 4—a curved battery and PCB (Ex.1001 at 12:61-13:7); and Fig. 3B—sensors and temperature sensors. Processors 210, communication module 250 and memory 260 are on the PCB. Ex.1001 at 7:41-58, 13:1-7. Potting can be used in the interior space and also to form the interior wall of the device. Ex. 1001 at 14:24-38.

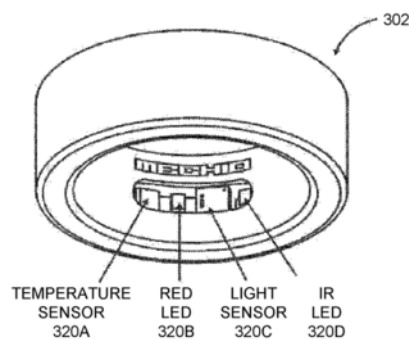


FIG. 3B

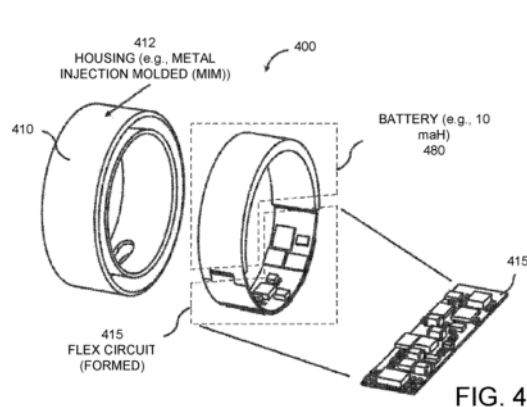
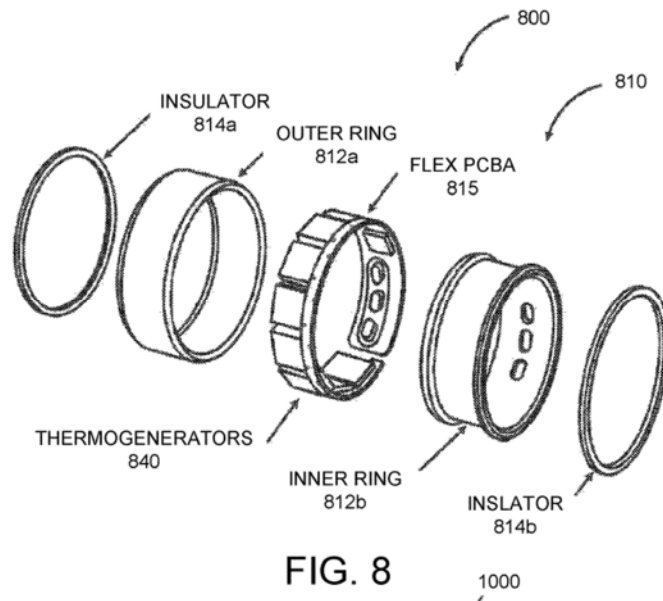


FIG. 4

Ex-1001 at Figs. 3B, 4.

153. In other words, the '124 Patent's interior space is defined by outer ring 812a and inner ring 812b in its Figure 8.



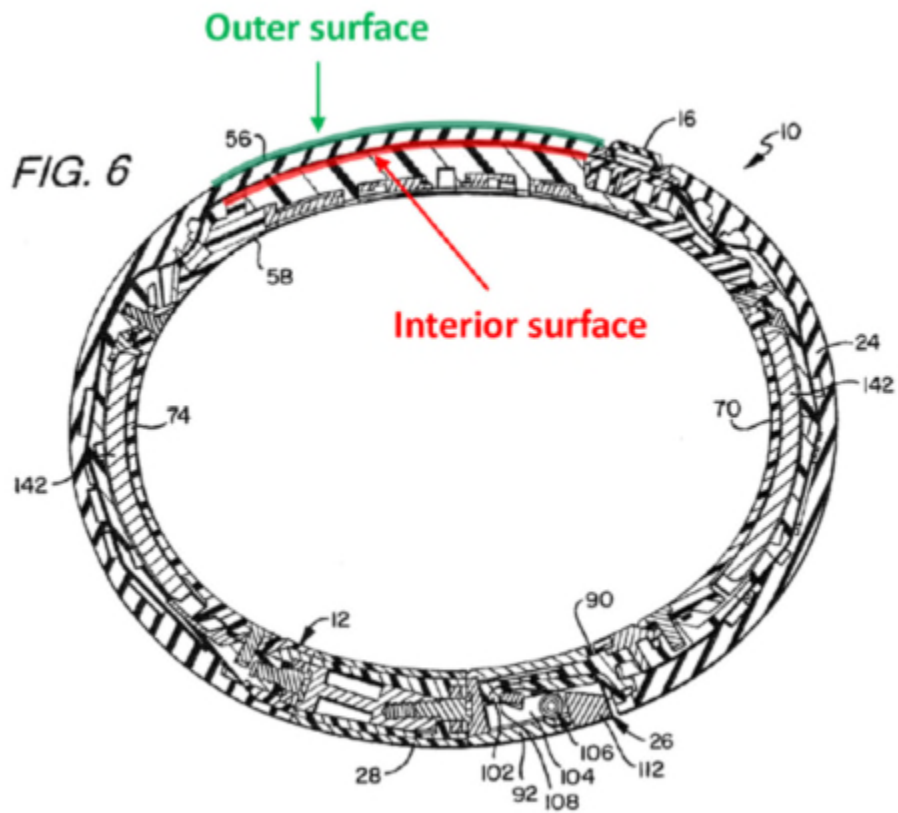
Ex-1001 at Fig.8.

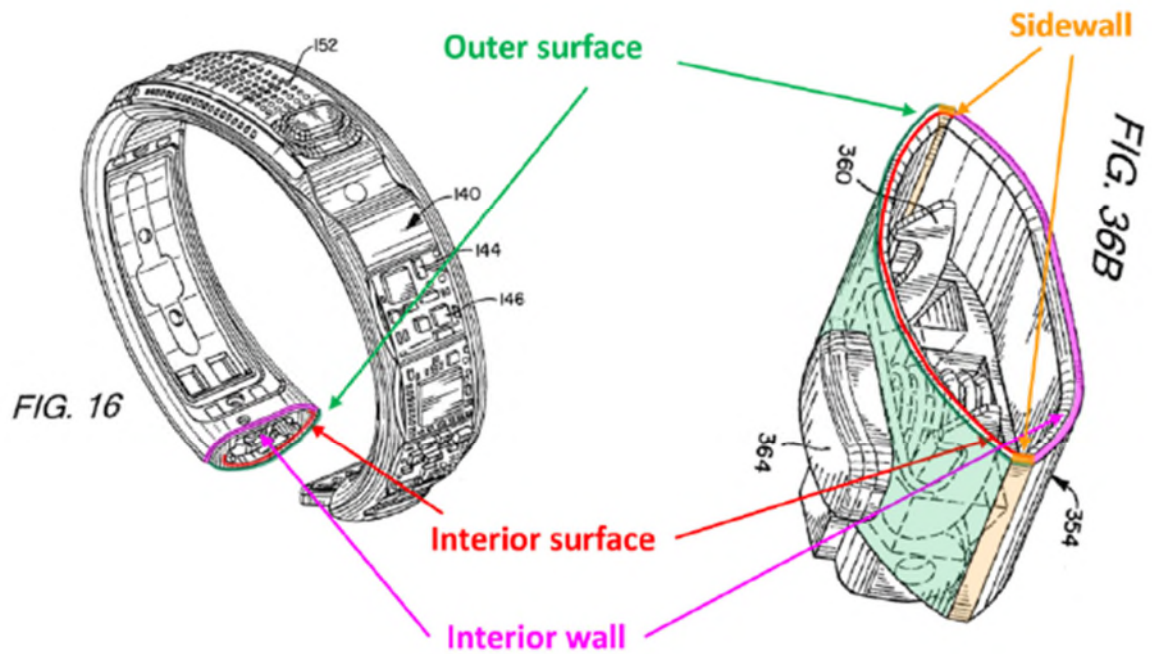
154. Although, Dr. Anthony and Petitioner claim that Mestas-Schröder teaches element 1[a], and 14[a], they only utilize citations to Mestas for this element. Pet. 23- 25.

155. Petitioner defines the combination’s interior space solely with Mestas. In Figures 6, 16, and 36B, Petitioner points to outer encasement member 24 of the external housing as element 1[a]’s “external housing”, outer surface 56 of the external housing as the “outer surface,” and inner surface 58 of the external housing as the “interior surface.” Pet. at 23; Ex-1006 at Fig. 6 (reproduced below). Petitioner points to optional features depicted in figures 16 and 36 (reproduced below) to teach sidewalls that purports to give the Mestas device an interior space with an approximate C-shape. Pet. at 24-25. Petitioner later argues that element 354 shown

in figure 36b (below) is the interior wall that encloses the interior space. Pet. at 32-34. At his deposition, Dr. Anthony confirmed that the interior space ends at element 354.

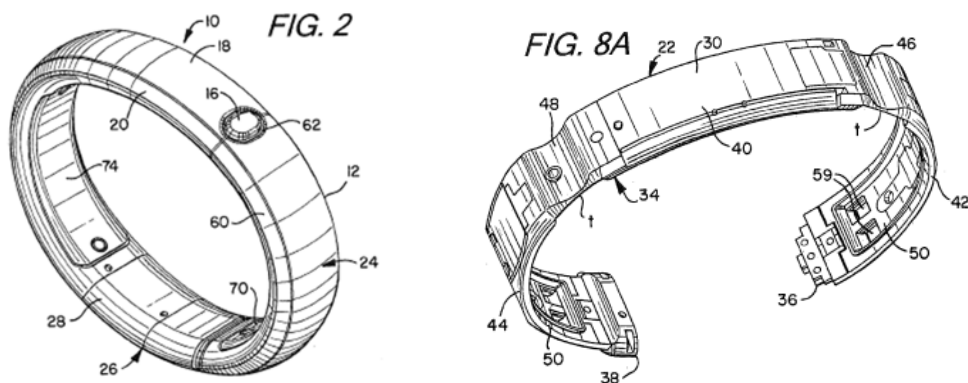
Ex-2150 at 31:6-15.





Ex-1010 at Figs. 6, 16 and 36B.

156. While Petitioner argues that inner portion 354 of the external housing defines the end of the interior space, Petitioner never addresses the claimed interior space defined in claim elements 1[a]/14[a].



Ex-1010 at Figs. 2, 8a; Ex-1010 at ¶ 0168.

157. Mestas shows that its batteries are in recesses 50, 52 of spine member

22. Petitioner's own labeling of figure 16 and 36B (reproduced above) leaves the battery recess in Figure 16 outside of the "internal space of the housing" defined in elements 1[a] and 14[a] defined by the interior surface of the external housing and the sidewall of the external housing. Mestas's batteries are in a separate space defined by recesses 50 and 52. The internal space formed by recesses 50, 52 and caps 70, 74 is separated from Petitioner's alleged internal space entirely by spine member 22. In Figure 16 (above), the battery is clearly placed above Petitioner's mapped interior wall, element 354.

158. At his deposition, Dr. Anthony vaguely stated that the interior space is the "space that's inside the device." Ex-2150 at 24:12-25:04. However, the '124 Patent's claim language is clear that the internal space is defined by the interior surface and sidewalls and is not simply "the space that's inside the device." Mestas's battery recesses are located not only beyond the sidewalls of Mestas, but are located beyond what Petitioner defines as the inner wall of Mestas.

159. Dr. Anthony alternatively argued that there could be smaller interior spaces that come together to form the claimed larger interior space, like rooms in a house. Ex-2150 at 38:20-39-21. Such a hypothetical device would not be the '124 Patent claimed finger ring device. The '124 Patent recites an interior defined by an interior surface and sidewalls. It does not recite multiple interior spaces that are split between multiple "rooms." Mestas's battery recesses are clearly separated from

Mestas's main interior space with a bulky spine member. A POSITA would not consider the battery recesses to be part of the space created by spine member 22 and the interior surface of Mestas.

160. Therefore, Mestas does not teach an “interior space configured to retain/store a plurality of components; wherein the plurality of components comprises: . . . a curved rechargeable battery.”

4. The Mestas-Schröder combination does not disclose or suggest limitations 1[b], and 14[b].

161. Claim 1[b] requires “a curved rechargeable battery disposed within the interior space of the housing, wherein the rechargeable battery is curved to conform to the interior surface.” Ex-1001 at 33:48-50. Claim 14[b] requires “a curved rechargeable battery disposed within the interior space of the housing, wherein the rechargeable battery is curved to conform to a curvature of the interior surface.” Ex-1001 at 35:48-51.

162. By way of example, Figure 6 in the '124 Patent shows a “curved battery 680” and an “electromagnetic induction charging coil 640” within the ring housing. Figure 4 also shows battery 480 within the housing. These are enclosed by the housing structure.

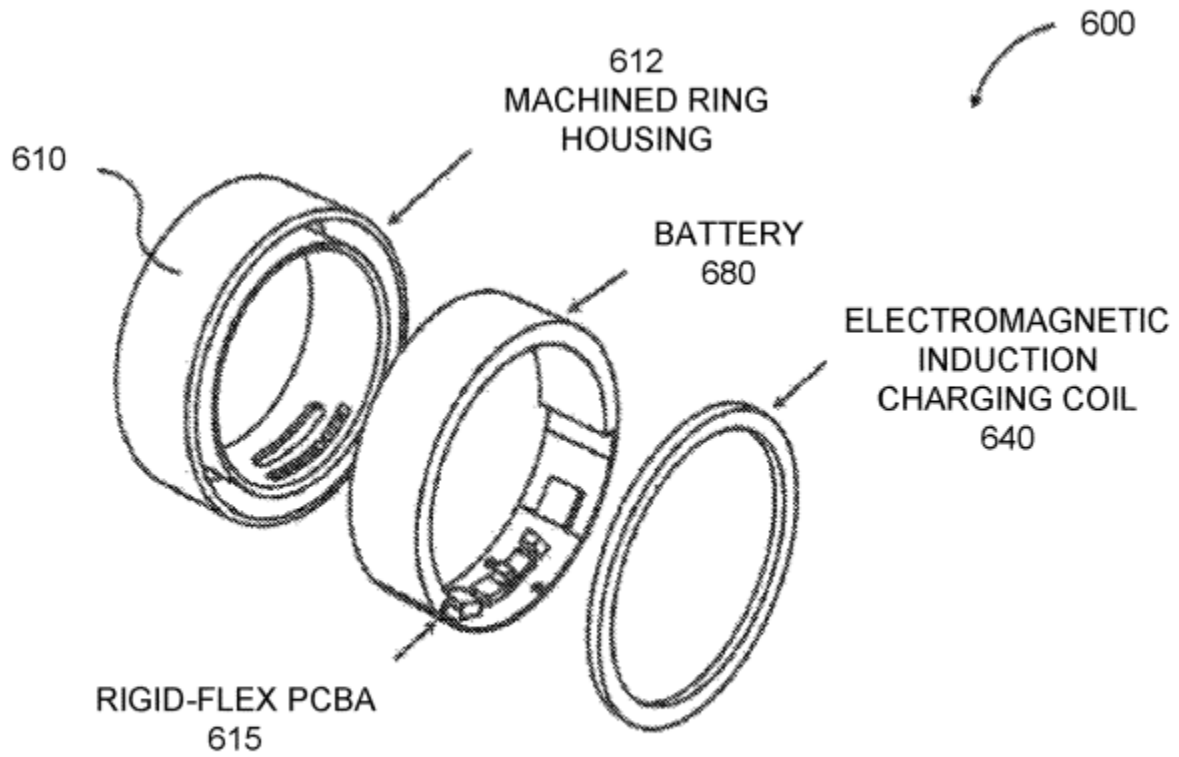
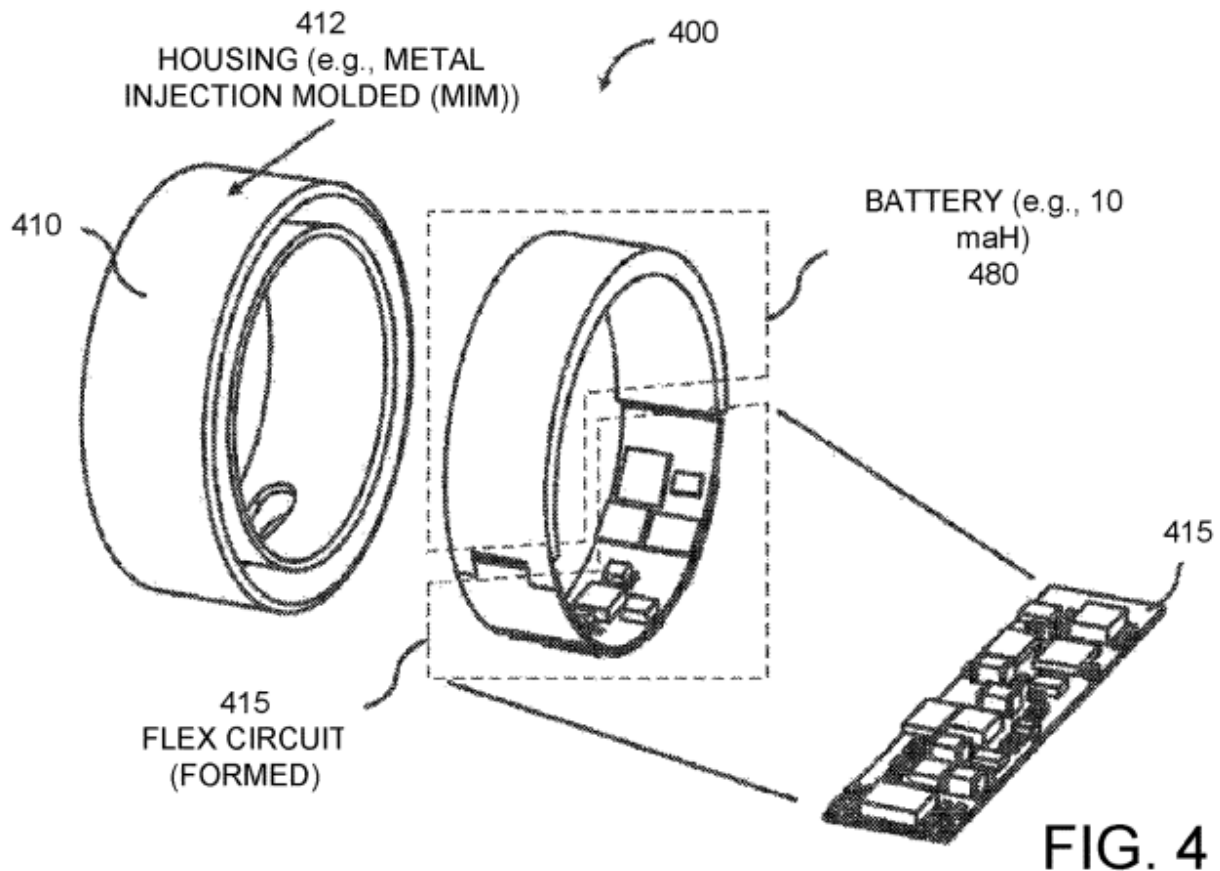


FIG. 6

Ex-1001 at Fig. 6.



Ex-1001 at Fig. 4.

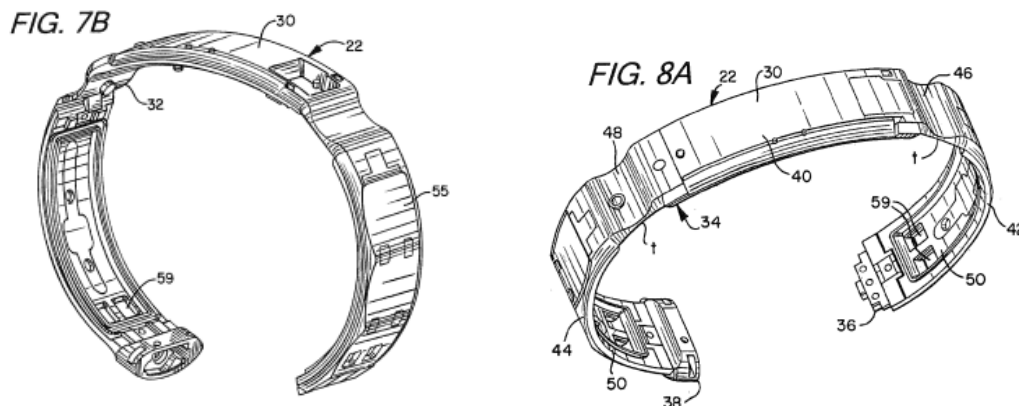
163. Although Dr. Anthony and Petitioner claim that Mestas-Schröder teaches element 1[b], and 14[b], they only utilize citations to Mestas for this element.

164. This is because Schröder's chip module 10, which contains the processor, memory (Ex-1007 at 11:3-8), and is connected to energy storage device (Ex-1007 at 11:47-48) is external to element 1[a]'s internal space. Ex-1007, Fig. 3. Its inlay 12 is an antenna carrier. Ex-1007 at 8:57-58. Schröder does not teach inlay 12 as hosting a battery as required by the claims. Schröder also does not teach or suggest the use of a spine member to hold components, nor that the (optional) battery

could be curved (or even where it is located).

165. Petitioner relies on Mestas for the “curved rechargeable battery” (Ex-1010 at ¶¶157, 168, 201) and wireless charging (Ex-1010 at ¶ 201), to be incorporated into Schröder’s ring. Pet. at 25-26.

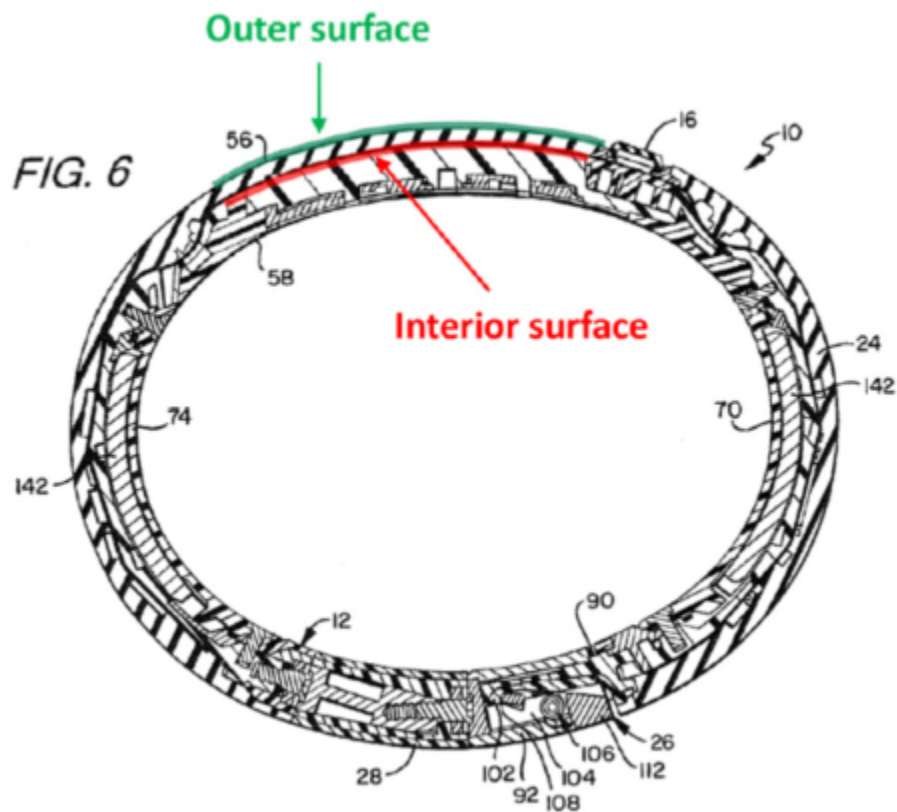
166. Mestas discloses that “spine member 22 may be considered a chassis member having various components attached thereto” (Ex-1010 at ¶ 0153) and has an inner surface 32 and an outer surface 30. Ex-1010 at ¶ 0153. Inner surface 32 has recesses 50, 52 for batteries. Ex-1010 at ¶ 0168. Outer surface 30 is proximate to controller 14, and display 30. Ex-1010 at ¶ 0155. External housing 24 is formed around center spine member 22. Ex-1010 at ¶ 0157.

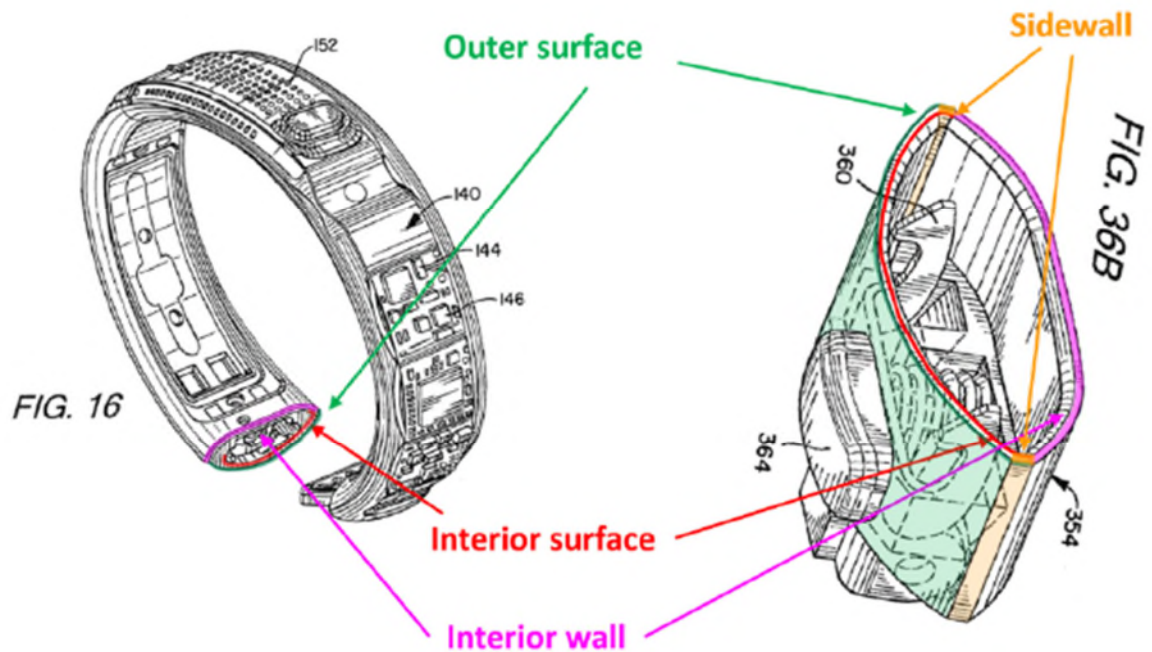


Ex-1010 at Fig. 7B, 8A.

167. In Figures 6, 16, and 36B, Petitioner points to outer encasement member 24 of the external housing as element 1[a]’s “external housing”, outer surface 56 of the external housing as the “outer surface,” and inner surface 58 of the

external housing as the “interior surface.” Pet. at 23; Ex-1006 at Fig. 6 (reproduced below). Petitioner points to optional features depicted in figures 16 and 36 (reproduced below) to teach sidewalls that would give the Mestas device an interior space with an approximate C-shape. Pet. at 24-25.



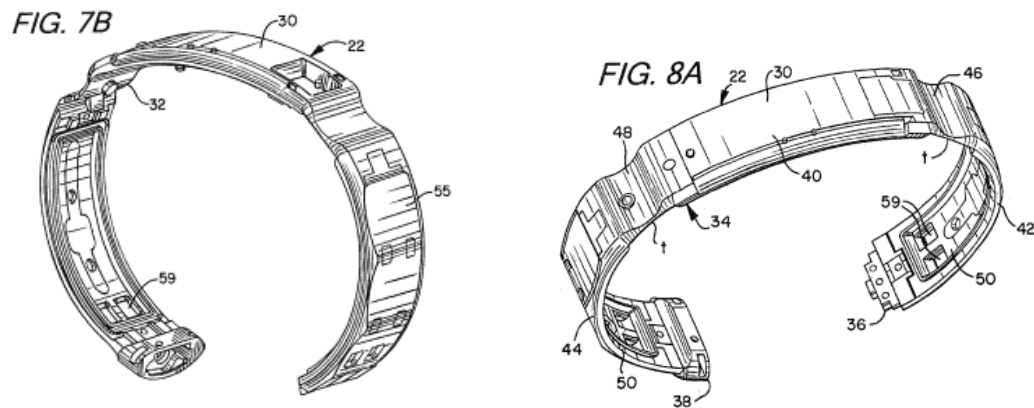


Ex-1010 at Figs. 6, 16, 36B.

168. Petitioner maps the inner surface of external housing 24 as the interior surface of claim 1[b].

169. Mestas's figures 7B, 8A, and 16 clearly shows that Mestas's batteries conform to recesses 50, 52 of spine member 52, not the inner surface of the external housing. *See* Ex-1002 ¶ 81 (Dr. Anthony explaining that "Mestas's device has 'compartments for power supplies . . .' Further, Mestas explains that the batteries are inserted into the battery compartments.") Element 50 and 52 possibly are sub-elements of 354 which Petitioner maps as the interior wall of element 1[i]/14[i] **not the interior surface of the external housing**. Therefore, Mestas does not teach a "curved rechargeable battery within the interior space of the housing, wherein the

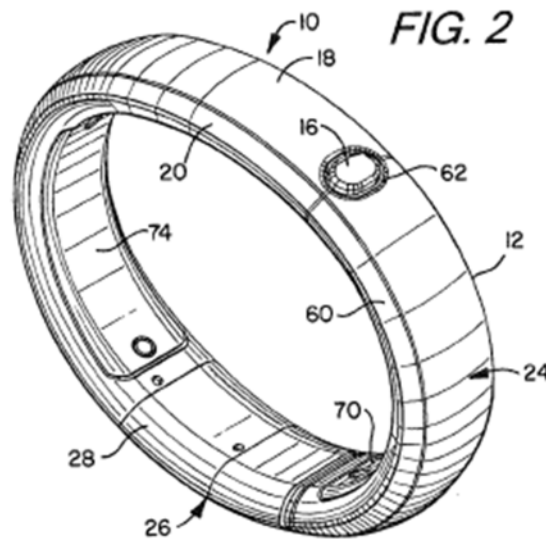
rechargeable battery is curved to **conform to the interior surface,” of the external housing** or “a curved rechargeable battery disposed within the interior space of the housing, wherein the rechargeable battery is curved to **conform to a curvature of the interior surface” of the external housing**.



Ex-1010 at Fig. 7B, 8A.

170. Further, Petitioner argues the “outer portion of the encasement member—in particular its interior surface and sidewalls—define an ‘interior space’ that stores the controller and other electronic components, as required by the claim.” Pet. at 25.

171. While Petitioner argues that inner portion 354 of the external housing defines the end of the interior space, Petitioner never addresses the claimed interior space defined in claim elements 1[a]/14[a].



Ex-1010 at Fig 2; ¶ 0168.

172. Mestas clearly shows that Mestas's batteries conform to recesses 50, 52 of spine member 52. Petitioner's own labeling of figure 16 and 36B (reproduced above) leaves the battery recess in Figure 16 outside of the "internal space of the housing" defined in elements 1[a] and 14[a] defined by the interior surface of the external housing and the sidewall of the external housing. Mestas's batteries are in a separate space defined by recesses 50 and 52. The internal space formed by recesses 50, 52 and caps 70,74 is separated from Petitioner's defined internal space entirely by spine member 22. At his deposition, Dr. Anthony confirmed that the interior space ends at element 354. Ex-2150 at 31:6-15. In Figure 16, the battery recesses are clearly placed above the surface of element 354.

173. Dr. Anthony also stated that the interior space is the "space that's inside the device." Ex-2150 at 24:12-25:04. However, the '124 Patent's claim language is

clear that the internal space is defined by the interior surface and sidewalls and is not simply “the space that’s inside the device.” Mestas’s battery recesses are located not only beyond the sidewalls of Mestas, but are located beyond what petitioner defines as the inner wall of Mestas.

174. Dr. Anthony alternatively argued that there could be smaller interior spaces that come together to form the claimed larger interior space, like rooms in a house. Ex-2150 at 38:20-39-21. Such a hypothetical device would not be the ’124 Patent claimed finger ring device. The ’124 Patent recites an interior defined by an interior surface and sidewalls. It does not recite multiple interior spaces that are split between multiple “rooms.” Mestas’s battery recesses are clearly separated from Mestas’s main interior space with a bulky spine member. A POSITA would not consider the battery recesses to be part of the space created by spine member 22 and the interior surface of Mestas.

175. Therefore, Mestas does not teach a “curved rechargeable battery within the **interior space of the [external] housing**, wherein the rechargeable battery is curved to conform to the interior surface,” or “a curved rechargeable battery disposed within the **interior space of the [external] housing**, wherein the rechargeable battery is curved to conform to a curvature of the interior surface.”

176. Additionally, Mestas’s curved batteries are for a wristband and are dimensionally unsuitable for Schröder’s or any similar slim finger-ring. Schröder

describes an optional “energy storage device” (e.g., battery) connected to its (typically external) chip module 10 or chargeable via its antenna coil 8 (Ex-1007 at 11:46-67). It does not depict or describe a curved battery, nor its placement within the external housing’s interior space conformed to the interior surface. Schröder’s Fig. 3, its primary embodiment, does not readily accommodate an internal Mestas-style spine member 22 or curved battery.

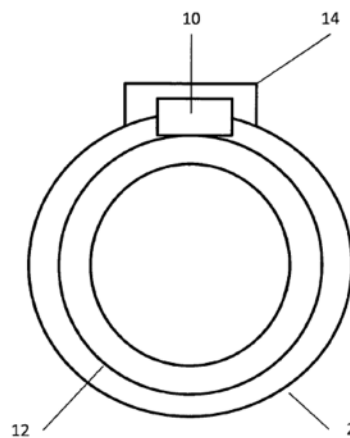


Fig. 3

Ex-1007 at Fig. 3.

177. As shown in Fig. 3, chip module 10 is far too large to fit within inlay 12 and protrudes beyond the surface of the ring housing, making it accessible via hinged cover 14. Ex-1007., at Fig. 3; *Id.*, 9:1-3 (“The chip module 10 is arranged in particular replaceably in the finger-ring 2.”). Certainly, Mestas’s spine member 22 is too large to fit within the narrow inlay.

178. Dr. Anthony confirmed that Schröder did not disclose an arrangement

where chip module 10 and associated components are located within a cavity but that he relied on the knowledge of a POSITA to “fill in the blanks:”

Q. Where does the rectangle tell them to put the battery relative to the printed circuit board relative to the antenna coil relative to the sensors, relative to any communication module, relative to any power regulation circuitry? Where does the rectangle tell the POSITA where to put all that stuff and how to arrange it?

...

A. Right. And as I was going through my declaration pointing out it's Schröder with the knowledge of a POSITA, and I subsequently started to describe the various arrangements of components inside of that cavity. So knowledge of POSITA in addition to what's disclosed in Schröder gives them the guidance in how to arrange this.

Q. So Schröder doesn't tell them, but the knowledge of the POSITA fills in all those blanks?

A. Yes. And I described that in the subsequent parts of my declaration

Ex-2020 at 208:5-209:15.

179. This asks too much of the ordinary artisan. Schröder's design is meant to accommodate a thin antenna coil. Moreover, RFID and NFC applications, for which Schröder is designed, typically involve ultra-thin applications such as a credit card chip or a hotel room key card. While placing a small RFID/NFC-style chip and an antenna coil on an inlay is reasonably within the skillset of a POSITA circa 2013, placing a large spine member as taught be Mestas, or arranging a curved battery (*See*

Section VI.B (showing suitable batteries available in 2013 were large)), a power management module (*see e.g.* Ex-2143 at 49 (showing a footprint of 2.1 x 2.1 mm and a height of .625 mm), a communication module (*see e.g.* Ex-2141 at 29 (showing a footprint of 6.1 x 6.1 mm and a height of 1 mm)) and a printed circuit board with sensors, a processor, and memory, within an internal space occupied by inlay is not, and is why all prior-art rings located their chips and boards in a stacked arrangement on top of the ring.

180. Indeed, Dr. Anthony testified that he didn't know the size of the battery in Schröder nor did he conduct any analysis to figure that out, instead simply suggesting that a skilled artisan would know that information:

Q. So how big is the battery or what's the size of the battery that's occupying the second half of the rectangle in Figure 7? Would a POSITA know that?

A. A POSITA would size the battery appropriately for the function that they were trying to accomplish.

Q. And you haven't done that analysis, have you?

A. It was not necessary to do that analysis in forming my opinion .
..

Ex-2020 at 214:7-215:10.

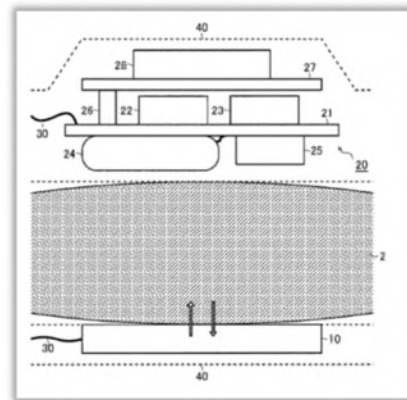
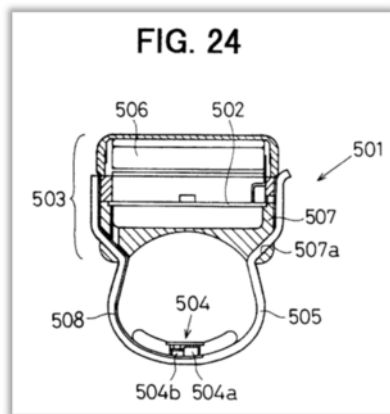
181. But without knowing the size of the battery, it is entirely conclusory of Dr. Anthony to suggest that the skilled artisan would place the battery, power management module, and all associated circuitry, which according to Dr. Anthony,

included a rectifier, chip module 10, a battery, *and* the antenna, within the cavity. Ex-2021 at 428:13-18; 426:10-429:12. Beyond the passive RFID authentication functionalities of Schröder, the additional proposed functionalities of Schröder would add significant power requirements and thus impact the size of the power management module, and in turn impact the placement of these components on the ring. Dr. Anthony agrees. Ex-2020 at 162:14-163:11 (“[Schröder is] silent on the particular capacity you start talking about these further embodiments that are taught, power requirements build up.”); *Id.*, at 166:11-19 (“as is envisioned in Schröder there are embodiments that include very power hungry things like display units.”). Thus, Dr. Anthony’s conclusion that a spine member and all of the components of the power management module would be included within the cavity of Schröder, or a similarly sized finger ring, is unsupported.

182. Dr. Anthony’s position is also contrary to the knowledge of the teachings of the prior art that is charged to one of ordinary skill in the art. The ordinary artisan would apply the teachings of the wearable ring prior art to date. When deciding where to locate the power management module in Schröder, the POSITA would apply these teachings:



Figure 8-1 First Prototype Ring Sensor



Ex-1037 at 7; Ex-1035 at 75; Ex-1028 at Fig. 24; Ex-1005 at Fig. 29.

183. Thus, the more likely result of a modified Schröder is not utilizing Mestas's spine member configuration and locating the battery alongside the chip module above the ring (similar to the prior art).

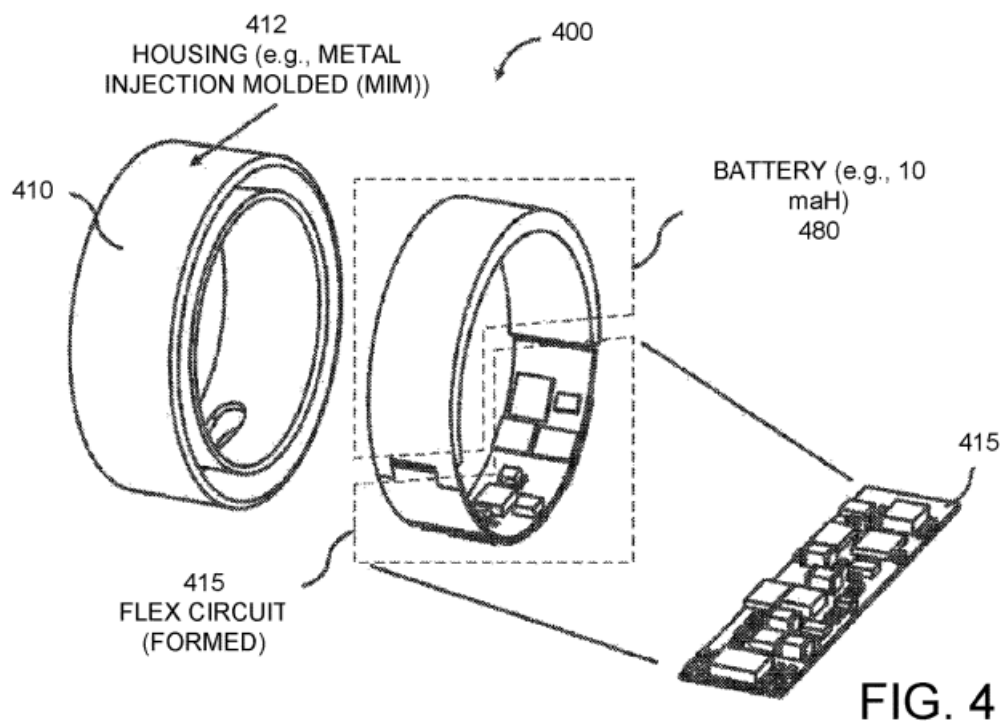
184. Mestas-Schröder fails to disclose the claimed curved rechargeable battery, within the interior space of the external that conforms to the curved interior surface of the external housing.

5. The Mestas-Schröder combination does not disclose or suggest limitations 1[c] and 14[c].

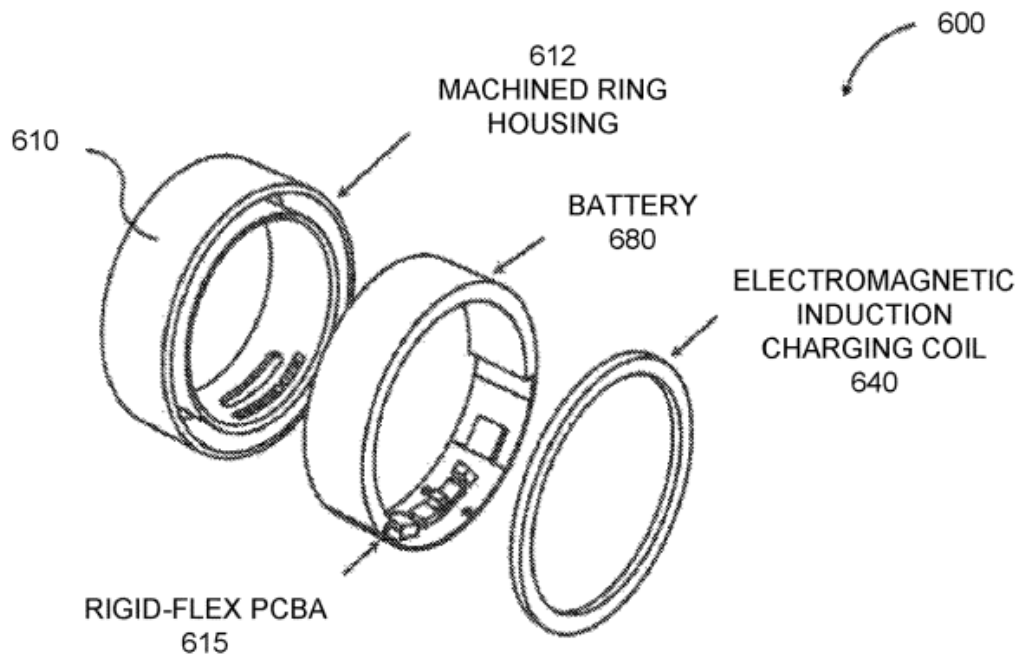
185. Claim 1[c] requires “a printed circuit board disposed within the interior

space configured to approximately conform to the interior surface.” Ex-1001 at 33:51-53. Claim 14[c] requires “a printed circuit board comprising a plurality of rigid circuit boards coupled with flexible regions, wherein the printed circuit board is disposed within the interior space and piecewise linearly conforms to the curvature the interior surface.” Ex-1001 at 35:52-56.

186. By way of example, Figure 4 of the '124 Patent shows “FLEX CIRCUIT 416” and Figure 6 shows “RIGID-FLEX PCBA 615,” which are conformed to the ring’s curvature and house the microprocessor and other components.



Ex-1001 at Fig. 4.



Ex-1001 at Fig. 6.

187. Although Dr. Anthony and Petitioner claim that Mestas-Schröder teaches elements 1[c], and 14[c] they only utilize citations to Mestas for this element. Pet. at 27-28; Ex-1002 ¶¶ 201-203.

188. As discussed above for elements 1[b] and 14[b], this is because Schröder's chip module 10, which contains the processor and memory (Ex-1007 at 11:3-8) and is connected to energy storage device (Ex-1007 at 11:47-48) is external to element 1[a]'s internal space. Ex-1007, Fig. 3. Its inlay 12 is an antenna carrier. Ex-1007 at 8:57-58. Schröder does not teach inlay 12 as a PCB containing a processor, memory, communications module, or sensors as required by the claims. Schröder also does not teach or suggest the use of a spine member to hold

components.

189. In the Final Written Decision for related proceeding PGR2024-00030 (EX-2151) on the related 11,868,178 Patent, the Board found that while “Schröder[‘s inlay] describes some aspects of a printed circuit board, Petitioner has not demonstrated that a person having ordinary skill in the art would have understood Schröder’s inlay 12 or carrier foil to be a ‘printed circuit board.’” Ex-2151 at 32. The Board reached that conclusion partially because Schröder “does not describe how, if at all, the components are connected on its carrier foil.” Ex-2151 at 33. The Board found my testimony that Schröder’s inly 12 “does not include many features of a PCB” credible over Dr. Anthony’s competing testimony. Ex-2151 at 35.

190. Instead, Petitioner and Dr. Anthony rely on Mestas for a PCB that conforms to the interior surface (Ex-1010 at ¶¶ 164, 177, 168), to be incorporated into Schröder’s ring. Pet. at 27-28; Ex-1002 at ¶¶ 201-203.

191. Mestas discloses that “spine member 22 may be considered a chassis member having various components attached thereto” (Ex-1010 at ¶ 0153) and has an inner surface 32 and an outer surface 30. Ex-1010 at ¶ 0153. Inner surface 32 has recesses 50, 52 for batteries. Ex-1010 at ¶ 0168. Outer surface 30 is proximate controller 14 and display 30. Ex-1010 at ¶ 0155. External housing 24 is formed around center spine member 22. Ex-1010 at ¶ 0157.

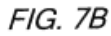
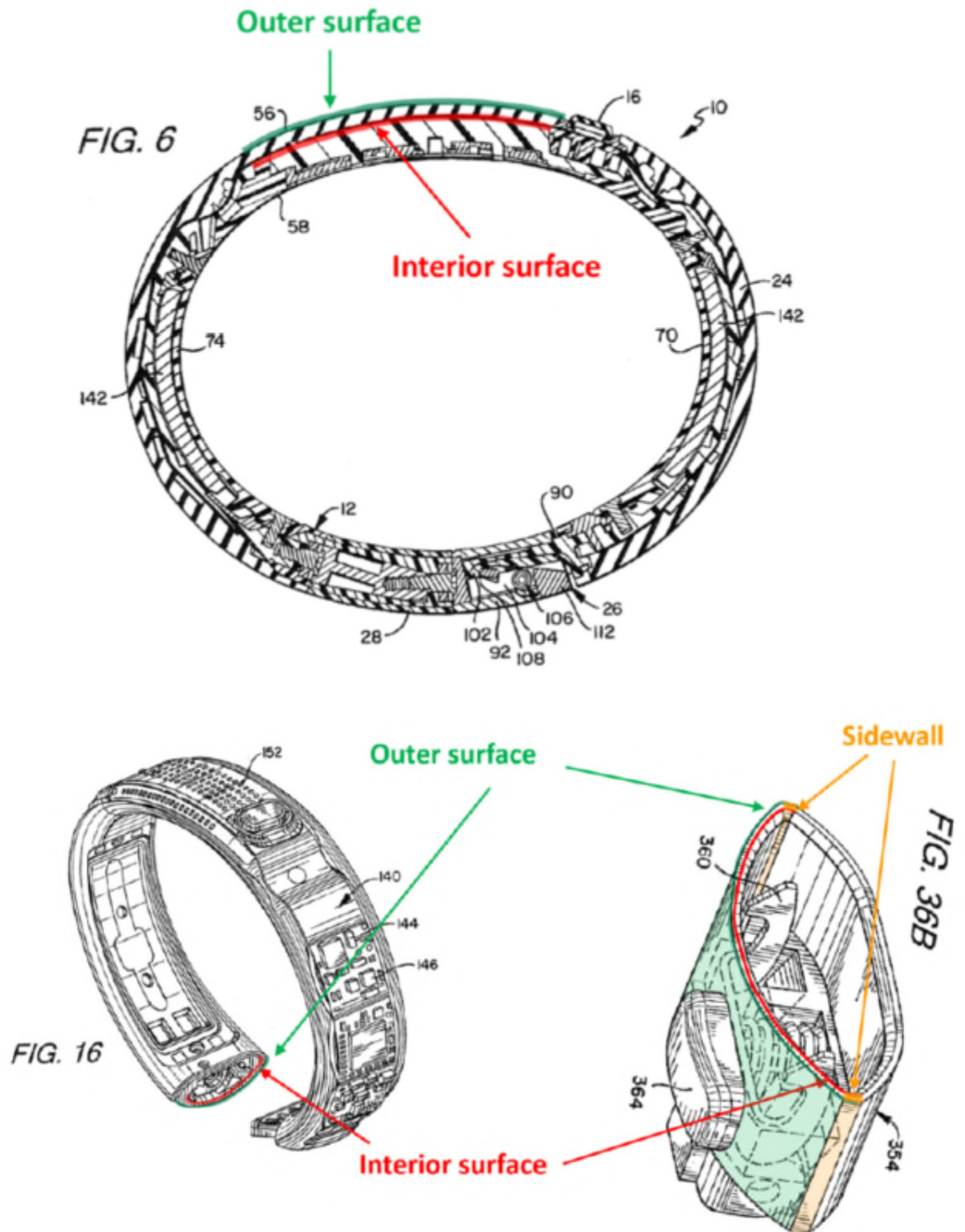


FIG. 8A

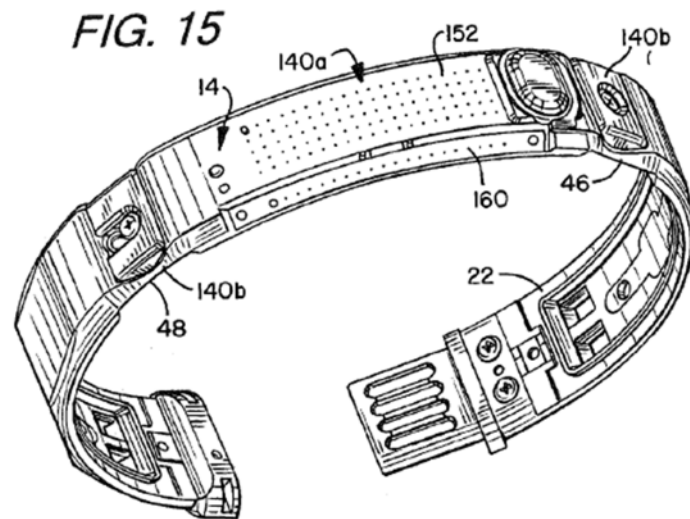
1010 at Fig. 7B, 8A.

192. In Figures 6, 16, and 36B, Petitioner points to outer encasement



193. Petitioner maps the inner surface of external housing 24 as the interior surface of claim 1[c].

194. Mestas discloses a “flexible circuit member” (PCB member 140) that is “wrapped around and mounted to the spine member 22” which has rigid and flexible zones (Ex-1010 at ¶0164, ¶0153, FIG. 15).



Ex-1010 at Fig. 15.

195. Figure 15 clearly shows that the printed circuit board member conforms the exterior surface of spine member 22. The exterior surface of spine member 22 is separated from the claimed interior surface of the external housing—Petitioner later argues that potting encapsulates the PCB which would necessitate a gap between the two surfaces. Pet. at 32. The smaller diameter surface of the exterior surface of spine member 22 compared to the interior surface of external housing 24 would necessitate the printed circuit board conform to a different arc. Therefore, Mestas does not teach “a printed circuit board disposed with the interior space configured to **approximately conform to the interior surface**” of element 1[c] or teach “a printed

circuit board comprising a plurality of rigid circuit boards coupled via flexible regions, wherein the printed circuit board is disposed within the interior space and **piecewise linearly conforms to the curvature of the interior surface**” of claim element 14[i].

196. Further, Petitioner and Dr. Anthony do not provide any explanation of how Mestas’s flexible circuit member that is attached to Mestas’s spine member would be adopted to Schröder’s finger-ring form. Schröder does not teach a spine member like Mestas’s, rather Schröder’s chip module is external. Ex-1007, Fig. 3.

197. Petitioner also ignores the extreme size mismatch between Schröder’s finger-ring form and Mestas’s large wristband embodiment. Ex-1010, Fig. 6. Mestas’s batteries, layout, and other components, in the words of Dr. Anthony, would have to be scaled down “5 to 10” times to be appropriately sized for a finger worn ring. Ex-2021 at 313:12. I agree.

198. Therefore, the combination of Mestas (teaching flexible or rigid-flex PCBs conformed to a wristband spine) and Schröder (teaching a simple flexible antenna inlay and a external chip module) does not disclose or suggest “a printed circuit board disposed within the interior space configured to approximately conform to the interior surface” of element 1[c] or “a printed circuit board comprising a plurality of rigid circuit boards coupled with flexible regions, wherein the printed circuit board is disposed within the interior space and piecewise linearly conforms

to the curvature the interior surface” of element 14[c].

6. The Mestas-Schröder combination does not disclose or suggest limitations 1[i], and 14[i].

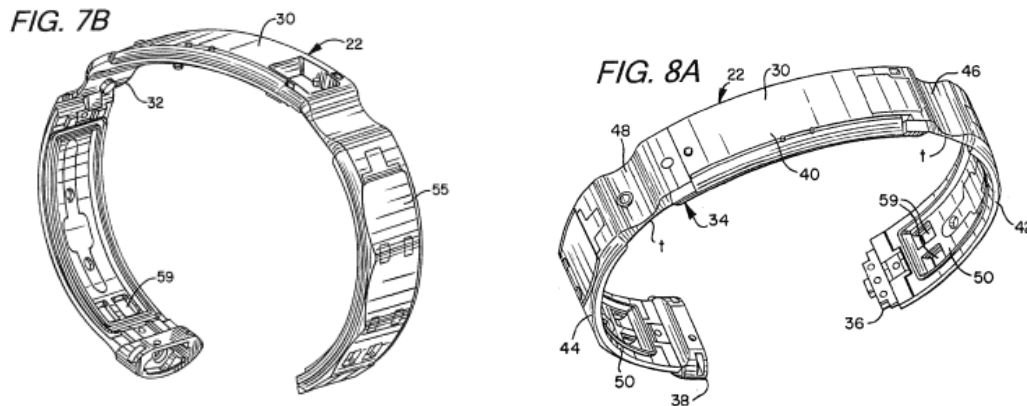
199. Claim elements 1[i] and 14[i] require “a potting material disposed in the interior space encapsulating the plurality of components, wherein the potting material forms an interior wall of the wearable computing device, wherein the potting material is substantially transparent to light selected from a group consisting of: visible light, infrared light, and ultraviolet light.” Ex-1001 at 34:13-19, 36:17-23.

200. Petitioner relies on Mestas’s disclosure that “[a]n interior diameter, or inner portion, [of external housing 24] may be injection molded onto the spine member 22” to teach elements 1[i]/14[i], a substantially transparent interior wall of the wearable computing device formed by potting deposited in the interior space. Ex-1010 at ¶ 173; Pet at 32.

201. Petitioner argues the “outer portion of the encasement member—in particular its interior surface and sidewalls— define an ‘interior space’ that stores the controller and other electronic components, as required by the claim.” Pet. at 25.

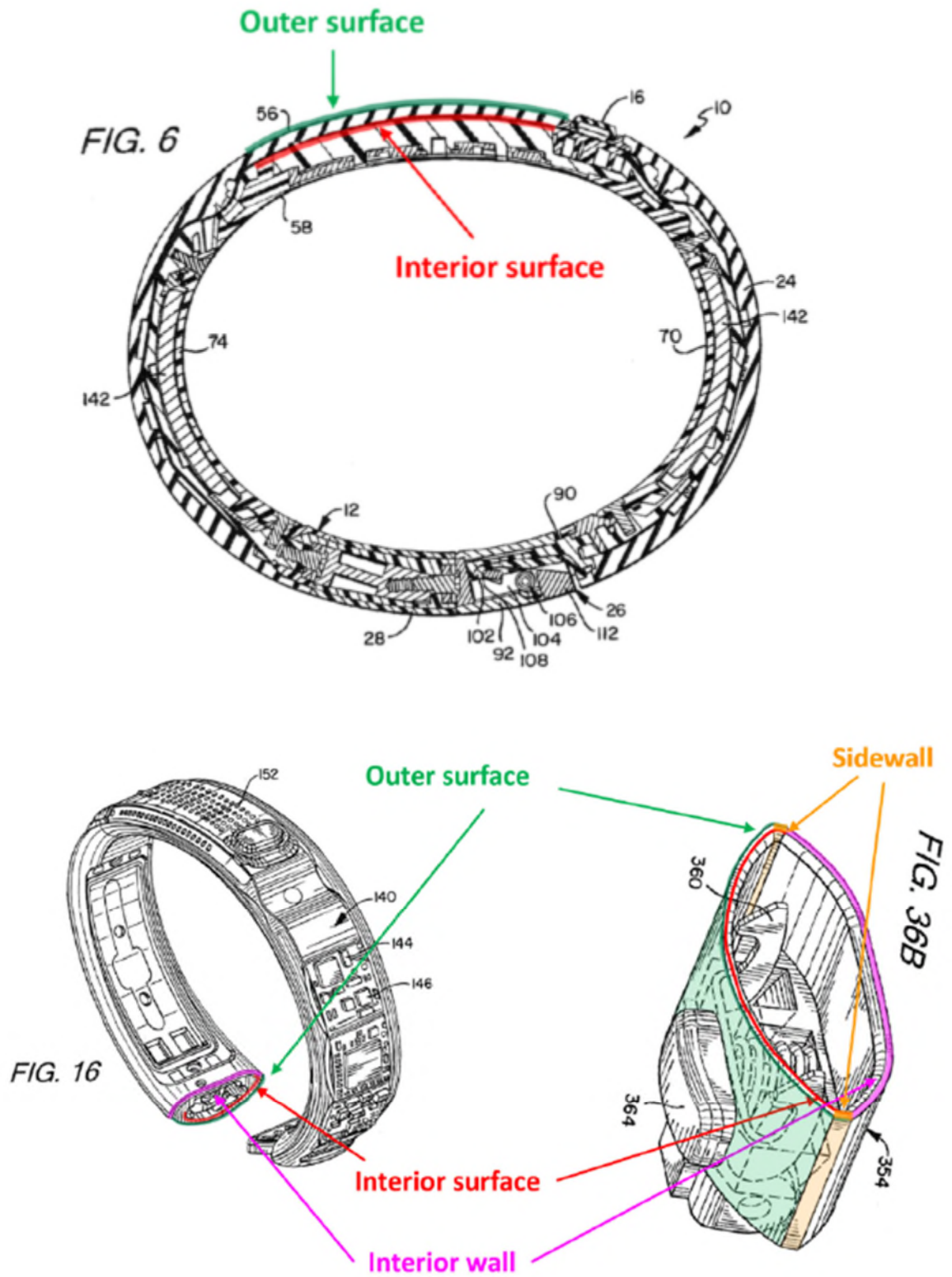
202. Mestas discloses that “spine member 22 may be considered a chassis member having various components attached thereto” (Ex-1010 at ¶ 0153) and has an inner surface 32 and an outer surface 30. Ex-1010 at ¶ 0153. Inner surface 32 has recesses 50, 52 for batteries. Ex-1010 at ¶ 0168. Outer surface 30 is proximate to the

controller 14 and display 30. Ex-1010 at ¶ 0155. External housing 24 is formed around center spine member 22. Ex-1010 at ¶ 0157.



Ex-1010 at Fig. 7B, 8A.

203. In Figures 6, 16, and 36B, Petitioner points to outer encasement member 24 of the external housing as element 1[a]’s “external housing”, outer surface 56 of the external housing as the “outer surface,” and inner surface 58 of the external housing as the “interior surface.” Pet. at 23; Ex-1006 at Fig. 6 (reproduced below). Petitioner points to optional features depicted in figures 16 and 36 (reproduced below) to teach sidewalls that would give the Mestas device an interior space with an approximate C-shape. Pet. at 24-25.



Ex-1010 at Figs. 6, 16 and 36B.

204. Petitioner argues that the inner portion 354 of the external housing can be deposited with injection molding, which can transparent. Pet. at 32-34.

205. Transparent epoxy deposited in place of element 354 would not “encapsulate[] the plurality of components” in the interior space. As described and depicted above, Petitioner chose to define the interior space as the area from the inner surface of the external housing to the outer surface of spine member 22 which is proximate to the controller 14, and display 30. Spine member 22 separates Petitioner’s transparent element 354 from those components. Epoxy deposited to form the interior wall of Mestas at element 354 cannot encapsulate components because spine member 22 is in the way.

206. Alternatively, if the Petitioner meant to point to epoxy deposited in what Petitioner defines as the interior space to fulfill the element, that material can never form the claimed “interior wall of the wearable computing device”, because spine member 22 would then be the most interior member and form the interior wall. Spine member 22 cannot serve as the interior wall because it is not substantially transparent. In other words, because spine member 22 separates the interior space and element 354, epoxy deposited cannot both encapsulate the interior space and form the interior wall of the device.

207. Mestas-Schröder fails to disclose “a potting material disposed in the interior space encapsulating the plurality of components, wherein the potting

material forms an interior wall of the wearable computing device, wherein the potting material is substantially transparent to light selected from a group consisting of: visible light, infrared light, and ultraviolet light.”

7. The Mestas-Schröder combination does not disclose or suggest claim 8.

208. Claim 8 requires “a module disposed upon the printed circuit board and coupled to the curved rechargeable battery and to the processor, wherein the module is configured to manage power to and from the curved rechargeable battery.” Ex-1001 at 34:58-59.

209. By way of example, Fig. 2 of the ’124 Patent shows a module 240 “for recharging the battery 280 and for providing electrical power to various modules 210-270 into the WCD.” Ex-1001 at 11:8-12. In Fig. 2 the module is made up of a DC-DC converter that regulates power from the battery from 3.7V to 1.8V, and CPV cells 340 that provides power to the battery 280 (Ex-1001 at 11:20-23):

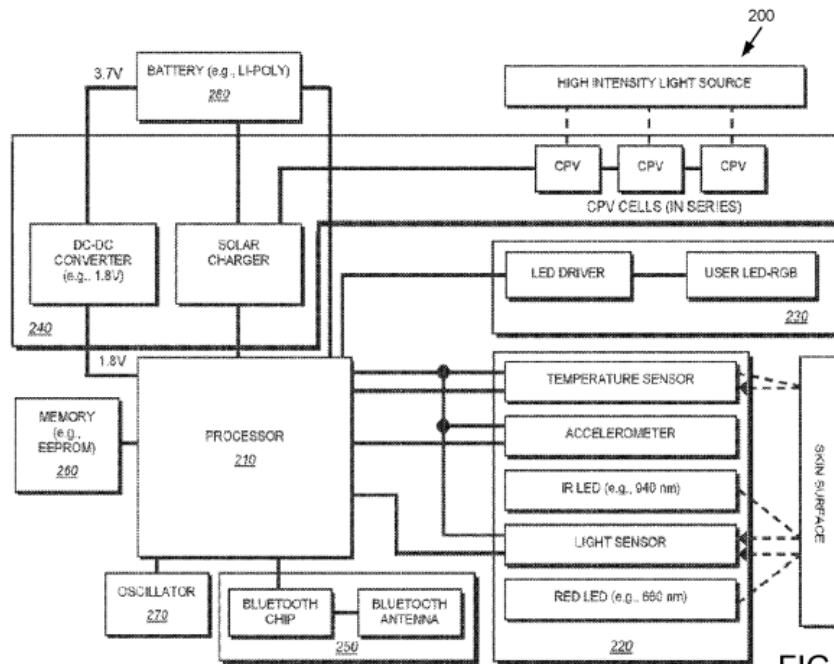


FIG. 2

210. In other embodiments, module 240 can include: an “electromagnetic induction charging coil,” or a “thermoelectric generator.” Ex-1001 at 11:33-35, 11:58-62. See Fig. 6, 8.

211. Petitioner and Dr. Anthony argue that Mestas’s “charging component 4309, coupled to processor 4301, **for charging** the battery” (Pet. at 37) and “low power mode” would allow a POSITA to “understand from these disclosures that the Mestas device has a module for managing power to and from the battery.” Pet. at 38; Ex-1002 ¶¶ 246-248. Petitioner also points to Schröder’s rectifier circuit “as a module for managing power **to the battery**, ensuring efficient energy conversion and safe battery charging.” Pet. at 37-38; Ex-1002 at ¶ 247.

212. These disclosures are insufficient. Element 8 requires a module

“configured to manage power **to and from** the curved rechargeable battery.” A module that manages power to the battery alone does not disclose claim 8. For Schröder’s rectifier circuit and Mestas’s charging component, Petitioner and Dr. Anthony only argue that the components help manage power to the battery. Pet. at 37-38; Ex-1002 at ¶¶ 246-247.

213. Petitioner and Dr. Anthony solely rely on Mestas’s “low power mode” to disclose a module that manages power from the battery. Pet. at 38; Ex-1002 at ¶ 246. I disagree that Mestas’s “low power mode” manages power from the battery.

214. When Mestas’s device reaches a low power from 3-10 or 3-20%, the display shows a “low battery” animation. Ex-1010 at ¶ 0241. In this initial low battery state, “there is no change in metric generation and no change in data storage.” *Id.* When power drops beneath 3%, the display “may stop generating metrics and the device may stop storing data . . . the radio connection may be closed and the network processor may also be shut down,” and the display may be changed to a “plug” animation. *Id.* In my opinion, these modes are implemented by Mestas’s processor as a means to manage its power, not by a module configured to manage power from the battery. “Power management” can refer to: 1) managing the power consumption of a load circuit by adjusting its operation and/or modes, which is what is described in Mestas, or 2) using a physical power management module, typically a DC-DC converter, to condition, convert, and manage power delivery between a battery and

load circuits. The '124 Patent is describing the latter, not the former. *See* Ex-1001 at Claim 8 (“[A] **module** disposed upon the printed circuit board and coupled to the curved rechargeable battery and to the processor where in the **module** is configured to manage power to and from the curved rechargeable battery”).

215. For example, the module that regulates power to and from the '124 Patent's battery, is **coupled** to the processor, but the module alone is configured to manage power to and from the curved rechargeable battery. This is necessary, as the voltage provided by a battery is unlikely to meet the voltage needs of a processor; thus a DC-DC converter module is almost always used in such scenarios. Mestas includes no such module. A mapping solely to functions carried out on Mestas's processor cannot meet element 8.

216. Also, Mestas's “low power mode” describes actions that lower the demand for power but that do not disclose managing power from the curved rechargeable battery. In my opinion, managing power requires affecting the conditions at which power flows from the battery, such as voltage levels, as described above. Petitioner fails to point to a disclosure in Mestas and Schröder that discloses an element that affects the voltage or current from the battery, like the '124 Patent's DC-DC converter.

217. Finally, Schröder's disclosure of a rectifier that directly charges a battery will not work with the types of batteries Dr. Anthony suggests a POSITA

might use (e.g., Lithium-based batteries, such as a Lithium Polymer battery). Such batteries require specialized power management modules to condition the power coming from the charging source (in this case, a rectifier) to provide specific constant-current and/or constant-voltage charging characteristics. A rectifier alone cannot provide such charging characteristics, and is thus unsuitable for the hypothetical Mestas-Schröder combination suggested by Dr. Anthony.

218. Therefore, Mestas-Schröder fails to disclose a module coupled to the processor that is configured to manage power to and from the battery.

8. The Mestas-Schröder combination does not disclose or suggest claim 10[b].

219. Claim 10[b] requires that the “thickness of the wearable computing device is within a range of 1.5 to 3 mm.” Ex-1001 at 35:8-10.

220. For example, and as shown below, the ’124 Patent discloses that “the thickness between diameters d_1 and d_2 can vary widely, but can typically reside in an approximate range of 1.5 mm to 3 mm.” Ex-1001 at 14:8-10.

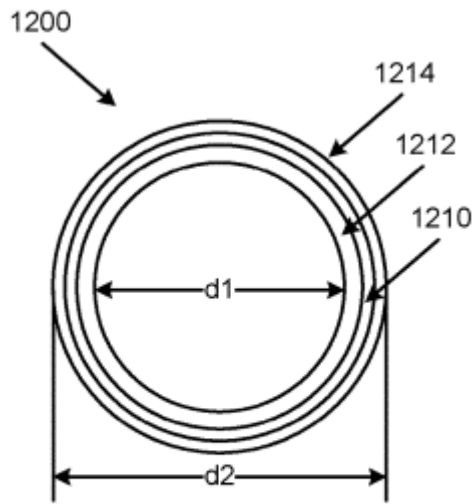


FIG. 10B

Ex-1001 at Fig 10B.

221. Petitioner does not rely on Schröder or Mestas to show the claimed thickness of 1.5 mm to 3 mm. Instead, Petitioner relies on Dr. Anthony's knowledge of a POSITA and Ex-1014 to show that a POSITA would understand that finger rings have a thickness of 1.8 to 2.3 mm. Pet. at 41-42; Ex-1002 at ¶ 263. This opinion is based on the design of regular finger-worn rings – not smart rings, of which Dr. Anthony cites no evidence of products or prototypes of a similar shape to that taught in the '124 Patent. A POSITA relying on ornamental finger ring teachings such as Ex-1014 would not want to increase the thickness of a finger ring. As discussed above, thick, heavy rings are uncomfortable to wear for long periods. Additionally, ornamental rings are typically made out of precious metals and increasing the thickness of a ring would increase the price of the ornamental ring.

222. Wearable smart ring devices must incorporate many components and are typically thicker than traditional rings like those described in Ex-1014. A POSITA restricted to a range of 1.8 to 2.3 mm may not be able to fit all of the components needed inside and/or arrive at the claimed embodiments of the '124 Patent. In fact, the Oura Ring 2, 3, and Samsung's Galaxy Ring are significantly thicker than the rings described in Ex-1014.

OURA RING 2

- Guides
 - Teardown
- Popular Forum Questions
- Details**
 - Background Information
 - Specifications
 - Additional Information

Specifications

- **Width:** 7.9 mm
- **Thickness:** 2.5 mm
- **Weight:** 4-6 grams
- **Water Resistance:** Up to 100 meters
- **Battery Life:** Up to 1 week
- **Sensors:**
 - Infrared optical pulse measurement
 - 3D accelerometer
 - Gyroscope
 - Body temperature sensor

Ex-2144.

Other Specifications

- Battery: Up to 7 days. Battery life and longevity can vary depending on the age of your ring and how often you use certain features. See **Ring Battery Tips** for more information
- Width: 7.9mm
- Thickness: ~2.7mm (Oura Ring Gen3 Heritage), ~2.9mm (Oura Ring Gen3 Horizon)
- Weight: 4-6 grams (depending on ring size)

Ex-2145; Ex-2059

Three-sensor technology on your finger

One Ring, three-sensor technology. Galaxy Ring is 7mm wide, 2.6mm thick and weighs 2.3g — **light** and comfortable but **fully equipped** to track your days and nights. ^{4, 6, 7}

Ex-2146 at 5.

223. Petitioner fails to show prior art disclosing or POSITA knowledge of wearable smart rings between 1.5 mm to 3 mm.

9. The Mestas-Schröder combination does not disclose or suggest claims 2, 4-5, 8-11, 14, 16, and 18-19.

224. Because Dr. Anthony has not shown that Mestas-Schröder renders Claim 1 and 14 obvious, Mestas-Schröder also does not disclose or suggest dependent claims 2, 4-5, 8-11, 14, 16, and 18-19.

10. Mestas in view of Schröder does not enable the claimed Invention of the '124 Patent.

225. The combined disclosures of these references would not have enabled a POSITA to achieve the specific wearable ring computing device claimed in the '124 Patent without resorting to undue experimentation. This lack of an enabling disclosure from the combination directly undermines any assertion that a POSITA would have had a reasonable expectation of success in arriving at the claimed invention.

226. The primary technical hurdles that a POSITA would face, for which Mestas and Schröder offer no enabling solutions, relate to the extreme miniaturization required and the integration of a comprehensive monitoring system into a functional and reliable ring form factor. Mestas discloses a complex system with components such as curved batteries and a multi-functional flexible printed circuit board, all designed to be placed on a bulky spine member and scaled for a 5-10 times larger wrist-worn athletic device (Ex-1010 at ¶143, Fig. 6). Schröder, on the other hand, describes a slim finger-ring primarily intended for security applications, with its main electronics often housed in an external, replaceable chip module and its internal structure accommodating little more than a thin antenna inlay. Ex-1007 at Fig. 3, 8:57-58, 9:1-3).

227. Petitioner relies on Mestas's wrist device for elements 1[a]/14[a] (an

external housing with a C-shaped cross section), 1[b]/14[b] (a curved rechargeable battery), 1[c]/14[c] (a PCB the conforms to the interior surface of the external housing), 1[d]/14[d] (motion sensors), 1[e]/14[e] (a memory), 1[g]/14[g] (a temperature sensor), and 1[h]/14[h] (a processor). These components are all mounted on a bulky, thick spine member. While discussing these elements, Petitioner and Dr. Anthony do not discuss how a thick spine member or these components would be physically incorporated into Schröder's much smaller form factor and much smaller inlay, and do not discuss how Schröder would power these components with a necessarily smaller battery.

228. Petitioner and Dr. Anthony fail to do so because the combined references provide no guidance on how to drastically reduce the physical size of Mestas's entire system—including its power source, substantial PCB, and diverse sensor suite—to fit within the highly constrained volume of Schröder's ring, while ensuring all components remain functional, reliable, and manufacturable. This miniaturization would necessitate significant inventive effort in component selection, potential custom fabrication, and ultra-dense packaging techniques not detailed or suggested by Mestas or Schröder for such a combined purpose.

229. Although Dr. Anthony claims that “battery miniaturization, driven by advancements in high-energy density and flexible battery technologies was standard” as I explained in Section VI.B, he fails to identify specific batteries that

would work in a '124 Patent device or provide a timeline for when one would be available. Ex-1002 at ¶¶93-102. Dr. Anthony's vagueness regarding the speed of miniaturization is clarified by his earlier testimony that miniaturization happens over "years." Ex-2021 at 455:6-8. Mestas has a priority date of February 22, 2013, months before the priority date of the '124 Patent and fails to consider any form factors as small as a finger ring. Ex-1010 at 1.

230. Meanwhile, Schröder's primary embodiment involves a protruding chip module, and no teachings as to where a battery, or any of the additional sophisticated electronics needed to operate a wearable computing device, would be located. A POSITA, with no other teachings or guidance provided by Schröder, would thus conclude that these extra elements would go into the protruding area, as in all of the prior art in smart ring designs. A POSITA would understand that the embodiments in Schröder that do not show the protruding area (e.g., Fig. 4) would be limited to a very small RFID/NFC-style chip module and antenna—like what are present in disposable hotel key cards. This is somewhat reasonable. Further stuffing a battery and sophisticated sensing, power management, wireless communication, and computing systems into such an arrangement without any explicit teachings is not, and goes well beyond the ability of the ordinary artisan circa 2013.

231. Therefore, a POSITA attempting to create the '124 Patent's invention from Mestas and Schröder would be confronted by numerous significant technical

gaps related to miniaturization, power management, mechanical and electrical integration, and functional implementation. The successful resolution of these challenges would require extensive and undue experimentation, far beyond the ordinary skill in the art, further demonstrating that the Mestas-Schröder combination does not render the claimed invention obvious.

B. Ground 2: Claims 3, 6, 12-13, 15, 17, and 20 are patentable over Mestas in view of Schröder in further view of Yuen.

232. In Ground 2, Petitioner alleges that Claims 3, 6, 12-13, 15, 17 and 20 are obvious over Mestas in view of Schröder in further view of Yuen. I disagree for several reasons.

1. A POSITA Would Not Have Been Motivated to Combine Mestas, Schröder, and Yuen and Would Have Lacked a Reasonable Expectation of Success.

233. For the same reasons as argued in Section VII.A.1, a POSITA would not combine Mestas, Schröder, and Yuen.

234. Petitioner further argues that 1) the three references are all “directed to wearable biometric sensing devices having similar structural components,” (Pet. at 45), 2) and that Yuen is “structurally equivalent and functionally similar or identical to a ‘finger ring’” (Pet. at 45). *Id.* These arguments ignore the substantial differences in the disclosed form factors, intended applications, and structural complexities when compared to the claimed finger ring computing device of the ’124 Patent.

235. Mestas describes a wrist-worn (or other large body part) “wearable

athletic device” focused on comprehensive athletic performance monitoring. Ex-1010 at ¶143. Schröder primarily discloses a “finger-ring” as an “external secure unit” for authentication and secure transactions using RFID/NFC and biometric vein pattern recognition (Ex-1007 at Abstract, 3:61-63, 9:54-10:4). Schröder’s focus is security and discrete event interaction, not continuous physiological health monitoring. Yuen primarily describes devices adapted for larger body parts like the arm, wrist, leg, or ankle, with preferred embodiments being wrist-worn or arm-mounted used for biometric monitoring. Ex-1006 at Abstract, 12:53-55. A POSITA would not view these as “the same type of devices” with similar components to be simply merged into a small ring form factor.

236. Yuen’s device is not structurally or functionally similar to a finger ring. As shown below in Fig. 13, Yuen primarily describes and illustrates a wrist-worn or arm-mounted device.

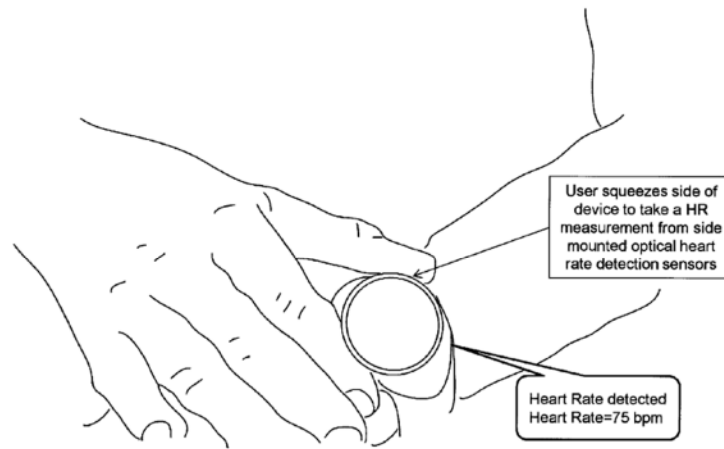


FIG. 13

Ex-1006 at Fig.13.

237. Petitioner’s reliance on Yuen’s passing and speculative reference to a “toe band” (Ex-1006 at 24:35-40) as a basis for a “wearable computing device configured to be worn around a finger of a wearer” is unavailing, as Yuen does not depict or describe a device around a finger of a wearer and does not provide any information on its “toe band” device.. As established in Section V of my declaration, the claimed “wearable computing device configured to be worn around a finger of a wearer” in the ’124 Patent is finger-worn ring wearable computer device. Yuen’s term “toe band” does not equate to a “finger-worn ring,” particularly a “wearable computing device configured to be worn around a finger of a wearer.”

238. Yuen defines a “band” as separate from the electronics in the biometric monitoring device. Ex-1006 at 24:3-6 (“A user may wear one or more of the

biometric monitoring devices . . . with the use of a band . . .”). The band has a variable circumference and is not electronically integrated with the biometric monitoring device. Ex-1006 at 24:6-14. (“[The] band [] is flexible and thereby readily fitted to the user . . . The band may have an adjustable circumference . . . The band may be detachable from the ‘electronic’ portion of the biometric monitoring device.”) More critically, Yuen provides no enabling disclosure for this “toe band” to function as a computing device. The word “toe” is mentioned exactly once in Yuen as a passing remark, and as a result the disclosure lacks essential details regarding its construction, the integration of necessary electronic components (processor, memory, sensors, battery, and PCB), power management for such a miniaturized form, and how the significant challenges of miniaturization compared to the primary disclosure of a wrist-worn device would be overcome. A toe-band is not present in the claims of Yuen either.

239. Dr. Anthony admitted during his deposition that essential layout and structural details for such a toe band are “not explicitly shown in Yuen.” Ex-2022 at 50:21-51:7. Such a cursory and unsupported mention would not motivate a POSITA to undertake the complex task of combining disparate elements from Yuen, Mestas, and Schröder to arrive at the claimed wearable computing device configured to be worn around a finger of a wearer, nor would it provide any reasonable expectation of success in doing so.

240. As explained above in Section VII.A.1, Petitioner ignores the challenges of miniaturizing Mestas's components into a Schröder sized finger ring in Ground 1. *See* Pet. at 44-45. Petitioner similar ignores the challenges of militarizing Yuen's components.

241. Further, the power requirements of Schröder, Mestas, and Yuen would also be different, given that Mestas and Yuen are constantly monitoring health conditions and Schröder only takes vein pattern images in a security validation event. Given the typically low power requirements of Schröder's intended RFID and NFC applications, and its description of the battery as optional, a POSITA would not be motivated to combine the references or have a reasonable expectation of success in doing so.

242. Given the significant scaling challenges, the lack of concrete disclosure for a ring form factor in Yuen, the different device contexts, and the substantial redesign required, a POSITA would not have been motivated to combine Mestas, Schröder, and Yuen as proposed by Petitioner with a reasonable expectation of successfully creating the specific wearable computing device configured to be worn around a finger of wearer as recited in the challenged claims.

2. The Mestas-Schröder-Yuen combination does not disclose or suggest claims 3 and 15.

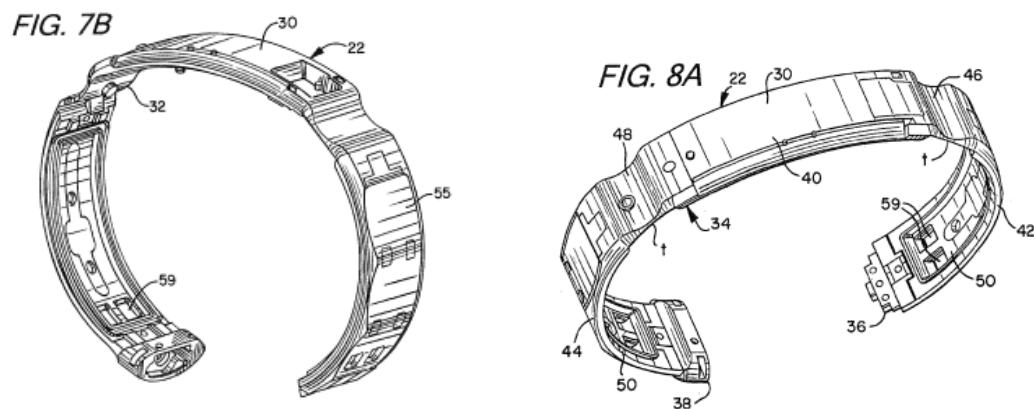
243. Claim 3[pre] requires "wherein the plurality of rigid circuit boards

comprises a first rigid circuit board, a second rigid circuit board and a third rigid circuit board, wherein the second rigid circuit board is disposed between the first rigid circuit board and the third rigid circuit.” Ex-1001 at 34:27-33. Claim 3[a] requires “an infrared light source disposed upon the first rigid circuit board, wherein the infrared light source is configured to illuminate a portion of skin of the finger with infrared light.” Ex-1001 at 34:34-38. Claim 3[b] requires “an imaging device disposed upon the second rigid circuit board, wherein the imaging device is configured to receive reflected light from the portion of the skin in response to the infrared light.” Ex-1001 at 34:38-42.

244. Claim 15[c] requires: “a first infrared light source disposed upon the first rigid circuit board, wherein the first infrared light source is configured to illuminate a first portion of skin of the finger with infrared light.” Ex-1001 at 36:37-39. Claim 15[d] requires: “a second infrared light source disposed upon the third rigid circuit board, wherein the second infrared light source is configured to illuminate a second portion of skin of the finger with infrared light” Ex-1001 at 36:40-43. Claim 15[e] requires: “an imaging device disposed upon the second rigid circuit board, wherein the imaging device is configured to receive reflected light from the first portion of the skin and the second portion of the skin” Ex-1001 at 36:43-47.

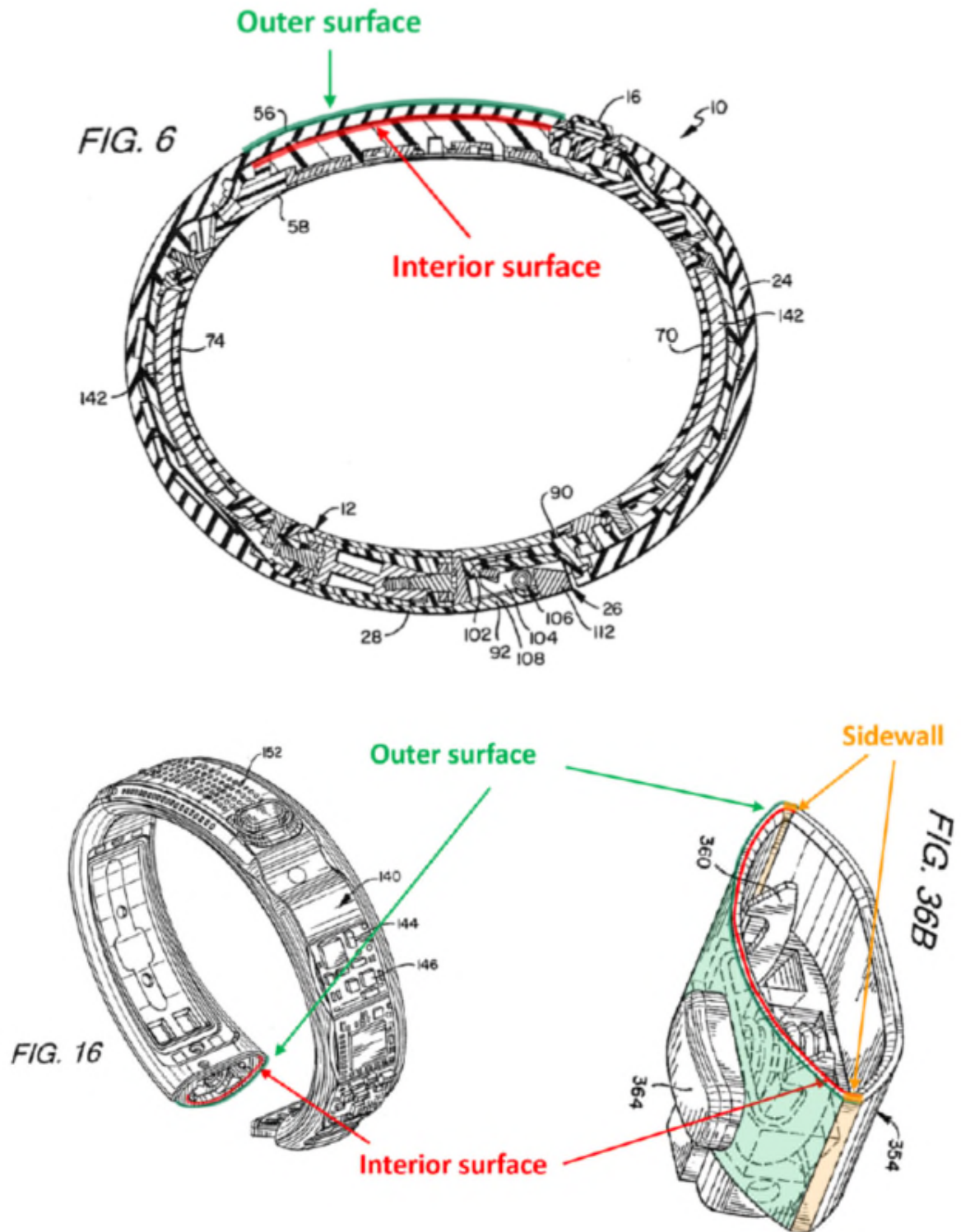
245. Mestas discloses that “spine member 22 may be considered a chassis

member having various components attached thereto” (Ex-1010 at ¶ 0153) and has an inner surface 32 and an outer surface 30. Ex-1010 at ¶ 0153. Inner surface 32 has recesses 50, 52 for batteries. Ex-1010 at ¶ 0168. Outer surface 30 is proximate controller 14 and display 30. Ex-1010 at ¶ 0155. External housing 24 is formed around center spine member 22. Ex-1010 at ¶ 0157.



Ex-1010 at Fig. 7B, 8A.

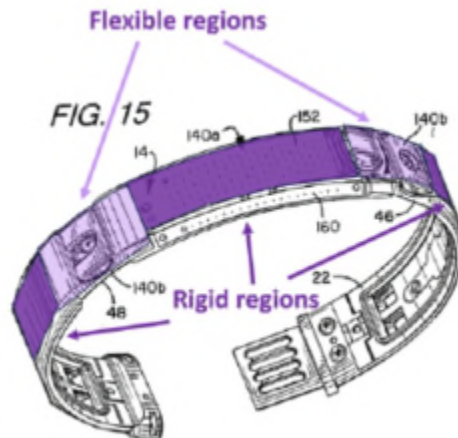
246. In Figures 6, 16, and 36B, Petitioner points to outer encasement member 24 of the external housing as element 1[a]’s “external housing”, outer surface 56 of the external housing as the “outer surface,” and inner surface 58 of the external housing as the “interior surface.” Pet. at 23; Ex-1006 at Fig. 6 (reproduced below). Petitioner points to optional features depicted in figures 16 and 36 (reproduced below) to teach sidewalls that would give the Mestas device an interior space with an approximate C-shape. Pet. at 24-25.



Ex-1010 at Fig. 6, 16, 36B.

247. Petitioner relies on Mestas to for claim element 3[pre] and Yuen to

show claim elements 3[a], 3[b]/15[c], 15[d] and 15[e]. Pet. at 46-48, 54-56. Petitioner does not rely on Schröder for this claim.



Ex-1010 at Fig. 15; Pet. at 46.

248. Petitioner fails to explain how placing Yuen's LEDs on Mestas's rigid circuit boards would facilitate "illuminat[ing] a portion of skin of the finger with infrared light." Spine member 22 would block light from traveling to the finger of the user.

249. Alternatively, if Petitioner were to argue that LEDs could be placed on the other side of spine member 22, then those LEDs and PCBs to support the LEDs would not be in the interior space as Petitioner defined the interior space for element 1[a]/14[a] and 1[c]/14[c].

250. Therefore, Mestas-Schröder-Yuen fails to disclose LEDs configured to illuminate a portion of the skin as required by claims 3 and 15.

3. The Mestas-Schröder-Yuen combination does not disclose or suggest claims 3, 6, 12-13, 15, 17, and 20.

251. Because Dr. Anthony has not shown that Mestas-Schröder renders Claim 1 and 14 obvious, Mestas-Schröder-Yuen also does not disclose or suggest dependent claims 3, 6, 12-13, 15, 17, and 20.

4. Mestas in view of Schröder in further view of Yuen does not enable the claimed Invention of the '124 Patent.

252. For the same reasons as argued in Section VII.A.10, the combination of Mestas and Schröder would not have enabled a POSITA to achieve the specific wearable ring computing device claimed in the '124 Patent without resorting to undue experimentation.

253. Adding Yuen to the Mestas-Schröder combination does not add any enabling disclosure that would allow a POSITA to have had a reasonable expectation of success in arriving at the claimed invention. Petitioner fails to explain how the wristband components of Yuen and/or Mestas would be applied to Schröder's finger ring, or how Mestas's circular wristband design would be adapted to Yuen's planar wristband design with a flexible band/strap to create a finger ring. The USPTO previously acknowledged the lack of teaching in Mestas (via Weast) on how its "battery can be reconfigured" for a ring.

254. The components of Yuen and Mestas are specifically designed for a wristband and are not compatible with a finger ring. Petitioner's assertion to simply

“shrink” Yuen’s device is based on hindsight and does not address the significant challenges of fitting Mestas’s curved batteries with Yuen’s planar PCB into a ring-sized device.

C. Ground 3: Claims 1-6, and 8-20 are patentable over Yuen in view of Schröder further in view of Mestas.

255. In Ground 1, Petitioner alleges that Claims 1, 11, and 13-20 are obvious over Yuen in view of Schröder in further view of Mestas. I disagree for several reasons.

1. A POSITA would not have been motivated to combine Yuen, Schröder, and Mestas and would have lacked a reasonable expectation of success in doing so.

256. For the same reasons as argued in Section VII.A.1 and VII.B.1, a POSITA would not combine and Yuen, Schröder, and Mestas.

2. The Yuen-Schröder-Mestas combination does not disclose or suggest limitations 1[pre] and 14[pre].

257. For the same reasons as argued in Section VII.A.2 for the Mestas-Schröder, the Yuen-Schröder-Mestas combination does not disclose or suggest the “wearable computing device configured to be worn around a finger of a wearer” of claim elements 1[pre] and 14[pre].

258. Petitioner further argues that Yuen teaches “a wearable device that can be ‘worn in any number of ways including, but not limited to’ a chest band, necklace, patch, bra, earring, glasses, ‘or toe band.’” Pet. at 60 (citing Ex-1006 at 24:35-40).

259. I agree with Petitioner that “Yuen does not explicitly teach that the device is ‘configured to be worn around a finger.’” Pet. at 60.

260. Petitioner made a similar argument in IPR2024-01077 that the Board rejected. Ex, 2153, 29. (“[I]t is undisputed that Yuen does not explicitly disclose the layout and internal structure of such a toe band design ... This lack of disclosure is important because Petitioner’s assumptions about what would have been obvious for its interpretation of a toe band embodiment, particularly with respect to the “curved battery” limitation, are a significant departure from Yuen’s express teachings.”)

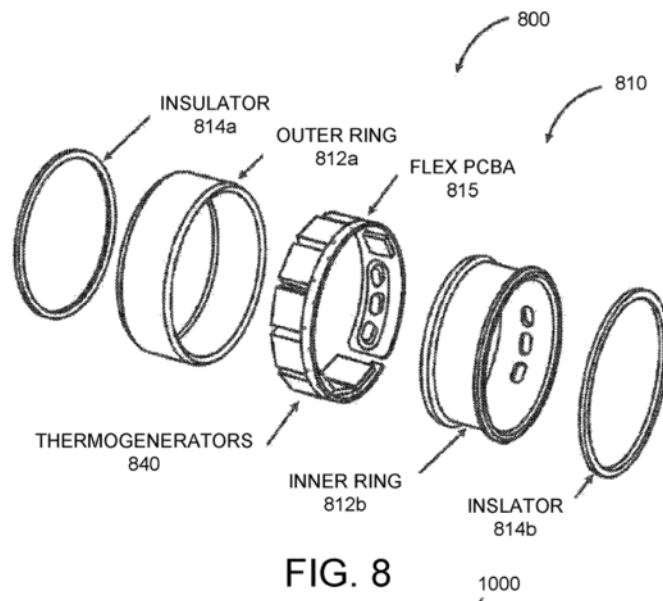
261. For the same reasons as argued in Section V, Yuen also does not disclose a form factor that is similar to a device configured to be worn around a finger of a wearer.

3. The Yuen-Schröder-Mestas combination does not disclose or suggest limitations 1[a] and 14[a].

262. Claim 1[a] requires “an external housing having an outer surface, an interior surface and sidewalls, wherein the interior surface and the sidewalls are characterized by approximately a C-shaped cross section and define an interior space, and wherein the interior space is configured to retain a plurality of components” Ex-1001 at 33:41-46. Claim 14[a] requires “an external housing having an outer surface forming an exterior wall of the wearable computing device, an interior surface and sidewalls, wherein the external housing is characterized by approximately a C-

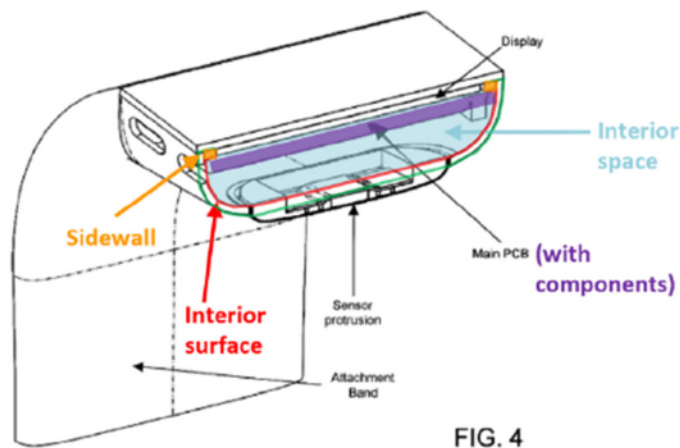
shaped cross section and define an interior space, and wherein the interior space is configured store a plurality of components.” Ex-1001 at 35:40-56.

263. By way of example, the '124 Patent's interior space is defined by outer ring 812a and inner ring 812b in its Figure 8.



Ex-1001 at Fig.8.

264. Although Dr. Anthony and Petitioner claim that Yuen-Schröder-Mestas teaches elements 1[a], and 14[a] they only utilize citations to Yuen for this element. Pet. at 60-64; Ex-1002 ¶¶ 326-330.



Pet. at 62. Ex-1006 Fig. 4.

265. Petitioner argues Yuen’s “interior space (blue) is defined by the interior surface (red) and sidewalls (orange) of the housing. Pet. at 61; *See* Ex-2150 at 47:21-48:3 (“The interior surface is defined by the sidewalls in the interior surface”). Petitioner fails to account for the two surfaces that define the depth of the interior space. *See* Ex-2150 at 46:16-47:1 (Q: . . . Figure 4 . . . the interior space, it’s colored from one side of the device to the other in a two-dimensional form – in two dimensional, correct? A: It’s a planar surface that is highlighted there showing the space that is inside of the device.”) The depth of the internal space of Yuen is defined by two additional surfaces, where the band attaches to the electronic package. *See*, IPR2024-01077, Paper 47 at 25 (The Board holding that Petitioner’s failure to account for “the sides abutting the ‘attachment band’” to define the cavity was fatal to petitioner’s Yuen-Mestas argument).

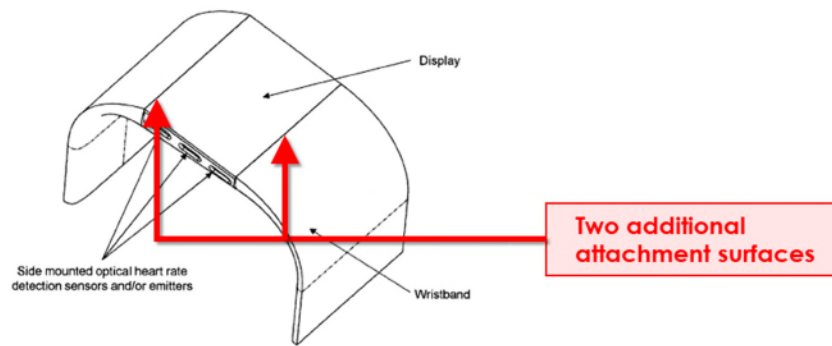


FIG. 12

Ex-1006 at Fig. 12.

266. Yuen’s device “consists of two major components—a body (containing the “electronics”) and a band (that facilitates attaching the device to the user). The body may include a housing (made, for example, of a plastic or plastic-like material) and extension tabs projecting from the body (made, for example, from a metal or metal-like material).” Ex-1006 at 24:17-20. Claim elements 1[a]/14[a] requires an interior space defined by an interior surface and sidewalls. Yuen’s interior space is defined by two additional surfaces not present in the ’124 Patent’s claimed structure. Therefore Yuen does not teach “an external housing having an outer surface, an interior surface and sidewalls, wherein **the interior surface and the sidewalls are characterized by approximately a C-shaped cross section and define an interior space**, and wherein the interior space is configured to retain a plurality of components

4. The Yuen-Schröder-Mestas combination does not disclose or suggest limitations 1[b], and 14[b].

267. Petitioner rests with its arguments it made for the Mestas-Schröder combination. For the reasons stated in Section VII.4, the Mestas-Schröder does not teach elements 1[b] and 14[b].

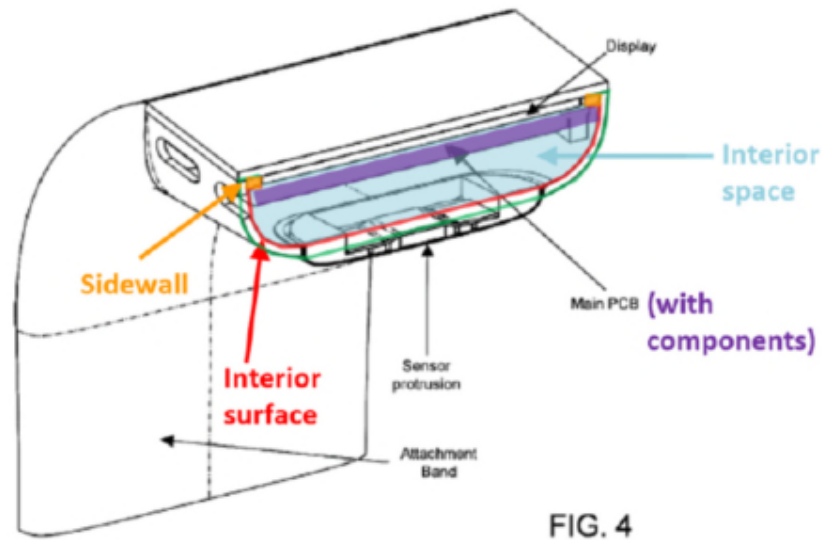
5. The Yuen-Schröder-Mestas combination does not disclose or suggest limitations 1[c], and 14[c].

268. Petitioner repeats its arguments Petitioner made for the Mestas-Schröder combination. For the reasons stated in Section VII.4, the Yuen-Mestas-Schröder does not teach elements 1[c] and 14[c].

269. Petitioner also appears to argue that Yuen meets this limitation. Pet. at 64; Ex-1002 at ¶¶ 333-335. Element 1[c]/14[c] requires the “printed circuit board . . . disposed in the interior space . . . to [approximately conform to/piecewise linearly conforms the curvature of] the **interior surface**.” Ex-1001. Other elements of claims 1/14 require the device to have sensors (1[d]/14[d]), a memory (1[e]/14[e]), a short range communication module (1[f]/14[f]), and a processor (1[h]/14[h]) disposed on the printed circuit board. Ex-1001.

270. Based on Dr. Anthony’s mapping of Yuen’s device for elements 1[a] and 14[a] Yuen does not disclose elements 1[c]/14[c]. Dr. Anthony argues that the Main PCB disclosed in Yuen’s figure 4 hosts Yuen’s electrical components. Ex-

1002 ¶¶ 328-329. (“This interior space houses **Yuen’s electrical components (purple)**, including a printed circuit board.”)



Pet. at 62; Ex-1002 at 328.

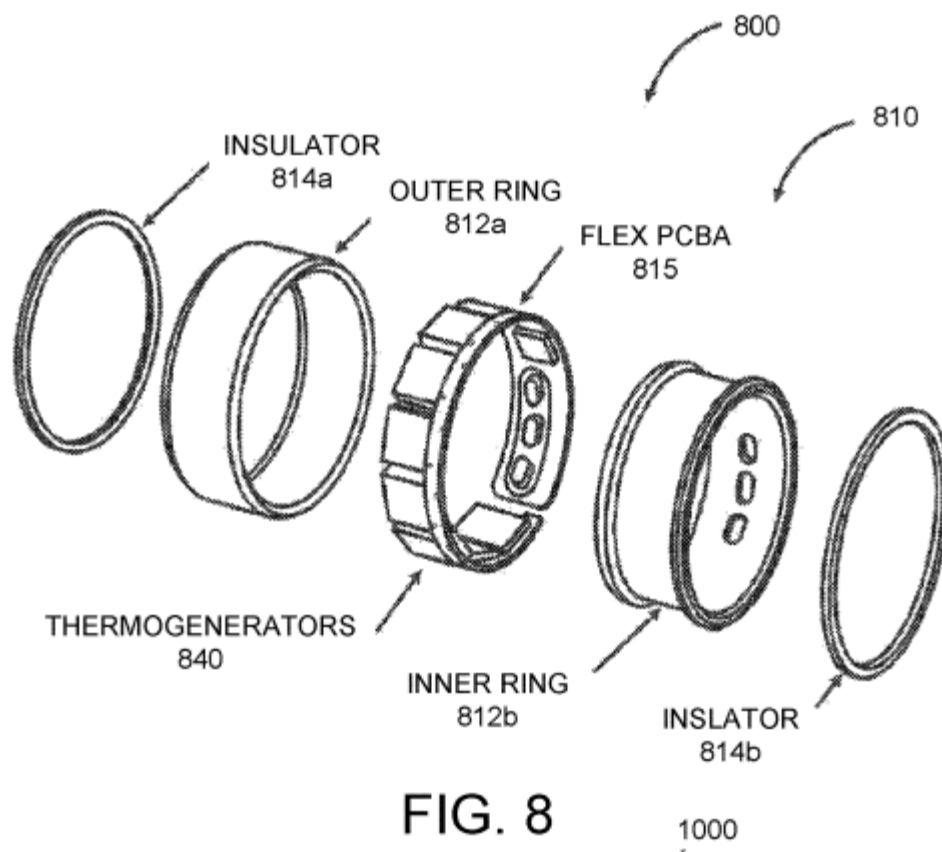
271. Yuen’s Main PCB, is located far away from Yuen’s interior surface denoted in red in the Petition and Dr. Anthony’s report. Pet. at 62; Ex-1002 at 328. The PCB identified by Dr. Anthony is flat, and conforms to the Yuen’s display surface. Therefore, Yuen’s PCB and the components disposed on Yuen’s PCB do not “[approximately conform to/piecewise linearly conforms the curvature of] the interior surface.” Petitioner has failed to show these claims are obvious.

6. The Yuen-Schröder-Mestas combination does not disclose or suggest limitations 1[d], and 14[d].

272. Limitations 1[d] and 14[d] require: “one or more sensors disposed upon the printed circuit board, wherein the one or more sensors are selected from a group

consisting of: an accelerometer, a gyroscope, and a motion sensor, wherein the one or more sensors are configured to sense physical perturbations and to output sensed data” Ex-1001 at 33:54-59, 35:57-62.

273. As shown below in Fig 8, the '124 Patent positions its sensor module, the flex PCBA (815) and associated sensors (sensor module), within the main enclosed cavity of the ring housing.



Ex-1001 at Fig. 8.

274. As discussed above, Dr. Anthony labels the Main PCB in Yuen’s figure 4 as holding Yuen’s electrical components. Ex-1002 at ¶¶328-329; *See also* Ex-1002

at ¶ 338 (“Yuen also teaches that the sensors may be disposed on the printed circuit board . . . A POSITA would have understood the advantages of placing sensors on a printed circuit board . . .”). Dr. Anthony cites to 12:40-41 of Yuen (Ex-1006) for support which discloses an alternative embodiment of Yuen. In the alternative embodiment, components are divided between two PCBs. Ex-1006 at 12:36-49. Yuen appears to show this embodiment in figure 6.

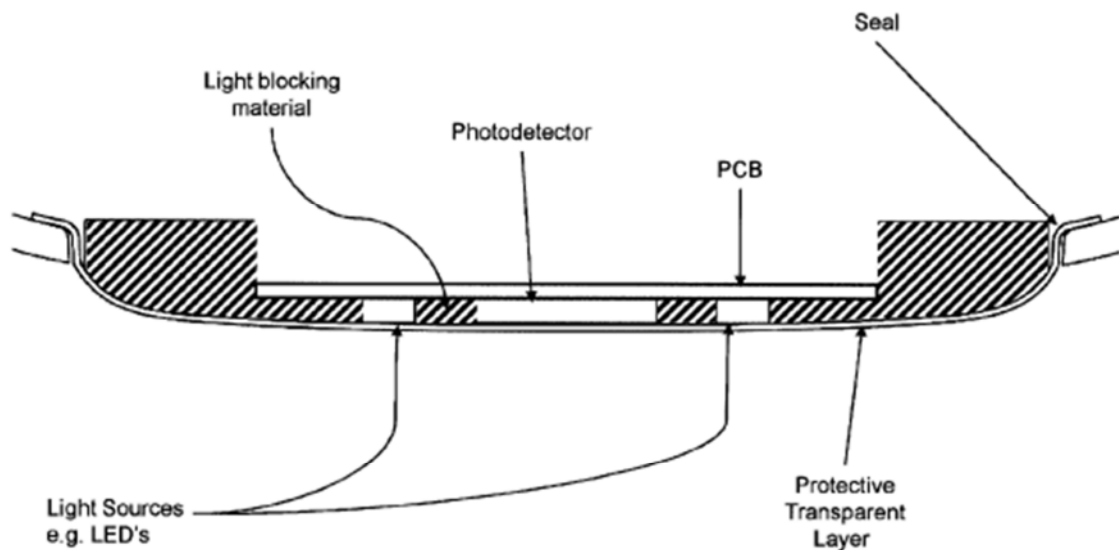
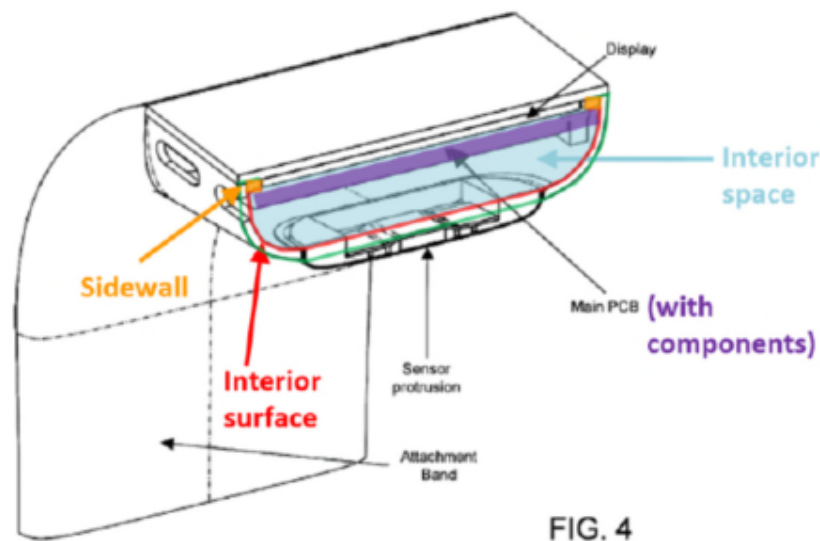


FIG. 6

Ex-1006 at Figure 6.

275. Dr. Anthony’s labeling of the main PCB holding electrical components for elements 1[a]/14[a] conflicts with his discussion of sensors in the embodiment of figure 6. If Dr. Anthony means to argue that Yuen’s secondary PCB holds the

claimed sensors, Yuen's sensor assembly is part of an open protrusion, and is not within the interior space defined by Petitioner in element 1[a]. (See Dr. Anthony's labeling of Figure 4 cutting the sensor protrusion off from the interior space, below). Petitioner provides no evidence how a POSITA would adapt Yuen's wristband sensor module for a ring device or place a sensor module within the claimed interior space. If Dr. Anthony is arguing that the main PCB is holding the claimed sensors, then the argument fails as discussed above because the PCB does not conform to the interior surface.



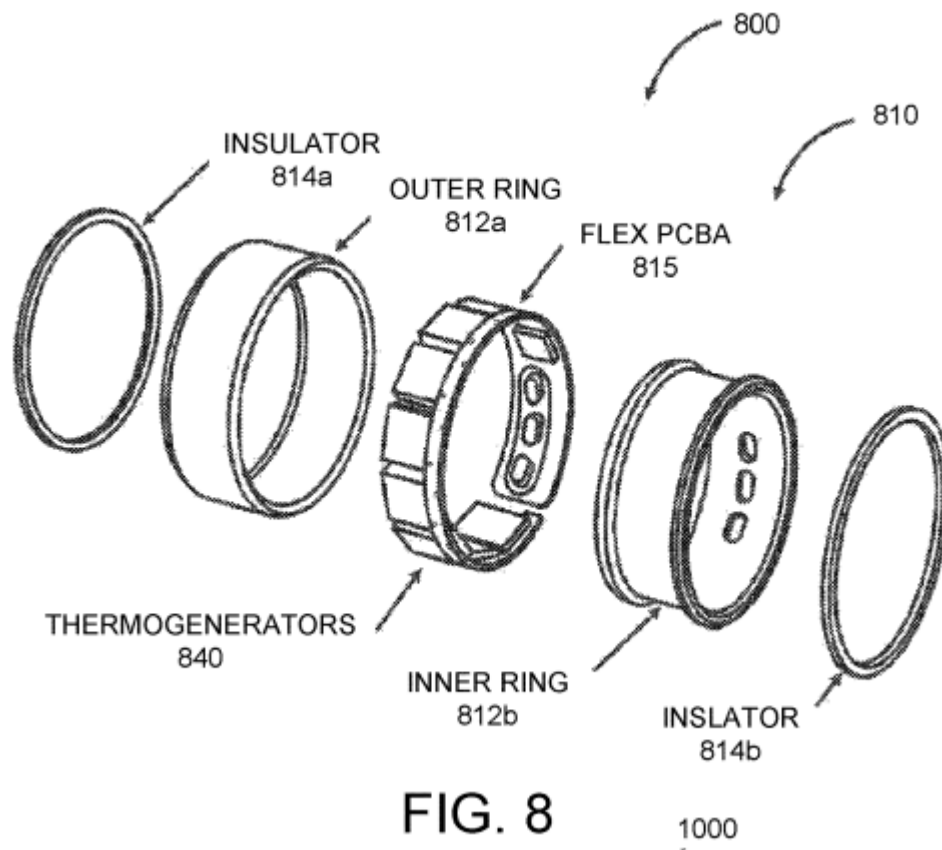
Pet. at 62; Ex-1002 at 328.

276. Thus, the combination of Yuen, Schröder, and Mestas fails to disclose or suggest the claimed sensors on the printed circuit board that is within the interior space.

7. The Yuen-Schröder-Mestas combination does not disclose or suggest limitations 1[g], and 14[g].

277. Limitations 1[g] and 14[g] require: “a first temperature sensor configured to provide first temperature data associated with a temperature of a wearer of the wearable computing device.” Ex-1001 at 34:1-3, 36:4-7. Element 1[a]/14[a] defines an interior space where the temperature sensor must be retained. Ex-1001.

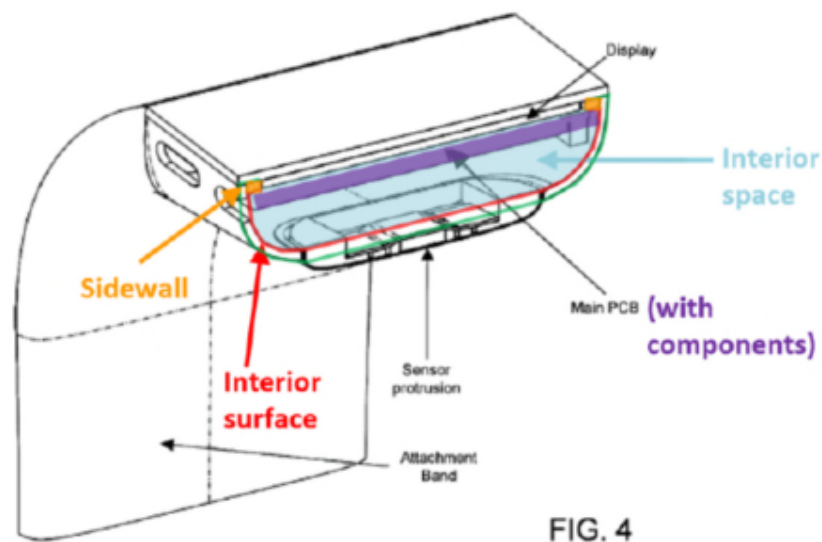
278. As shown below in Fig 8, the '124 Patent positions its sensor module, the flex PCBA (815) and associated sensors (sensor module), within the main enclosed cavity of the ring housing.



Ex-1001 at Fig. 8.

279. Dr. Anthony relies solely on Yuen for this element. Ex-1002 at ¶¶ 347-348. While Dr. Anthony states that Yuen has a temperature sensor, he fails to opine on the location of Yuen's temperature sensor. Ex-1002 at ¶¶ 347-348.

280. Yuen's sensor assembly is part of an open protrusion, not within the interior space defined by Petitioner in element 1[a]. (See Dr. Anthony's labeling of Figure 4 cutting the sensor protrusion off from the interior space, below). Petitioner provides no evidence how a POSITA would adapt Yuen's wristband sensor module for a ring device or place a sensor module within the claimed interior space.



Pet. at 62; Ex-1002 at 328.

281. Thus, the combination of Yuen, Schröder, and Mestas fails to disclose or suggest the claimed temperature sensor in the interior space.

8. The Yuen-Schröder-Mestas combination does not disclose or suggest limitations 1[i], and 14[i].

282. For elements 1[i] and 14[i] Petitioner relies solely on Yuen. For element 1[a] and 14[a], Petitioner mapped Yuen's external housing as the claimed external housing. Pet at 61-62.

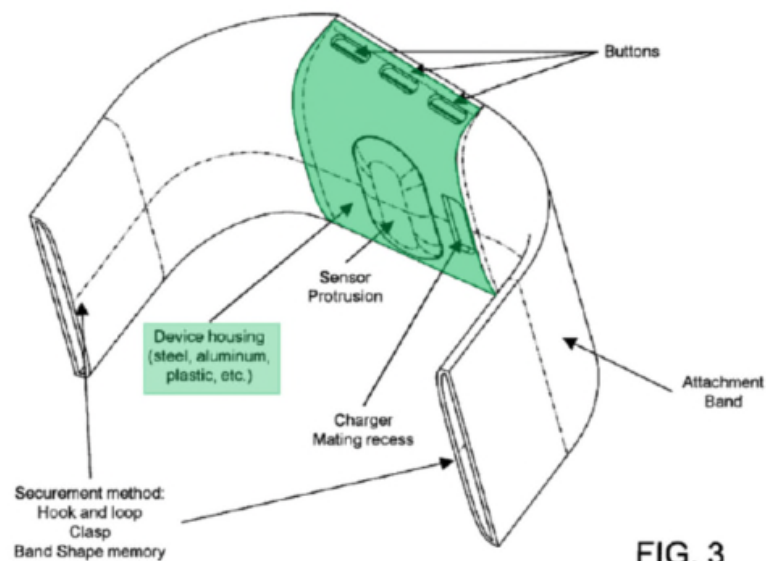


FIG. 3

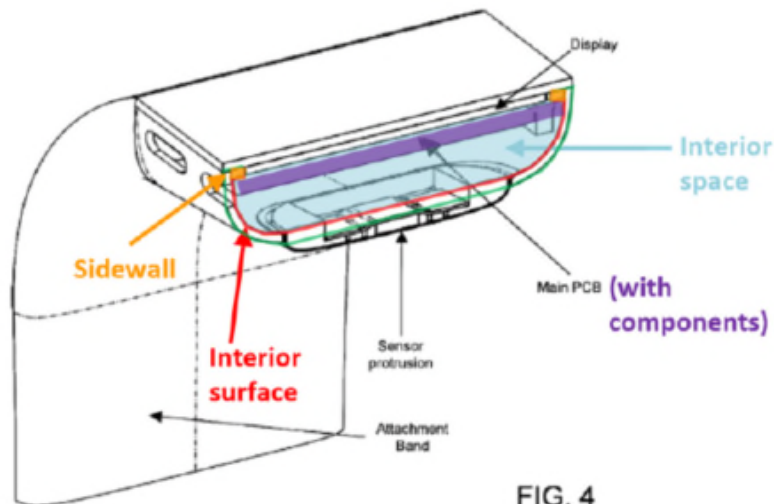
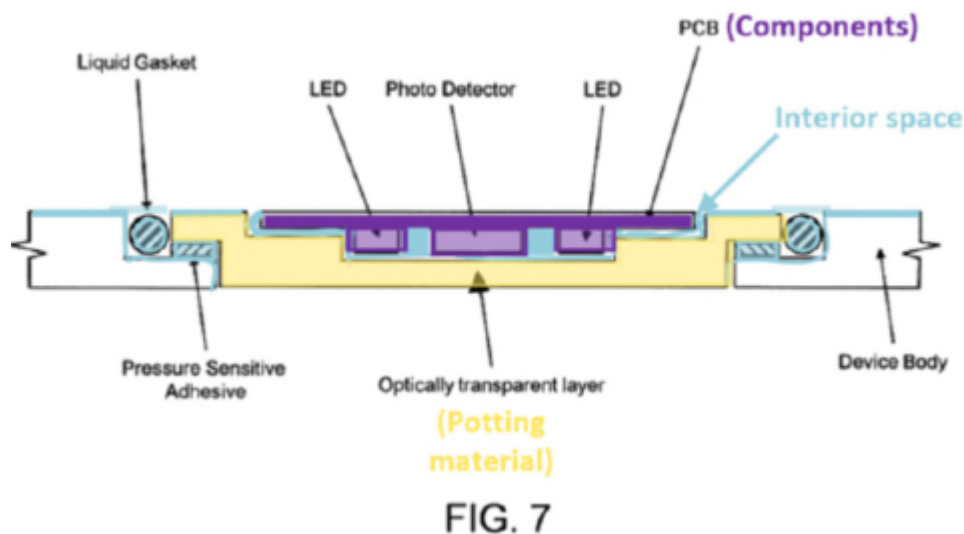


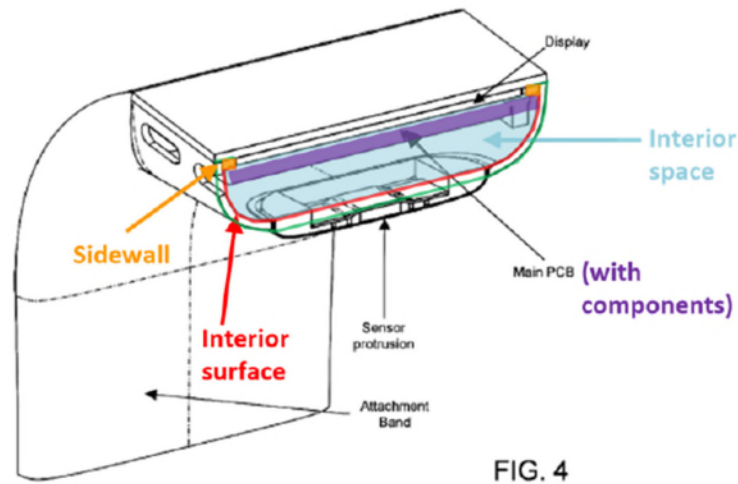
FIG. 4

Ex-1006 at Figs. 3 and 4.

283. Elements 1[i] and 14 [i] require a “a potting material disposed in the interior space encapsulating the plurality of components, wherein the potting material forms **an interior wall** of the wearable computing device, wherein the potting material is substantially transparent to light selected from a group consisting of: visible light, infrared light, and ultraviolet light.” Ex-1001 at 34:13-19, 36:17-23.

284. Petitioner maps the “optically transparent layer” of Fig. 7 as potting material that forms “an interior wall” of the wearable computing device. Pet. at 71-72.





285. Figure 7 “illustrates another cross-sectional view of a PPG sensor, wherein in this embodiment, the PPG sensor does not include a protrusion; moreover, a gasket and/or a pressure sensitive adhesive may be employed to resist, inhibit and/or prevent liquid from entering the body of the device.”

286. In other words, Petitioners map the interior wall to the same element as the exterior housing’s interior surface.

287. Therefore, the combination of Yuen, Schröder, and Mestas does not disclose or suggest the claimed potting material that forms the “interior wall” of the device. Rather, according to Petitioner’s mapping, the potting material forms the external housing of claim 1[a] and 14[a].

9. The Yuen-Schröder-Mestas combination does not disclose or suggest claim 8.

288. Petitioner relies on arguments made in Ground 1 for this element and does not utilize Yuen. Pet. at 79. For the reasons discussed in Section VII.A.9, the

combination of Yuen, Schröder, and Mestas does not disclose a power management module that regulates power to and from the curved rechargeable battery.

10.The Yuen-Schröder-Mestas combination does not disclose or suggest claim 10.

289. Petitioner relies on arguments made in Ground 1 for this element and does not utilize Yuen. Pet. at 80-81. For the reasons discussed in Section VII.A.1, the combination of Yuen, Schröder, and Mestas does not disclose a device with a thickness within a range of 1.5 to 3 mm.

11.The Yuen-Schröder-Mestas combination does not disclose or suggest claims 2-6, 8-13, and 15-20.

290. Because Dr. Anthony has not shown that Yuen in view of Mestas renders Claim 1 and 14 obvious, Yuen in view of Mestas also does not disclose or suggest dependent claims 2-6, 8-13, and 15-20.

12.Yuen in view of Schröder in further view of Mestas does not enable the claimed Invention of the '124 Patent.

291. For the same reasons as argued in Section VII.A.10 and Section VII.B.4, the combination of Yuen, Schröder, and Mestas would not have enabled a POSITA to achieve the specific wearable ring computing device claimed in the '124 Patent without resorting to undue experimentation.

VIII. SECONDARY CONSIDERATION OF NON-OBVIOUSNESS

292. In the U.S. International Trade Commission (“ITC”) Investigation No. 337-TA-1398, the Administrative Law Judge (“ALJ”) made several findings

regarding objective indicia of non-obviousness concerning the asserted related '178 Patent (Ex-2122). The ALJ found that Oura was entitled to a presumption of nexus for the Oura Ring Gen. 3 and Gen. 4 with the claims of the '178 Patent, as they were commercial embodiments coextensive with those claims, and that this presumption was not rebutted. Ex-2018 at 108-110. Regarding copying, while the ALJ noted evidence of competitors' access to and analysis of Oura Rings and found credibility issues with certain testimonies from respondents (Ex-2122 at 112-113), the ALJ concluded that the specific legal factor of "copying" did not support non-obviousness in that case because the evidence did not demonstrate "overwhelmingly similar" replication required for that legal test (Ex-2122 at 113). However, the ALJ found that other objective indicia—specifically commercial success of the Oura Ring, industry praise for the Oura Ring, the failure of others to achieve a comparable wearable ring device, and a long-felt but unmet need for a compact and comfortable wearable monitoring ring—all weighed in favor of a determination of non-obviousness for the '178 Patent. Ex-2122 at 107, 110-112, 114-116.

293. In the Final Written Decision for related proceeding PGR2024-00039 (EX-2153) on the related 11,874,702 Patent, the Board made several findings relating to secondary considerations of non-obviousness. Regarding nexus, the Board rejected Petitioner's arguments that unclaimed features of products practicing the claims of the '702 Patents such as the Oura Ring Application and the appearance

and materials of the rings should prevent a presumption of nexus. Ex-2153 at 52-55. The Board also rejected Petitioner’s argument that there is no nexus because Oura asserted the same objective indicia evidence in multiple proceedings. Ex-2153 at 55-56 (“Patent Nos. 11,874,702; 10,139,859; 10,281,953; and 11,868,178, are all part of the same patent family. . . . [T]he claims of all four patents recite the essential components or enclosures or bounding members that when joined, define a circumferential cavity therebetween, and electronic components such as printed circuit boards, sensors, and batteries configured to fit within and/or conform to the cavity . . . the identified claims of these patents all cover substantially overlapping subject matter and are entitled to a presumption of nexus.”).

294. In yet another final written decision in IPR2024-01077, the Board made similar findings regarding secondary considerations with respect to at least nexus as PGR2024-00039. The ’124 Patent is the parent of the ’702 and ’178 Patents and captures the same invention of a ring structure that holds printed circuit boards, sensors and batteries.

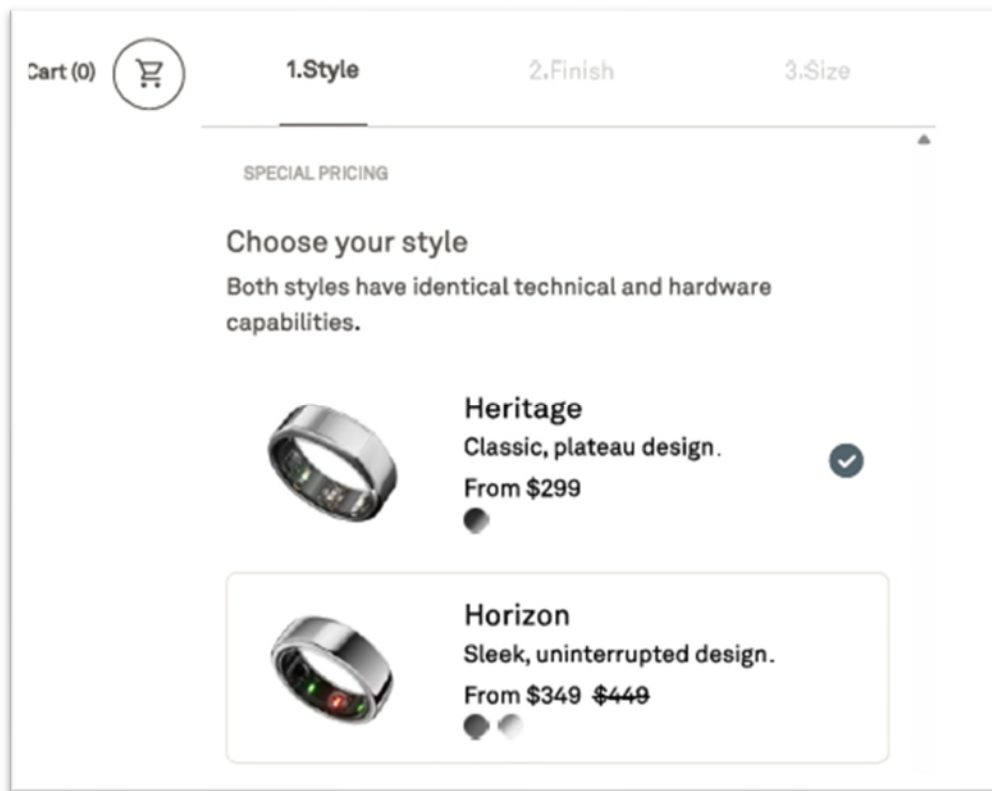
A. Nexus

295. Oura manufactures the Oura Ring that embodies the claims of the ’124 Patent. Since its founding, Oura has released four generations of Oura Ring: Generation (“Gen.”) 1 in 2015, Gen. 2 in 2018, Gen. 3 in 2021, and Gen. 4 in 2024.

296. Oura Ring Gen. 3 is coextensive with the Challenged Claims of the ’124

Patent. In coming to this conclusion, I conducted an element-by-element analysis of the claims against Oura Ring for Gen. 3 as detailed below. Claim 1 of the '124 Patent recites the overall structure that provides for the particular form factor of the Oura Ring Gen. 3 Horizon and Heritage, i.e., a finger-ring design that allows for the electronic components to be entirely contained within the ring housing.

297. Oura Gen. 3 is available in two styles Horizon and Heritage. I have analyzed the styles and the only difference between the styles is the shape of the exterior housing. Oura Ring Horizon is an uninterrupted design that has a near round exterior for the full length, whereas the Heritage variation includes a minor plateau design on the exterior for a portion of the ring. Ex-2145 at 1; EX2156. The plateau design is to assist users in orienting the ring such that the sensors are aligned on the palm side of the hand. Horizon accomplishes the same functionality by including a minor divot at the bottom of the ring such that users can adjust the positioning of the ring based on the divot (i.e., facing the palm). Outside of the external structure for part of the ring, both styles have the same technical and hardware capabilities. Ex-2145 at 1. In my claim by claim nexus analysis, I use Oura Ring Gen 3 Horizon photographs. The same nexus arguments would apply equally to the Oura Ring Gen 3 Heritage device.



EX2156, 1. (<https://ouraring.com/oura-gen3/heritage>)

Heritage	Horizon
	
EX2156, 2.	EX2156, 2.

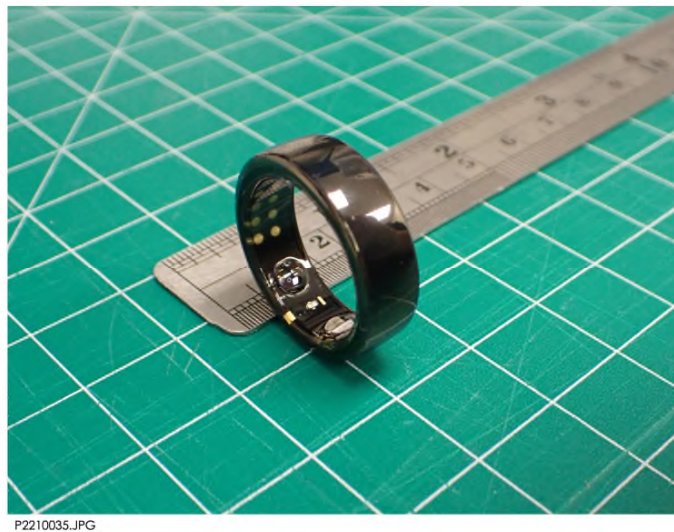
1. Independent Claim 1

a. Limitation 1 [pre]

298. Limitation 1[a][i] requires “a wearable computing device, configured to be worn around a finger of a user.” Ex-1001 at 33:39-40. The Oura Ring Gen. 3 practices this limitation.

i. Oura Ring Gen. 3

299. Oura Ring Gen. 3 is a wearable computing device, configured to be worn around a finger of a user:



Ex-2029 at 7.

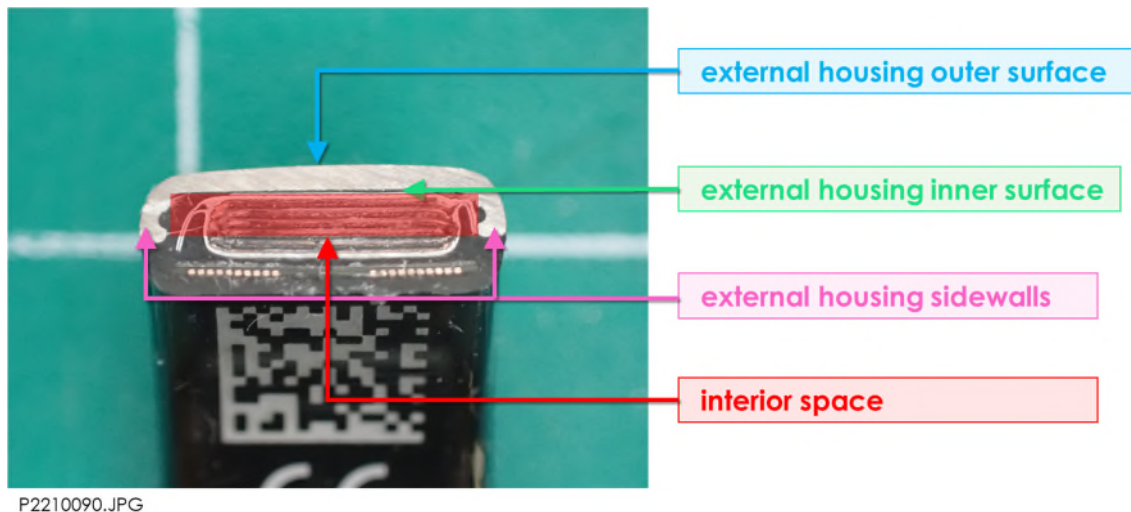
b. Limitation 1[a]

300. Limitation 1[a] requires “an external housing having an outer surface, an interior surface and sidewalls, wherein the interior surface and the sidewalls are characterized by approximately a C-shaped cross section and define an interior space, and wherein the interior space is configured to retain a plurality of components; wherein the plurality of components comprises:” Ex-1001 at 33:41-46. Oura Ring Gen. 3 practices this limitation.

i. Oura Ring Gen. 3

301. The Oura Ring Gen. 3 includes an external housing having an outer surface, an interior surface and sidewalls, wherein the interior surface and the sidewalls are characterized by approximately a C-shaped cross section and define an interior space, and wherein the interior space is configured to retain a plurality of

components.



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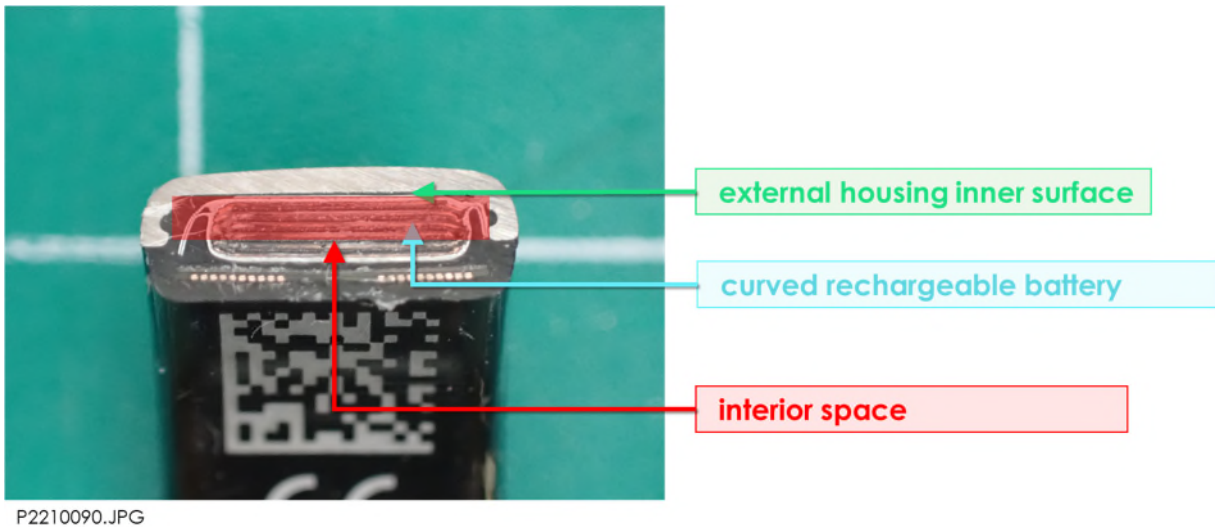
Ex-2029 at 10.

c. Limitation 1[b]

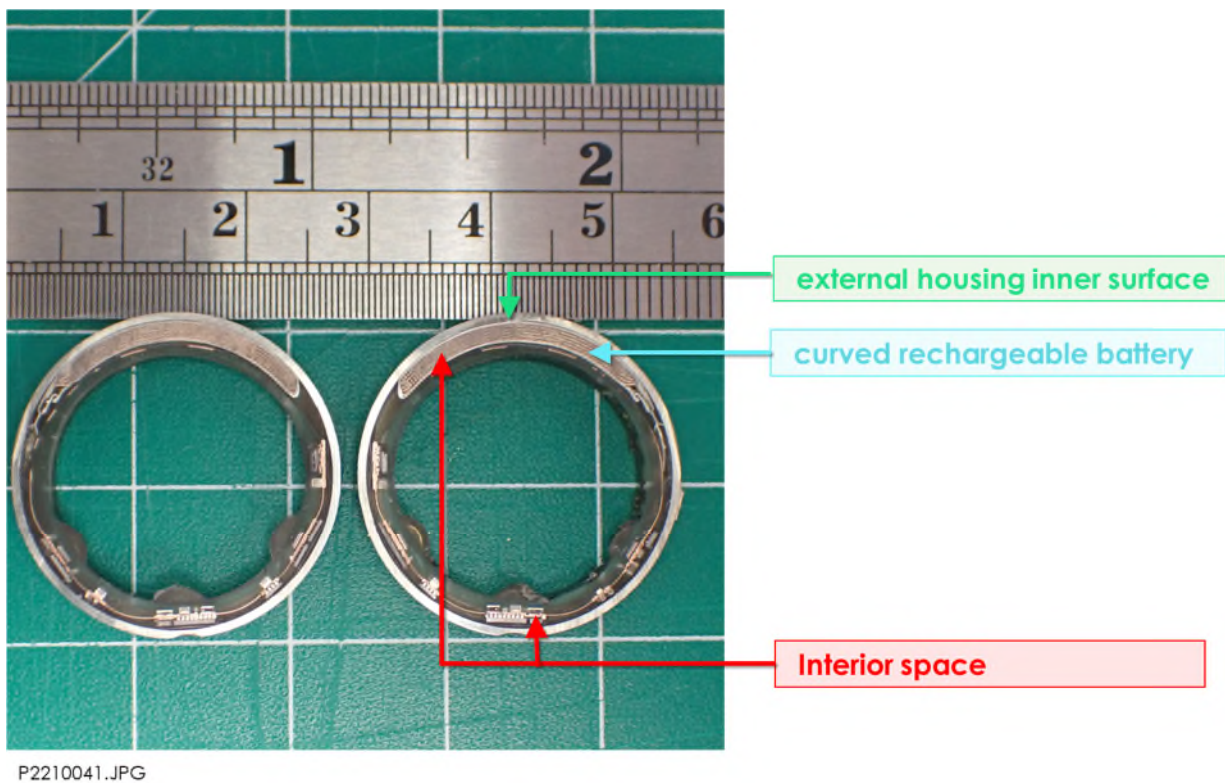
302. Limitation 1[b] requires “a curved rechargeable battery disposed within the interior space of the housing, wherein the rechargeable battery is curved to conform to the interior surface” Ex-1001 at 33:48-50. Oura Ring Gen. 3 practices this limitation.

i. Oura Ring Gen. 3

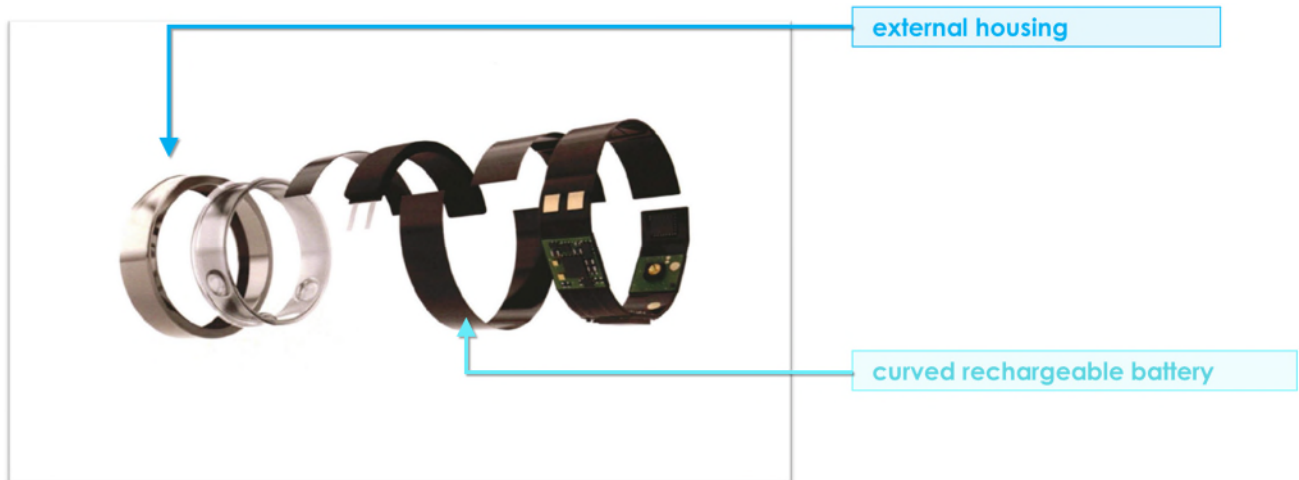
303. Oura Ring Gen. 3 includes a curved rechargeable battery disposed within the interior space of the housing, wherein the rechargeable battery is curved to conform to the interior surface.



Ex-2029 at 10.



Ex-2029 at 9.



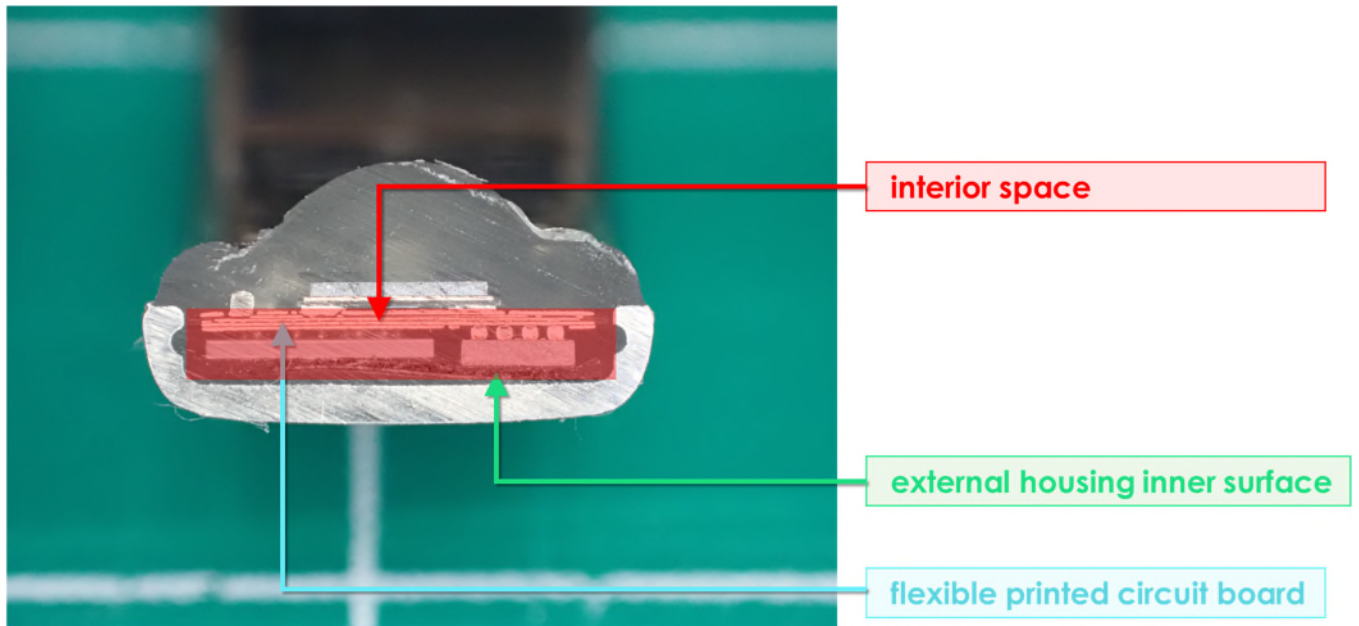
Ex-2031.

d. Limitation 1[c]

304. Limitation 1[c] requires “a printed circuit board disposed within the interior space configured to approximately conform to the interior surface.” Ex-1001 at 33:51-53. Oura Ring Gen. 3 practices this limitation.

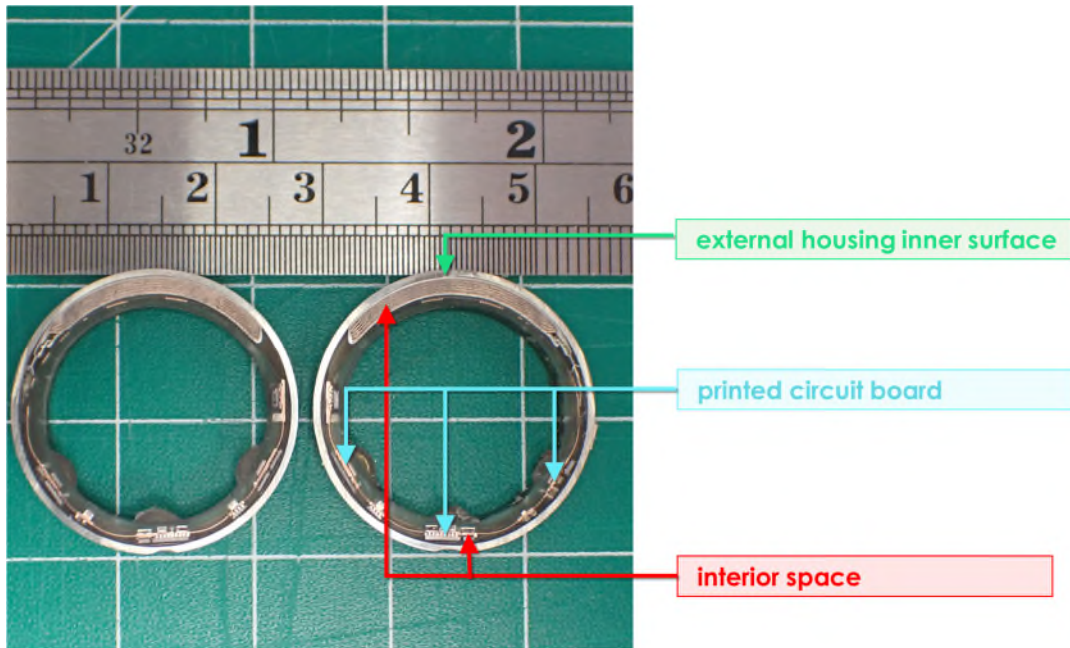
i. Oura Ring Gen. 3

305. Oura Ring Gen. 3 includes a printed circuit board disposed within the interior space configured to approximately conform to the interior surface.



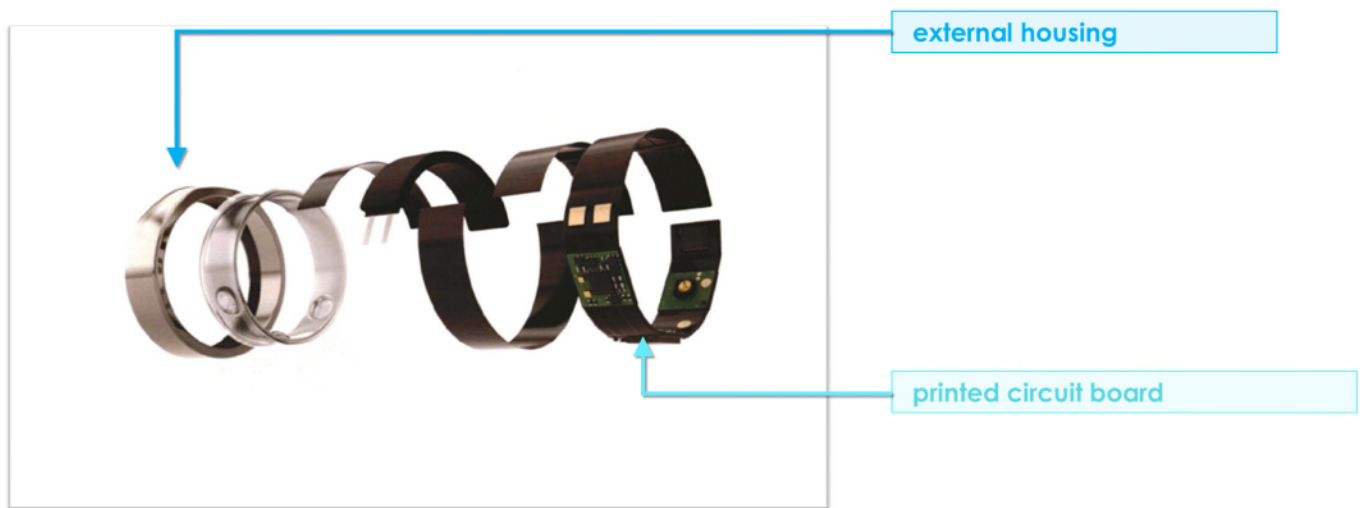
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Ex-2029 at 11.



P2210041.JPG

Ex-2029 at 9.



Ex-2031.

e. Limitation 1[d]

306. Limitation 1[d] requires “one or more sensors disposed upon the printed circuit board, wherein the one or more sensors are selected from a group consisting of: an accelerometer, a gyroscope, and a motion sensor, wherein the one or more sensors are configured to sense physical perturbations and to output sensed data” Ex-1001 at 33:54-59. Oura Ring Gen. 3 practices this limitation.

i. Oura Ring Gen. 3

307. Oura Ring Gen. 3 includes one or more sensors disposed upon the printed circuit board, wherein the one or more sensors are selected from a group consisting of: an accelerometer, a gyroscope, and a motion sensor, wherein the one or more sensors are configured to sense physical perturbations and to output sensed data. The Oura Ring Gen. 3 includes a 3D accelerometer. Ex-2055; Ex-2059.

f. Limitation 1[e]

308. Limitation 1[e] requires “a memory disposed upon the printed circuit board, the memory configured to store one or more executable instructions.” Ex-1001 at 33:60-62. Oura Ring Gen. 3 practices this limitation.

i. Oura Ring Gen. 3

309. Oura Ring Gen. 3 features a memory disposed upon the printed circuit board, the memory configured to store one or more executable instructions. Ex-2055; Ex-2059.

g. Limitation 1[f]

310. Limitation 1[f] requires “a short-range communication module disposed upon the printed circuit board, the short-range communications module configured to communicate a first set of data to a client computing device via a first communications protocol.” Ex-1001 at 33:63-67. Oura Ring Gen. 3 practices this limitation.

i. Oura Ring Gen. 3

311. The Oura Ring Gen. 3 features a short-range communication module disposed upon the printed circuit board, the short-range communications module configured to communicate a first set of data to a client computing device via a first communications protocol. Ex-2055; Ex-2059.

h. Limitation 1[g]

312. Limitation 1[g] requires “a first temperature sensor configured to provide first temperature data associated with a temperature of a wearer of the wearable computing device.” Ex-1001 at 34:1-3. Oura Ring Gen. 3 practices this limitation.

i. Oura Ring Gen. 3

313. The Oura Ring Gen. 3 features a first temperature sensor configured to provide first temperature data associated with a temperature of a wearer of the wearable computing device. Ex-2055; Ex-2059.

i. Limitation 1[h]

314. Limitation 1[h] requires “a processor disposed upon the printed circuit board and coupled to the battery, the one or more sensors, the memory, the short-range communication module, and the first temperature sensor, wherein the processor is configured to receive the sensed data, is configured to perform the one or more executable instructions in response to the sensed data, and is configured to direct the short-range communication module to output data to the client computing device” Ex-1001 at 34:4-12. Oura Ring Gen. 3 practices this limitation.

i. Oura Ring Gen. 3

315. The Oura Ring Gen. 3 features a processor disposed upon the printed circuit board and coupled to the battery, the one or more sensors, the memory, the

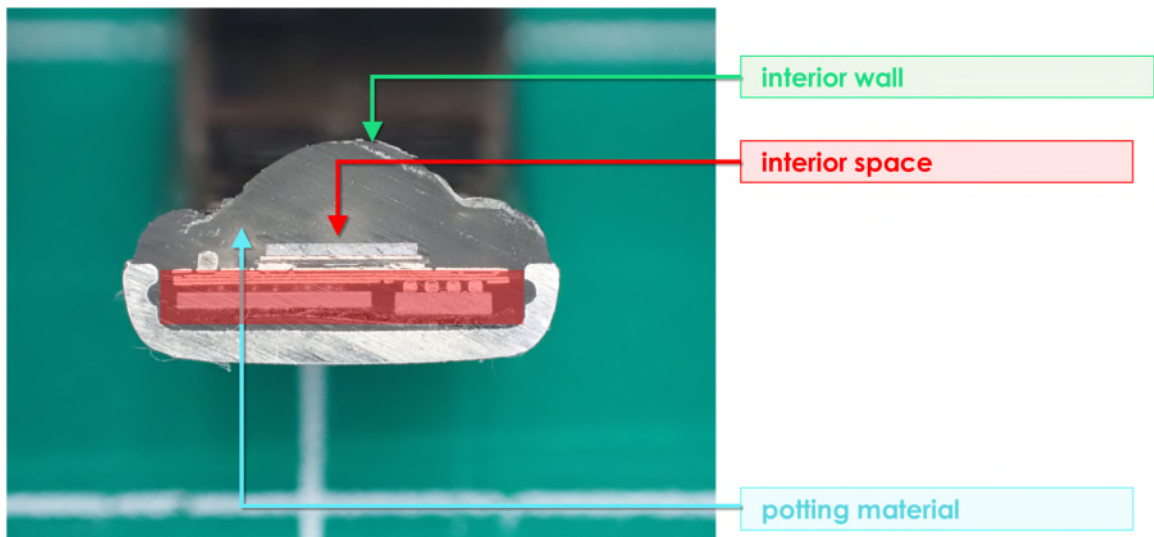
short-range communication module, and the first temperature sensor, wherein the processor is configured to receive the sensed data, is configured to perform the one or more executable instructions in response to the sensed data, and is configured to direct the short-range communication module to output data to the client computing device. Ex-2055; Ex-2059.

j. Limitation 1[i]

316. Limitation 1[i] requires “a potting material disposed in the interior space encapsulating the plurality of components, wherein the potting material forms an interior wall of the wearable computing device, wherein the potting material is substantially transparent to light selected from a group consisting of: visible light, infrared light, and ultraviolet light.” Ex-1001 at 34:13-19. Oura Ring Gen. 3 practices this limitation.

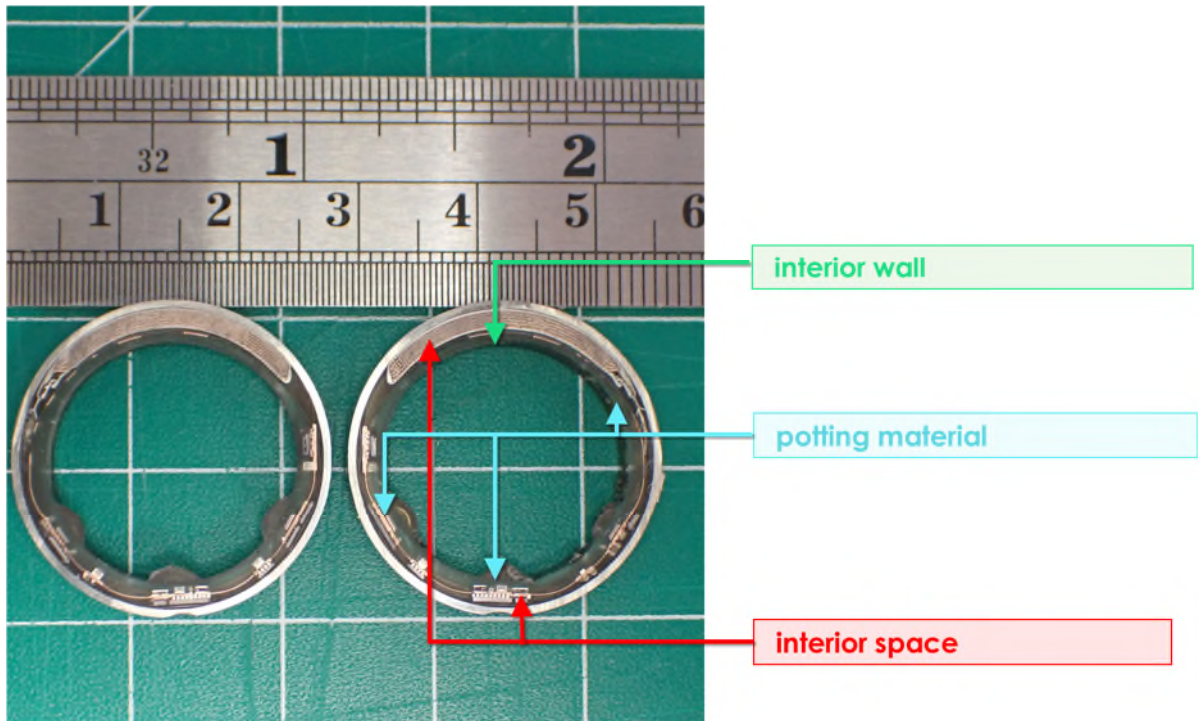
i. Oura Ring Gen. 3

317. The Oura Ring Gen. 3 features a potting material disposed in the interior space encapsulating the plurality of components, wherein the potting material forms an interior wall of the wearable computing device, wherein the potting material is substantially transparent to light selected from a group consisting of: visible light, infrared light, and ultraviolet light.



P2210095.JPG

Ex-2029 at 11.



P2210041.JPG

Ex-2029 at 9.

B. Evidence of Copying of Oura Ring Gen. 3 by the Industry

318. Oura Ring has been recognized for its ingenuity in the smart ring market. *See e.g.*, Ex-2002 (“A big part of awarding the Oura Ring 3 [the wearable

of the year award] is how it’s defined a whole segment of wearables—and moved forward the discussion about what a wearable should be.”). Thus, it’s no surprise that new entrants in the ring market would seek replicate Oura’s success.

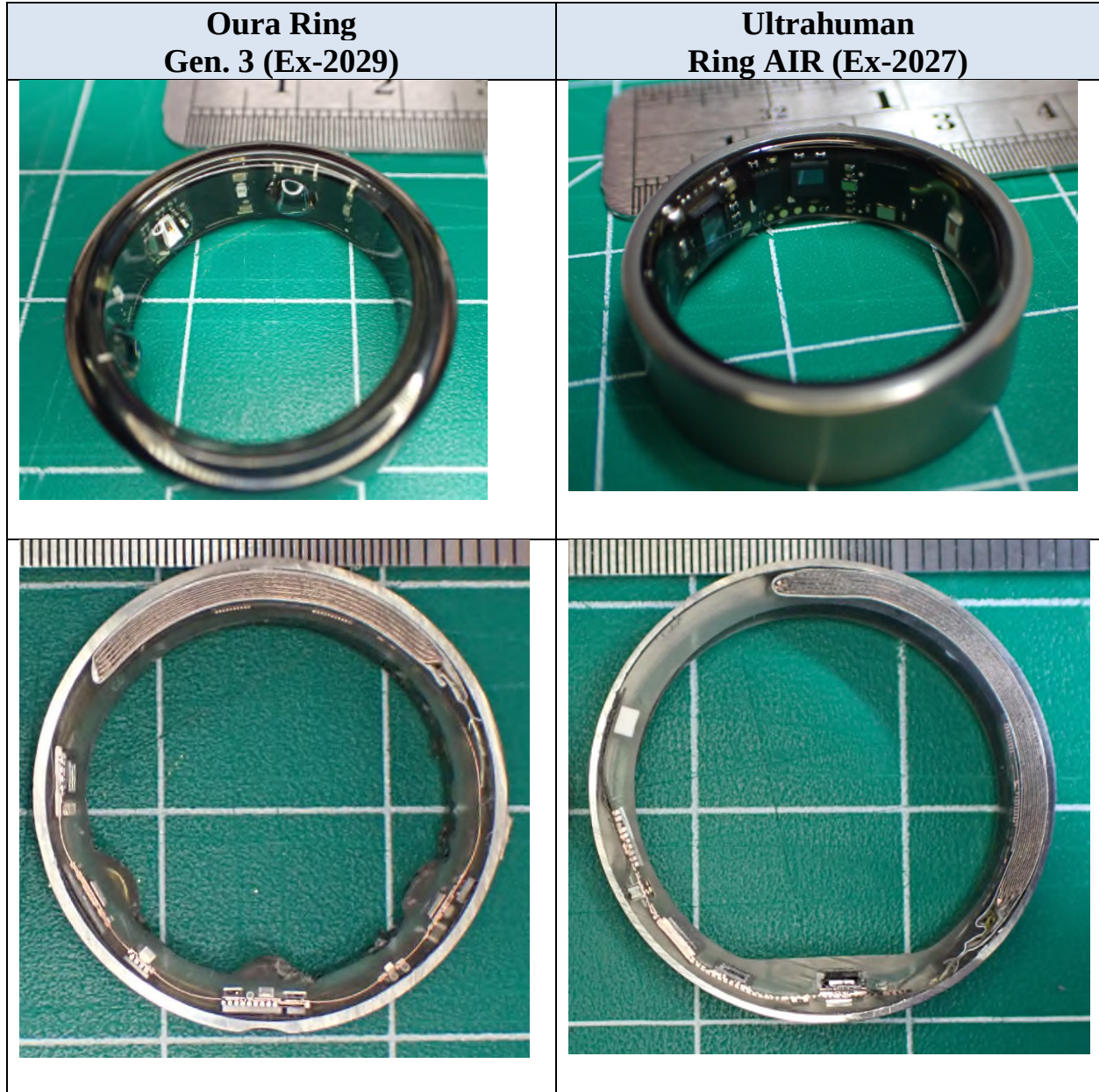
319. In the Final Written Decision for related proceeding PGR2024-00039 (EX-2153) on the related 11,874,702 Patent, the Board agreed, and found that several of Oura’s competitors replicated the Oura Ring Gen. 3 Horizon product. Ex-2153 at 69. The Board found that “Ultrahuman has access to, and disassembled, the Oura Ring Gen. 3 ring product prior to launching its own ring.” Ex-2153 at 68. According to the Board, “the Ultrahuman and Ringconn products demonstrate a striking resemblance in not only the external housing components but also the placement of the internal components . . . within the cavity formed by the housings.” Ex-2153 at 69.

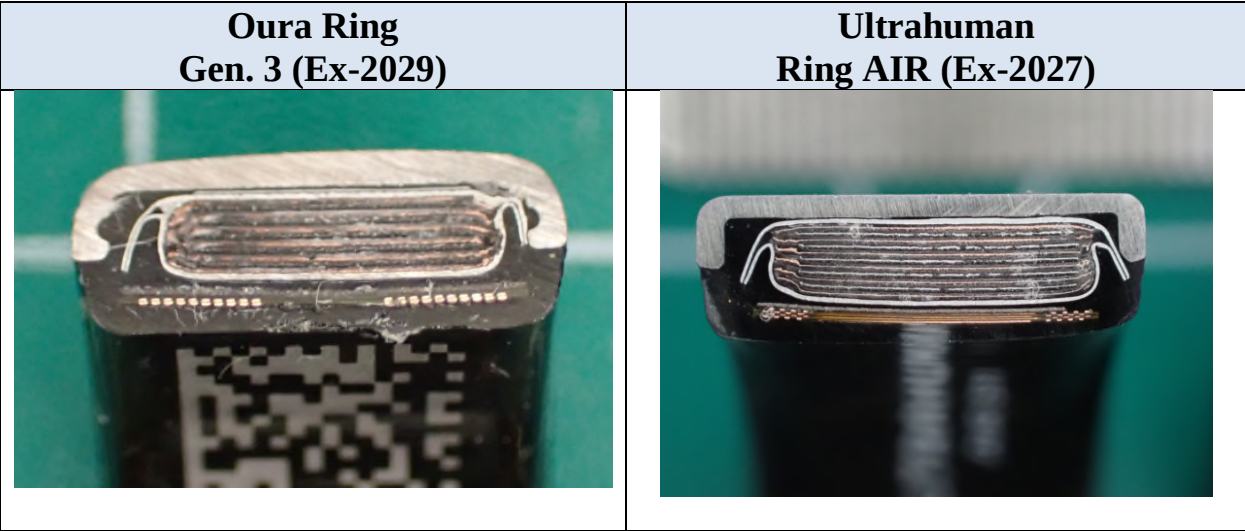
1. Ultrahuman Ring AIR

320. I understand that Ultrahuman Healthcare Pvt. Ltd. is an Indian Non-Government Company incorporated in India that manufactures a smart ring (Ultrahuman Ring AIR) that competes against Oura Ring. I also understand from counsel that Oura currently has a pending International Trade Commission Investigation against Ultrahuman with trial that was held in December 2024.

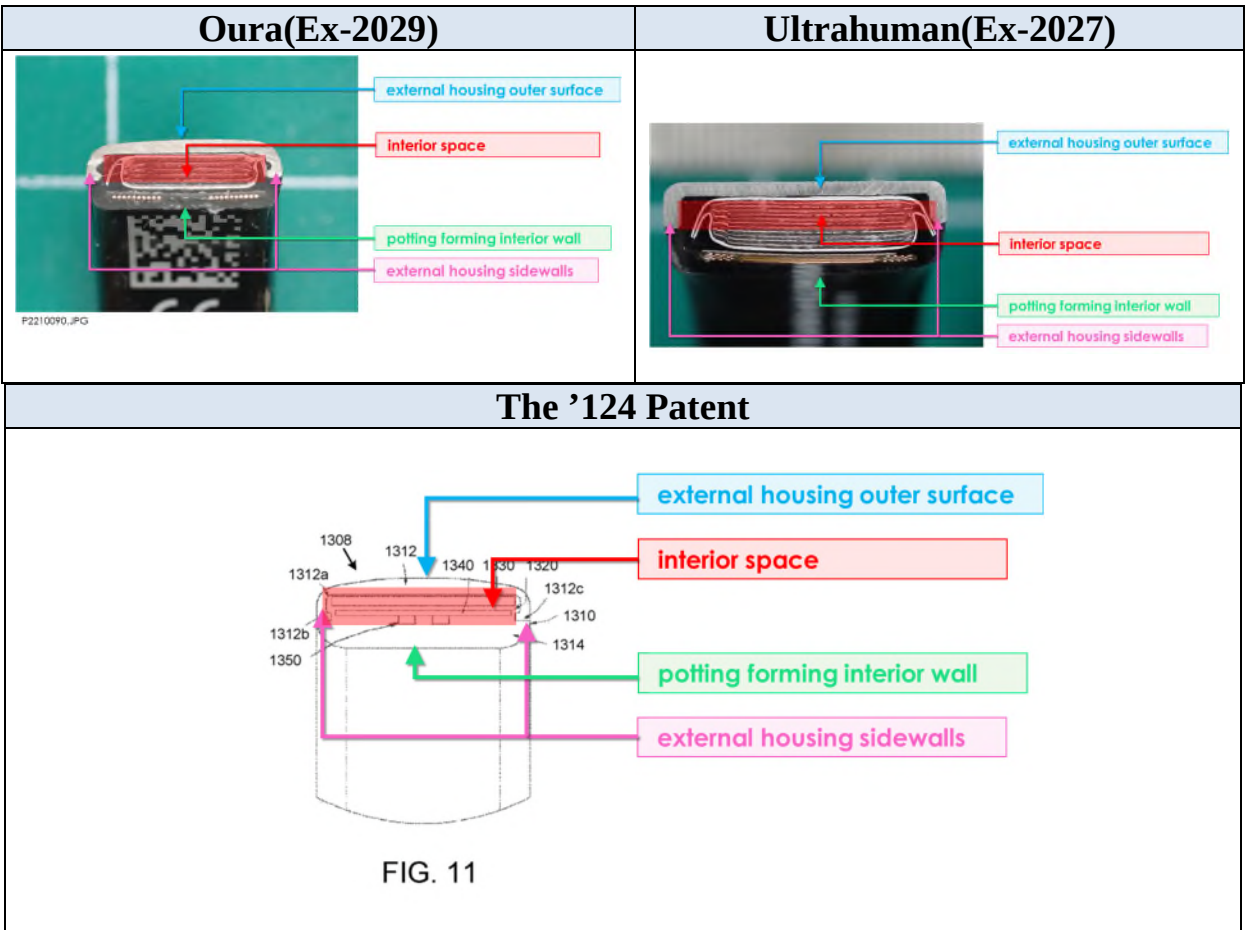
321. As shown below in side-by-side comparison of Oura Ring Gen. 3 and Ultrahuman Ring AIR, Ultrahuman adopted the use of an external housing and

interior wall of the Oura Ring where the interior wall is made of internal potting to develop a directly competing product:



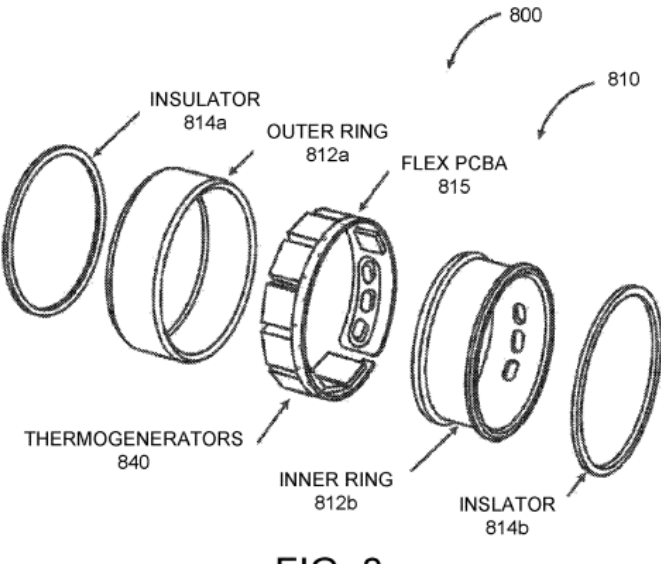


322. Oura Ring Gen. 3 and Ultrahuman ring both embody the disclosure of the '124 Patent that shows potting material forming the interior wall:



'124 Patent (Ex-1001) at Fig. 11

323. The industry also appears to have copied the marketing materials of Oura Ring. For example, Ultrahuman copied the marketing materials of Oura that depicted the ring’s structural design, which mirrors figure 8 of the ’124 Patent—Ultrahuman simply reversing the orientation and changing the silver external housing to black:

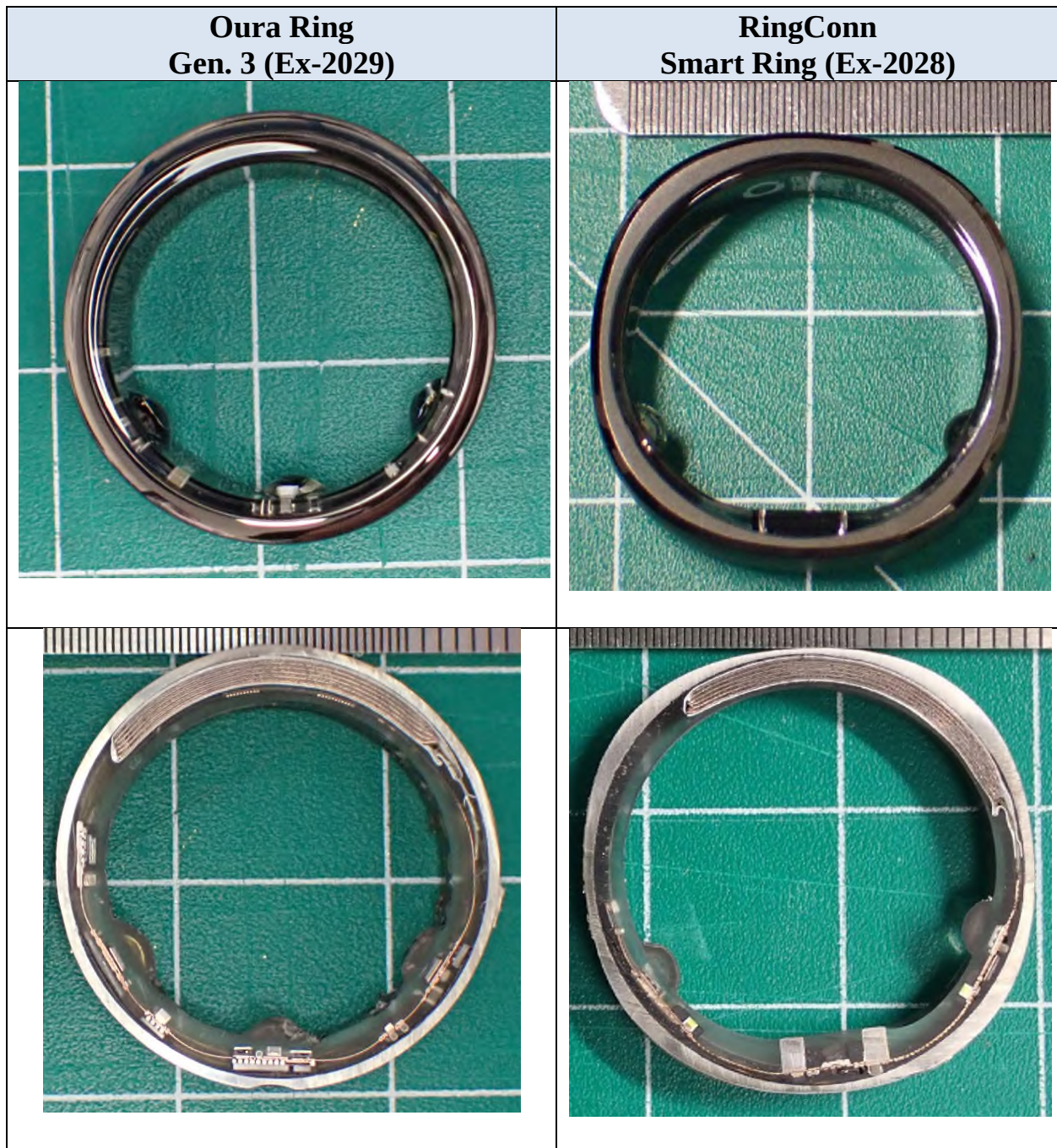
Oura	Ultrahuman
 Ex-2032	 Ex-2027
The '124 Patent	
 FIG. 8	
'124 Patent (Ex-1001) at Fig. 8	

324. The similarities do not appear to be mere coincidence. At the ITC hearing, Ultrahuman’s chief executive officer (CEO) admitted that he was personally an early adopter of the Oura Ring and bought a Gen. 1 product in 2015—years before he founded Ultrahuman in 2019. Ex-2024 (Kumar) at 683:19-21, 686:15-24. Kumar bought a Gen. 2 product in 2018. Ex-2024 at 685:16-24. Ultrahuman bought another 5-10 Oura Ring Gen. 3 for analysis later. Ex-2024 at 692:19-693:8. And Ultrahuman’s entire R&D team, including the hardware, software, and firmware teams, analyzed Oura Rings to learn their structure and design. Ex-2024 at 695:1-21, 698:3-24. Ultrahuman also reviewed video teardowns of the Gen. 3 product. Ex-2024 at 696:12-698:2. Ultrahuman’s extensive internal teardowns had the goal of “figur[ing] out everything” about the Oura Ring, including components and structure. Ex-2024 at 699:2-5 (“I think we would have figured out everything . . . like how large the battery is, what is the Rx coil, how does the PCB look? But that would be like the overview of how devices are made.”).

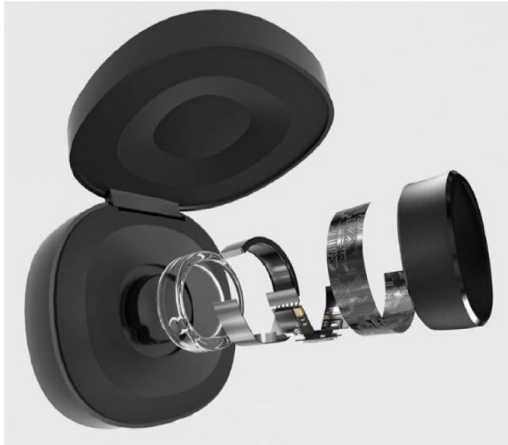
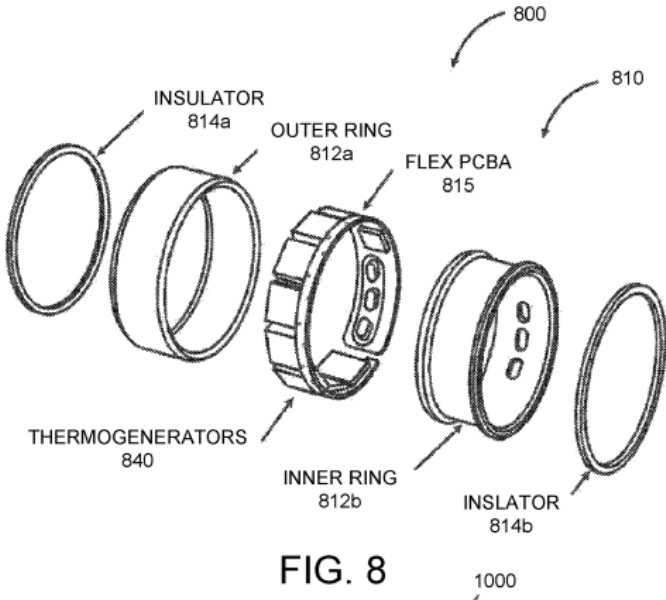
2. RingConn Smart Ring

325. I understand from counsel that another respondent in the ITC Investigation is Shenzhen Ninenovo Technology Ltd., a Chinese manufacturer that sells smart ring in the U.S. called RingConn Smart Ring. It is my understanding that RingConn Smart Ring was released in 2023—two years after Oura Ring Gen. 2. There is also evidence that RingConn Smart Ring appears to have copied Oura Ring

Gen. 1, including the optical protrusions in the potting material, based on significant similarities that are more than coincidental:



326. And like Ultrahuman, RingConn also appears to have copied the marketing materials of Oura that depicted the ring’s structural design, which mirrors figure 8 of the ’124 Patent:

Oura(Ex-2031)	RingConn(Ex- 2028)
	
The '124 Patent	
 FIG. 8	
'124 Patent (Ex-1001) at Fig. 8	

C. The '124 Patent fulfilled a long felt need for a company and comfortable wearable finger ring.

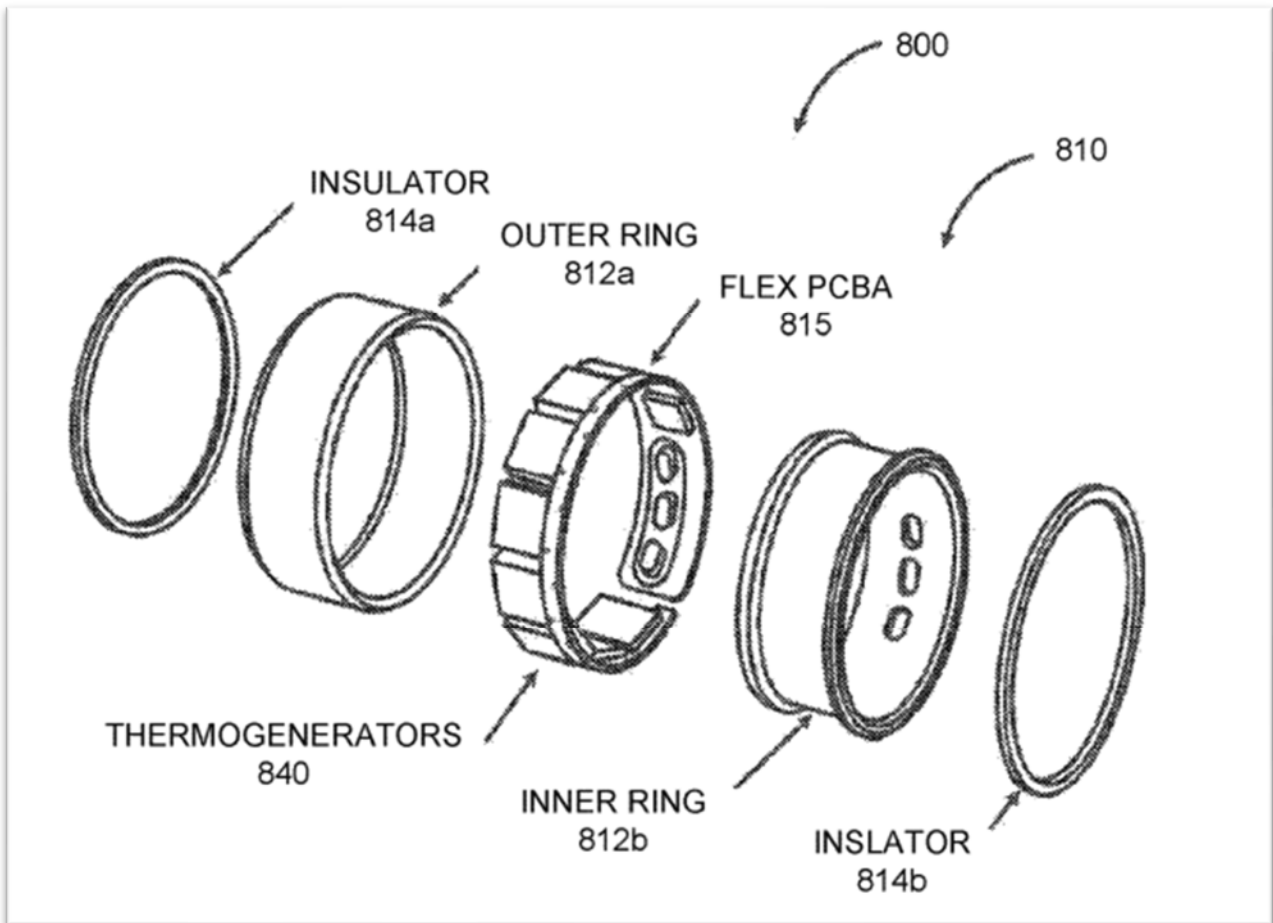
327. The world’s leading wearable ring researcher Asada recognized the advantages a wearable ring has over wearables worn on other parts of the body a decade prior to the '124 Patent. Ex-2025 at 1:56-58. Asada recognized, however,

that comfort and compactness were the keys to realizing the advantages of a finger-worn ring. Ex-1035 at 9-10; Ex-1037 at 3. If the ring were as comfortable as a wedding ring, the wearer would not take it off, thereby achieving the goal of round-the-clock biometric monitoring. Asada even recognized that his prototype—which as I noted above, I have previously inspected—failed to achieve these goals. Ex-1035 at 74 (“the size of the first prototype, as shown in Figure 8-1, was too large to be of use in real life.”).

328. The development of wearable rings did not fulfill these needs until the ’124 Patent. The prior art largely followed Asada’s lead, bunching components at the top of the ring in an attempt to at least make the ring wearable by limiting the width of the sides of the ring. Even my own efforts in 2013 in creating a smart ring as part of the Center of Wearable Sensors at UCSD required me to put components and a battery on top of the ring, similar to Asada. None of these efforts proposed using a curved battery in conjunction with a printed circuit board mounted within a ring housing. Indeed, in my own endeavor on this front in 2013, the balancing of power requirements, component sizes, and functionality drove the decisions by myself and my colleagues at the time to design a ring similar to Asada and other prior designs.

329. Even Oura followed the Superbowl ring-type design with its first-generation product, released after the priority date of the ’124 Patent. Ex-2033, 2034,

2047. It was not until the '124 Patent that wedding-ring-like comfort and compactness were achieved with the following inventive design:



Ex-1001 at Fig. 8.

330. This arrangement, as disclosed in the '124 Patent, finally satisfied the long-felt need for a finger-ring wearable device that the user would actually want to wear continuously. I personally was surprised that Oura managed to fit all the components and functionality into such a compact, wedding-ring-type of device. The satisfaction of this long-felt need is validated by the considerable commercial

success enjoyed by the commercial embodiment, as well as by competitors subsequently adopting similar design layouts. In the ITC Initial Determination (Ex-2018), the ALJ found that for the related '178 Patent, the “record evidence demonstrates a long-felt but unresolved need for a compact, comfortable ring that could provide continuous health monitoring, and that others failed to provide such a wearable monitoring system.” The ALJ cited consumer desire for a less obtrusive yet accurate tracker, especially for sleep, as evidence of this need. Accordingly, the ALJ concluded, “This factor weighs in favor of a determination of non-obviousness of the asserted claims.” Ex-2018 at 116.

E. Failure of Others to Develop a Comparable Wearable Ring.

331. The difficulty in achieving a compact, comfortable, and functional smart ring like that disclosed in the '124 Patent is underscored by the earlier efforts of others in the field. Prior to the innovations of the '124 Patent, the development of wearable rings had not successfully integrated the necessary components into a truly wearable and user-friendly form factor.

332. For instance, the pioneering work by Asada, while recognizing the potential of ring-based wearables, resulted in prototypes that were acknowledged as too large for practical, real-life use. Ex-1035 at 74 (“the size of the first prototype, as shown in Figure 8-1, was too large to be of use in real life.”).

333. The prior art largely followed Asada’s approach, typically bunching

components at the top of the ring in an attempt to make the ring wearable by limiting the width of its sides. Even my own efforts in 2013 in creating a smart ring as part of the Center of Wearable Sensors at UCSD required me to place components and the battery atop the ring, similar to Asada's design. None of these earlier efforts, including my own, proposed or achieved the use of a curved battery in conjunction with a flexible printed circuit board efficiently mounted within a slim ring housing as disclosed in the '124 Patent. The challenges of balancing power requirements, component sizes, and overall functionality within a compact and comfortable design drove these earlier, less integrated designs with electronics mounted on top of the ring. The eventual success of the Oura Ring starting with Generation 2, embodying the '124 Patent's design, highlights the non-obviousness of overcoming these prior failures. In the ITC Initial Determination (Ex-2018) for the related '178 Patent, the ALJ considered the failure of others, citing the efforts of Yang and Asada at MIT who aimed to create wearable ring devices for healthcare monitoring but "neither was able to package the components neatly within a ring housing" or achieve the subject matter claimed in the '178 Patent, such as the specific battery configuration. The ALJ concluded, "This factor weighs in favor of a determination of non-obviousness of the asserted claims." Ex-2018 at 114-116.

IX. SUPPLEMENTATION

334. I reserve my right to supplement or amend this Declaration in light of

any additional information or documents, or in response to any critique of my Declaration or alternative opinions advanced by or on behalf of Petitioner.

I hereby 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 and/or imprisonment under Section 1001 of Title 18 of the United States Code, and such willful false statements may jeopardize the validity of the patent which is under review in this proceeding.

Dated: December 17, 2025

A handwritten signature in black ink, appearing to read "P. Mercier", written over a horizontal line.

Dr. Patrick Mercier

Patrick P. Mercier

Professor and Vice Chair, Electrical and Computer Engineering
Co-Director, Center for Wearable Sensors
Site Director, Power Management Integration Center
University of California, San Diego
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La Jolla, CA 92093

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Email: pmercier@ucsd.edu

Web: <http://efficiency.ucsd.edu> | <http://cws.ucsd.edu> | <https://pmic.engineering.dartmouth.edu/>

Professional Highlights

- Currently leading a ~20-person group undertaking high-impact research spanning multiple domains, from near-zero-power integrated circuits, power management, energy harvesting, neural interfaces, wearable physiochemical sensors, RFICs and RF systems, and beyond
- Over 220 peer-reviewed publications, including 32 *ISSCC* papers, 37 *JSSC* papers, and several papers in high-impact journals such as *Science*, *Nature Biotechnology*, *Nature Biomedical Engineering*, *Nature Electronics*, *Nature Communications*, *Advanced Science*, *Energy and Environmental Science*, and more
- Recognized as one of the top contributors of all time at the 2023 *IEEE International Solid-State Circuits Conference (ISSCC)*
- Co-founder and co-director of the successfully industry-supported UCSD Center for Wearable Sensors
- Site Director of the successfully industry/NSF-supported IUCRC Power Management Integration Center, partnered with Dartmouth College
- Multiple young investigator awards: DARPA YFA, NSF CAREER, Beckman YIA
- ISSCC Jack Kilby Award for Outstanding Student Paper
- Over \$40MM in research fundraising to date
- UCSD-wide Academic Senate Teaching Award, and two ECE department teaching awards
- IEEE Fellow
- ISSCC Executive Committee member; former ISSCC, VLSI, and CICC TPC member
- Startup co-founder (Traq), board member (QuantalRF), and scientific advisory board member (Nanovision and NeuroVigil)
- 28 issued US patents

Education

Ph.D. **Massachusetts Institute of Technology**, Electrical Engineering, June 2012

Thesis title: *Communication and Power Delivery Architectures for Personal Medical Devices* (GPA: 5.0/5.0)

Advisor: Anantha P. Chandrakasan

- S.M. **Massachusetts Institute of Technology**, Electrical Engineering, June 2008
Thesis title: *An All-Digital Transmitter for Pulsed Ultra-Wideband Communication* (GPA: 5.0/5.0)
Advisor: Anantha P. Chandrakasan
- B.Sc. **University of Alberta**, Electrical and Computer Engineering, May 2006
GPA: 4.0/4.0

Related Experience

University of California, San Diego

Vice Chair, Electrical and Computer Engineering (2024-present)
Professor, Electrical and Computer Engineering (2023-present)
Site Director, Power Management Integration Center (2021-present)
Associate Professor, Electrical and Computer Engineering (2018-2023)
Co-Founder/Co-Director, Center for Wearable Sensors (2014-present)
Assistant Professor, Electrical and Computer Engineering (2012-2018)

Expert Witness

Providing expert technical advice, reports, depositions, and courtroom testimony on a variety of patent litigation cases (2020-present)

NeuroVigil

Scientific Advisory Board Member (2020-present)

Nanovision

Scientific Advisory Board Member (2019-present)

Quantal RF

Board Member (2018-2024)

Traq / Mouthsense Inc.

Co-Founder/Scientific Advisor (2016-present)

Mercier Engineering

Owner, providing engineering and technical expertise to technology companies. (2013-present)

Massachusetts Institute of Technology, Microsystems Technology Laboratory, *Research Assistant* (2006-2012)

Intel Corporation, Circuits Research Lab, *Graduate Technical Intern* (2008)

Selected Honors and Awards

- **IEEE Fellow** – awarded to less than 0.1% of voting members in the IEEE Solid-State Circuits Society – Class of 2025
- **Teacher of the Year Award** – Jacobs School of Engineering at UC San Diego Annual Best Teacher Award Selected by Ballot of the Students – 2023

- **IEEE International Solid-State Circuits Conference (ISSCC) Author-Recognition Award** – Awarded to authors who have contributed more than 20 papers to ISSCC – 2023
- **San Diego County Engineering Council Outstanding Engineer Award** – Awarded annually to a single local engineer who has made significant technical contributions to their society – 2020
- **National Academy of Engineering Frontiers of Engineering Speaker** – A competitive invitation-only event for those who have demonstrated accomplishment in engineering research and technical work with recognizable contributions to advancing the frontiers of engineering – 2019
- **IEEE Solid-State Circuits Society Distinguished Lecturer** – Nominated to deliver invited lectures at local chapters and regional meetings across the world for a two-year term – 2019
- **NSF CAREER Award** – The National Science Foundation’s most prestigious awards in support of early-career faculty – 2018
- **Biocom Catalyst Award** – Awarded to ten academics, entrepreneurs, investors, corporate leaders, and business advisers under 40 years old who are igniting innovation and growth in the San Diego and Los Angeles life sciences industry – 2017
- **IEEE Senior Member** – Elected for showing significant performance over a 10+ year career – 2017
- **Moore Inventor Fellow Finalist** – Selected as a top-10 fellow amongst >200 other applicants at top US universities; received \$25k award – 2017
- **UCSD Academic Senate Distinguished Teaching Award** – Awarded yearly to five distinguished teachers across all departments at UCSD (totaling ~2200 senate members – i.e., the top 0.2% of teachers). First winner in the ECE department since Jack Wolf in 1999. Received 2016
- **DARPA Young Faculty Award** – Awarded to young faculty members who propose high-impact, high-risk research programs – 2015
- **Beckman Young Investigator Award** – Awarded to eight junior faculty members across the US for innovating research within the chemical and biological sciences – 2015
- **Hellman Fellowship Award** – Awarded to junior faculty members who show capacity for great distinction in their research and creative activities – 2014
- **Graduate Teaching Award** – Awarded annually to one (of ~50) faculty in the UCSD ECE department for outstanding teaching and service – 2013
- **Jack Kilby Award** – One awarded per year for outstanding student paper at the *International Solid-State Circuits Conference (ISSCC)* – received 2010
- **Intel Foundation Ph.D. Fellowship** – awarded to 26 applicants across the US – 2009
- **Post Graduate Scholarship** – Natural Sciences and Engineering Council of Canada (NSERC) – 2007, 2009
- **Best Presentation Award**, Microsystems Technology Lab Annual Research Conference – 2008, 2010
- **Julie Payette Postgraduate Research Fellowship** – Awarded to the top 24 Master’s NSERC applicants in Canada – 2006
- **APEGGA Medal** – Highest undergraduate GPA in Electrical Engineering – 2006
- **Atco Electric Centennial Award** – March 2005
- **Schlumberger Scholarship** in Electrical Engineering – 2004, 2005

Other Awards and Recognitions

- **IEEE Custom Integrated Circuits Conference (CICC) 2025** – Best Paper Award Finalist
- **IEEE International Solid-State Circuits Conference (ISSCC) Student Research Preview Poster Award** – 2024
- **IEEE Solid-State Circuits Society (SSCS) Outstanding Reviewer Reward** – 2024.
- **IEEE ISCAS Women in Circuits and Systems (WiCAS)** – Runner Up Paper Award – 2023.
- **IEEE International Symposium on Circuits and Systems (ISCAS)** – Best Runner Up Paper – 2023.
- **Qualcomm Innovation Fellowship (QIF) 2023** – Winner
- **IEEE Applied Power Electronics Conference (APEC)** – Outstanding Presentation Award 2023 – “A Series/Parallel Magnetic-Less Step-Down Converter Based on Piezoelectric Resonators”
- **IEEE Brain Technical Community and IEEE Solid-State Circuits Society** – Brain-Related Best Paper Award 2021 – “An Optically-Addressed Nanowire-Based Retinal Prosthesis with 73% RF-to-Stimulation Power Efficiency and 20nC-to-3[^]C Wireless Charge Telemetry” presented at ISSCC 2021.
- **IEEE Symposium on Very Large Scale Integration (VLSI Symposium) 2020** – Best Student Paper Award Nominee – “A -105dB THD 87dB-SNDR VCO-based Sensor Front-end Enabled by Background-Calibrated Differential Pulse Code Modulation”
- **IEEE Symposium on Very Large Scale Integration (VLSI Symposium) 2020** – Best Student Paper Award Nominee – “A 4.4 μ W -92/-90.3dBm Sensitivity Dual-mode BLE/Wi-Fi Wake-up Receiver”
- **Qualcomm Innovation Fellowship (QIF) 2020** – Winner
- **IEEE EMBS Workshop on Brain, Mind and Body – Cognitive Neuroengineering for Health and Wellness 2019** – Third place poster award
- **IEEE Custom Integrated Circuits Conference (CICC) 2019** – Outstanding Student Paper Award Nominee
- **IEEE Custom Integrated Circuits Conference (CICC) 2018** – Outstanding Student Paper Award Nominee
- **IEEE Custom Integrated Circuits Conference (CICC) 2015** – Outstanding Student Paper Award Nominee
- **Qualcomm Innovation Fellowship (QIF) 2014** – Finalist

List of Publications

BOOKS

- [1] S. Ha, C. Kim, P.P. Mercier, G.C. Cauwenberghs, **High-Density Integrated Electrocortical Neural Interfaces**, Elsevier Academic Press, 2019, 187 pages.
- [2] M.M. Hella and P.P. Mercier (eds), **Power Management Integrated Circuits**, CRC Press, 2016, 329 pages.
- [3] P.P. Mercier and A.P. Chandrakasan (eds), **Ultra-low-power Short-Range Radios**, Springer, 2015, 394 pages.

BOOK CHAPTERS

- [1] F. Laiwalla, V.W. Leung, J. Lee, P. Mercier, P. Asbeck, R. Rao, L. Larson, A. Nurmikko, “Next Generation Microscale Wireless Implant System for High-Density, Multi-areal, Closed-Loop Brain Computer Interfaces,” in **Brain-Computer Interface Research**, C. Guger et al. (eds.), Springer Nature Switzerland, 2021.
- [2] S. Ha, C. Kim, H. Wang, Y.M. Chi, P.P. Mercier, G. Cauwenberghs, “Low-power integrated circuits for wearable electrophysiology,” in **Wearable Sensors – Fundamentals, Implementation and Applications 2nd Edition**, E. Sazonov, Ed., Academic Press, 2021.
- [3] L.G. Salem and P.P. Mercier, “Recursive Switched-Capacitor DC-DC Converters,” in **Power Management Integrated Circuits**, M.M. Hella and P.P. Mercier, Eds., CRC Press, 2016.
- [4] D. Lee and P.P. Mercier, “Introduction to Ultra Low Power Transceiver Design,” in **Ultra-low-power Short-Range Radios**, P.P. Mercier and A.P. Chandrakasan, Eds., Cham, Switzerland: Springer, 2015.
- [5] P.M. Nadeau, A. Paidimarri, P.P. Mercier, and A.P. Chandrakasan, “Architectures for Ultra-Low-Power Multi-Channel Resonator-Based Wireless Transceivers,” in **Ultra-low-power Short-Range Radios**, P.P. Mercier and A.P. Chandrakasan, Eds., Cham, Switzerland: Springer, 2015.
- [6] P.P. Mercier, D.C. Daly, F.S. Lee, D.D. Wentzloff, and A.P. Chandrakasan, “Pulsed Ultra-Wideband Transceivers,” in **Ultra-low-power Short-Range Radios**, P.P. Mercier and A.P. Chandrakasan, Eds., Cham, Switzerland: Springer, 2015.
- [7] P.P. Mercier and A.P. Chandrakasan, “Near-Field Wireless Power Transfer,” in **Ultra-low-power Short-Range Radios**, P.P. Mercier and A.P. Chandrakasan, Eds., Cham, Switzerland: Springer, 2015.

JOURNAL PAPERS

- [1] M.I. Khan, R. Burns, A. Agarwal, L. Yin, J. Moon, B. Choi, S. Ding, T. Saha, J. Wang, P.P. Mercier, “A smart cup for wireless, biofuel-powered, sweat-based vitamin C sensing,” *Biosensors and Bioelectronics*, vol. 292, Jan. 2026.
- [2] N.S.K. Fathy, R. Vatsyayan, A.M. Bourhis, S.A. Dayeh, P.P. Mercier, “A TDMA Neural Recording SoC With IIR-RLS Adaptive Filters for 83.4 dB Artifact Suppression Across 256 Channels,” *IEEE Journal of Solid-State Circuits*, vol. 60, no. 11, pp. 4101-4113, Nov. 2025.
- [3] D. Valencia, P.P. Mercier, A. Alimohammad, “An Efficient Brain-Switch for Asynchronous Brain-Computer Interfaces,” *IEEE Transactions on Biomedical Circuits and Systems*, vol. 19, no. 1, pp. 130-141, Feb. 2025.
- [4] W.-C.B. Liu, G. Pillonnet, P.P. Mercier, “An Integrated Dual-Side Series/Parallel Piezoelectric Resonator-Based DC–DC Converter,” *IEEE Journal of Solid-State Circuits*, vol. 59, no. 12, pp. 4162-4174, Dec. 2024.
- [5] H. Lu, P.P. Mercier, “Linear Periodically Time-Variant Digital PLL Phase Noise Modeling Using Conversion Matrices and Uncorrelated Upsampling,” *IEEE Transactions on Circuits and Systems I*, vol. 71, no. 12, pp. 6021-6033, Dec. 2024.
- [6] Y. Xu, A. Uppal, M.S. Lee, K. Mahato, B.L. Wuerstle, M. Lin, O. Djassemi, T. Chen, R. Lin, A. Paul, S. Jain, F. Chapotot, E. Tasali, P. Mercier, S. Xu, J. Wang, G. Cauwenberghs, “Earable Multimodal Sensing and Stimulation: A Prospective Towards Unobtrusive Closed-Loop Biofeedback,” *IEEE Reviews in Biomedical Engineering*, vol. 18, pp. 5-25, Nov. 2024.

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TUTORIALS

- [1] P.P. Mercier, "Enabling Standards-Compliant Wireless Communications at >100x Lower Power," *Tutorial Presented at the International Microwave Symposium (IMS)*, Atlanta, GA (virtual due to COVID-19), Jun. 2021.
- [2] P.P. Mercier, "Interface Circuits for Wearable and Implantable Sensing Systems," *Tutorial presented at the IEEE International Solid-State Circuits Conference (ISSCC)*, San Francisco, CA, Feb. 2020.
- [3] P. P. Mercier, "Physiochemical Interface Circuits for Wearable and Implantable Sensing Systems," *IEEE Solid-State Circuits Society ISSCCedu online mini-course*, San Francisco, CA, Feb. 2020.
- [4] P.P. Mercier, "Building Li-ion-compatible DC-DC Converters in Scaled CMOS," *IEEE Solid-State Circuits Society CICCedu online mini-course*, Austin, TX, Apr. 2019.
- [5] P.P. Mercier, "Power Management for the Internet-of-Things," *Tutorial presented at the IEEE Custom Integrated Circuits Conference (CICC)*, Austin, TX, Apr. 2019.

- [6] P.P. Mercier, "Nanowatt wake-up radios: exploring power and sensitivity trade-offs," *Tutorial presented at the IEEE International Microwave Symposium (IMS)*, Philadelphia, PA, June 2018.
- [7] P.P. Mercier, "Design of Low-Power Wake-up Radios for IoT Applications," *Tutorial presented at the IEEE Custom Integrated Circuits Conference (CICC)*, San Diego, CA, April 2018.
- [8] P.P. Mercier, "Unawareables: new wearable sensors and circuits for unobtrusive health and fitness monitoring," *Tutorial presented at the IEEE European Solid-State Circuits Conference (ESSCIRC)*, Leuven, Belgium, Sep. 2017.
- [9] P.P. Mercier, "Improving Battery-Life of Deeply Duty-Cycled IoT Nodes via Ultra-Low-Power Wake-up Receivers," *Tutorial presented at the IEEE International Microwave Symposium (IMS)*, Honolulu, HI, Jun. 2017.
- [10] P.P. Mercier, "Ultra-Low-Power RC Oscillators," *Tutorial presented at the IEEE International Microwave Symposium (IMS)*, Honolulu, HI, Jun. 2017.

INVITED ABSTRACTS, PRESENTATIONS, AND POSTERS

- [1] P.P. Mercier, "Wearable, Ingestible, and Implantable Wireless Sensing Systems for Healthcare Applications," *Presented at the Department of Neurosciences-Digital Tools and Wearable Devices Seminar*, La Jolla, CA, May. 2025.
- [2] P.P. Mercier, "Wearable, Ingestible, and Implantable Wireless Sensing Systems for Healthcare Applications," *Presented at the LINKJ Special Symposium*, Tokyo, Japan, Apr. 2025.
- [3] P.P. Mercier, "Ambient IoT: Power and Connecting the Next Information Frontier," *Presented at the University of California, Berkeley*, Berkeley, CA, Feb. 2025.
- [4] P.P. Mercier, "Directions in Wearable Sensing," *Presented at the EverythingALS and ALSOne Neurotech Day*, Nov. 2024.
- [5] P.P. Mercier, "Unawareables: Enabling Unobtrusive Wearable Devices via Smart Sensors and Low-Power Wireless Circuits," *Presented at the UC Davis ECE Department Distinguished Seminar Series*, Nov. 2024.
- [6] P.P. Mercier, "Low-Power Wearable and Ingestible Physiochemical Monitoring Devices," *Presented at the Medical Wearables Conference*, Oct. 2024.
- [7] P.P. Mercier, "Low-Power Standards-Compatible Wireless Communication Circuits for Next-Generation IoT and Wearable Applications," *Presented at the Tokyo Institute of Technology*, Tokyo, Japan, Jul. 2024.
- [8] P.P. Mercier, "Low-Power Sensing and Wireless Communication Circuits," *Presented at the IEEE Internet of Things Vertical and Topical Summit*, Jan. 2024.
- [9] P.P. Mercier, "Low-Power and Energy-Efficient Integrated Circuit Design for a Sustainable Future," *Presented at the IEEE Solid-State Circuits Society and Power Electronics Society: ICs Addressing Societal Grand Challenges: Sustainability and Climate Change Seminar*, Sep. 2023.
- [10] P.P. Mercier, "Enabling Low-Power yet Standards Compatible Wireless Communication via Wake-Up Receivers and Backscatter Circuits," *Presented at the IEEE International Microwaves Symposium*, San Diego, CA, Jun. 2023.
- [11] P.P. Mercier, "Next-Generation Wearable Hybrid Physiochemical Sensing Systems," *Presented at the Cali-Baja Symposium*, La Jolla, CA, Apr. 2023.
- [12] P.P. Mercier, "Unawareables: Building Invisible yet Useful Wearable Devices," *Chancellor's Associates Colloquium*, La Jolla, CA, Mar. 2023.
- [13] P.P. Mercier, "Next-Generation Wearable Sensor Technologies," *Presented at the National Academy of Engineering Southern California Regional Symposium*, San Diego, CA, Mar. 2023.

- [14] P.P. Mercier, "Wearable Sensors and Low-Power WiFi-Compatible Communication Circuits for Emerging IoT Applications," *Presented at the Medical Wearables Conference*, Dec. 2022.
- [15] P.P. Mercier, "Ultra-low-power Integrated Circuits and Physiochemical Sensors for Next-Generation Unawareables," *Presented at the BioXTech virtual group*, Dec. 2022.
- [16] P.P. Mercier, "Energy Harvesting and Self-Powered Sensing for Miniaturized IoT and Unawareable Devices," *Presented at the ACM International Workshop on Energy Harvesting & Energy-Neutral Sensing*, Boston, CA, Nov. 2022.
- [17] P.P. Mercier, "Unaware-ables: Low-Power, Robust, and Useful Wearable Devices", *Presented at the IEEE International Microwave Symposium*, Denver, CO, Jun. 2022.
- [18] P.P. Mercier, "Energy-Efficient Power Management Circuits for IoT and Wearable Devices," *Keynote presentation at the IEEE Sensors Interface Meeting*, Veldhoven, The Netherlands, May 2022.
- [19] P.P. Mercier, "Energy Harvesting and Self-Powered Sensing for Miniaturized IoT and "Unawareable" Devices," *Presented at the PSMA International Energy Harvesting Workshop (EnerHarv)*, Raleigh, NC, Apr. 2022.
- [20] P.P. Mercier, "Enabling Low-Power yet Standards Compatible Wireless Communication via Wake-up Receivers and Backscatter Circuits for the IoT," *Presented as an IEEE SSCS Society-wide Webinar*, Jan. 2022.
- [21] P.P. Mercier, "Energy Harvesting and Self-Powered Sensing for Next-Generation "Unawareables" and IoT," *Presented at the Sensors Converge Conference*, (virtual due to COVID-19), Sep. 2021.
- [22] P.P. Mercier, "Ultra-low-power integrated circuits and physiochemical sensors for next-generation unwareables," *IEEE Solid-State Circuits Society Distinguished Lecture at Oregon IEEE Solid-State Circuits Society local chapter*, Hillsboro, OR (virtual due to COVID-19), Jun 2021.
- [23] P.P. Mercier, "Ultra-Low-Power Integrated Circuits and Physiochemical Sensors for Next-Generation Unwareables", *Presented at the International Symposium on Advanced Sensor Technology*, Seoul, Korea (virtual due to COVID-19), Mar. 2021.
- [24] P.P. Mercier, "Energy-Efficient Communication Technologies for Emerging Internet-of-Things Applications," *IEEE Solid-State Circuits Society Distinguished Lecture at the SSCS Northern Virginia Section*, (virtual due to COVID-19), Oct. 2020.
- [25] P.P. Mercier, "Hybrid Converters for Mobile and IoT Applications," *Presented at the Integrated Power Conversion and Power Management Conference (PwrSoC)* (virtual due to COVID-19), Nov. 2020.
- [26] P.P. Mercier, "Low-Power Communication Circuits and Technologies for Emerging Internet-of-Things Applications," *IEEE Solid-State Circuits Society Distinguished Lecture at the SSCS Princeton Central Jersey Section*, (virtual due to COVID-19), Nov. 2020.
- [27] P.P. Mercier, "Energy-Efficient Communication Technologies for Emerging Internet-of-Things Applications," *Presented at the 2020 RFID Conference*, (virtual due to COVID-19), Oct. 2020.
- [28] P.P. Mercier, "Energy-Efficient Communication Technologies for Emerging Internet-of-Things Applications," *IEEE Solid-State Circuits Society Distinguished Lecture at the SSCS Utah Section*, (virtual due to COVID-19), Oct. 2020.
- [29] P.P. Mercier, "Energy-Efficient Communication Technologies for Emerging Internet-of-Things Applications," *IEEE Solid-State Circuits Society Distinguished Lecture at the Advanced Circuits Research Center in Israel*, (virtual due to COVID-19), July 2020.

- [30] P.P. Mercier, "Ultra-low-power integrated circuits and physiochemical sensors for next-generation unwearables," *IEEE Solid-State Circuits Society Distinguished Lecture at the Beijing IEEE Solid-State Circuits Society local chapter*, (virtual due to COVID-19), May 2020.
- [31] P.P. Mercier, "Low-Power Wireless Systems: Opportunities and Challenges," *Presented at the DARPA MTO Offsite Planning Meeting on the U.S.S. Midway*, San Diego, CA, Dec. 2019.
- [32] P.P. Mercier, "Ultra-low-power integrated circuits and physiochemical sensors for next-generation unwearables," *IEEE Solid-State Circuits Society Distinguished Lecture at the Scotland and UK IEEE Solid-State Circuits Society local chapter*, Edinburgh, UK, Sep. 2019.
- [33] P.P. Mercier, "Ultra-low-power integrated circuits and physiochemical sensors for next-generation unwearables," *IEEE Solid-State Circuits Society Distinguished Lecture at the Maryland/Virginia/DC IEEE Solid-State Circuits Society and Circuits and Systems local chapter*, College Park, MD, Sep. 2019.
- [34] P.P. Mercier, "Ultra-low-power integrated circuits enabling next-generation IoT applications," *Presented at the National Academy of Engineering Frontiers of Engineering event*, San Diego, CA, Jun. 2019.
- [35] P.P. Mercier, "Ultra-low-power integrated circuits and physiochemical sensors for next-generation unwearables," *IEEE Solid-State Circuits Society Distinguished Lecture at the San Diego IEEE Solid-State Circuits Society local chapter*, San Diego, CA, May. 2019.
- [36] P.P. Mercier, "Unwearables: Addressing Sensor, Circuit, and Energy Harvesting Challenges in Next-Generation Wearable Devices," *Presented at the IEEE Custom Integrated Circuits Conference (CICC)*, Austin, TX, Apr. 2019.
- [37] P.P. Mercier, "Ultra-Low-Power Integrated Circuits and Physiochemical Sensors for Next-Generation Unwearables," *Presented at the DARPA Actuation, Sensing, and Control for Rapid Injury Response Workshop*, Arlington, VA, Apr. 2019.
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- [39] P.P. Mercier, "Unwearables: new wearable sensors, circuits, and analytics for unobtrusive monitoring," *Presented at the SEMI MEMS & Sensors Executive Congress*, Napa, CA, Nov. 2018.
- [40] P.P. Mercier, "Ultra-small near-zero-power radios, implants, and sensing systems," *Presented at the DARPA Microsystems Exploratory Council Millimeter-Scale Wirelessly Powered Sensors Workshop*, Los Angeles, CA, Jul. 2018.
- [41] P. P. Mercier, "Wearable Sensors", *Presented at the US Marine Corps Innovation Event*, La Jolla, CA, Feb. 2018.
- [42] P.P. Mercier, "The Next Industrial Revolution: IoT, Wearables, and AI," *Presented at the Next Business Forum*, Seoul, South Korea, Nov. 2017.
- [43] P.P. Mercier, "Global Hubs for Innovative Ecosystems in Biotechnology," *Presented at the Stevanato Innovation Day*, San Diego, CA, Jun. 2017.
- [44] P.P. Mercier, "Non-Invasive Blood Alcohol Monitoring," *Presented at the Biomedical Technology Exhibition, sponsored by the American Institute for Medical and Biological Engineering (AIMBE) in partnership with the Congressional Research and Development Caucus and the Congressional Robotics Caucus*, Capitol Hill, Washington, DC, May 2017.
- [45] P.T. Theilman, J. Warchall, P. Mercier, H. Garudari, "Work Towards a Fieldable Multi-Channel EEG System for Continuous Monitoring," in *Proc. IEEE International Symposium on Circuits and Systems (ISCAS)*, Baltimore, MD, May 2017.

- [46] P.P. Mercier, "Beyond Activity Tracking: next-generation wearable and implantable sensor technologies" *Presented at the SPIE Defense and Commercial Sensing Conference*, Anaheim, CA, Apr. 2017.
- [47] D.A. Hall, H. Jiang, P.-H. Wang, L. Gao, P. Sen, Y.-H. Kim, G. Rebeiz, P.P. Mercier, "A 10nW Wake-up Radio with -60dBm Sensitivity," in *Government Microcircuit Applications & Critical Technology Conference (GOMACTech)*, Reno, NV, Mar. 2017.
- [48] P.P. Mercier, "Physiochemical Sensor Technologies and Ultra-Low-Power Integrated Circuits for Next-Generation "Unawearables" Systems," *Invited Seminar at the Microsystems Technology Lab at MIT*, Cambridge, MA, Dec. 2016.
- [49] P.P. Mercier, "Transcutaneous Power of Single-Chip Implants," *Presented at the Sensors Global Summit*, La Jolla, CA, Dec. 2016.
- [50] D. Ahn, P.P. Mercier, "A 200-kHz/6.78-MHz Wireless Power Transmitter Featuring Concurrent Dual-Band Operation," in *Proc. IEEE International SoC Design Conference (ISOC)*, Jeju, South Korea, Oct. 2016. DOI: 10.1109/ISOC.2016.7799763
- [51] P.P. Mercier, J. Rogers, A. Arias, N. Verma, J. Rabaey, "Drawing the line(s): processing sensor information in the right place(s) in energy-constrained systems," *Panel organization and presentation at the SRC SONIC Center Annual Review*, Champaign, IL, Oct. 2016.
- [52] P.P. Mercier, "Wearables: an opportunity for healthcare?," *Presented at the 5G Connected Healthcare Workshop*, La Jolla, CA, May 2016.
- [53] P.P. Mercier, "New Circuit Topologies & Techniques for High-Efficiency Power Conversion in Compact Form Factors," *Invited seminar presented at UCLA and Intel Corporation*, Apr. 2016.
- [54] P.P. Mercier, "Energy-Efficient Wearable Sensors," *Presented at the UCSD Orthopaedic Surgery Research Conference*, April 2016.
- [55] P.P. Mercier and L.G. Salem, "Multi-Ratio Switched-Capacitor DC-DC Converters for Power Management Applications," *Presented at the International Symposium on Quality Electronic Design*, Santa Clara, CA, Mar. 2016.
- [56] P.P. Mercier, "Energy-Harvesting for Autonomous Operation of Low-Power Wireless Sensors," *Presented at the Sensors Global Summit*, La Jolla, CA, Nov. 2015.
- [57] P.P. Mercier, "Enabling energy-autonomous wearable and implantable sensors through energy harvesting and near-zero-power electronics," *Presented at the KAIST-UCSD Joint Symposium on Wearable Devices*, Daejeon, Korea, Oct. 2015.
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- [71] P.P. Mercier, "nW Energy Harvesting: What can it do for you?," *Presented at the Office of Naval Research Power and Energy Systems 6.1 Program Review*, San Diego, CA, Nov. 2012.
- [72] P.P. Mercier, "Ultra-Low-Power Radios for Miniaturized Sensing Systems," *Presented at the Center for Wireless Communications Semiannual Research Review*, La Jolla, CA, Nov. 2012.
- [73] P.P. Mercier, "Zero-Leakage Electronics and Opportunities in Miniaturized Wireless Systems," *Presented at the Center for Magnetic Recording Research Review*, La Jolla, CA, Oct. 2012.
- [74] P.P. Mercier, "Cyborg Insects and Autonomous Sensors: How Efficient Radios can Enable the Next Generation of Connectivity," *Presented at the Qualcomm Research Center*, San Diego, CA, Oct. 2012.
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- [76] P.P. Mercier, "Self-Powered Personal Microsystems for Medical Monitoring Applications," *Presented at TechConnect World*, Boston, MA, Jun. 2011.
- [77] P.P. Mercier, "Attaining Extreme Energy Efficiency in Body-Area Networks Using Electronic Textiles," *Presented at the MEDRC Next Generation Medical Electronic Systems Workshop*, Cambridge, MA, May, 2011.
- [78] P.P. Mercier, "Connected Health for Remote Patient Monitoring," *Presented at the MTL Annual Research Conference (MARC)*, Cambridge, MA, Jan. 2010.
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- [80] P.P. Mercier, "Energy Efficient Pulsed-UWB for Miniaturized Flying Vehicles," *Presented at the CMOS Emerging Technologies Workshop*, Banff, AB, Canada, Feb. 2009.
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- [3] P. Mercier, J. Park, “Low Power Magnetic Field Body Area Network With Quenching and Quick Start,” U.S. Patent 12,121,318, Oct. 22, 2024.
- [4] J. Wang, A.J. Bandodkar, P.P. Mercier, “Non-invasive and wearable chemical sensors and biosensors,” U.S. Patent 12,023,154, Jul. 2, 2024.
- [5] J. Wang, P. Mercier, “Salivary Biosensors and Biofuel Cells,” U.S. Patent 11,980,462, May 14, 2024.
- [6] J. Wang, P. Mercier, A.F. Yeknami, S. Imani, “Self-Powered Biosensors,” U.S. Patent 11,633,134, Apr. 25, 2023.
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- [8] H. Wang, P. Mercier, “Near Zero Power Fully Integrated Digital Conversion, Sensors, and Sensing Methods,” U.S. Patent 11,444,633, Sep. 13, 2022.
- [9] S. Amin, P. Mercier, “Li-ion-compatible fully-integrated hybrid converter,” U.S. Patent 11,356,017, Jun. 7, 2022.
- [10] P. Mercier, H. Wang, “Stabilized voltage and current reference generator and circuits,” U.S. Patent 11,334,105, May 17, 2022.
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- [21] J. Park, P. Mercier, "Low power magnetic field body area network," U.S. Patent 10,623,112, Apr. 14, 2020.
- [22] J. Wang, P. Mercier, "Salivary biosensors and biofuel cells," U.S. Patent 10,595,759, Mar. 24, 2020.
- [23] L.G. Salem, P.P. Mercier, "Switched capacitor DC-to-DC converter and power conversion control methods," U.S. Patent 10,374,511, Aug. 6, 2019.
- [24] L.G. Salem, P.P. Mercier, "Multi-level adiabatic charging methods, devices and systems," U.S. Patent 10,348,300, Jul. 9, 2019.
- [25] L.G. Salem, J.F. Buckwalter, P.P. Mercier, "Switched Capacitor House of Cards Power Amplifier," U.S. Patent 10,333,477, Jun. 25, 2019.
- [26] L.G. Salem, P.P. Mercier, "Successive approximation digital voltage regulation methods, devices and systems," U.S. Patent 10,224,944, Mar. 5, 2019.
- [27] K. Stankovich, A. Chandrakasan, P. Mercier, S. Bandyopadhyay, A. Lysaght, "Energy Extraction," U.S. Patent 9,369,005, Jun. 14, 2016.
- [28] P.P. Mercier and A.P. Chandrakasan, "Multi-Taped Inductively-Coupled Charging System," U.S. Patent 9,293,942, Mar. 22, 2016.

Teaching Experience

University of California, San Diego

La Jolla, CA

Instructor

Fall 2024: ECE 203 – Biomedical Integrated Circuits and Systems

Spring 2024: ECE 165 – Digital Integrated Circuits

Fall 2023: ECE 203 – Biomedical Integrated Circuits and Systems (87% instructor rating)

Spring 2023: ECE 165 – Digital Integrated Circuits (98% instructor rating)

Fall 2022: ECE 203 – Biomedical Integrated Circuits and Systems (92% instructor rating)

Spring 2022: ECE 165 – Digital Integrated Circuits (93% instructor rating)

Fall 2021: ECE 203 – Biomedical Integrated Circuits and Systems (83% instructor rating)

Spring 2021: ECE 165 – Digital Integrated Circuits (85% instructor rating)

Fall 2020: ECE 203 – Biomedical Integrated Circuits and Systems (94% instructor rating)

Spring 2020: ECE 165 – Digital Integrated Circuits (92% instructor rating – **even during fully virtual instruction due to COVID-19**)

Fall 2019: ECE 203 – Biomedical Integrated Circuits and Systems (94% instructor rating – **TA won the best ECE TA Award**)

Spring 2019: ECE 165 – Digital Integrated Circuits (96% course rating)

Fall 2018: ECE 203 – Biomedical Integrated Circuits and Systems (95% instructor rating)

Winter 2018: ECE 165 – Digital Integrated Circuits (100% instructor rating)

Winter 2018: ECE 203 – Biomedical Integrated Circuits and Systems (91% instructor rating)

Spring 2017: ECE 165 – Digital Integrated Circuits (100% instructor rating)

Spring 2017: ECE 203 – Biomedical Integrated Circuits and Systems (93% instructor rating)

Fall 2016: ECE260A - VLSI Digital System Algorithms and Architectures (93% instructor rating)

Spring 2015: ECE 165 – Digital Integrated Circuits (**100% instructor & course rating from an 82 student class – ECE dept. record**)

Winter 2015: ECE 203 – Biomedical Integrated Circuits and Systems (93% instructor rating)

Fall 2014: ECE260A - VLSI Digital System Algorithms and Architectures (87% instructor rating)

Spring 2014: ECE 165 – Digital Integrated Circuits (**100% instructor & course rating from a 77 student class – ECE dept. record**)

Winter 2014: ECE 203 – Biomedical Integrated Circuits and Systems (98% instructor rating)

Spring 2013: ECE 283 – Biomedical Integrated Circuits and Systems (99% instructor rating)

Winter 2013: ECE 165 – Digital Integrated Circuits (94% instructor rating)

Massachusetts Institute of Technology

Cambridge, MA

Teaching Assistant

Spring 2010: MIT EECS Course 6.776 – High Speed Communication Circuits.

Funding

Energy-Efficient Microsystems Lab

As PI of the Energy-Efficient Microsystems Lab, I have raised over \$40MM for research at UCSD from the following sources:

- DARPA
- NIH
- NSF
- The Arnold and Mabel Beckman Foundation
- Semiconductor Research Corporation
- ONR
- iARPA
- Army Research Lab
- KETI
- NextFlex
- The Fetzer Franklin Fund
- The Hellman Foundation
- Samsung
- Qualcomm
- Dockon Inc.
- Mouthsense Inc.
- Peregrine Semiconductor
- IMA Life North America
- Moore Foundation
- University of California Multi-Campus Research Programs and Initiatives
- California Energy Commission
- The UCSD Center for Brain Activity Mapping
- The UCSD Center for Wireless Communications (corporate sponsored)
- The UCSD Center for Wearable Sensors (corporate sponsored)
- The Power Management Integration Center (corporate sponsored)

UC San Diego Center for Wearable Sensors

As co-director of the Center for Wearable Sensors, I have been instrumental in fundraising over \$7MM from corporate partners, with the bulk of this funding used to support collaborative

efforts across six engineering departments, the School of Medicine, and the Department of Visual Arts.

Power Management Integration Center

As Site Director of the Power Management Integration Center, I have help recruit corporate members to support research at both UCSD and at Dartmouth College.

Service

Journal service

- Guest Editor – *IEEE Open Journal of the Solid-State Circuits Society (OJ-SSCS) Special Issue on Low-Power RF Circuits and Systems (2023)*
- Guest Editor – *IEEE Journal of Solid-State Circuits Special Issue on the 2018 International Solid-State Circuits Conference (ISSCC) (2018)*
- Associate Editor – *IEEE Solid-State Circuits Letters (2017-2023)*
- Associate Editor – *IEEE Transactions on Biomedical Circuits & Systems (2013-2023)*
- Associated Editor – *IEEE Transactions on VLSI (2015-2017)*
- Guest Editor – *IEEE TBioCAS Special Issue on the 2014 International Solid-State Circuits Conference (ISSCC) (December, 2014)*
- Guest Editor – *IEEE TBioCAS Special Issue on the 2013 International Solid-State Circuits Conference (ISSCC) (December, 2013)*

Conference service

- Executive Committee member – Demo Chair – *IEEE International Solid-State Circuits Conference (ISSCC) (2022-present)*
- Technical Program co-Chair – *IEEE Sensor Interfaces Meeting (2022-2024)*
- Subcommittee Chair – Power Management – *IEEE Custom Integrated Circuits Conference (CICC) (2021-2023)*
- Technical Program Committee member – *IEEE VLSI Circuits Symposium (2018-2022)*
- International Technical Program Committee member – *IEEE International Solid-State Circuits Conference (ISSCC) Technology Directions subcommittee (2017-2022)*
- Technical Program Committee member – *IEEE Custom Integrated Circuits Conference (CICC) (2017-2023)*
- Technical program committee – *IEEE Biomedical Circuits and Systems Conference (BioCAS) (2014-2015)*
- Session chair – *International Symposium on Low-Power Electronics and Design (ISLPED) (2014)*
- Technical program committee - *CMOS Emerging Technologies Research Symposium (2013-2016)*

Peer reviewer (2009-present)

- *IEEE Journal of Solid-State Circuits (JSSC)*
- *IEEE Transactions on Circuits and Systems I (T-CAS I)*
- *IEEE Transactions on Circuits and Systems II (T-CAS II)*
- *IEEE Transactions on Microwave Theory and Techniques (T-MTT)*
- *IEEE Sensors Journal*
- *IEEE Transaction on Power Electronics*

- *Journal of Low Power Electronics and Applications* (JLPEA)
- *IET Circuits, Devices & Systems*
- *IEEE International Conference on Ultra-Wideband* (ICUWB)
- *IEEE Transactions on Biomedical Circuits & Systems* (TBioCAS)
- *IEEE Transactions on Biomedical Engineering* (TBME)
- *IEEE International Conference on Circuits and Systems* (ISCAS)
- *IEEE Biomedical Circuits and Systems Conference* (BioCAS)
- *IEEE Journal of Emerging and Selected Topics in Power Electronics*
- *IEEE Transactions on Industrial Electronics*
- *Nature Nanotechnology*
- *Advanced Materials*
- *Nature Biomedical Engineering*
- *Science Advances*

Grant review service

- NSF SenSE panel reviewer (July 2020)
- NSF ECCS panel reviewer (February 2019)
- NSF ECCS panel reviewer (January 2018)
- NSF ECCS panel reviewer (March 2015)
- ARL ARL Director's Research Initiative (DRI) reviewer (June 2015)

UCSD Campus-wide Service

- Chair, Academic Senate Faculty Affairs Committee (2024-present)
- Co-Director – *Center for Wearable Sensors* – including 23 faculty across four engineering departments, the School of Medicine, and Arts and Humanities (Department of Visual Arts). Funding comes from the membership of 6-10 corporate partners. (2014-present)
- Site Director – *Power Management Integration Center* – includes 5 faculty across multiple engineering departments. Funding comes from the membership of 8-12 corporate partners. (2021-present)
- Vice Chair Academic Senate Faculty Affairs Committee (2023-2024)
- Chair, UCSD Academic Senate Awards Committee (2020-2022)
- Member, UCSD Academic Senate Awards Committee (2018-2020)
- Member, Office of Research Affairs Center Launch Review Panel. (2017-2018)
- Member, UCSD School of Public Health Advisory Committee (2017-2019)
- UCSD representative on Capitol Hill – presented to congressional staffers via an event hosted by the American Institute for Medical and Biological Engineering, then met, alongside UCSD's Executive Director of Government Research Relations, with the offices of three San Diego Congressmen and one California Senator to discuss research at UCSD. (2017)
- Faculty representative, Campus-wide commencement ceremony (2017)
- Organizer & presenter, KAIST-UCSD Symposium on Micro/Nanotechnologies and Electronics for Next-Generation Mobile, Wearable, and IoT Systems, Deajeon, Korea (2015)
- Faculty representative, Welcome Week Convocation Ceremony (2013)

UCSD ECE Departmental Service

- Vice Chair, ECE Department (2024-present)
- Member, Faculty search committee, Systems Focus (2024)
- Adhoc committee member, faculty review files (2x in 2024)
- Chair, ECE Faculty Awards Committee (2023-present)

- Chair, ECE Admissions Steering Committee (2020-2022)
- Member, ECE Admissions Committee (2019-present)
- Medical Devices and Systems curriculum advisor (2018-2020)
- ECE 50th Anniversary planning committee (2015-2016)
- MS Exam committee (2014-present)
- Alumni Initiative (2014-2020)
- Undergraduate/Graduate Affairs and Student Award Nomination committee (2012-2014)
- Medical Devices and Systems curriculum director (2013-2014)
- Medical Devices and Systems Ad-hoc committee - responsible for creating a new program in this area (2012-2013)

Co-Chair, Microsystem Technology Lab Annual Research Conference (2011)

Annual research conference with over 200 academic and industrial attendees. Responsible for steering committee leadership and conference organization including: solicitation of papers, managing paper edits, keynote speaker invitation, opening and closing remarks, and general planning. Created interactive attendee activities to solicit social and technical engagement amongst industry members and students. Cited by a high-ranking industry member as “the best student run conference in the country”.

Broader Impacts & Outreach

- Presented a webinar at BioXTech, a country-wide club founded and run by high school women interested in the intersection of biology and technology, and answered questions about technology and gave career advice (2023)
- Featured in the publication entitled “Building Blocks for Better Science: Case Studies in Low-Cost and Open Tools for Science”, which describes my work in low-cost COVID-19 symptoms monitoring devices (2020)
- Guest instructor at Hands-on-Technology summer camp at Wangenheim Middle School focused on accelerating the understanding of computer science in elementary and school-aged children (2014-present)
- Directly mentored ten B.S., M.S., and Ph.D. students from historically underrepresented backgrounds, including two high school students (2012-present)
- Directly mentored two high school students from historically underrepresented backgrounds (2013, and 2016-2017)
- Keynote speaker at ENSPIRE: one of the largest outreach at UCSD, where over 300 middle-school children visit UCSD to learn about higher education and engineering (Feb. 2015)

Press Articles

Prof. Mercier’s work across several different projects and his expert opinion have been featured in hundreds of press articles and in other forms of media (e.g., TV and radio). A few select articles/videos are shown below.

- [1] Adee, S. “Cyborg moth gets a new radio,” *IEEE Spectrum*, Feb. 2009.
<http://spectrum.ieee.org/robotics/military-robots/cyborg-moth-gets-a-new-radio>
- [2] Dillow, C. “Researchers turn animals ears into bio-batteries,” *Popular Science*, Nov. 7, 2012.
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- http://www.popularmechanics.com/how-to/blog/scientists-tap-into-the-battery-in-your-ear-14556133?click=pm_latest
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