

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.

Case PGR2024-00030
U.S. Patent No. 11,868,178

PGR2024-00030
U.S. Patent No. 11,868,178

DECLARATION OF DR. PATRICK MERCIER

Patent Owner Oura Ex. 2018, 0001

Petitioner Samsung Ex-1063, 0001

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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. 11,868,178 (“’178 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 ’178 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 ’178 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 '178 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, diagnostic 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. Furnidge, 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. Bandodkar, 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 semester-long 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 (2013-2024): 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, including the '178 patent. Further, I have listed certain additional materials that I have reviewed as part of my Declaration preparation which is attached as **Exhibit B**.

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 '178 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 '178 patent is the date that the inventors filed their earliest patent application to which the '178 patent claims priority. I understand that the '178 patent claims priority to a provisional application filed November 29, 2013.

26. I understand that Dr. Anthony contends that for the '178 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.

Ex-1002 at ¶ 21.

27. I generally agree with Dr. Anthony's proposed definition of a POSITA with respect to the '178 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 '178 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 '178 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 '178 PATENT

A. Specification

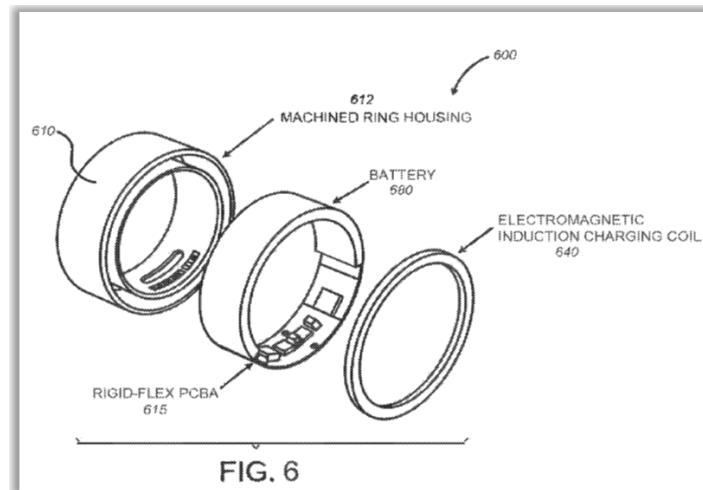
40. The '178 patent titled “Wearable computing device” issued on January 9, 2024, and has an earliest effective priority date of November 29, 2013. *See* '178 patent (Ex-1001) at Cover. The '178 lists three inventors: Curt C. von Badinski, Michael J. Strasser, and Peter Twiss. *Id.*

41. The invention disclosed in the '178 patent “is in the field of wearable electronic devices.” *Id.*, 1:34-35. The inventors of the '178 patent recognized that “many current wearable electronics are bulky and can be intrusive or interfere with a person’s daily life.” *Id.*, 1:42-44. 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.” *Id.*, 9:29-33. Thus, the “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.” *Id.*, 1:50-55.

42. In particular, the patent describes “[a] smart ring [that] includes a curved housing having a U-shape[d] interior storing components including: a curved

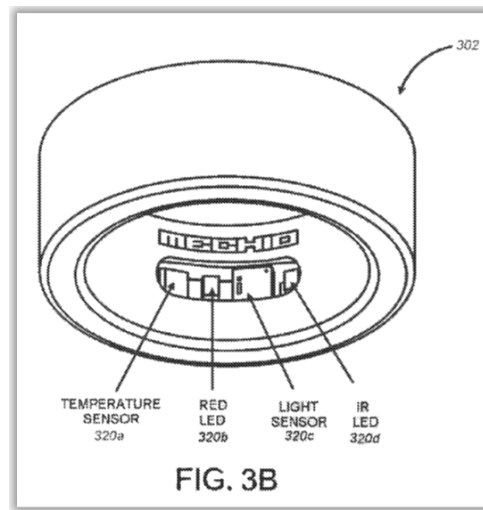
battery approximately conforming to the curved housing, a semiflexible PCB [(printed circuit board)] approximately conforming to the curved housing” and one or more sensors. Ex-1001, Abstract.

43. Fig. 6 shows an exploded view of one embodiment of the invention:



Id. at Fig. 6.

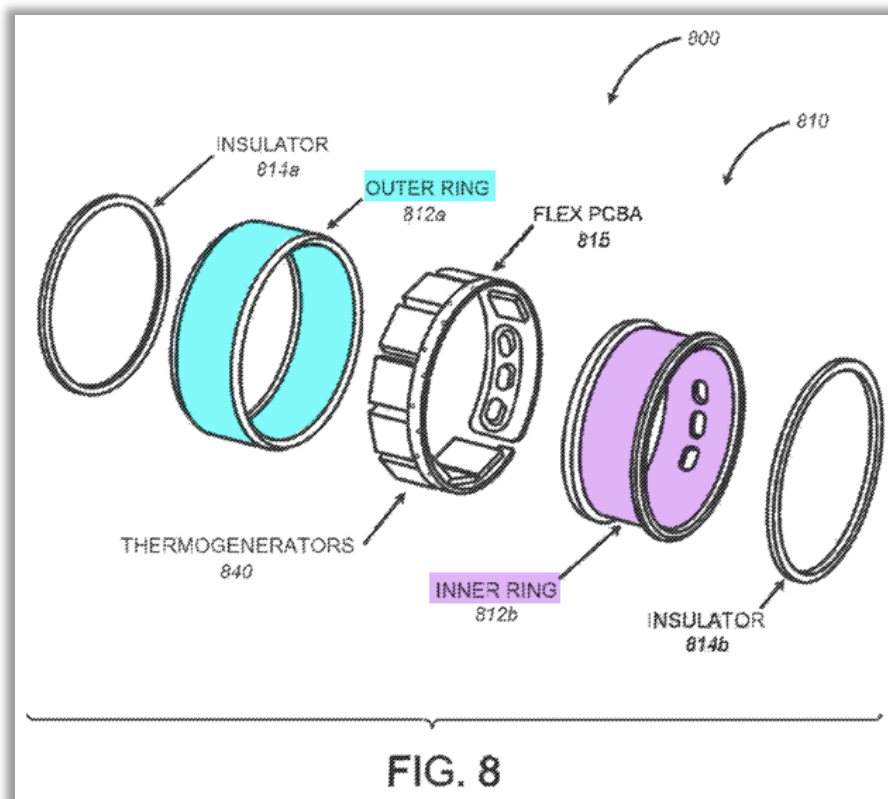
44. As shown in Fig. 6, a curved battery 680 and printed circuit board 615 are shaped and configured to fit within ring housing 612. The ring is also equipped with sensors that enable the ring to “function as a sleep monitor, a heart rate sensor, a cardiac monitor[,], a body temperature detector, or the like.” Ex-1001, 9:44-45. Examples of such sensors are shown below in Fig. 3B.



Id. at Fig. 3B.

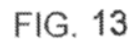
45. Sensors 320a-320d “are directly related to biological sign monitoring [and] can be configured and positioned in a way that is close to the skin (e.g., facing the interior window 130 of the WCD 110).” *Id.*, 11:18-20. A motion sensor (not shown) may also be used to detect an “activity level” of the wearer and whether the wearer is sleeping or engaged in exercise. *Id.*, 11:58-64 (“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.”).

46. Significant to the claims, the ’178 patent discloses an **outer housing component** coupled to an **inner housing component** to form a cavity for accommodating the battery, circuit board, and sensors. *Id.*, 44:46-52.



Id. at Fig. 8.

47. Fig. 13 below shows a cross section of one embodiment of the ring having a housing 1310 comprising internal and external housing components 1314 and 1312. *Id.*, 18:64-67. A space 1320 is formed and occupied by battery 1330 and printed circuit board 1340. *Id.*, 19:6-10.



Id. at Fig. 13.

B. Prosecution History

48. When the examiner allowed the claims, they issued the following reasons for allowance:

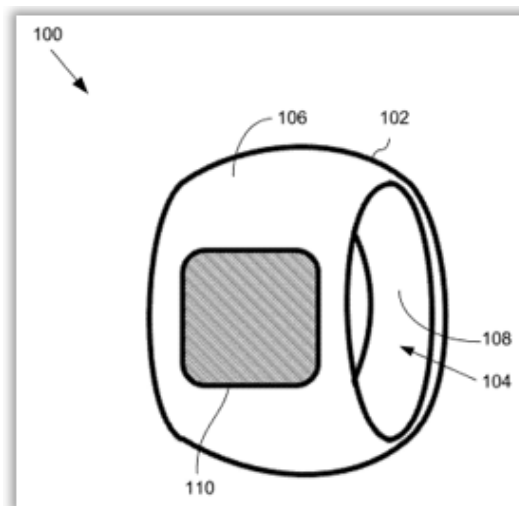
The following is an examiner's statement of reasons for allowance: the prior art does not disclose nor suggest a finger-worn ring device with internal and external housing components, an inner circumferential cavity with a battery positioned and shaped to fit inside the cavity and including a circuit board disposed within the interior and exterior component and extending through a portion of the cavity. The closest prior art to Vescovi (US 20150277559) discloses a similar computing device but fails to disclose the particularly claimed structure.

Ex-1004 at 1314.

49. As shown herein, these reasons remain applicable to the prior art relied on by Petitioner, as the prior art does not disclose or suggest the “particularly claimed structure” of internal and external housing components, a battery positioned and shaped to fit inside a first portion of a cavity formed between outer and inner circumferential surfaces of the external and internal housing components, and a circuit board extending through a portion of the cavity different than the first portion.

50. The closest prior art identified by the examiner was Vescovi (Ex. 2005).

Fig. 1 of Vescovi is shown below:



Ex. 2005 at Fig. 1.

51. As stated in Vescovi:

Fig. 1 illustrates a ring computing device 100 in accordance with some embodiments of the present invention. A structural member 102 houses one or more electronic components (such as a processor, memory, and sensors, as

described in greater detail below with reference to Fig. 7) and defines an aperture 104 capable of receiving a user's finger. The member 102 includes an outer peripheral surface 106 and an inner peripheral surface 108.

Id., ¶ [0032].

52. Vescovi also discloses that the ring includes biometric sensors:

In some embodiments, the ring computing device (902) includes one or more biometric sensors (716) and controllers (760). These sensors may be used to collect biometric data of the user, such as heart rate, temperature, motion, cardiac rhythm, perspiration, and galvanic skin response, and this information may be collected and displayed by the ring computing device (902) and/or a paired electronic device so that the user may monitor his or her health, fitness, activity, or caloric energy expended.

Id., ¶ [0166].

53. As noted by the examiner, however, Vescovi fails to disclose the “particularly claimed structure” of the ’178 patent. Indeed, Vescovi does not disclose the internal structure of the housing 102 nor how the electronic components are shaped and configured within the housing, which are disclosed and claimed in detail in the ’178 patent.

V. CLAIM CONSTRUCTION

54. 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. I understand that Dr. Anthony states that he does not believe that any claim term in the ’178 patent requires explicit

construction to resolve the issues presented in this Petition. Ex-1002 at ¶¶ 132-33. I generally agree.

55. I also understand that in a co-pending U.S. International Trade Commission Investigation, the Administrative Law Judge construed certain terms of the '178 patent. *Certain Smart Wearable Devices, Systems, and Components Thereof*, Inv. No. 337-TA-1398, Order No. 17 (Oct. 23, 2024) (Ex. 2016). Specifically, the ALJ first adopted constructions agreed-upon by the parties¹:

Claim Term	Agreed Construction
“A finger-worn wearable ring device” Claim 1 [preamble]	The preamble is limiting
“[positioned / configured to fit] within a cavity” Claim 1	Plain and ordinary meaning, which is “[positioned/configured to fit] within a hollow space”
“[the internal housing component] coupled with [the external housing component]” Claim 1	Plain and ordinary meaning, which is “[the internal housing component] is connected with [the external housing component]”

Id. at 5.

56. The ALJ also construed two disputed terms: (1) “an [internal/external] housing component” and (2) “circumferential” as follows:

Claim Term	ALJ Construction
“an [internal/external] housing component”	Plain and ordinary, “which is an [internal/external] structure that encloses space and which does not necessarily exclude potting

¹ I understand that the Petitioner was not a party to the ITC Investigation.

Claim Term	ALJ Construction
	material.” <i>Id.</i> at 14
“circumferential”	Plain and ordinary meaning and does not require a closed shape. <i>Id.</i> at 17.

Id. at 6, 14.

57. I do not believe that the above constructions impact the issues presented in this Petition. Nonetheless, I have taken the above constructions into consideration for my below analysis.

VI. TECHNOLOGY BACKGROUND

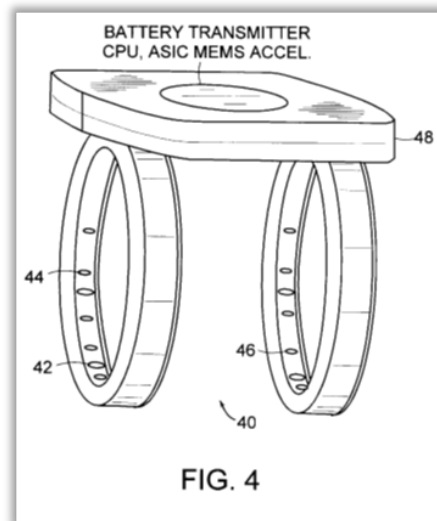
A. State of Wearable Ring Devices up to 2013

58. 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 '178 patent.

59. The lack of commercially available smart rings in 2013 is not surprising. Prior to the '178 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).

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

61. 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:

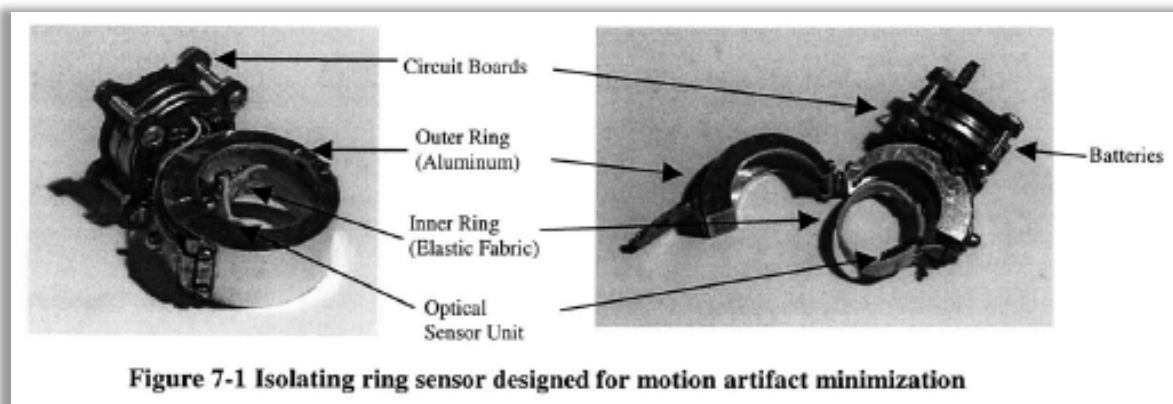


Id. at Fig. 4.

62. 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.

63. 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.

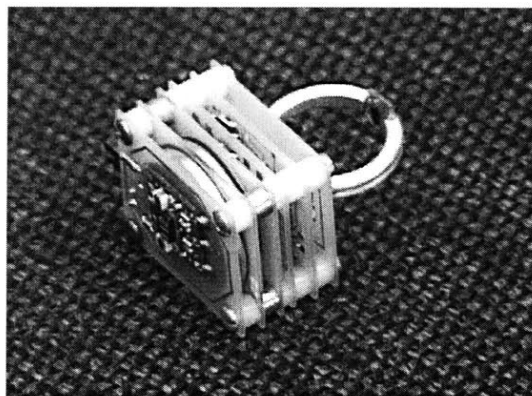
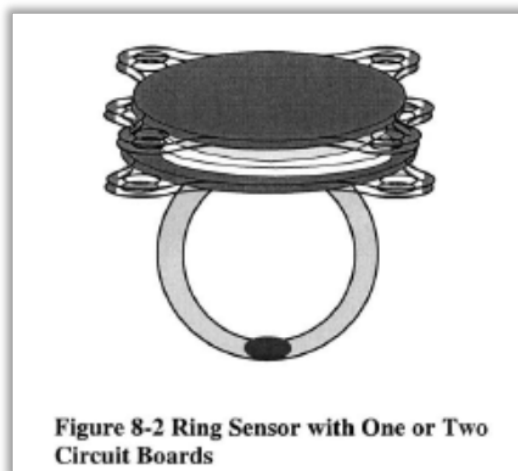


Figure 8-1 First Prototype Ring Sensor

Id. at 75.

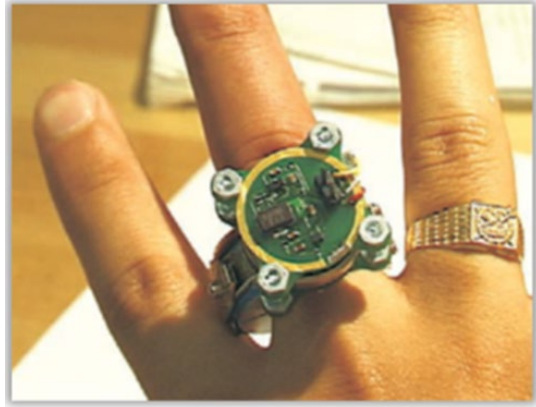
64. Rhee acknowledged that “the size of the first prototype, as shown in Figure 8-1, was too large to be of use in real life.” *Id.* at 74. Rhee’s proposed solution sought to reduce the number of circuit boards, but continued the practice of mounting components on top of the ring:



Id. at 75; *Id.* 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).”).

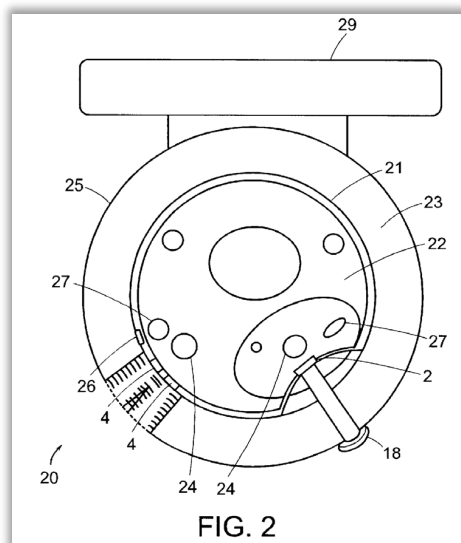
65. In an IEEE article published in 2003, Asada again acknowledged that the ring is “ideal for long term measurements.” Ex-1037 at 3. Asada again acknowledged that “comfort” and “compactness” were keys to making a useable wearable finger ring. *Id.* at 1-2. In terms of comfort and compactness, Asada’s

prototype changed little in the three years since the Rhee dissertation—again mounting the circuit board and battery on top of the ring:



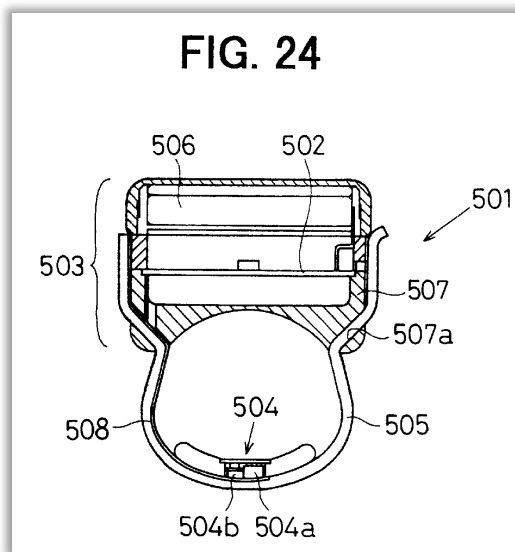
Ex-1037 at 7.

66. 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. *Id.*, 3:18-19.



Id. at Fig. 2.

67. 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:

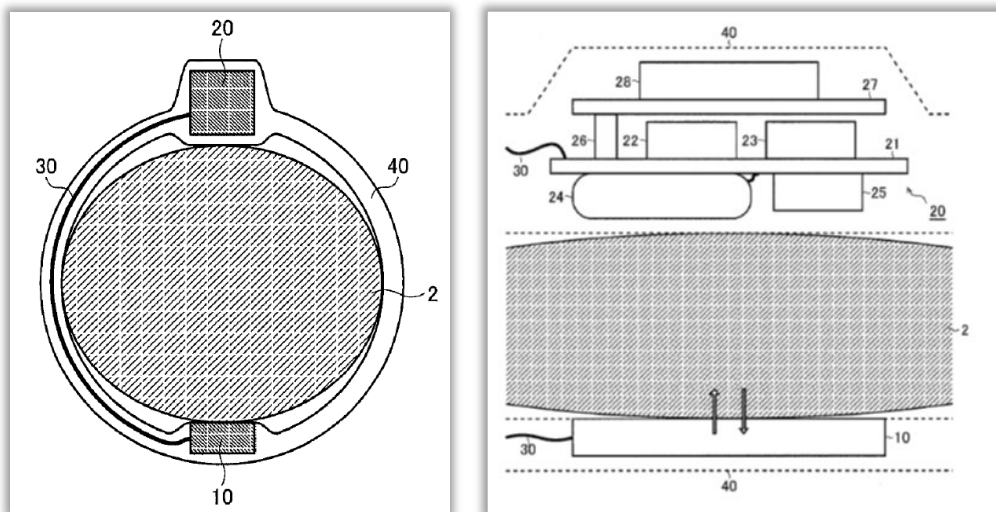


Ex-1028 at Fig. 24. Like Asada, Kimura shows the battery 506 and circuit 502

mounted on top of the ring and the light detector 504 at the bottom of the finger.

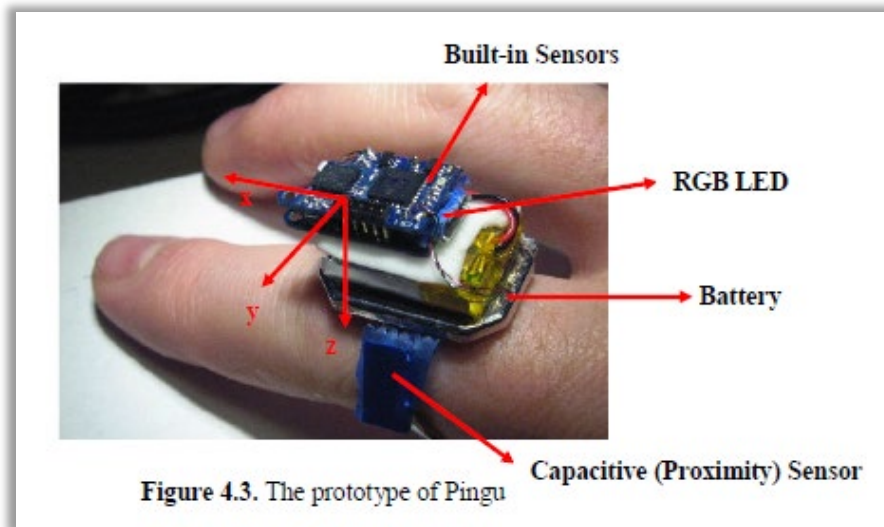
Id., 14:55-67.

68. 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; *id.* at Fig. 29.

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

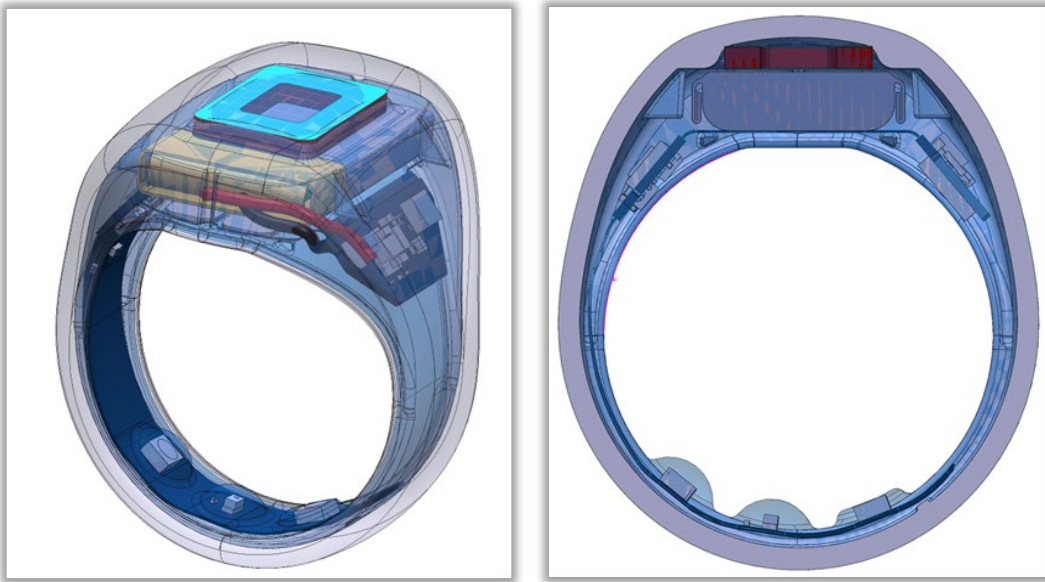


Ex. 2115.

70. 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.

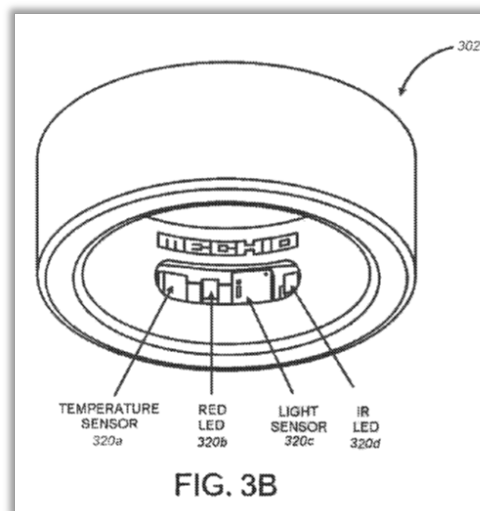
71. Even after the priority date of the '178 patent, Oura's first generation ring released in 2015 used a Superbowl ring-type design, with the battery and other components mounted on top of the ring.²

² I understand that the inventors of the '178 patent were initially part of another company called Motiv that launched the Motiv Ring. Ex. 2033. I further understand that Oura subsequently acquired Motiv and its patented technology.



Ex. 2034.

72. In sum, nothing similar to the design implemented in the '178 patent had ever been seen before.



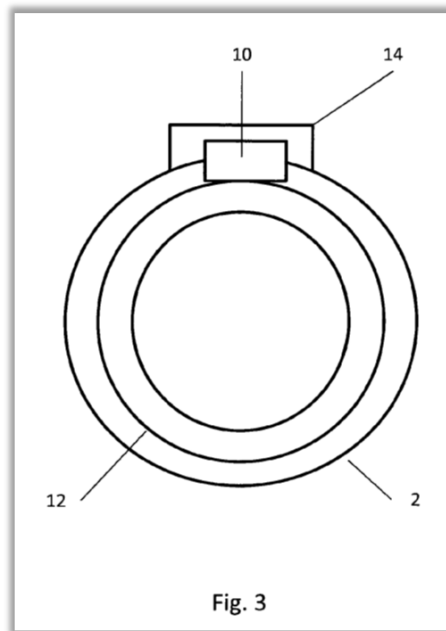
Ex-1001 at Fig. 3B.

B. The Prior Art Relied on by Petitioner

1. Schröder

73. Schröder describes an “external secure unit” for the purpose of authenticating a user. Ex-1007, Abstract (“security-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. *Id.*, 4:63-5:9. Schröder employs an antenna coil in the ring to achieve this purpose. *Id.*, 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 . . .”).

74. 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. *Id.*, at Fig. 3; *Id.*, 9:1-3 (“The chip module 10 is arranged in particular replaceably in the finger-ring 2.”).



Id., at Fig. 3.

75. None of the embodiments depicted in the figures of Schröder include a battery or a sensor because its focus is an improved antenna. *Id.*, 5:12-14. Schröder’s specification does suggest that a “further embodiment example” has a battery, which is “connected to” a chip module 10. *Id.*, 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. *Id.*, 8:57-58 (“The inlay 12 serves as a carrier for at least one antenna coil 8.”); *id.*, 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.”).

76. Schröder also discloses an embodiment using a “biometric sensor” for authentication purposes. *Id.*, 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 sensors to monitor any health parameters. 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.” *Id.*, 9:60-62.

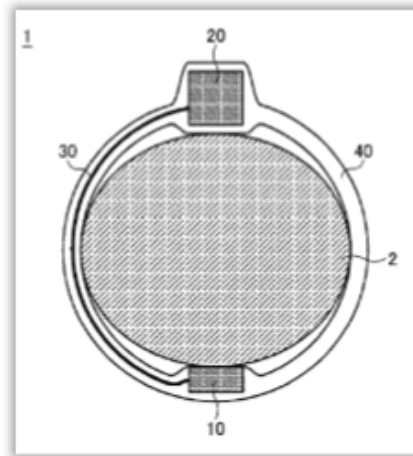
77. Schröder teaches scanning the ring wearer’s vein pattern and comparing it to a stored pattern for authentication. *Id.*, 10:42-45 (“The user of the finger-ring 2 authenticates himself by means of the biometric data stored in the finger-ring 2. The terminal compares the biometric data received from 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.”).

2. Niwa

78. Niwa discloses a plethysmogram sensor. Ex-1005, Abstract. Photoplethysmograms direct light at an individual’s blood vessel and measure the light that is reflected from the vessel. *Id.*, at Fig. 1. The resultant measured light can be used to measure changes in heart rate over time. Fluctuations in heart rate can provide useful information about a person. *Id.*, ¶ [0118] (“A fatigue level, a pleasant

sleep level, and a stress level of the measured person can be learned from the fluctuation of the heart rate.”).

79. Niwa discloses one implementation of the sensor in a ring, as shown in Fig. 22 below:



Id. at Fig. 22.

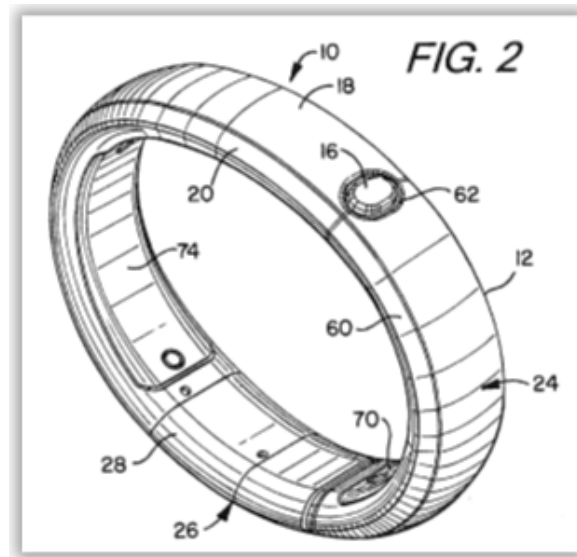
80. This implementation is similar to Schröder (and other finger ring prior art) in that it shows a significant protrusion from the ring to accommodate certain components. In Niwa, second unit 20 is used to supply power via cable 30 to first unit 10, which is used to measure the plethysmogram. *Id.*, ¶¶ [0192] (“The first unit 10 is a unit to measure the plethysmogram . . .”), [0193] (“The second unit 20 is a unit to supply a power to the first unit 10 mainly.”). Niwa states that “it is desirable to construct the thickness of the second unit 20 twice as large as the thickness of the

first unit 10.” *Id.*, ¶ [0199]. Niwa also teaches locating power supply unit 20 “as far as possible” from the first unit 10 to avoid noise in the first unit 10. *Id.*, ¶ [0215].

81. Unlike the ’178 patent, Niwa teaches using a “highly flat” battery “located right above the finger 2 . . . to enhance an affinity of the plethysmogram sensor 1 when the pulse sensor 1 is worn on the finger” *Id.*, ¶ [0217]. Niwa includes little detail of the construction of housing 40, other than showing it as a unitary structure. *Id.*, Fig. 22.

3. Mestas

82. 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, ¶ [0143]. Mestas preferred embodiment is as a wristband, as shown in Fig. 2 below:



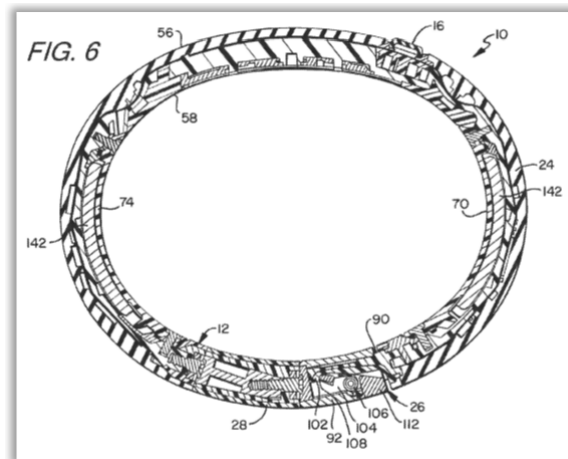
Id. at Fig. 2; ¶[0152] (“As further shown in FIGS. 2-6, the wearable device assembly 10 is annular or generally circular in shape and, in this illustrative example, is configured for wearing around a user's wrist.”).

83. While Mestas is not listed on the '178 patent, U.S. Patent Application Pub. No. US 2013/0106603 (“Weast”) (Ex. 2006) was considered by the examiner both during prosecution of the '178 patent itself, *see* Ex-1001 at 3 (“References Cited”), and in prosecution of related parent U.S. Patent No. 10,768,666 (Ex. 2007). Weast and Mestas have a common assignee and contain the same disclosure that is relied on by Petitioner.

84. During prosecution of the '666 patent, the examiner specifically rejected the pending claims (which recited a curved battery) over Vescovi in view of Weast:

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



Ex. 2006 at Fig. 6.

85. Oura responded, inter alia, 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.

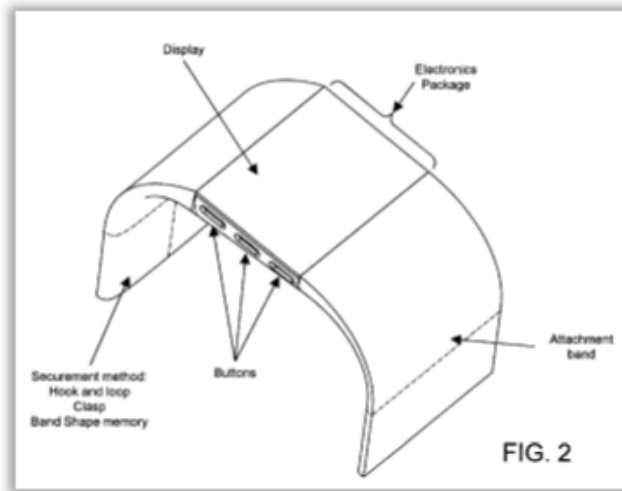
Ex. 2009, at 3.³

86. In response to this argument, the examiner withdrew the rejection and allowed the claims. Ex. 2010. Thus, the Patent Office has considered and rejected Petitioner's argument that it would be obvious to use the battery of Weast/Mestas in a ring. I agree with the Patent Office's reasoning.

4. Yuen

87. Like Mestas, 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, 12:50-52. The device of Yuen is shown below in Fig. 2:

³ All emphasis added unless stated otherwise.



88. The device utilizes an attachment band with an appropriate fastener to secure the device to a user's arm or wrist. Ex-1006, 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.”)).

VII. CHALLENGED CLAIMS ARE NOT OBVIOUS

A. Ground 1: Petitioner fails to show that claims 1-3 and 17-18 are obvious over Schröder in view of the knowledge of a POSITA.

89. In Ground 1, Petitioner alleges that Claims 1-3 and 17-18 are obvious over Schröder in view of the knowledge of a POSITA. I disagree for several reasons.

1. Schröder in view of knowledge of POSITA fails to disclose limitation 1[c]

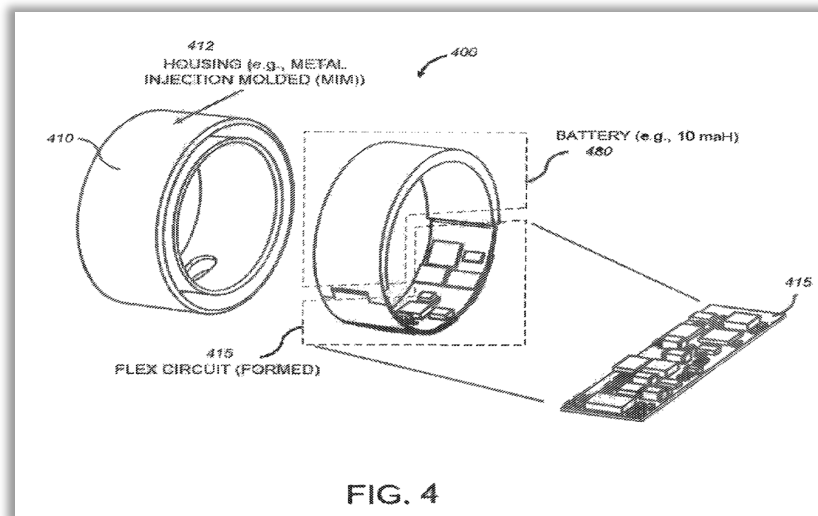
90. Limitation 1[c] of the '178 patent requires:

a battery positioned within a cavity formed between the internal housing component and the external housing component, wherein the battery comprises a shape and size configured to fit within the cavity between the outer circumferential surface of the external housing

component and the inner circumferential surface of the internal housing component, and wherein the battery extends through at least a first portion of the cavity of the finger-worn wearable ring device[.]

Ex-1001, 44:57-65.

91. By way of example, as shown in Fig. 4 of the '178 patent below, the battery 480 comprises a shape and size configured to fit within the cavity of the ring between outer and inner circumferential surfaces of external and internal housing components.⁴



Ex-1001 at Fig. 4.

92. In contrast, Schröder does not disclose any position of a battery, or what such a battery would look like, and thus cannot meet any of the structural limitations

⁴ Fig. 4 shows a unitary housing. Fig. 8 shows an embodiment of the internal and external housing components (“inner ring” and “outer ring”).

set forth in limitation 1[c]. Indeed, a battery is not shown in any figure of Schröder, nor does Schröder describe its position in describing one “unshown” embodiment that refers to a battery. Consequently, Schröder does not disclose or suggest that a battery is “positioned within a cavity formed between the internal housing component and the external housing component” as claimed. Schröder also does not disclose any “shape and size” of a battery, and therefore does not disclose a battery having “a shape and size configured to fit within the cavity between the outer circumferential surface of the external housing component and the inner circumferential surface of the internal housing component.” Finally, since Schröder discloses neither a shape, size, nor position of a battery, it cannot disclose that “the battery extends through at least a first portion of the cavity of the finger-worn wearable ring device.”

93. Schröder discloses an unshown *optional* battery:

In a further embodiment example, the external secure unit 2 has an energy storage device, e.g. an accumulator or a battery. The energy storage device is connected to the chip module 10 in order to supply the chip module 10 with energy The energy storage device can, for charging, be connected directly to the antenna coil 8 via a rectifier circuit, with the chip module 10 connecting the energy storage device to the antenna coil 8 accordingly by means of a suitable connection device.

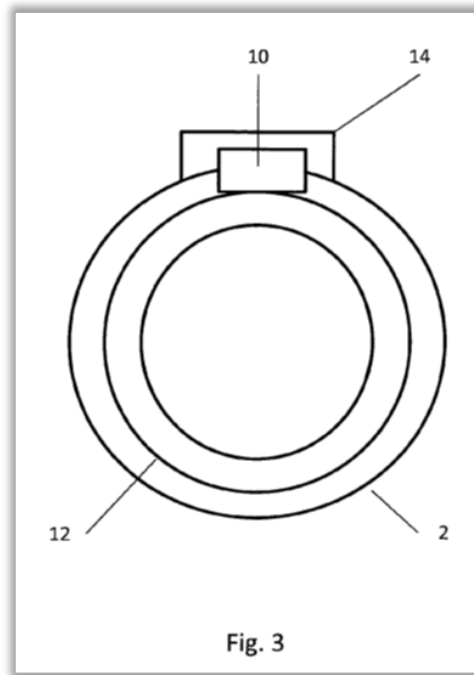
Ex-1007, 11:46-67.

94. This cursory description of a battery is not surprising, as Schröder relates to RFIDs, which are usually fully passive and do not require battery at all. *Id.*, 4:65-5:9; 18:45-46 (“The application on the finger-ring 2 simulates e.g., an RFID tag.”); Ex. 2013 (“Passive RFID systems use tags with **no internal power source** and instead are powered by the electromagnetic energy transmitted from an RFID reader.”).

95. Petitioner states “it would have been obvious that because the energy storage unit (i.e., battery) powers chip module 10 and chip module 10 resides in inlay 12, the battery is also positioned inside the ring.” Ex-1002 ¶ 164; Pet. at 23. I disagree with this statement.

96. First, I note that both the Petitioner and Dr. Anthony refer to the “inlay 12” as both the cavity in which the battery and chip module reside *and* as the PCB itself. *See e.g.*, Ex-1002 ¶ 164 (“the energy storage unit (i.e., battery) powers chip module 10 and chip module 10 resides *in* inlay 12” referring to the inlay as the cavity); *Id.* at ¶ 171 (“It is my opinion that a POSITA would have understood that Schröder’s inlay corresponds to the claimed PCB.”). An inlay cannot be both a cavity and the PCB.

97. Second, Schröder does not disclose that chip module 10 resides in inlay 12. The only figure that shows the chip module 10 is Fig. 3 shown below.



98. In this figure, Schröder discloses that chip module 10 is far too big to reside in inlay 12. The other figures, including figure 7 of Schröder show cross sections of the ring that do not include chip module 10, which therefore provides no support for Petitioner's theory.

99. Petitioner also cites to the following paragraph as support for the chip module residing in inlay 12:

In the finger-ring 2 as an external secure unit 2 there can be arranged at least one inlay 12. The inlay 12 can have at least one chip module 10 with at least one antenna coil 8, with at least one further electronic device, e.g. a display, optionally being arranged on the inlay 12.

Ex-1007 at 12:61-65. This statement does not inform a POSITA the location of chip module or how it is oriented relative to the inlay 12. In fact, the sentence accurately

describes Fig. 3, which is counter to Petitioner’s theory that the entire chip module within a cavity.

100. In fact, Schröder strongly implies that chip module 10 would not fit in inlay 12: “Should steps or shoulders nevertheless arise e.g. through the chip module 10, said steps or shoulders can be compensated by applying a paste which is e.g. thermally or UV-curing.” Ex-1007 at 14:10-13. This passage plainly acknowledges the fact that chip module 10 is too large to fit in the thin inlay and would result in a protrusion similar to Fig. 3 (the difference being that the chip module is not “replaceably mounted” as in Fig. 3). Thus, the following is a likely application of the teachings of Schröder:

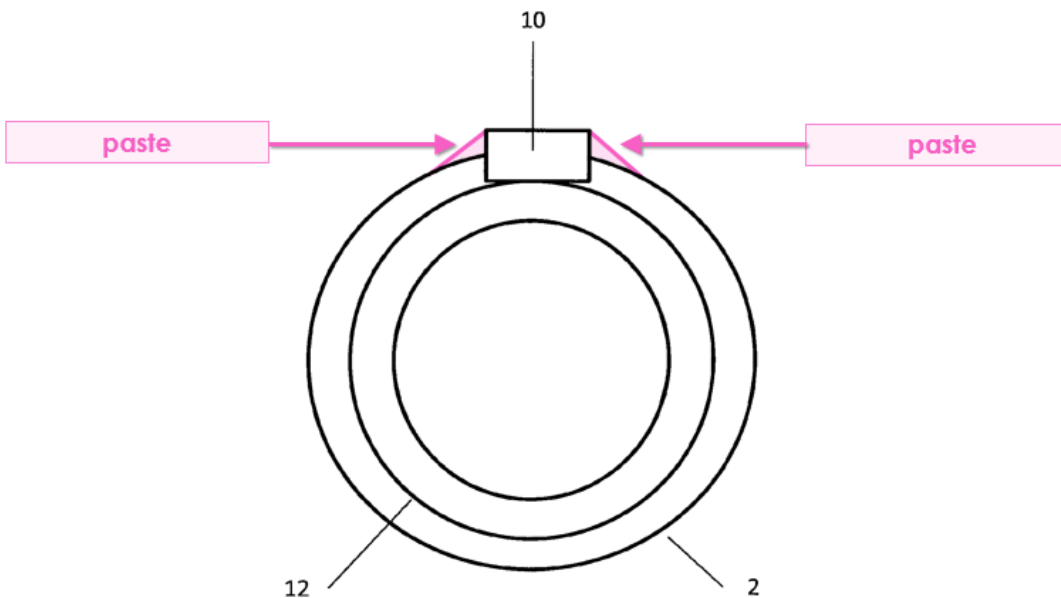


Fig. 3

Id. at Fig. 3 (annotated).

101. Even if Schröder taught that chip module resides in inlay 12, it does not follow that the battery “must” also reside inlay. Dr. Anthony states that placing the battery within the inlay would be obvious “because the battery . . . is charged wirelessly[.]” Ex-1002 ¶ 164. Whether the battery is charged wirelessly does not impact where the battery is located within the design of Schröder. Wireless charging can occur whether the battery is located external or internal to the ring housing.

102. Dr. Anthony further states that the battery “must” be located within the inlay because it otherwise “sticks out or is exposed to the environment[.]” Ex-1002 ¶ 166. This ignores the teachings of Schröder, which show a chip module mounted on top of the ring protected by a cover; and, as discussed above, further discloses using a paste to cover components that “stick out” as shown below:

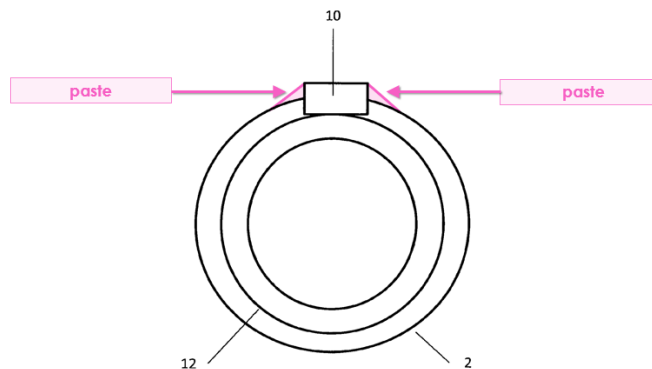
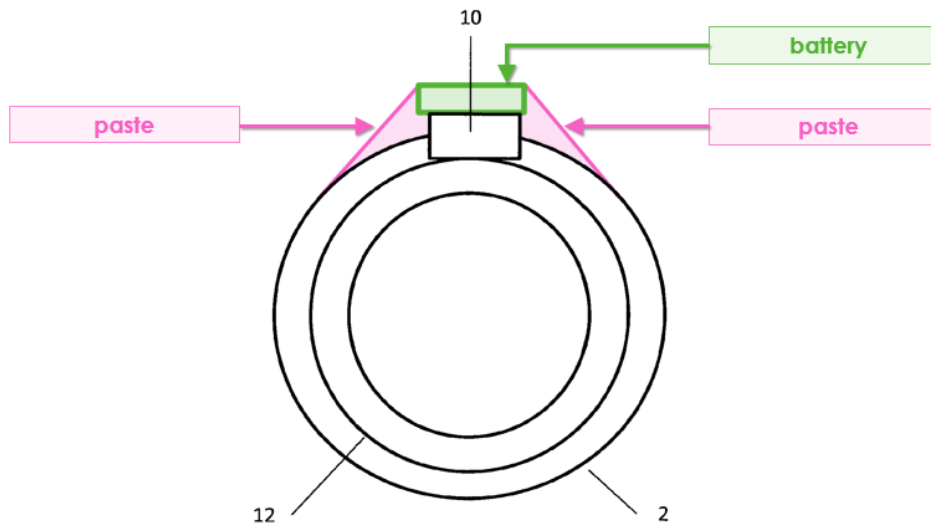


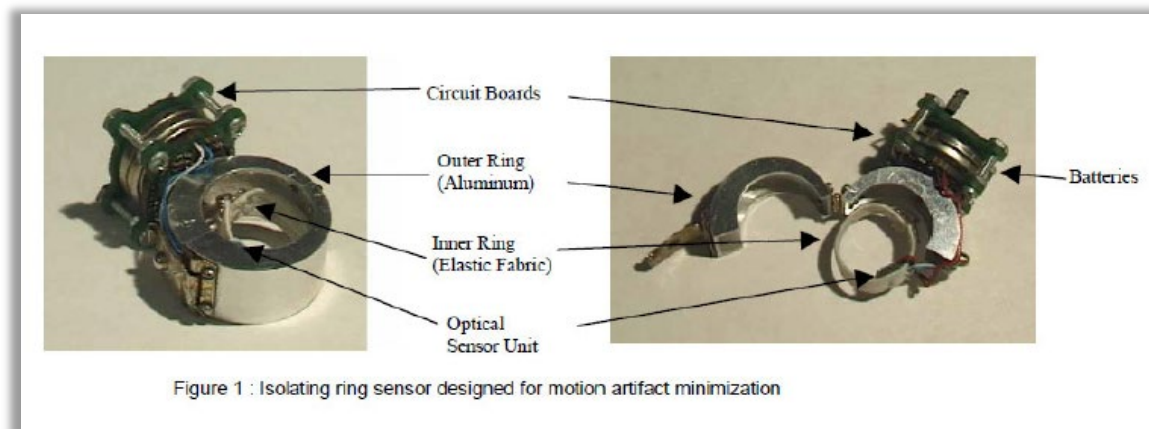
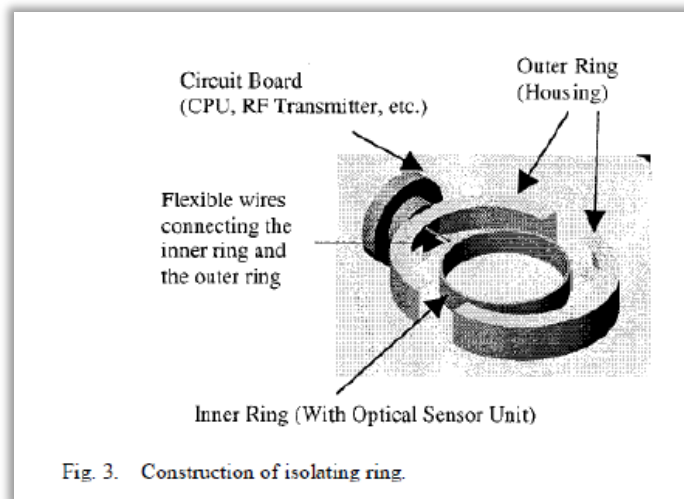
Fig. 3

103. Therefore, if there is a battery located on the ring, a POSITA would understand the battery to also be located above the ring as shown below:



Ex-1007 at Fig. 3 (annotated).

104. Dr. Anthony also refers to Rhee as evidence that it was known to place “electronics housed inside [] a cavity.” Ex-1002 ¶ 165. But as shown below Asada and Rhee teach the opposite, as the optical electronics are not housed in any cavity. Their publications repeatedly taught mounting the battery and circuit boards on top of the ring external to the housing—not within a cavity of the ring:



Ex-1033, at 3 and 5; Ex-1002, ¶¶ 71, 120.

105. Like Schröder itself, these references directly teach away from locating the battery in a cavity within a ring housing, instead teaching and depicting these elements positioned outside of the ring housing. While protecting components from the environment is a laudable goal, the general desire to protect batteries from the environment does not provide a POSITA with the knowledge of how to arrange a

battery within the inlay of Schröder (to the extent that Dr. Anthony considers “inlay” to be a cavity). But as noted above, Dr. Anthony is inconsistent in his reference to inlay. And if “inlay” is a PCB as also suggested by Dr. Anthony, then the battery would, at best, be connected *to* the inlay—not *in* the inlay. Ex-1002 at ¶ 171 (“It is my opinion that a POSITA would have understood that Schröder’s inlay corresponds to the claimed PCB.”).

106. Dr. Anthony also argues that the battery “must” be located within inlay 12 because otherwise there would “a wired connection to power its components, which is contrary to the intent of having a portable, wearable device.” Ex-1002 ¶ 166. I do not understand his point. As shown in the very references (e.g., Rhee and Asada, and even Oura Ring Gen. 1 released in 2015), the battery is mounted on top of the ring with a wired connection to the components.

107. Since Schröder does not disclose any details of the battery shape, size, or location within the housing structures of Schröder, Petitioner leaves such complicated tasks up to the POSITA. At his deposition, Dr. Anthony testified that he didn’t find it necessary to conduct any analysis on the size of the battery in Schröder:

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.

108. But without knowing the size of the battery, it is entirely conclusory of Dr. Anthony to suggest that the skilled artisan would place such optional and unknown sized battery in the cavity of Schröder that is outfitted to carry no more than a wire. Indeed, beyond the passive RFID authentication functionalities of Schröder, the additional optional functionalities of Schröder would add significant power requirements and thus impact the size of the battery, and in turn impact the placement of the battery 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 the battery “must” be placed within a cavity of Schröder is unsupported.

109. Indeed, I understand that a POSITA is charged with the knowledge of the teachings of the prior art. The ordinary artisan would apply the teachings of the wearable ring prior art to date. When deciding where to put a battery in Schröder,

the size of which would be significant given the “power hungry” features such as display unit suggested as options, the POSITA would apply these teachings:

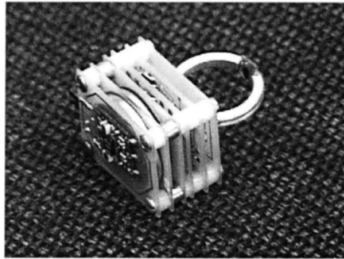
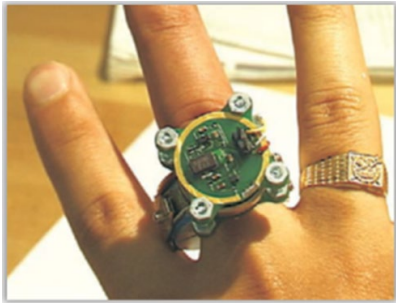
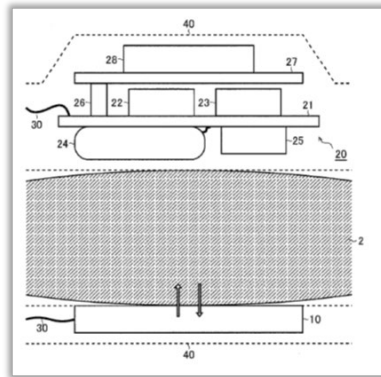
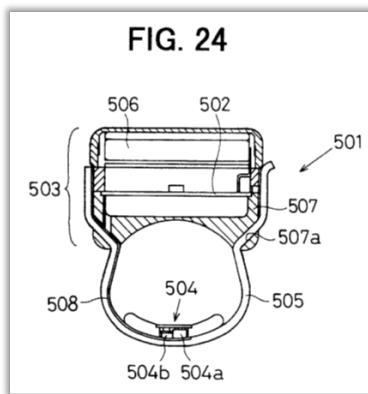
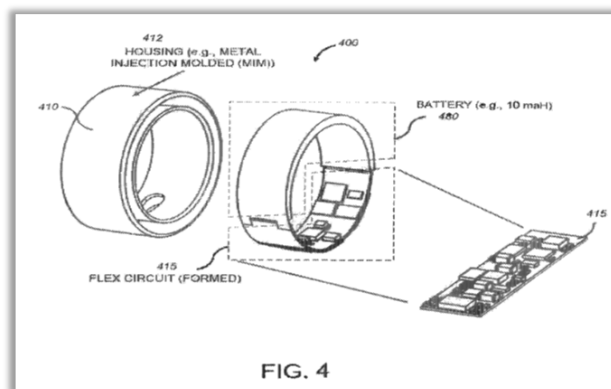


Figure 8-1 First Prototype Ring Sensor



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

110. Which is not close to this:



Ex-1001 at Fig. 4.

111. The likely outcome is not the claimed invention but rather a significantly sized battery placed on top of the ring near the chip module to power the “power hungry” embodiments of Schröder similar to all the art from 1997 to 2012 (Asada to Niwa):

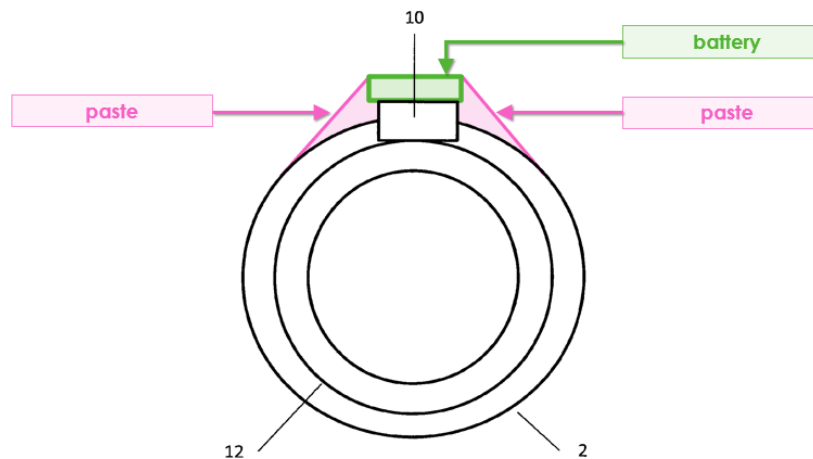


Fig. 3

Ex-1007 at Fig. 3 (Annotated).

2. Schröder and the knowledge of POSITA do not disclose or suggest limitations 1[d] and 1[e]

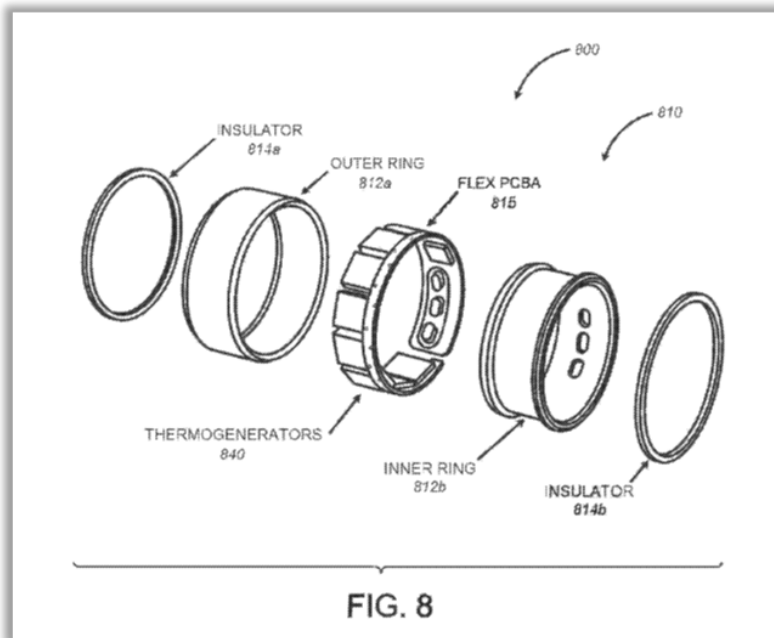
112. Limitations 1[d] and 1[e] of the '178 patent require:

a printed circuit board disposed between the internal housing component and the external housing component, wherein the printed circuit board extends through at least a second portion of the cavity of the finger-worn wearable ring device different from the first portion; and

one or more sensors electrically coupled with the printed circuit board and the battery and configured to acquire data from the user through the internal housing component.

Ex-1001, 44:66-45:3.

113. As shown below in Fig. 8 of the '178 patent and recited in claim 1, the battery (840) and printed circuit board (815) and sensors are constructed and arranged to occupy different portions of the cavity between the internal (inner ring 812b) and external housing (outer ring 812a) components:



Ex-1001 at Fig. 8.

- a. Schröder does not disclose or suggest a printed circuit board with one or more sensors electrically coupled thereto in a second portion of the cavity different from the first portion occupied by a battery.**

114. Claim 1 and the '178 patent describe a specific arrangement of a printed circuit board, battery and sensors within first and second portions of a cavity between internal and external housing components. In contrast, Schröder discloses a blank rectangular “inlay” with no details of how any of the components described in Schröder are arranged, or if they are present in the inlay at all. Dr. Anthony confirmed that Schröder did not disclose these claim limitations but that he relied on the 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.

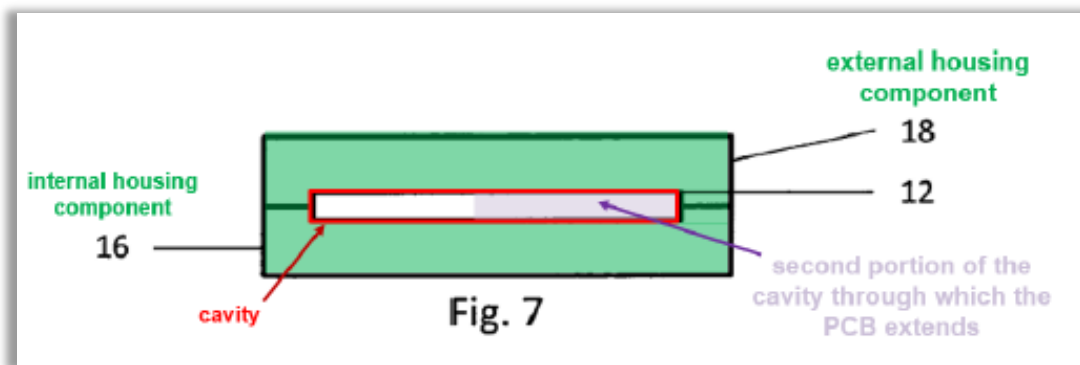
Q. So Schröder doesn't tell them, but the knowledge of the POSITA fills in all those blanks?

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

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

115. 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. While placing an antenna coil on an inlay on a finger-worn ring might be within the skill of a POSITA, arranging a printed circuit board, battery, sensors and related circuitry on inlay 12 is not.

116. Petitioner’s expert simply colors in “half” of the rectangular inlay 12 to show the claimed printed circuit board:



Ex-1002, ¶ 174.

117. Schröder does not disclose or suggest this arrangement. Petitioner contends that it would be obvious that a PCB occupies a portion of the cavity “necessarily different from the ‘portion of the cavity’ occupied by the battery.” Pet. at 25. That statement falsely presumes that the battery is located in the recess

between ring halves 14 and 16, which is neither disclosed nor suggested by Schröder. As such, Petitioner's annotated Fig. 7 of Schröder is contrary to the teachings of Schröder, and appears to be nothing more than an attempt to modify Schröder to meet the claims of the '178 patent.

118. Schröder's inlay 12 is shown to occupy the entire space between ring halves 16 and 18. Yet Petitioner, without stating why or how, contends that a POSITA "would have understood" that inlay 12 (contrary to Fig. 7) only occupies roughly half of the recess—the other half of which is presumably occupied by a battery (which is neither shown nor described). Petitioner fails to explain how this "side-by-side" arrangement of the battery and the PCB would be obvious to a POSITA at the time of the invention.

119. Petitioner's expert cited "thermal management" as justification for this annotation, but no thermal management is achieved by this rudimentary pictorial. Ex-1002, ¶ 175. Considerations of thermal management in designing the "modified" ring of Schröder also are irrelevant if the size, shape, and capacity of the battery and the size and shape of the printed circuit board are unknown. Thermal management considerations would be much simpler if the POSITA followed the teachings of Asada and located the battery on top of the ring, as is already suggested by Schröder in Figure 3. The POSITA in the would follow these teachings of the prior art, rather than attempt a wholesale redesign of Schröder.

b. Schröder discloses an inlay, not a printed circuit board.

120. Petitioner contends that Schröder’s inlay 12 constitutes “a printed circuit board” as recited in claim 1 of the ’178 patent. Pet. at 24 (“A POSITA would have understood that Schröder’s inlay corresponds to the claimed PCB”). However, there is no support for Petitioner’s contention that a mere inlay is a printed circuit board. *See e.g.*, Ex. 2014 (describing five components and fourteen manufacturing steps for printed circuit boards). Petitioner’s notion that the inlay materials are “common PCB materials” does not support the conclusion that inlay 12 is a printed circuit board. Pet. at 24.

121. Petitioner’s expert adopted this definition of a printed circuit board from Wikipedia:

A printed circuit board (PCB), also called printed wiring board (PWB), is a laminated sandwich structure of conductive and insulating layers, each with a pattern of traces, planes and other features (similar to wires on a flat surface) etched from one or more sheet layers of copper laminated onto or between sheet layers of nonconductive substrate.

Ex. 2023 at 1; Ex-1002 ¶ 32, n. 1; Ex. 2020 at 73:12-74:11; 76:14-20.

122. I agree that a POSITA would apply this definition to the phrase “printed circuit board” around 2013. Schröder’s description of inlay 12, however, does not include the described features (laminated sandwich structure of conductive and insulating layers, pattern of traces etched on sheet layers of copper, between sheet

layers of nonconductive substrate). Moreover, Schröder uses the term “circuit board” in other embodiments (Ex-1007 at 22:48-49), further evidence that a POSITA would not consider inlay 12 a printed circuit board.

3. Schröder and the knowledge of the ordinary person does not disclose or suggest dependent claims 2 and 3

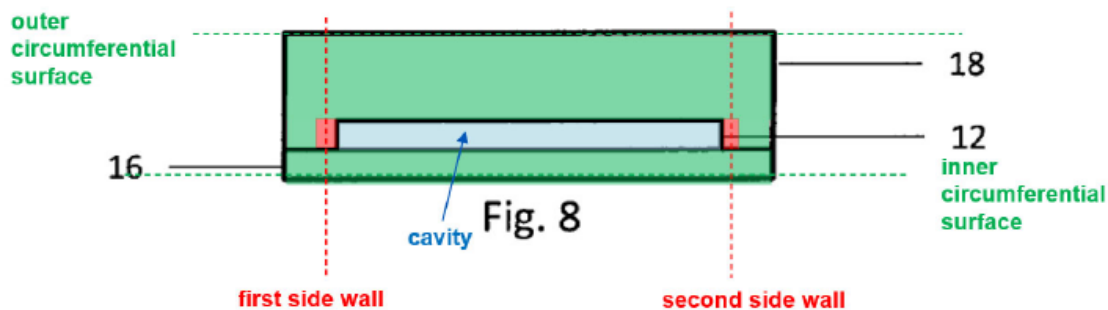
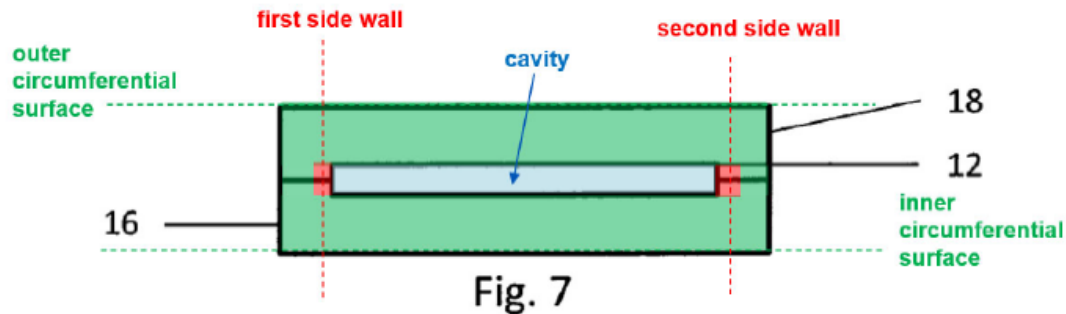
123. Claims 2 and 3 further define the arrangement of the battery and printed circuit board between the internal and external housing components. Claim 2 recites that the first and second portions of the cavity are “non-overlapping,” and Claim 3 recites that the first and second portion of the cavity “at least partially overlap.”

124. Because Schröder teaches neither arrangement, Dr. Anthony is again forced to rely completely on the POSITA for two mutually exclusive arrangements. This results in a blatant contradiction within his testimony. Ex-1002 ¶ 184 (“Taken together, it is my opinion that the non-overlap of the portions of the cavity is not the product of innovation, but of ordinary skill and common sense.”); *id.* ¶ 188 (“In my opinion, a POSITA would have been motivated to design the first portion of the cavity that has the battery to at least partially overlap with the portion of the cavity that has the PCB to reduce the risk of electrical components and the PCB losing mechanical or electrical connections to each other.”). Dr. Anthony fails to explain how a POSITA would consider both arrangements obvious given the stated reasons he gives for choosing one over the other. This is especially true considering that

Schröder does not disclose *any* structure of the inlay nor provides any explanation as to where the battery would be located in relation to the inlay.

4. Schröder and the knowledge of the ordinary person does not disclose or suggest dependent claims 17 and 18

125. Claims 17 and 18 include further details of the housing components and the arrangement of the battery and printed circuit board within those components. As stated above, since Schröder does not disclose any position of the battery and fails to disclose a printed circuit board, Dr. Anthony again relies on the ordinary person to fill in the blanks of claims 17 and 18. In fact, despite the fact that the claims describe the specific positioning of the components, Ex-1001, claim 17 (“wherein the external housing component and the internal housing component define the cavity configured to at least partially surround the battery, and the printed circuit board”), Dr. Anthony’s annotation fails to even show these elements:



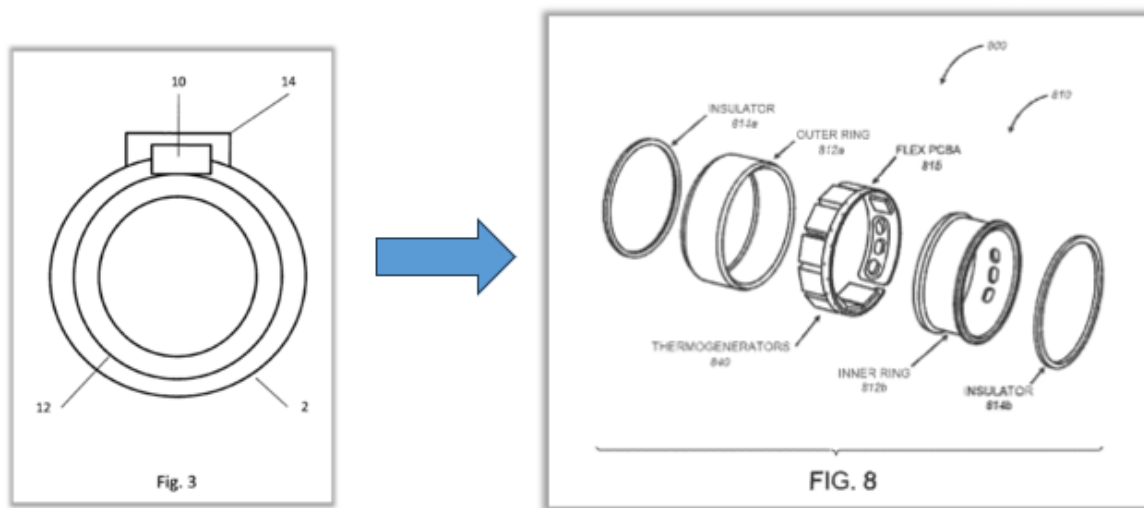
Ex-1002 at ¶¶ 190 and 192.

126. Here, Dr. Anthony labels inlay 12 as a cavity. And, as I’ve emphasized above, Dr. Anthony is repeatedly inconsistent in his reference to the “inlay 12” as both the cavity in which the battery and chip module reside *and* as the PCB itself. *See e.g.*, Ex-1002 ¶ 164 (“the energy storage unit (i.e., battery) powers chip module 10 and chip module 10 resides *in* inlay 12” referring to the inlay as the cavity); *Id.* at ¶ 171 (“It is my opinion that a POSITA would have understood that Schröder’s inlay corresponds to the claimed PCB.”). However, even in this annotated figure where the “inlay 12” is a cavity, Dr. Anthony fails to identify the location of the

battery and printed circuit board as claimed. As such, Petitioner fails to show that this limitation is obvious in view of Schröder and the knowledge of a POSITA.

5. Schröder in view of the knowledge of a POSITA does not enable the claimed invention of the '178 patent

127. In my opinion, Schröder does not enable a POSITA to make and use the invention without undue experimentation. The leap from Schröder's rudimentary disclosure to the detailed claimed invention is too great for the POSITA:



128. Schröder, at most, discloses an inlay sandwiched between two ring halves, and a replaceable chip module mounted (like a jewel) on top of the ring. No teaching in Schröder or the knowledge of a POSITA enables one to make and use the invention of claim 1. a POSITA is more apt to apply the teachings of the prior art and mount the battery on top of the chip module. Indeed, I considered the same problems in the 2013 timeframe when establishing the Center of Wearable Sensors

and sought to develop a smart ring. And at the time, I came to the same conclusion that the battery and other components would not fit within the body of the ring, and instead would go on top of the ring.

129. In contrast to Schröder, the '178 patent goes into extensive detail describing a first-of-its-kind engineering feat of incorporating all components within a ring housing. The '178 patent specification uses 49 figures and associated description to explain how one would construct the claimed ring, including a detailed schematic (Fig. 2), detailed views and descriptions of the components and housing, and specific dimensions. *See, e.g.,* Ex-1001, 15:53-21:10.

B. Ground 2: Claims 1-3 and 13-16 are patentable over Schröder in view of Niwa .

1. A POSITA would not combine Schröder and Niwa because they are directed to different applications and teach incompatible constructions.

130. As an initial matter, a POSITA would not be motivated to combine Schröder and Niwa in the manner suggested. Dr. Anthony aptly stated: “the sole goal of Schröder in isolation is targeted to providing security.” Ex. 2020 at 244:18-20. Thus, Schröder is directed to security verification while Niwa is directed to sensing heart rate using a PPG sensor. Ex-1007, 1:5-6 (“The present invention describes an external secure unit”); Ex-1005, ¶ [0003] (“This disclosure relates to a plethysmogram sensor”).

131. I do not agree with Petitioner’s suggestion that a POSITA would apply Niwa’s multiple wavelength teachings to Schröder because there is no apparent reason to combine these teachings given the different objectives of the two references (security and health monitoring). Adding PPG sensing of Niwa to Schröder would be essentially changing the fundamental “sole goal” of Schröder by designing a new and different device. Adding more components to the already space-starved ring of Schröder would not occur to the ordinary person, especially since Schröder’s infrared detection serves the function of the vein pattern imaging.

132. Niwa also teaches directly away from the Schröder-Niwa combination that arranges components within the curved inlay 12 of Schröder. Niwa teaches using a “highly flat” battery and the advantages of “stacking” planar, flat elements contrary to the curved inlay arrangement proposed by Petitioner. Ex-1005, ¶ [0217] (“the battery 24 formed as highly flat is located right above the finger 2 . . . to enhance an affinity of the plethysmogram sensor 1 when the pulse sensor 1 is worn on the finger . . .”). Thus, a skilled artisan would not place the “highly flat” battery of Niwa within curved inlay 12 of Schröder.

2. Schröder in view of Niwa does not disclose or suggest limitations 1[c] or 1[e].

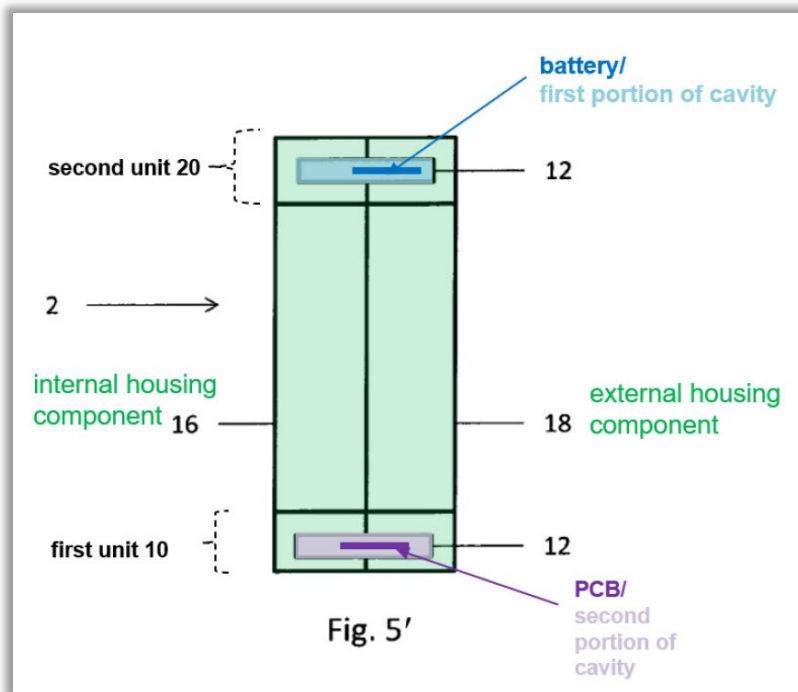
133. Petitioner appears to rely solely on Schröder to teach the battery and sensor limitations 1[c] and 1[e]. Pet. at 35 (“Schröder teaches Elements 1[pre]-1[c]

and 1[e]”). Petitioner does not allege that Niwa discloses these limitations. *Id.* Thus, for the reasons stated above with respect to Ground 1, Schröder in view of Niwa also does not disclose or suggest these elements of claim 1.

3. Schröder in view of Niwa does not disclose or suggest limitations 1[d].

134. Petitioner relies on Schröder in view of Niwa to disclose limitation 1[d]. Pet. at 35-38. But Petitioner fails to explain why it would be obvious to modify Schröder in view of Niwa, especially since Petitioner already contends that Schröder allegedly discloses this element. Pet. at 24 (“Schröder teaches Element 1[d].”).

135. Petitioner refers to Dr. Anthony’s “modified Figure 5” to illustrate the combination of Schröder and Niwa:



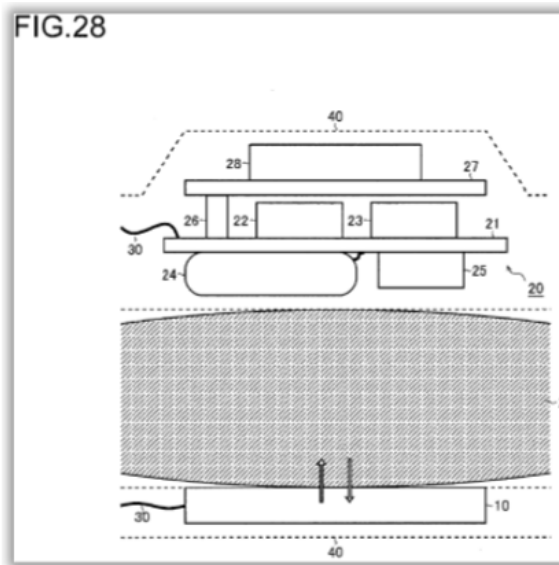
Pet. at 38 (annotating Fig. 5 of Schröder).

136. It is apparent that Dr. Anthony is using the '178 invention as a template for his annotated figure as neither Schröder nor Niwa teach such an arrangement. Moreover, as Dr. Anthony acknowledged at his deposition, ring halves 16 and 18 of Figures 4 and 5 in Schröder are not respective internal and external housing structures that each define inner and outer circumferential surfaces of a finger-worn wearable ring, as claimed. Rather, Figures 4 and 5 shows top and bottom ring halves 16 and 18 that are joined in the middle of the ring (like two halves of a bagel), not inner and outer surfaces of a ring. Ex. 2020 at 48:19-49:2. Thus, neither ring half 16 or 18 of Fig. 5 constitutes an inner or outer housing component as each constitutes half of the inner and half of the outer surfaces of a ring, respectively. *Id.*

137. And as stated above with respect to Ground 1, Schröder does not disclose or suggest that the battery is located in inlay 12, as in Petitioner's annotated figure 5. Niwa does not cure this deficiency, as Niwa teaches forming battery 24 in second unit 20 stacked with additional power supply components.

FIG. 28 is a cross section diagram illustrating a construction example of the second unit 20 of the implementation example 2 schematically. The second unit 20 of this construction example includes the first substrate 21, the power source circuit 22, the memory 23, the battery 24, the charging circuit 25, the connector 26, the second substrate 27, and the wireless communication circuit 28.

Ex-1005, ¶ [0213].



138. Petitioner improperly picks and chooses certain portions of Niwa and ignores teachings that are contrary its proposed combination. In my opinion, the proposed Schröder-Niwa combination is at odds with the teachings of Niwa. A POSITA would be aware of Niwa’s teachings and not be motivated to make the proposed changes.

139. For example, in constructing its “modified” Figure 5 of Schröder, Petitioner relies on the fact that Niwa discloses a battery and a printed circuit board in two different sections of Niwa’s housing. Pet. at 36-37. But Niwa teaches using a “highly flat” battery and the advantages of “stacking” planar, flat elements instead of the arrangement proposed by Petitioner:

In this way, according to an adoption of the *stack layer* construction formed with several Substrates, ***compared to mounting all circuit elements on one substrate***, each area of the first Substrate 21 and the second substrate 22 is decreased. Therefore, the largeness of the second

unit 20 can be restrained not to protrude from the third joint of the finger 2. Furthermore, a consciousness of the examinee for wearing the plethysmogram sensor 1 can be reduced. In addition, because the second unit 20 located at the back side of the finger 2 can be designed thicker than the first unit 10 located at the ball side of the finger 2, it is possible to adopt the stack layer construction formed with several substrates without any problem.

Ex-1005, ¶ [0219]; *id.* ¶ [0217] (“In addition, according to this construction, the battery 24 **formed as highly flat . . .**”). The “stacking” arrangement taught by Niwa is counter to the curved inlay arrangement of Schröder because arranging Niwa’s flat components in the thin curved inlay of Schröder would not be feasible and would result in too wide a ring. Dr. Anthony fails to address this conflict in the teachings of Schröder and Niwa.

140. Petitioner also fails to show or explain how the power supply components which accompany battery 24 in Niwa would be located in Fig. 5 of Schröder, nor why a POSITA would be motivated to leave them out altogether as apparently shown in Petitioner’s annotated Fig. 5. Indeed, Niwa discloses that the power source circuit 22 is “equipped to the surface of the first substrate 21 directly, and the battery 24 and the charging circuit 25 are equipped to the back side of the first substrate 11 directly.” Ex-1005, ¶ [0214]. “The power source circuit 22 converts the input voltage from the battery 24 to a desired output voltage and supply it to each parts of the plethysmogram sensor 1.” *Id.*, ¶ [0215].

141. Because the power source circuit 22 and charging circuit 25 are a necessary part of the power supply of Niwa that accompanies the battery 24, combining Niwa and Schröder would presumably result in a second unsightly and uncomfortable protrusion in addition to chip module 10. The only motivation Petitioner provides for this modification is simply a restatement of the claim limitation at issue: “to separate a battery and PCB that are in the same ring housing.” Pet. at 38; *cf.* Ex-1001, 45:1-3 (“wherein the printed circuit board extends through at least a second portion of the cavity of the finger-worn wearable ring device different from the first portion”). This is further evidence of the use of improper hindsight used by Petitioner.

4. Schröder in view of Niwa does not disclose or suggest dependent claims 2 and 3.

142. Petitioner relies on Niwa to meet the “non-overlapping” and “partially overlaps” limitations of claims 2 and 3. Pet. at 38-41. But Petitioner fails to explain how or why the flat components located between the flat housing surfaces of Niwa housing would be adapted to the curved inlay of Schröder. A POSITA simply would not apply those teachings from Niwa, as it would not be compatible with curved inlay 12. As such, dependent claims 2 and 3 are not taught by the combination of Schröder and Niwa.

5. Schröder in view of Niwa does not disclose or suggest dependent claims 13-16.

143. Claim 13 relates to the use of first and second light emitting sensors that emit light at different wavelengths. Ex-1001, 46:25-31. Claim 14 states that one of the wavelengths is infrared. *Id.*, 46:31-34. Claim 15 specifies the position of the light emitting components within the ring. *Id.*, 46:35-40. Claim 16 adds a photodetector. *Id.*, 46:42-45.

144. The '178 patent discloses using different wavelengths for sensing vascular information, such as heart rate, about the wearer. *Id.*, 11:13-16 (“As shown in the example of FIG. **3B**, the sensor modules **220** can include a temperature sensor **320a**, a red light emitting diode (LED) **320b**, a light sensor **320c**, and an infra-red LED **320d**.”). Niwa also uses multiple LEDs and wavelengths to increase the accuracy of its sensor, as shown in Figure 3.

145. Schröder, however, is not directed to photoplethysmography and has no use for these detection methods. Ex-1007, 2:47-52. Schröder discloses infrared imaging to take an image of a vein pattern and compare it to a stored pattern to verify the identity of the wearer of the ring. *Id.*, 10:1-9.

146. Dr. Anthony states:

A POSITA would have understood that both Schröder and Niwa’s techniques involve data collection from veins. This understanding would indicate that advances or techniques developed in one application (like pulse oximetry) could potentially inform or enhance

methodologies in the other (like vein pattern biometrics), highlighting the interconnectedness of these imaging and sensing technologies in capturing venous information.

Ex-1002 at 140.

147. In my opinion, a POSITA would not look to PPG sensing to inform vein pattern imaging for security purposes. As an expert, I am not aware that this has ever been achieved, or even proposed as of 2013. In fact, I am not aware of evidence of anyone that has performed the vein pattern matching in a finger ring at all, much less the act of attempting to incorporate plethysmogram sensing in vein pattern matching.

148. Dr. Anthony admitted as much when he testified “the intent for PPG is not to measure a vein image[.]” Ex. 2020 at 229:14-16. Dr. Anthony proposed “using the functionality of Niwa for like a live dead check or use of the variability in heart rate . . . as a further identification of the person.” *Id.* at 237:2-8. In my opinion, determining whether a person is alive or dead is not an application of either Schröder or Niwa, and the use of heart rate variability to identify a person is beyond any disclosure of Schröder or Niwa, and well beyond the skill of a POSITA, if such technology exists with any sort of precision that would be needed by such applications at all.

149. Simply put, Schröder is not concerned with monitoring health parameters of the wearer, and adding PPG sensing from Niwa would add a feature

unrelated to any stated object of Schröder. A POSITA would not consider adding the teachings of Niwa to achieve the vein pattern matching goal of Schröder.

6. Schröder in view of Niwa does not enable the claimed invention of the '178 patent.

150. As discussed above, Schröder alone does not enable a POSITA to make and use the claimed invention. Niwa does little to cure this deficiency. Both Schröder and Niwa disclose, at most, how to fit a wire along the interior of a ring. Schröder discloses placing an antenna coil 8 on a thin inlay in a ring, while Niwa discloses cable 30 connecting two “stacking” arrangements 10 and 20. Neither reference discloses how one would construct a ring having a battery and printed circuit board between inner and outer circumferential surfaces of internal and external housing components in different portions of a cavity.

C. Ground 3: Claims 3 and 12 are patentable over Schröder in view of Mestas.

1. A POSITA would have no motivation to combine Mestas' curved battery with Schröder with any reasonable expectation of success.

151. 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. As such, the curved batteries of Mestas could not be used in Schröder, which Dr. Anthony seems to acknowledge. *Id.* at 307:21-22 (“Nor did I propose just copying and pasting it wholesale.”).

152. Petitioner and Dr. Anthony initially proposed that “miniaturization” of Mestas’s curved battery would be “trivial”:

As miniaturization of electronic components improved, a POSITA would have found it trivial to implement Mestas’s teachings into a ring form like that of Schröder’s “finger-ring.”

Ex-1002 at 165.

153. I disagree. The ordinary person is not skilled in battery design and would not have the skill to “miniaturize” the battery of Mestas. 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. I also agree with that statement.

154. Changing course, Dr. Anthony at his deposition testified that a 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.

155. I see no evidence in the record that curved batteries of an appropriate size and specification were available in 2013 to power Schröder, and I am not aware of any. The named inventor of the ’178 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.”).

156. 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.

157. 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. 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 189:12-190:3.

158. 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.

159. The power requirements of Schröder and Mestas would also be different, given that Mestas is 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. Indeed, as Dr. Anthony admits, Mestas' 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. *Id.* 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 (e.g., PPG sensor from Mestas) given the significant reduction in battery capacity.

160. 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.

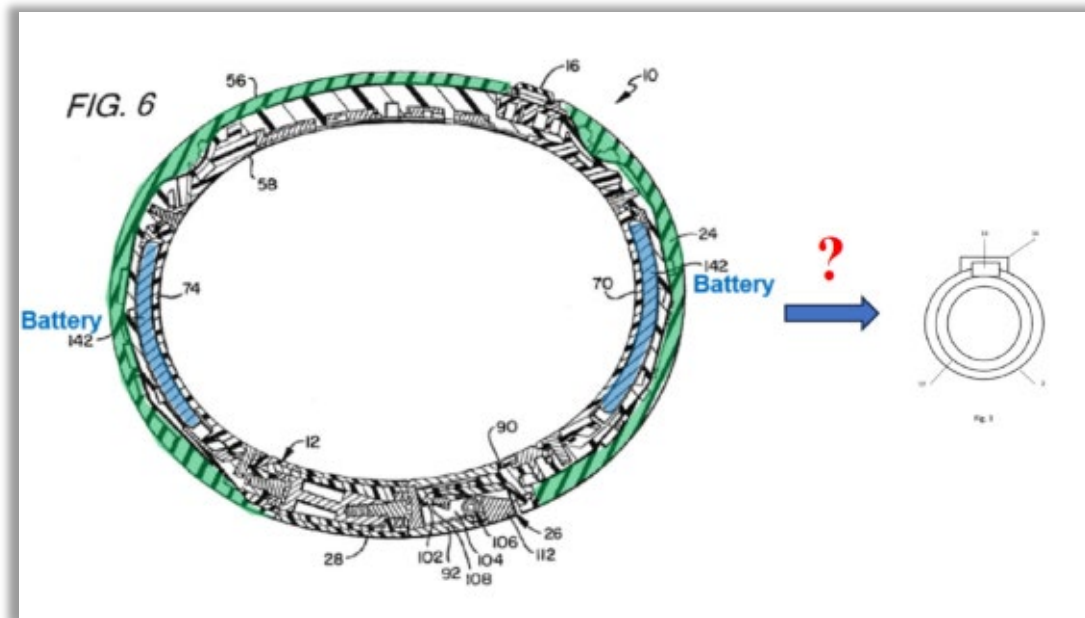
161. Given all of the development in finger ring wearables up to the '178 patent had used “coin” type batteries, the ordinary person would look to that type of battery. Unlike pouch cells, coin and button cells are known for their compact size and reliability in low-power devices. *Id.* Mestas is further evidence of this. 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, ¶ [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.”).

162. 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, the ordinary person would find the smallest coin-sized battery they could and construct the ring appropriately.

2. Schröder-Mestas combination does not disclose or suggest dependent claims 3 and 12.

163. The combination of Schröder and Mestas does not teach a “curved battery that approximates a corresponding arc of the external housing component” for use in a “finger-worn wearable ring device” as recited in claim 12.

164. At best, the Schröder-Mestas combination teaches curved batteries that are 5-10 times too big to be of any use in a finger ring, as illustrated below:



165. Thus, not only is the proposed combination incompatible, it fails to teach a critical element of the claimed invention—a curved battery within internal and external housing components of a finger ring. Combining the teachings of Mestas and Schröder in the manner suggested would require a wholesale redesign of both references, which is beyond the skill of the ordinary person and therefore not obvious.

166. The USPTO supports my opinion in this respect. The USPTO considered and rejected Petitioner’s argument that it would be obvious to apply the curved batteries of Mestas to a ring form factor. *See* Section IV.B, *supra*; Ex. 2013

at 3 (Patent Owner successfully arguing: “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.”). I agree with the Patent Owner and in my opinion the Patent Office was correct to accede to this argument.

167. The combination also does not teach dependent claim 3. The fact that the components in a bracelet “partially overlap” is of no moment as to how those components would be arranged in a ring like Schröder. Like the curved battery, Schröder-Mestas does not disclose or suggest that the first and second portions of the cavity containing the battery and the printed circuit board “partially overlap” in a “finger-worn wearable ring device.”

D. Ground 4: Claims 1, 4-11, and 13-16 are patentable over Schröder in view of Yuen.

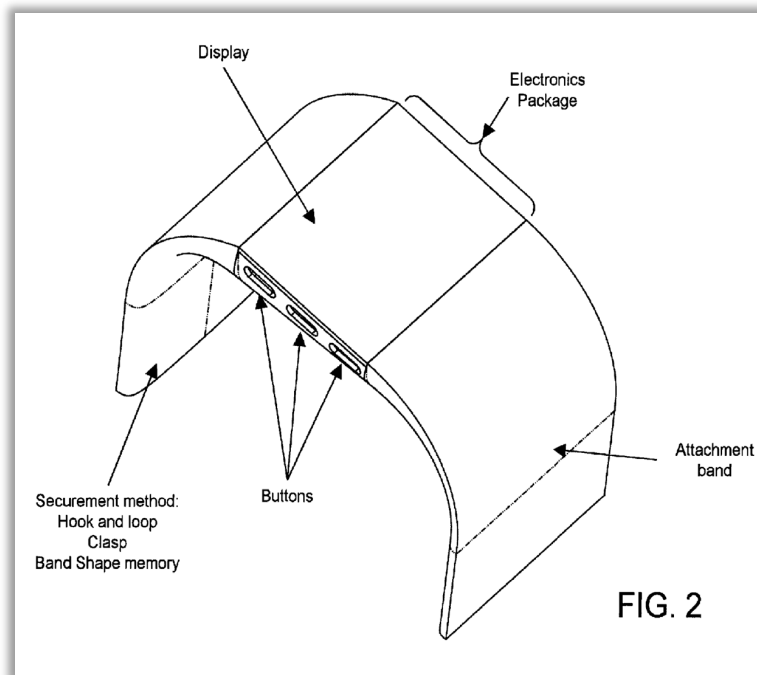
1. A POSITA would not make the proposed combination with a reasonable expectation of success.

168. The Schröder-Yuen combination has the same shortcomings as the Schröder-Mestas combination. A POSITA would not combine the teachings of Schröder and Yuen for many of the same reasons stated above with respect to Schröder and Mestas.

169. First, none of the teachings of Yuen are applicable to a finger-worn wearable ring. The teachings in Yuen relied on by Petitioner all relate to a wristband

embodiment of Yuen, which Yuen repeatedly emphasizes. Ex-1006 (Yuen), 12:30 (“for example, wrist, arm ankle and/or leg”); 12:50-52 (“The biometric monitoring device is adapted (for example, includes a size and shape) to be worn or carried on the body of a user (for example, arm, wrist, leg and/or ankle).”); 12:52-55 (“In preferred embodiments including the optical heart rate monitor, the device may be a wrist-worn or arm-mounted accessory such as a watch or a bracelet. (See, for example, FIGS. 2-13).”); 19:58-59 (“the invention is a wrist or arm-mounted device”); 22:51-53 (“For example, having a device on the waist, wrist, and ankle could improve the detection of the user taking a step over that of a single device in only one of those locations.”); 24:4-7 (“A user may wear one or more of the biometric monitoring devices of the present inventions on their wrist or ankle (or arm or leg) with the use of a band that is flexible and thereby readily fitted to the user.”); 24:22-24; 27:8-10.

170. As stated above with respect to Mestas, the form factor of Yuen does not translate to the finger ring of Schröder, and a POSITA would not look to combine the two with any reasonable expectation of success. Not only is Yuen’s form factor 5-10 times too large, its electronics are not even formed in a “ring” shape. Rather, Yuen’s “electronics package” is flat and planar:



Ex-1006 at Fig. 2.

171. Petitioner relies on Yuen’s passing reference to a “toe band” but Yuen does not describe how it could be built: “The device **may be built in such a way** that the sensor package/portion of the biometric monitoring device is removable and can be worn in any number of ways” Ex-1006 at 24:35-41. This disclosure provides no guidance to a POSITA, particularly since the embodiment of Figs. 2-13 is specifically intended to be a “watch or bracelet.” *Id.* at 12:55. Dr. Anthony confirmed Yuen’s lack of disclosure in this regard:

Q. Okay. It's fair to say, though, whatever he has in mind for a toe band would look different from . . . what's disclosed in Figures 2 through 13, correct?

A. Again, it was not opining about Yuen by itself but in combination. **It could look very similar, but it could be different . .**

Ex. 2021, 391:2-11.

172. A Schröder -Yuen combination would thus require a complete redesign of Yuen to fit in a finger ring, and a complete redesign of Schröder to accommodate the components of Yuen. Petitioner's contention that the electronic components of Yuen and Schröder are "interchangeable" simply has no basis in the actual teachings of the references. A POSITA would not be motivated to make such wholesale changes and would have no reasonable expectation of success. While a POSITA could reduce to practice a complete design that was provided to them, designing a finger worn wearable device given two incompatible devices like Schröder and Yuen is beyond their skill.

173. The power requirements of Yuen and Schröder are also not compatible, as the Yuen is directed to continuous monitoring and Schröder is directed to discrete RFID or NFC security validation.

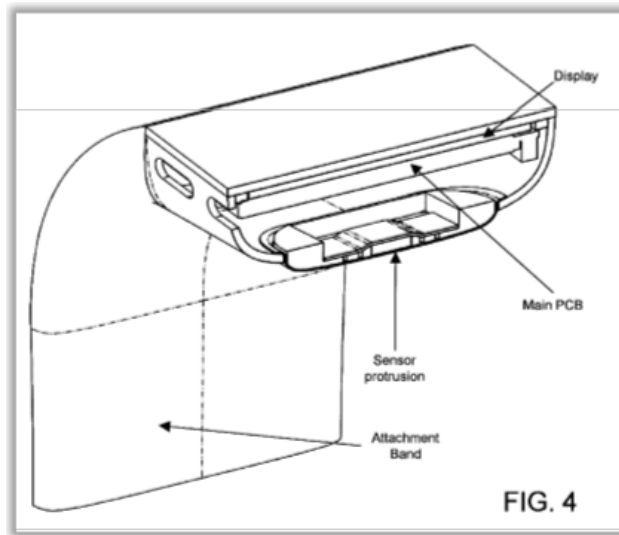
2. Schröder and Yuen do not disclose or suggest limitations 1[c] and 1[e] of the '178 patent.

174. Petitioner again relies solely on Schröder to teach limitations 1[c] and 1[e]. Pet. at 58. Petitioner does not allege that Yuen discloses these limitations. *Id.*

Thus, for the reasons stated above with respect to Ground 1, Schröder in view of Yuen also does not disclose or suggest these elements of claim 1.

3. Schröder and Yuen do not disclose or suggest limitation 1[d] and 1[e] of the '178 patent.

175. With respect to limitation 1[d], Petitioner contends that “A POSITA would understand that the PCB could be applied to Schröder’s inlay” Pet. at 59. In my opinion, it is apparent that the PCB of Yuen *cannot* be applied to a finger worn device. The “main PCB” (shown in Fig. 4 of Yuen below) by itself is several times the diameter of a finger worn ring.



Ex-1006 at Fig. 4.

176. Petitioner’s conclusion that a POSITA “would understand that the PCB could be applied to Schröder’s inlay” is contrary to the teachings of both references.

177. Petitioner’s reasons for applying Yuen’s PCB to Schröder is also lacking. No reason is given why Yuen’s too large and planar PCB would offer any advantage over the inlay for the security application of Schröder. Petitioner argues that “PCBs are lightweight, save space, and are easier to assemble into curved constructions.” Pet. at 55. The PCB taught by Yuen, however, certainly would not save any weight or space in Schröder’s ring, nor does Petitioner point to any teaching as to how one would adapt the PCB of Yuen to an appropriate size and shape for a ring—especially given Yuen’s statement that its device “is adapted” to a “size and shape” for much larger body parts. Ex-1006, 12:50-52. I see no advantage to attempting to adapt the PCB of Yuen to Schröder since Schröder already discloses inlay 12. Nor would a POSITA look to use the much too large PCB of Yuen in Schröder.

4. Schröder-Yuen does not disclose or suggest claims 4-11 and 13-16

178. With respect to claims 13-16, for the same reasons stated above with respect to the Schröder and Niwa combination, a POSITA would not look to add additional LEDs to the Schröder, which already discloses an infrared LED to detect vein patterns—the stated objective of Schröder.

5. Schröder in view of Yuen does not enable the claimed invention of the '178 patent

179. As discussed above, Schröder alone does not enable a POSITA to make and use the claimed invention without undue experimentation. Yuen does little to cure this deficiency. Yuen discloses a form factor and components, such as a flat wrist-sized printed circuit board, that are inapplicable to the claimed ring construction. Neither reference discloses how one would construct a finger worn ring having a battery and printed circuit board between inner and outer circumferential surfaces of internal and external housing components.

E. Ground 5: Claims 1-3 and 13-18 are patentable over Niwa.

1. Niwa does not disclose or suggest limitations 1[a] and 1[b].

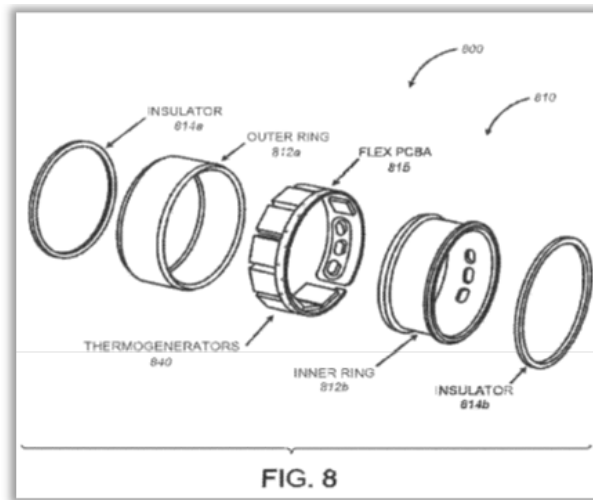
180. Elements 1[a] and 1[b] of the '178 patent recite:

[Element 1a] an external housing component defining an outer circumferential surface of the finger-worn wearable ring device;

[Element 1b] an internal housing component defining an inner circumferential surface of the finger-worn wearable ring device, the internal housing component coupled with the external housing component[.]

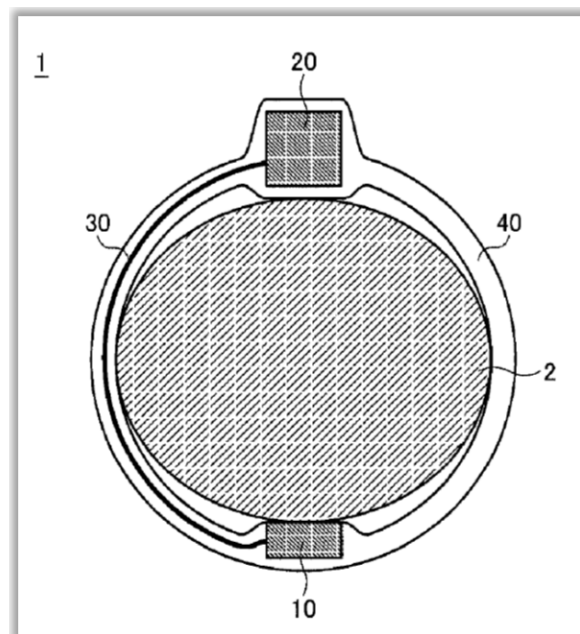
Ex-1001, 44:46-52.

181. The '178 patent discloses and claims external and internal housing components coupled with one another, as shown below—for example, by outer ring 812a and inner ring 812b.



Ex-1001 at Fig. 8.

182. Niwa does not disclose or suggest internal and external housing components, as claimed. Rather, Niwa discloses a unitary, component-less housing 40, shown in Fig. 23 below, and fails to disclose how the housing is constructed.



Ex-1005, at Fig. 23.

183. Dr. Anthony agrees, testifying that “Niwa is silent” as to the construction of housing 40. Ex. 2020 at 251:11-15. Thus, Niwa does not disclose or suggest inner and outer housing components “coupled” together. This “particularly claimed structure” that is not disclosed by Niwa is the stated reason the claims were allowed over Vescovi. *See* Section IV (B) (*infra*).

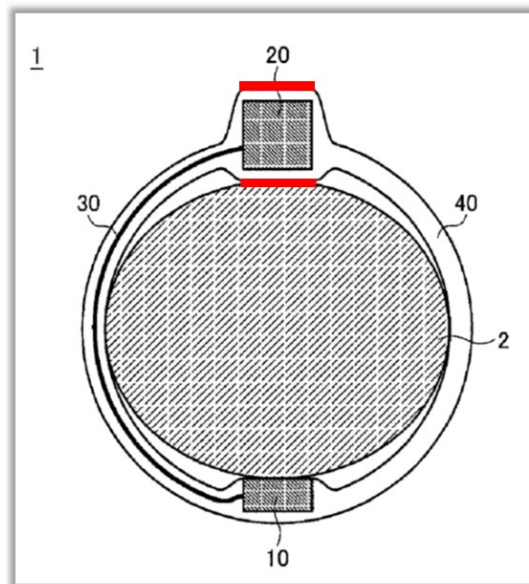
184. The petition includes no explanation as to why the use of a unitary housing renders the claims obvious. Pet. at 77-79. Rather, it appears that Petitioner is identifying sections of the unitary housing 40 as being “components.” *Id.* at 77 (“the outside of finger ring housing 40 that is exposed to the environment is the ‘external housing component’”); *id.* at 79 (“Annotated Figures 22 and 26 show the inner portion (green) is coupled with the outer portion to form Niwa’s circular finger ring type housing 40.”).

185. Petitioner’s interpretation of Niwa reads at least the limitations “component” and “coupled with” completely out of the claims. Under Petitioner’s interpretation, the term “housing” is synonymous with both “external housing component” and “internal housing component,” and “the internal housing component coupled with the external housing component” has no meaning at all. In my opinion, this shows the invention is nonobvious as these limitations cannot be ignored.

2. Niwa does not disclose or suggest limitation 1[c].

186. Niwa also does not disclose or suggest several aspects of battery limitation 1[c]. First, as stated above, Niwa does not disclose internal and external housing components and therefore does not disclose “a battery positioned within a cavity formed between the internal housing component and the external housing component.”

187. Second, as shown in Fig. 22 of Niwa, unit 20 contains battery 24. But the unit is not disposed “between” outer and inner circumferential surfaces of Niwa. Rather, the battery is located between two flat surfaces of the housing protrusion, as shown below in red:



188. Dr. Anthony agrees that the surfaces around unit 20 “appears to be planar.” Ex. 2021 at 398:6-12.

189. Petitioner again ignores the claim language, contending that the protrusion housing the battery unit 20 is part of a circumferential surface when it is not. Consequently, Niwa also does not disclose a battery comprising “a shape and size configured to fit within the cavity between the outer circumferential surface of the external housing component and the inner circumferential surface of the internal housing component,” as claimed. Further, since no portion of battery extends into a cavity between two circumferential surfaces, Niwa does not disclose or suggest “wherein the battery extends through at least a first portion of the cavity of the finger-worn wearable ring device.”

3. Niwa does not disclose or suggest limitations 1[d].

190. As stated above, because Niwa does not disclose or suggest internal and external housing components, Niwa does not disclose or suggest “a printed circuit board disposed between the internal housing component and the external housing component.”

4. Niwa does not disclose or suggest dependent claims 17 and 18.

191. With respect to claims 17 and 18, Niwa’s unitary housing 40 discloses none of the particular details regarding the internal and external housing components. Dr. Anthony’s statement that Niwa is “silent” supports my opinion in this respect.

5. Niwa does not enable the invention.

192. Niwa fails to teach how one would construct a ring having a battery and printed circuit board between inner and outer circumferential surfaces of internal and external housing components in different portions of a cavity. Rather, Niwa teaches connecting two arrangements of stacked components by a cable. Niwa thus teaches an entirely different arrangement that offers no clue as to how one of ordinary skill in art would make and use the claimed invention without undue experimentation.

F. Ground 6: Claims 1 is patentable over Niwa in view of Schröder.

1. One of ordinary skill would not combine Niwa and Schröder

193. For the same reasons stated above with respect to the Schröder-Niwa combination, a POSITA would not combine Niwa and Schröder. The rings are directed to disparate applications. Schröder uses infrared to image vein patterns for security validation and Niwa uses photoplethysmograms to monitor health conditions. The housings are also fundamentally different. Niwa touts the advantages of “stacking” flat components in planar sections of the ring housing, which is at odds with placing the components within the curved inlay of Schröder.

194. There is no valid reason (absent hindsight) to combine the teachings of the two references as their objectives and approaches are inapposite and the technology they disclose will not help the other device achieve those objectives.

2. Niwa-Schröder does not disclose or suggest limitation 1[a]

195. As discussed above, Niwa discloses a unitary housing 40, rather than external and internal housing components, as recited in claim 1. *See* VII (E)(i) (*supra*). While Petitioner points to Schröder as disclosing such components, Petitioner’s analysis ends there. Pet. at 78 (“Schröder’s ‘finger-ring’ consists of ‘two ring halves’”). Petitioner gives no reason as to how or why a POSITA would modify the unitary housing of Niwa to include “ring halves” in Schröder, nor how Schröder’s housing would accommodate Niwa’s “stacked” power supply unit 20 and sensor unit 10.

196. Petitioner also fails to explain how Niwa’s preferred “stacking arrangement” discussed above (Ex-1005, ¶[0219]) would be combined with Schröder’s curved inlay. Accordingly, Petitioner has not shown this limitation is met by Niwa-Schröder.

3. Niwa-Schröder does not disclose or suggest limitation 1[b]

197. As stated above with respect to limitation 1[a], Petitioner again relies on the disclosure of Schröder, but includes no analysis or reasoning as to how or why it would have been obvious to use the “ring halves” of Schröder in the unitary structure of Niwa that teaches a “stacking arrangement.” Pet. at 79-80. Moreover, as explained above with reference to Schröder, ring halves 16 and 18 of Fig. 5 in Niwa do not define outer and inner circumferential surfaces of a finger-worn wearable

ring, as claimed. Rather, Fig. 5 discloses top and bottom ring halves 16 and 18 that are joined in the middle of the ring (like a bagel), not inner and outer surfaces. Thus, neither ring half 16 or 18 of Fig. 5 constitute an inner or outer component.

4. Niwa-Schröder does not disclose or suggest limitation 1[c]

198. Petitioner relies on Niwa as disclosing the “battery” limitation of claim 1. Pet. at 84. For the same reasons stated above with respect to Ground 5, Niwa does not disclose or suggest this limitation.

5. Niwa-Schröder does not disclose or suggest limitation 1[d]

199. Petitioner relies on Niwa as disclosing the “printed circuit board” limitation of claim 1. Pet. at 86. For the same reasons stated above with respect to Ground 5, Niwa-Schröder does not disclose or suggest this limitation.

6. Niwa-Schröder does not enable a POSITA to make and use the claimed invention.

200. As discussed above, Niwa alone does not enable a POSITA to make and use the claimed invention. Schröder does little to cure this deficiency. Both Schröder and Niwa disclose, at most, how to fit a wire in a ring. Schröder discloses placing an antenna coil 8 on an inlay in a ring, while Niwa discloses cable 30 connecting two “stacking” arrangements 10 and 20. Neither reference discloses how one would construct a ring having a battery and printed circuit board between inner

and outer circumferential surfaces of internal and external housing components within first and second portions of a cavity.

G. Ground 7/8: Claims 12 is patentable over Niwa and Niwa-Schröder in view of Mestas.

201. For the same reasons stated above with respect to the Schröder-Mestas combination, a POSITA would not be motivated to apply the curved batteries from Mestas's bracelet to the ring of Niwa or Niwa-Schröder, nor have any reasonable expectation of success in doing so. As above, the proposed combination fails to disclose a battery with a "shape and sized configured" within a "finger-worn wearable ring."

202. In addition to those reasons, Niwa itself teaches directly away from using a curved battery. Niwa teaches using a "highly flat" battery to accommodate the "stacking arrangement" taught by Niwa. Ex-1005, ¶ [217] ("the battery 24 formed as highly flat is located right above the finger 2 . . . to enhance an affinity of the plethysmogram sensor 1 when the pulse sensor 1 is worn on the finger 2, furthermore, the consciousness of the examinee for wearing the plethysmogram sensor 1 can be reduced."). And Dr. Anthony admitted that using a flat cell, as used in Niwa, is beneficial to reducing the size of the ring:

Q. Do you have any opinion as to why Niwa chooses to use, or at least says he chooses to use a highly flat battery here?

A. Again, in general, a POSITA - - a person designing a ring wants to minimize size, minimize volume, so using a relatively flat, highly flat battery could be beneficial there.

Q. And that would facilitate also the stacked layer construction that he utilizes?

A. Could facilitate the saving of space, facilitate as described, and with the battery number - - battery 24.

Ex. 2021 at 281:5-20.

203. Ignoring this express disclosure and stated benefits of using a “highly flat” battery in Niwa that would be appreciated by a skilled artisan, Petitioner proposes modification that runs against the use of curved batteries. Using curved components would be antithetical to stacking components in one section of the ring above the knuckle and would not be considered by the ordinary person given the teaches of Niwa.

VIII. SECONDARY CONSIDERATION OF NON-OBVIOUSNESS

A. Nexus

204. Oura manufactures the Oura Ring that embodies the claims of the ’178 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.

205. Both Oura Ring Gen. 3 and 4 are coextensive with the Challenged Claims of the ’178 patent. In coming to this conclusion, I conducted an element-by-

element analysis of the claims against Oura Ring for both Gen. 3 and 4 as detailed below.

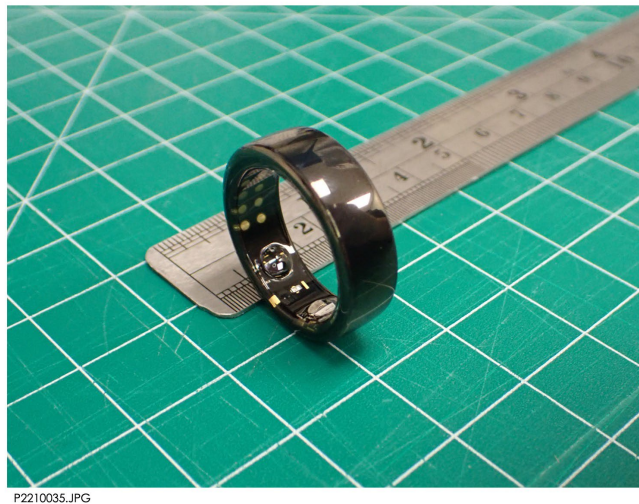
1. Independent Claim 1

a. Limitation 1 [Pre]

206. The preamble of the claim 1 requires “a finger-worn wearable ring device.” Ex-1001 at 44:45-46. Both Oura Ring Gen. 3 and Gen. 4 practice this limitation.

i. Oura Ring Gen. 3

207. Oura Ring Gen. 3 is a finger-worn wearable ring device configured to be worn on user’s finger:



Ex. 2029.

ii. Oura Ring Gen. 4

208. Oura Ring Gen. 4 is also a finger-worn wearable ring device configured to be worn on user's finger:



Ex. 2030 at 1.

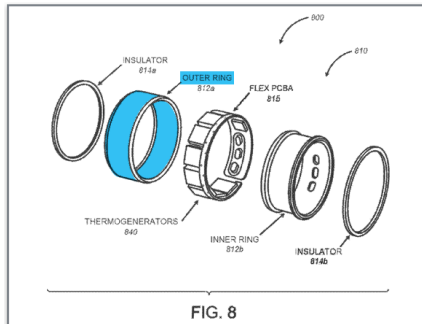
b. Limitation 1[a]

209. Limitation 1[a] requires “an external housing component defining an outer circumferential surface of the finger-worn wearable ring device.” Ex-1001 at 44:46-48. Both Oura Ring Gen. 3 and Gen. 4 practice this limitation.

i. Oura Ring Gen. 3

210. Oura Ring Gen. 3 includes an **external housing component** defining an **outer circumferential surface** of the finger-worn wearable ring device. Indeed, as shown in below side-by-side comparison of the '178 patent and Oura's own depiction of Oura Ring, the external metal structure of the ring is the **external**

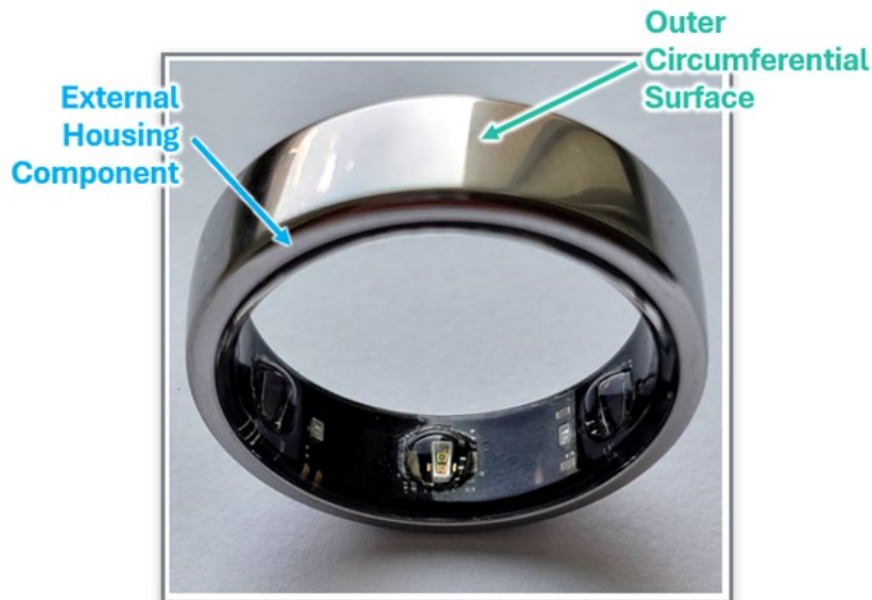
housing component and the **outer circumferential surface** is the curved surface that is visible when the user is wearing the ring.



'178 Patent (Ex-1001) at Fig. 8 (Annotated)



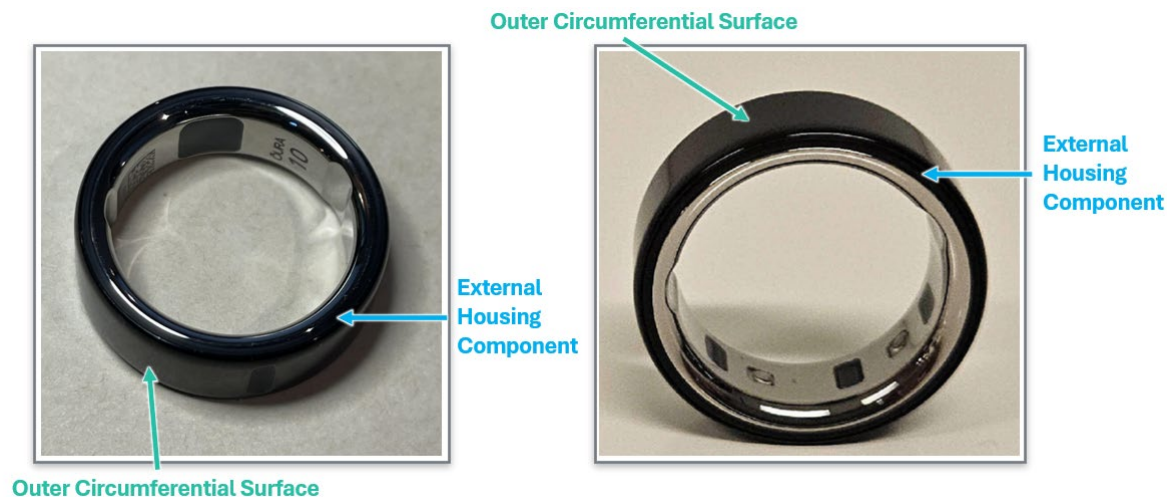
Ex. 2031 (Annotated)



Ex. 2029.

ii. Oura Ring Gen. 4

211. Oura Ring Gen. 4 also includes include an **external housing component** defining an **outer circumferential surface** of the finger-worn wearable ring device. Indeed, in the Gen. 4, the external metal structure of the ring is the **external housing component** and the **outer circumferential surface** is the curved surface that is visible when the user is wearing the ring:



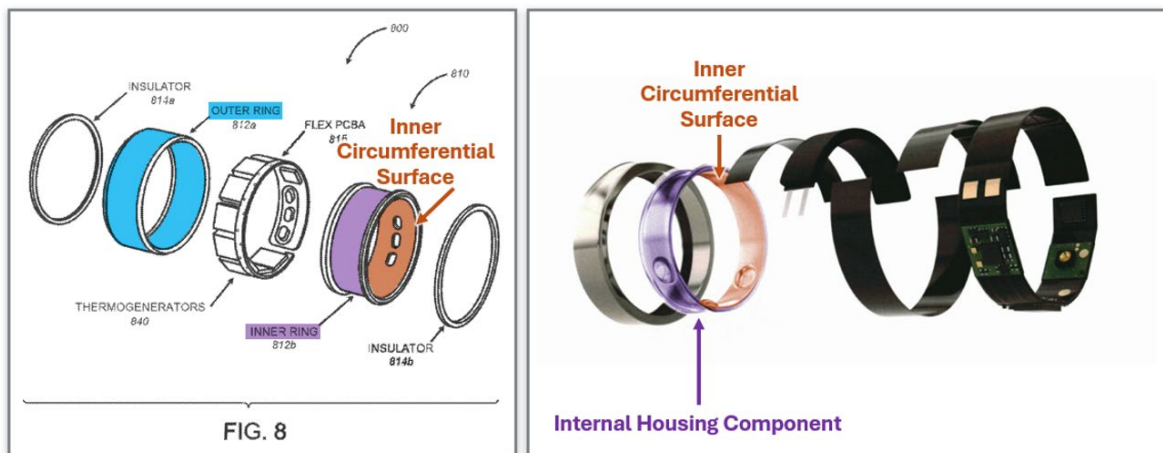
Ex. 2030.

c. Limitation 1[b-i]

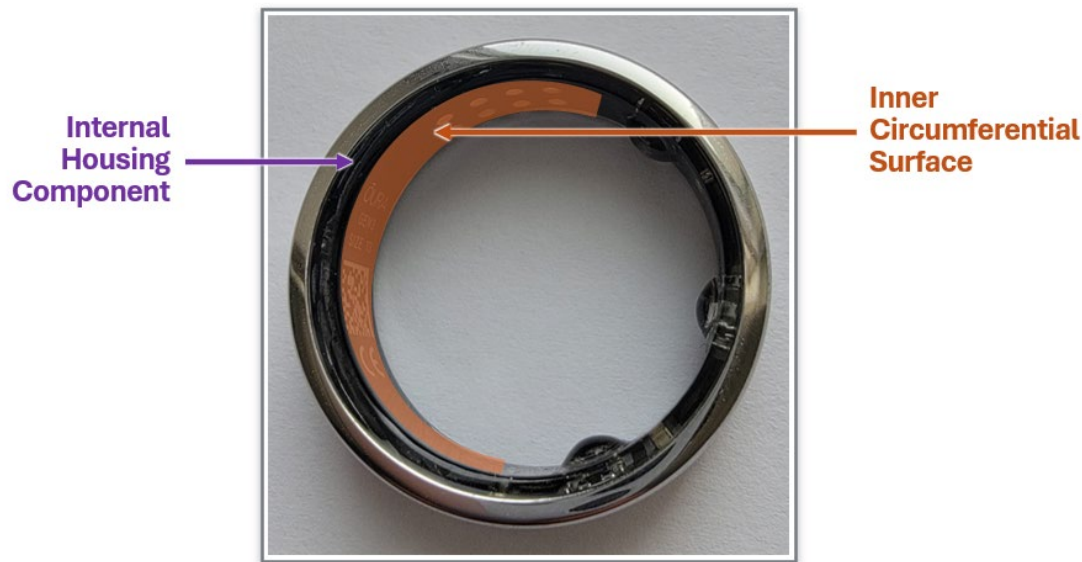
212. Limitation 1[b-i] requires “an internal housing component defining an inner circumferential surface of the finger-worn wearable ring device.” Ex-1001 at 44:49-51. Both Oura Ring Gen. 3 and Gen. 4 practice this limitation.

i. Oura Ring Gen. 3

213. Oura Ring Gen. 3 includes an **internal housing component** defining an **inner circumferential surface** of the finger-worn wearable ring device. As shown below, Oura Ring Gen. 3 includes an **internal housing component** that is a structure formed from cured epoxy (i.e., potting material) which includes a curved surface that touches the user's finger when worn, thus includes an **inner circumferential surface**:



Ex-1001 at Fig. 8; Ex. 2031 (Annotated).

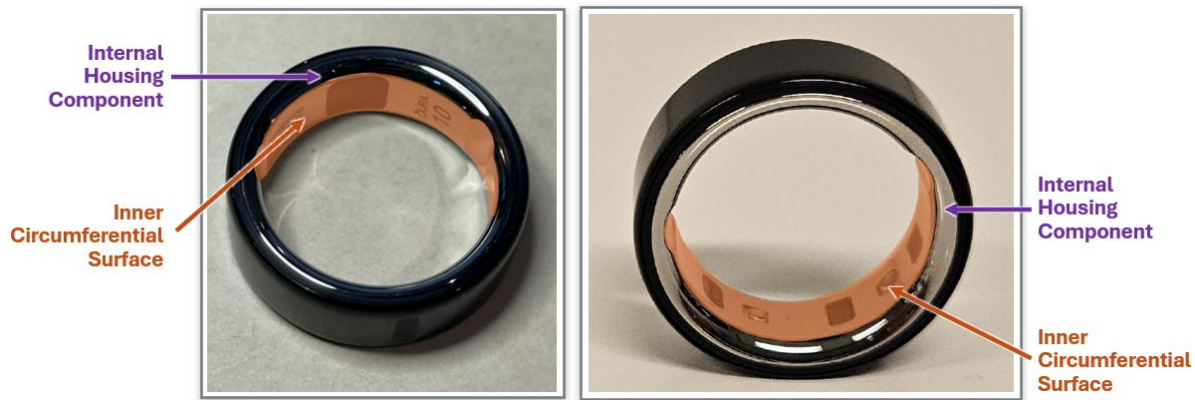


Ex. 2029.

214. Thus, as shown above, the internal housing component is the layer of potting material that covers the battery and PCB, forms a seal with the external housing component, and defines the inner circumferential surface of the ring.

ii. **Oura Ring Gen. 4**

215. Oura Ring Gen. 4 also includes an internal housing component defining an inner circumferential surface of the finger-worn wearable ring device. Ex. 2024 (Sarrafzadeh) at 280:9-21; Ex. 2029. In contrast, to the Oura Ring Gen. 4 where the internal housing component is made of potting material, the Gen. 4 internal housing component is made of metallic material. And the inner surface of the Oura Ring Gen. 4 includes a curved surface that touches the surface of user's finger which is the inner **circumferential surface**:



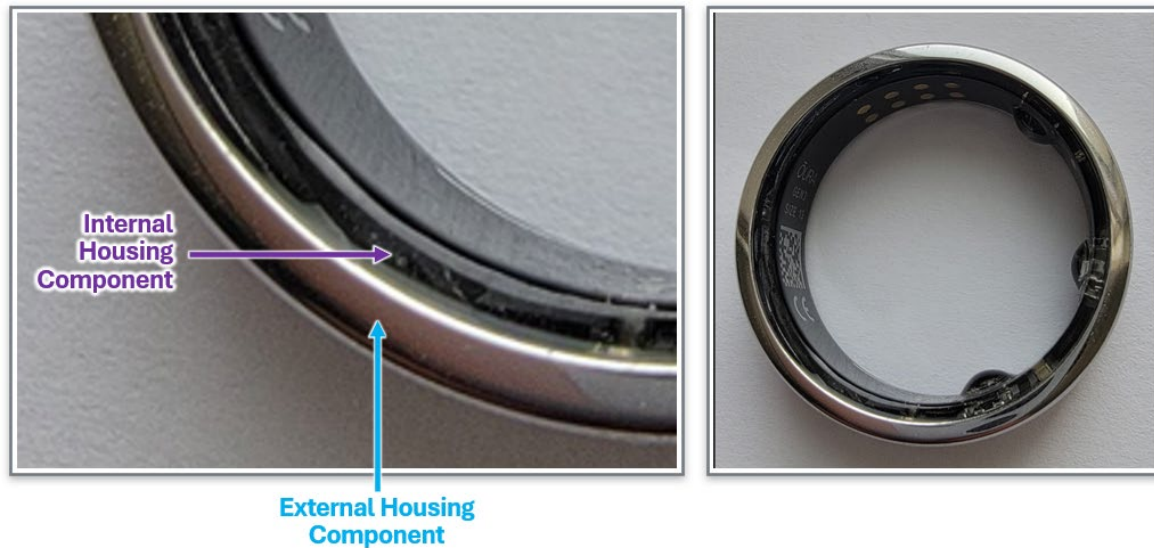
Ex. 2030.

d. Limitation 1[b-ii]

216. Limitation 1[b-ii] requires “the internal housing component coupled with the external housing component.” Ex-1001 at 44:51-52. Both Oura Ring Gen. 3 and Gen. 4 practice this limitation.

i. Oura Ring Gen. 3

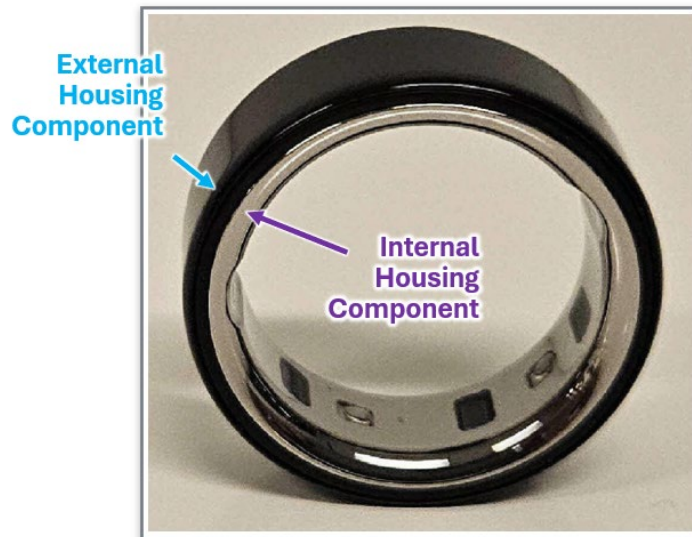
217. Oura Ring Gen. 3 includes the **internal housing component** coupled with (i.e., connected with) the **external housing component**. Indeed, the potting material that forms the internal housing component adheres to the metallic structure that is the external housing component, and therefore the internal housing and external housing components are coupled or connected together:



Ex. 2029.

ii. Oura Ring Gen. 4

218. Oura Ring Gen. 4 also includes the **internal housing component** coupled with (i.e., connected with) the **external housing component**. Specifically, the two metallic structures (i.e., external and internal housing components) are coupled together by an epoxy that is used to connect or adhere the two structures together:



Ex. 2030.

e. Limitation 1[b-iii]

219. Limitation 1[b-iii] requires “wherein at least a portion of the inner circumferential surface of the internal housing component is configured to contact a tissue of a user when the finger-worn wearable ring device is worn by the user.” Ex-1001 at 44:52-56. Both Oura Ring Gen. 3 and Gen. 4 practice this limitation.

i. Oura Ring Gen. 3

220. Oura Ring Gen. 3 includes at least a portion of the inner circumferential surface of the internal housing component that is configured to contact a tissue of a user when the finger-worn wearable ring device is worn by the user. For example, when the Oura Ring Gen. 3 is worn by the user, at least a portion of the inner circumferential surface touches the tissue of the user which he confirmed by wearing the ring.

ii. Oura Ring Gen. 4

221. Oura Ring Gen. 4 also includes at least a portion of the inner circumferential surface of the internal housing component that is configured to contact a tissue of a user when the finger-worn wearable ring device is worn by the user. For example, when the Oura Ring Gen. 4 is worn by the user, at least a portion of the inner circumferential surface touches the tissue of the user which he confirmed by wearing the ring.

f. Limitation 1[c-i]

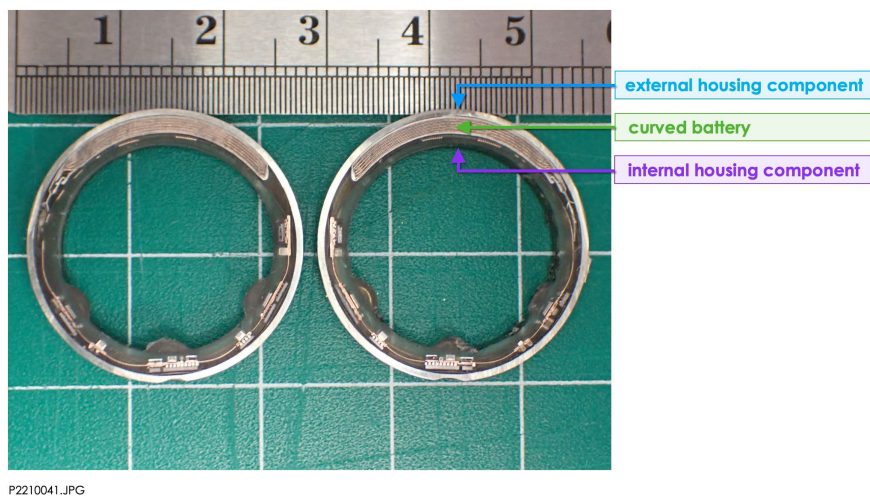
222. Limitation 1[c-i] requires “a battery positioned within a cavity formed between the internal housing component and the external housing component.” Ex-1001 at 44:57-59. Both Oura Ring Gen. 3 and Gen. 4 practice this limitation.

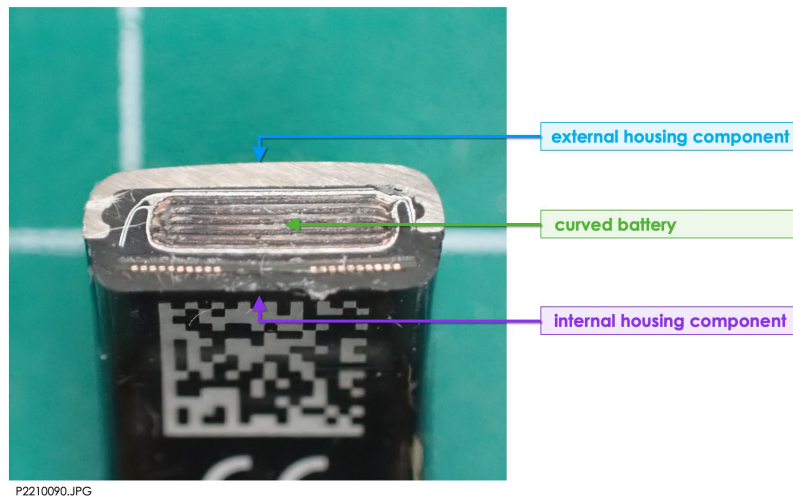
i. Oura Ring Gen. 3

223. Oura Ring Gen. 3 includes a battery positioned within a cavity formed between the internal housing component and the external housing component. As shown in Oura’s own marketing materials, the **battery** is positioned within the space that is created between the external metallic structure (i.e., **external housing component**) and the internal structure formed of solidified epoxy or potting material (i.e., **internal housing component**) as shown below:



Ex. 2031.



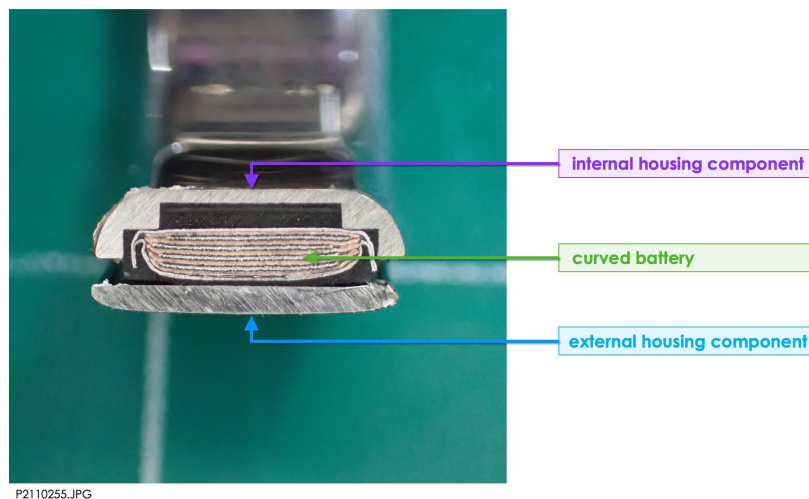
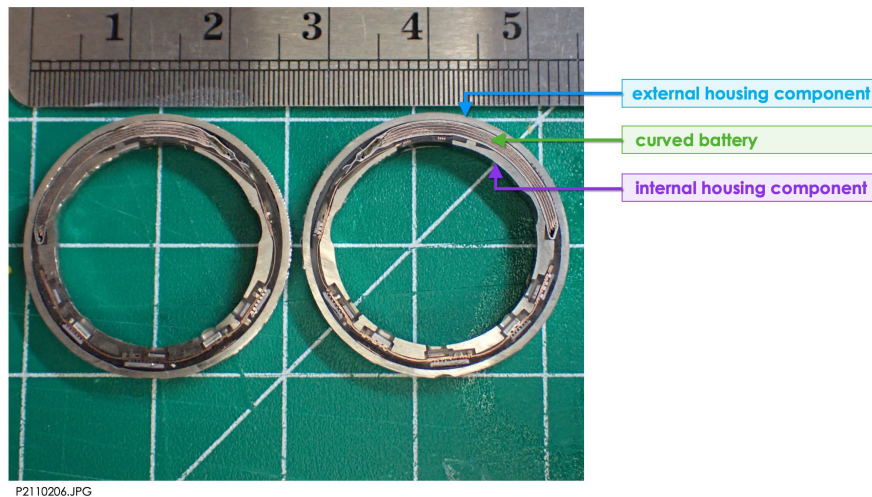


Ex. 2029.

224. Once assembled, Oura Ring Gen. 3 includes a battery that is necessarily positioned within a cavity formed between the internal housing component and the external housing component.

ii. Oura Ring Gen. 4

225. Oura Ring Gen. 4 also includes a battery positioned within a cavity formed between the internal housing component and the external housing component:



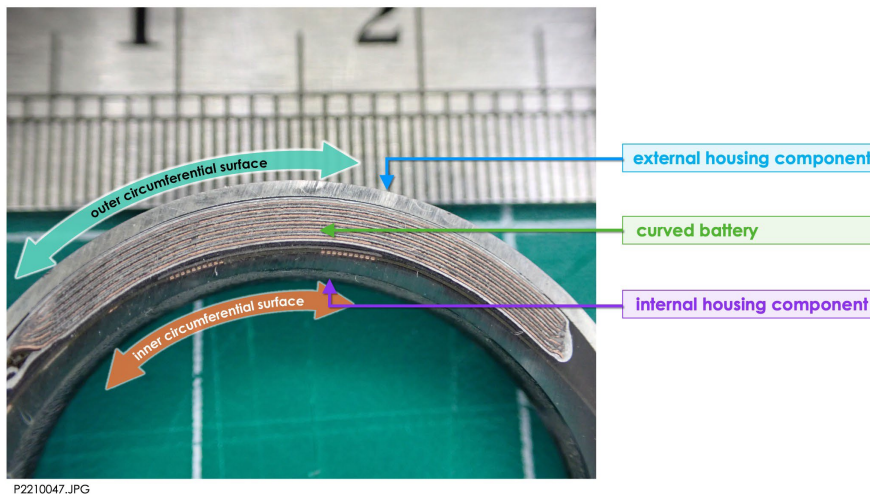
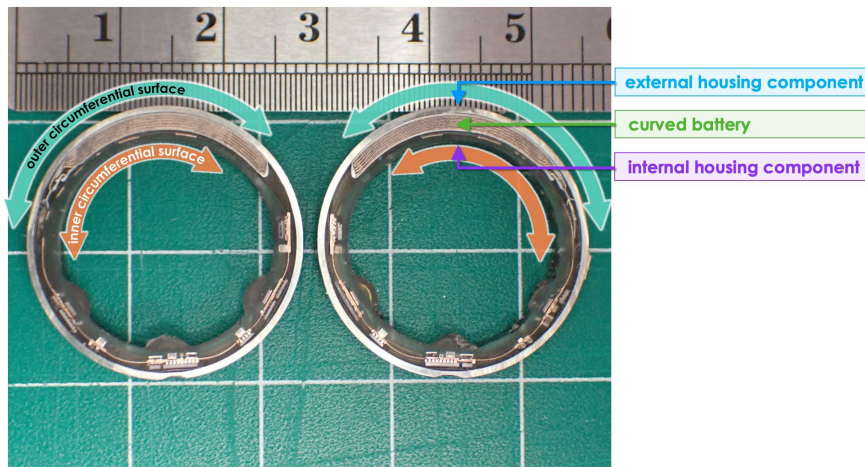
Ex. 2030.

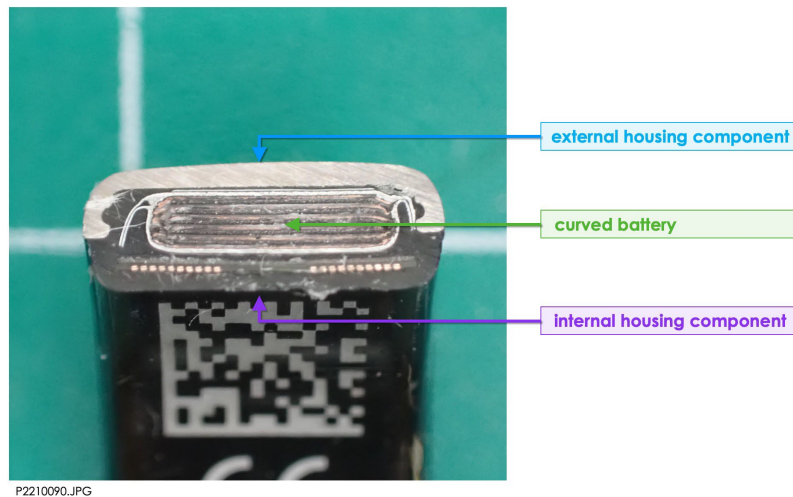
g. Limitation 1[c-ii]

226. Limitation 1[c-ii] requires “wherein the battery comprises a shape and size configured to fit within the cavity between the outer circumferential surface of the external housing component and the inner circumferential surface of the internal housing component.” Ex-1001 at 44:59-63. Both Oura Ring Gen. 3 and Gen. 4 products practice this limitation.

i. Oura Ring Gen. 3

227. Oura Ring Gen. 3 includes the battery that comprises a shape and size configured to fit within the cavity between the outer circumferential surface of the external housing component and the inner circumferential surface of the internal housing component because it is a curved battery and therefore fits within the circumferential surfaces of the external and internal housing components:





Ex. 2029.

ii. **Oura Ring Gen. 4**

228. Oura Ring Gen. 4 includes the battery that comprises a shape and size configured to fit within the cavity between the outer circumferential surface of the external housing component and the inner circumferential surface of the internal housing component. Indeed, the battery in Gen. 4 is also curved and shaped and sized to fit within the circumferential surfaces of the external and internal housing components:



Ex. 2030.

h. Limitation 1[c-iii]

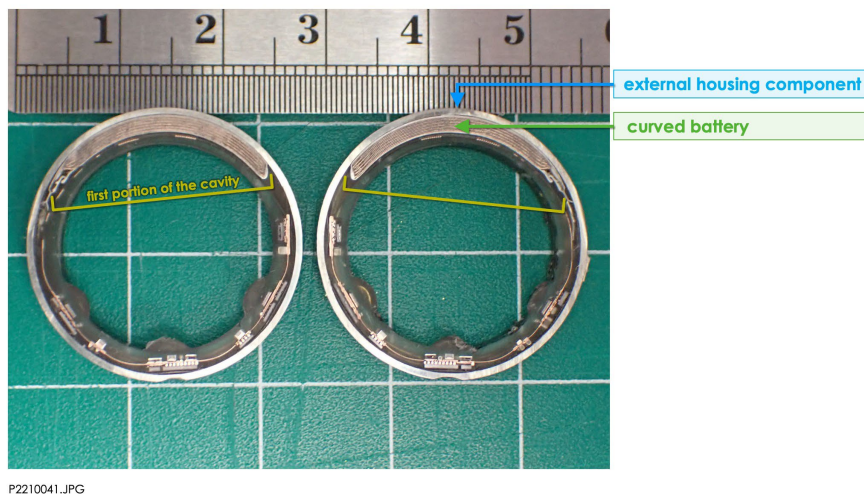
229. Limitation 1[c-iii] requires “wherein the battery extends through a first portion of the cavity of the finger-worn wearable ring device.” Ex-1001 at 44:63-65.

Both Oura Ring Gen. 3 and Gen. 4 practice this limitation.

i. Oura Ring Gen. 3

230. Oura Ring Gen. 3 includes the battery that extends through a first portion of the cavity of the finger-worn wearable ring device. Indeed, as shown

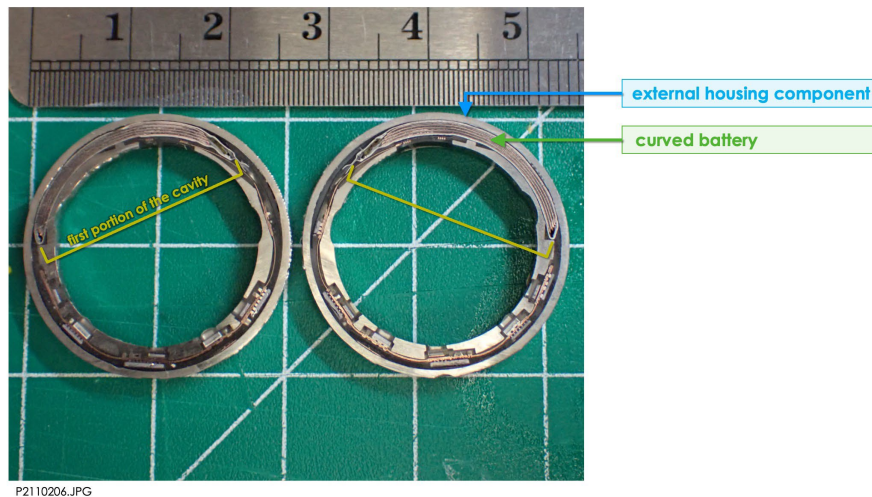
below, the battery is positioned in the non-overlapping space of the ring compared to the PCB, and therefore battery extends through a first portion of the cavity of Oura Ring Gen. 3:



Ex. 2029.

ii. Oura Ring Gen. 4

231. Oura Ring Gen. 4 includes the battery that extends through a first portion of the cavity of the finger-worn wearable ring device. Indeed, as shown below, the battery is positioned in the non-overlapping space of the ring compared to the PCB, and therefore battery extends through a first portion of the cavity of Oura Ring Gen. 4:



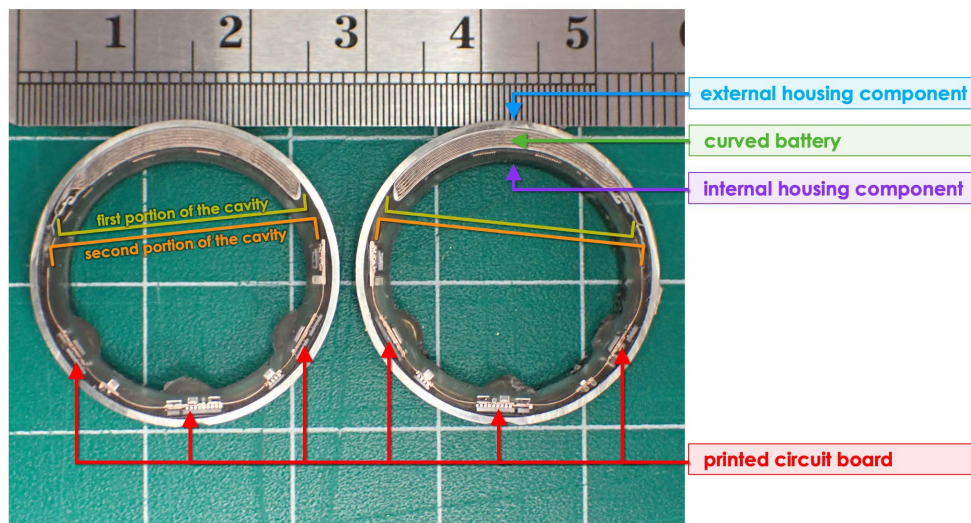
Ex. 2030.

i. Limitation 1[d]

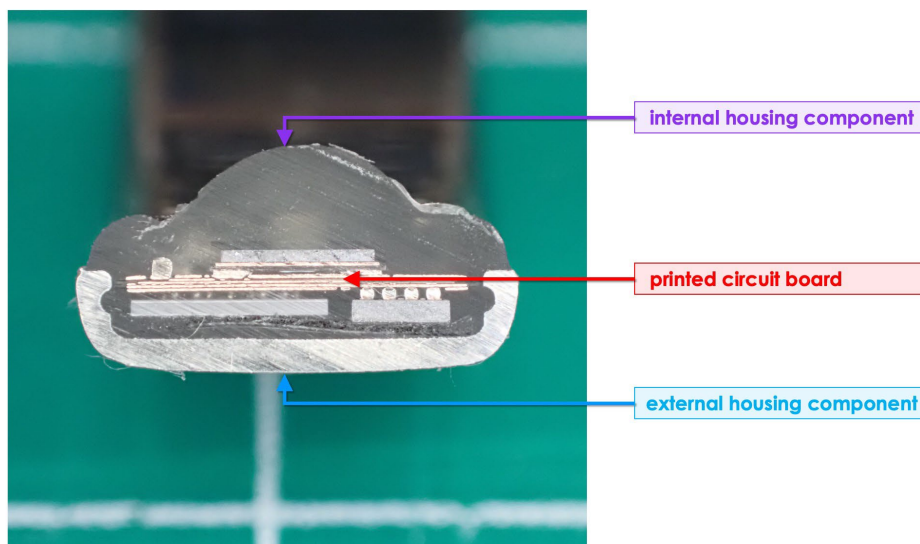
232. Limitation 1[d] requires “a printed circuit board disposed between the internal housing component and the external housing component, wherein the printed circuit board extends through at least a second portion of the cavity of the finger-worn wearable ring device different from the first portion.” Ex-1001 at 44:66-45:4. Both Oura Ring Gen. 3 and Gen. 4 practice this limitation.

i. Oura Ring Gen. 3

233. Oura Ring Gen. 3 includes a printed circuit board disposed between the internal housing component and the external housing component, wherein the printed circuit board extends through at least a second portion of the cavity of the finger-worn wearable ring device different from the first portion.



P2210041.JPG



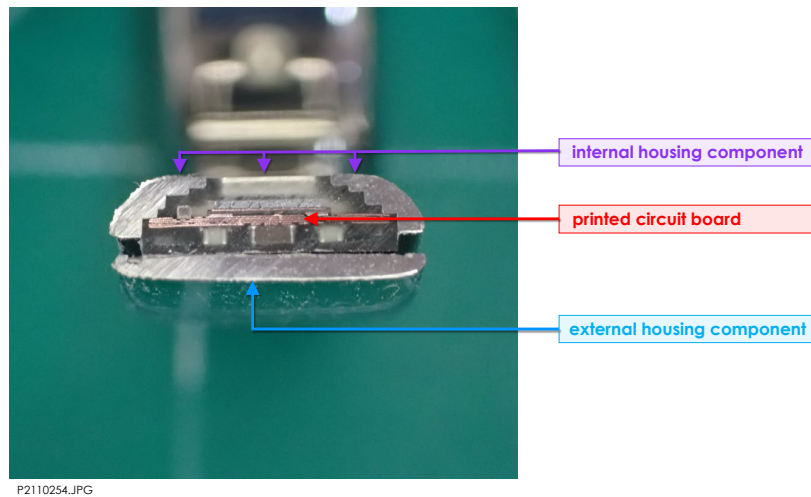
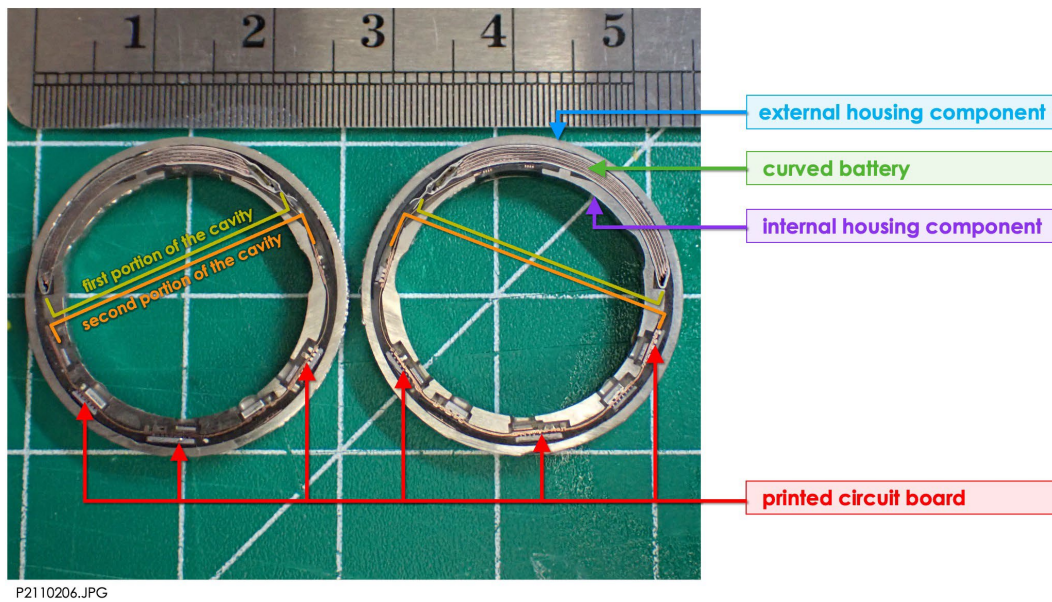
P2210095.JPG

Ex. 2029.

ii. Oura Ring Gen. 4

234. Oura Ring Gen. 4 also includes a printed circuit board disposed between the internal housing component and the external housing component,

wherein the printed circuit board extends through at least a second portion of the cavity of the finger-worn wearable ring device different from the first portion.



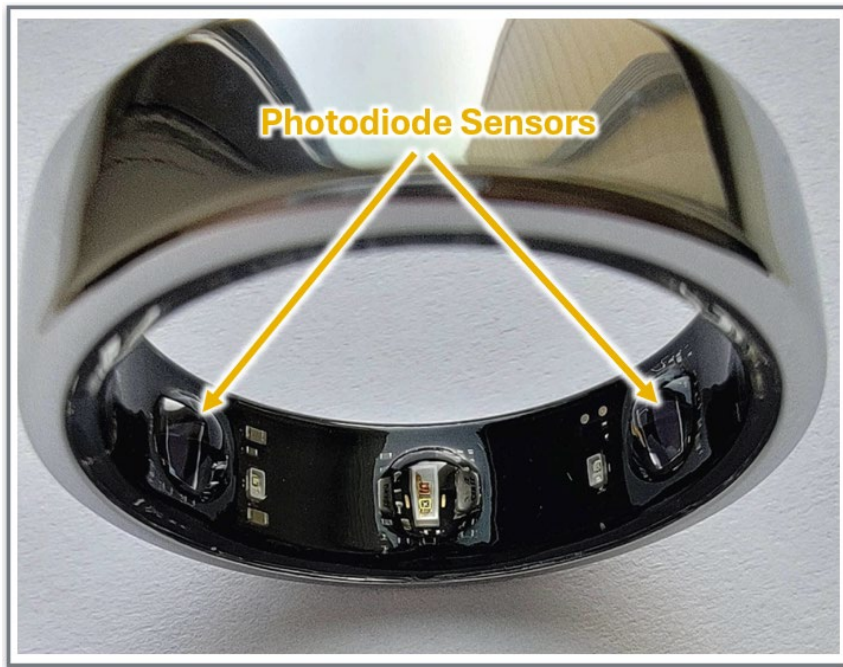
Ex. 2030.

j. Limitation 1[e]

235. Limitation 1[e] requires “one or more sensors electrically coupled with the printed circuit board and the battery and configured to acquire data from the user through the internal housing component.” Ex-1001 at 45:5-8. Both Oura Ring Gen. 3 and Gen. 4 practice this limitation.

i. Oura Ring Gen. 3

236. Oura Ring Gen. 3 includes one or more sensors electrically coupled with the printed circuit board and the battery and configured to acquire data from the user through the internal housing component. Indeed, Oura Ring Gen. 3 includes a number of LEDs and photodiode sensors coupled to the PCB and battery to acquire data from the red, green, and infrared light emitted from the LEDs and detected by the one or more photodiode sensors through the transparent internal housing component:



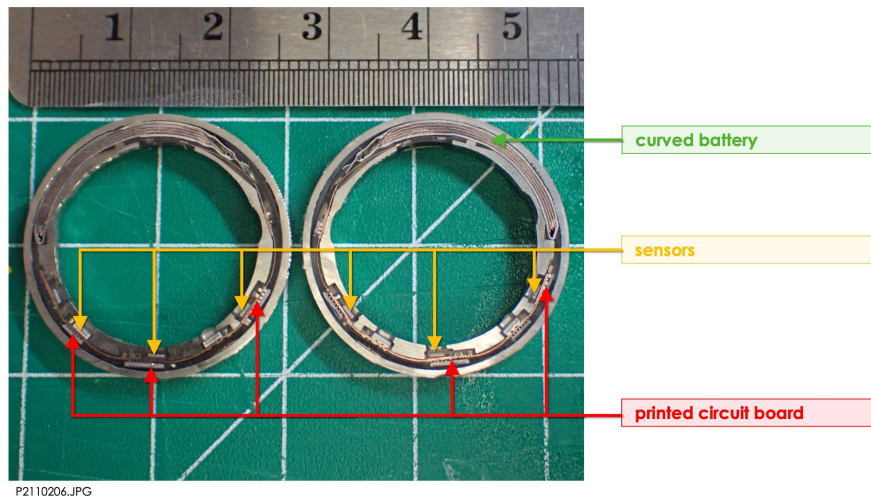
Ex. 2029.

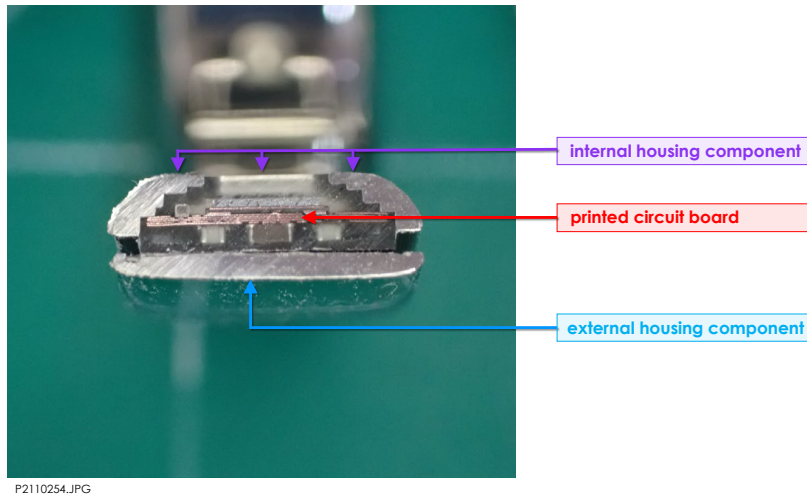


Id.

ii. Oura Ring Gen. 4

237. Oura Ring Gen. 4 includes one or more sensors electrically coupled with the printed circuit board and the battery and configured to acquire data from the user through the internal housing component. Indeed, Oura Ring Gen. 4 includes a number of LEDs and photodiode sensors coupled to the PCB and battery to acquire data from the red, green, and infrared light emitted from the LEDs and detected by the one or more photodiode sensors through the transparent windows included within the internal housing component to facilitate transmission and reception of light:





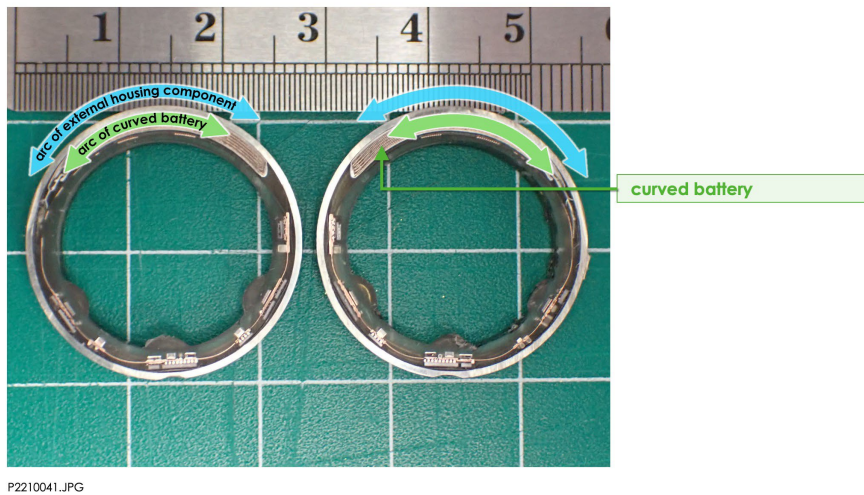
Ex. 2030.

2. Claim 12

238. Dependent claim 12 further specifies that the battery comprises a curved battery, wherein an arc of the curved battery approximates a corresponding arc of the external housing component. Both Oura Ring Gen. 3 and Gen. 4 practice this limitation.

a. Oura Ring Gen. 3

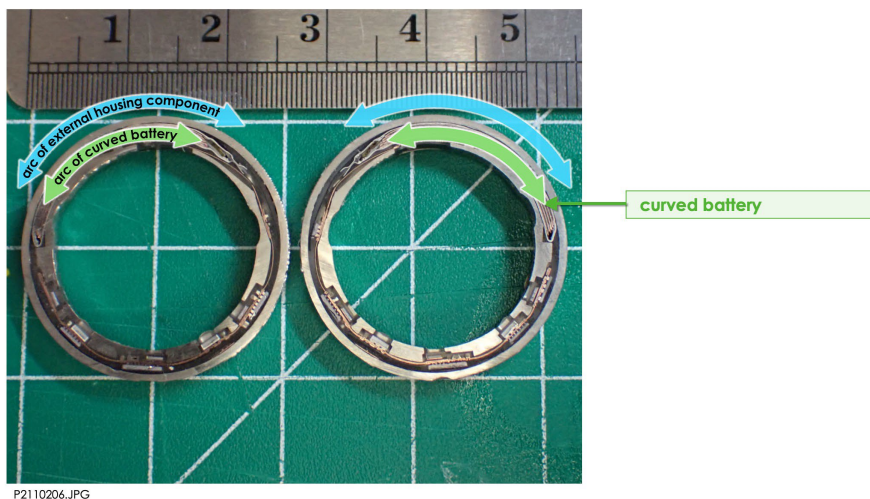
239. Oura Ring Gen. 3 includes a curved battery, wherein an arc of the curved battery approximates a corresponding arc of the external housing component:



Ex. 2029.

b. Oura Ring Gen. 4

240. Oura Ring Gen. 4 includes a curved battery, wherein an arc of the curved battery approximates a corresponding arc of the external housing component:



Ex. 2030.

241. Thus, as shown above, the claimed invention of the '178 patent is not merely a subcomponent of Oura Ring, but rather encompasses the entire structural apparatus. Because the claims of the '178 patent are coextensive with Oura Ring Gen. 3 and 4, I understand that there is a presumption of a nexus between the secondary consideration evidence and the merits of the claimed invention.

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

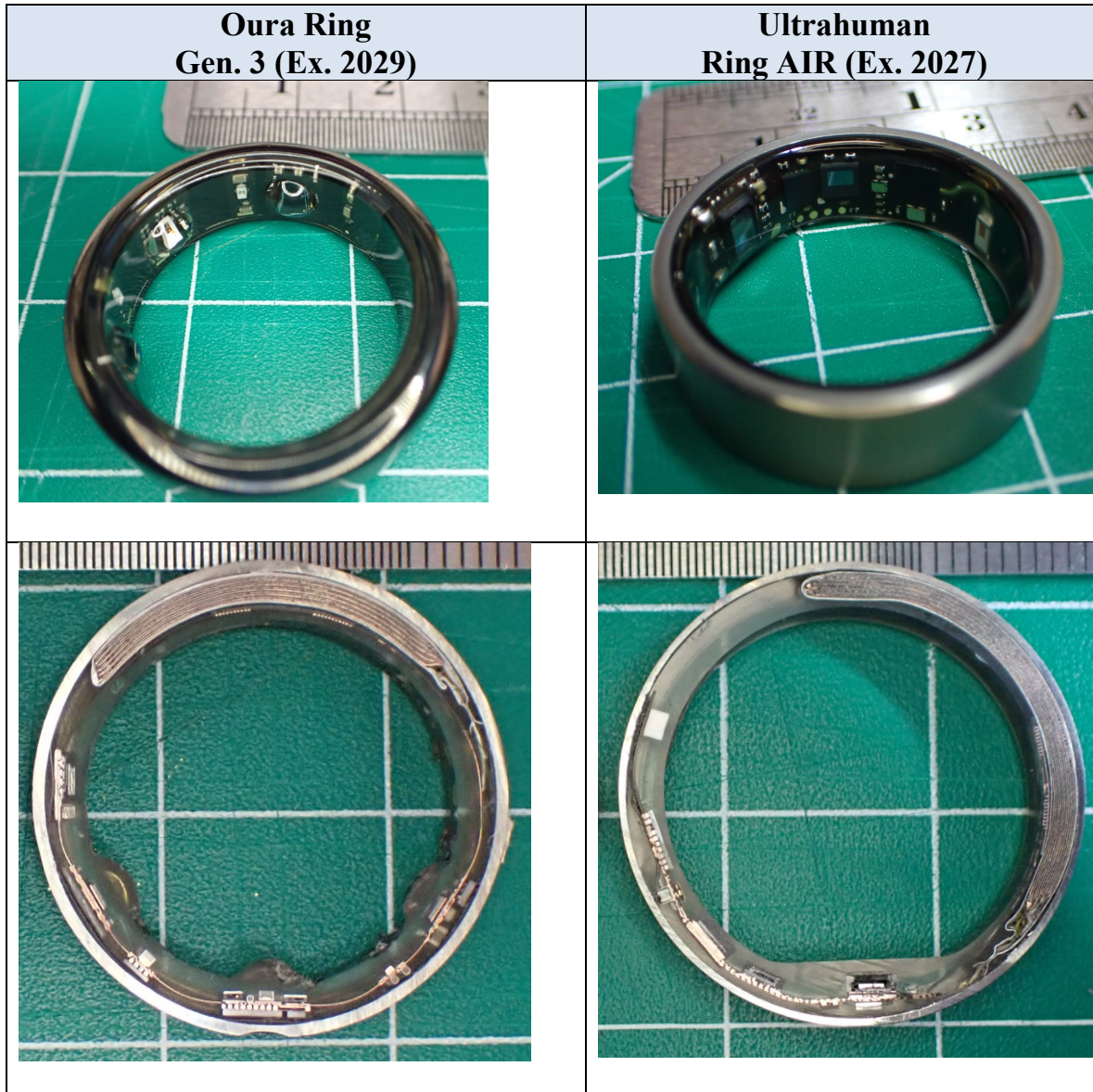
242. Oura Ring has been recognized for its ingenuity in the smart ring market. *See e.g.*, Ex. 2003 (“A big part of awarding the Oura Ring 3 [the wearable of the year award] is how it’s defined a whole segment of wearables – and moved forward the discussion about what a wearable should be.”). Thus, it’s no surprise that new entrants in the ring market would seek replicate Oura’s success.

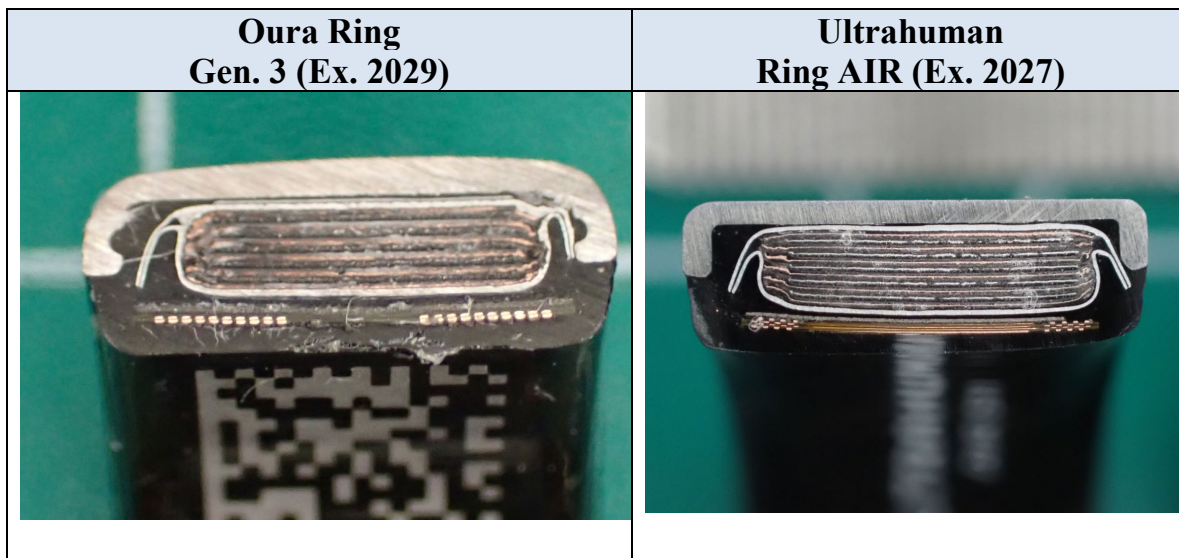
243. There is, however, evidence that a number of manufactures of smart rings copied the Oura Ring Gen. 3, including the use of internal potting as the internal housing component as disclosed in the '178 patent.

1. Ultrahuman Ring AIR

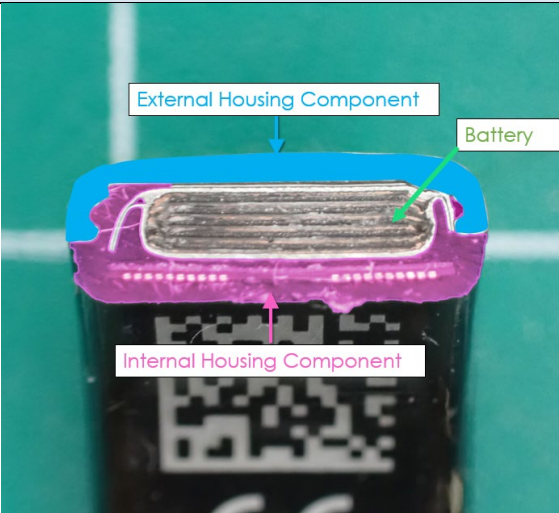
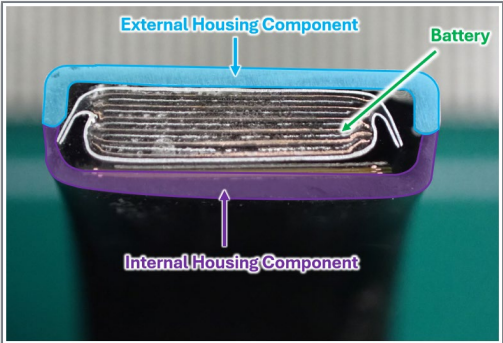
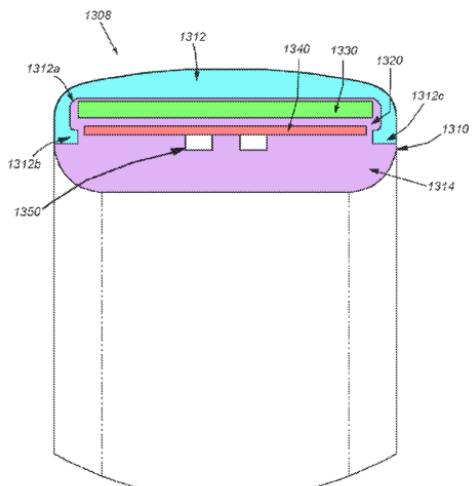
244. I understand that Ultrahuman Healthcare Pvt. Ltd. is an Indian Non-Government Company incorporated in India that manufactures a smart ring (Ultrahuman Ring AIR) that competes against Oura Ring. I also understand from counsel that Oura currently has a pending International Trade Commission Investigation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

245. As shown below in side-by-side comparison of Oura Ring Gen. 3 and Ultrahuman Ring AIR, Ultrahuman adopted the use of external housing and internal housing component of Oura Ring where the internal housing is made of internal potting to develop a directly competing product:



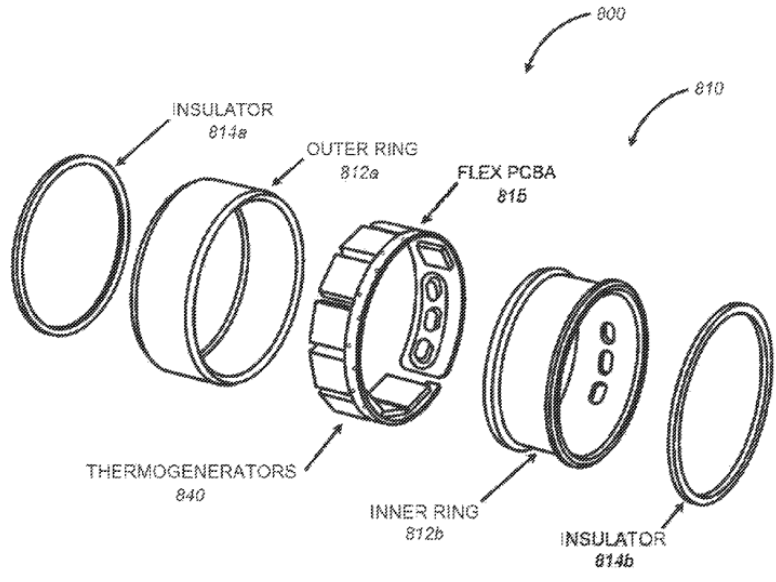


246. Oura Ring Gen. 3 and Ultrahuman ring both embody the disclosure of the '178 patent that shows **potting material** forming the internal housing component:

Oura	Ultrahuman
 Ex. 2029	 Ex. 2027
The '178 Patent	
 FIG. 13 '178 Patent (Ex-1001) at Fig. 13	

247. 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 '178 patent—

Ultrahuman simply reversing the orientation and changing the silver external housing to black:

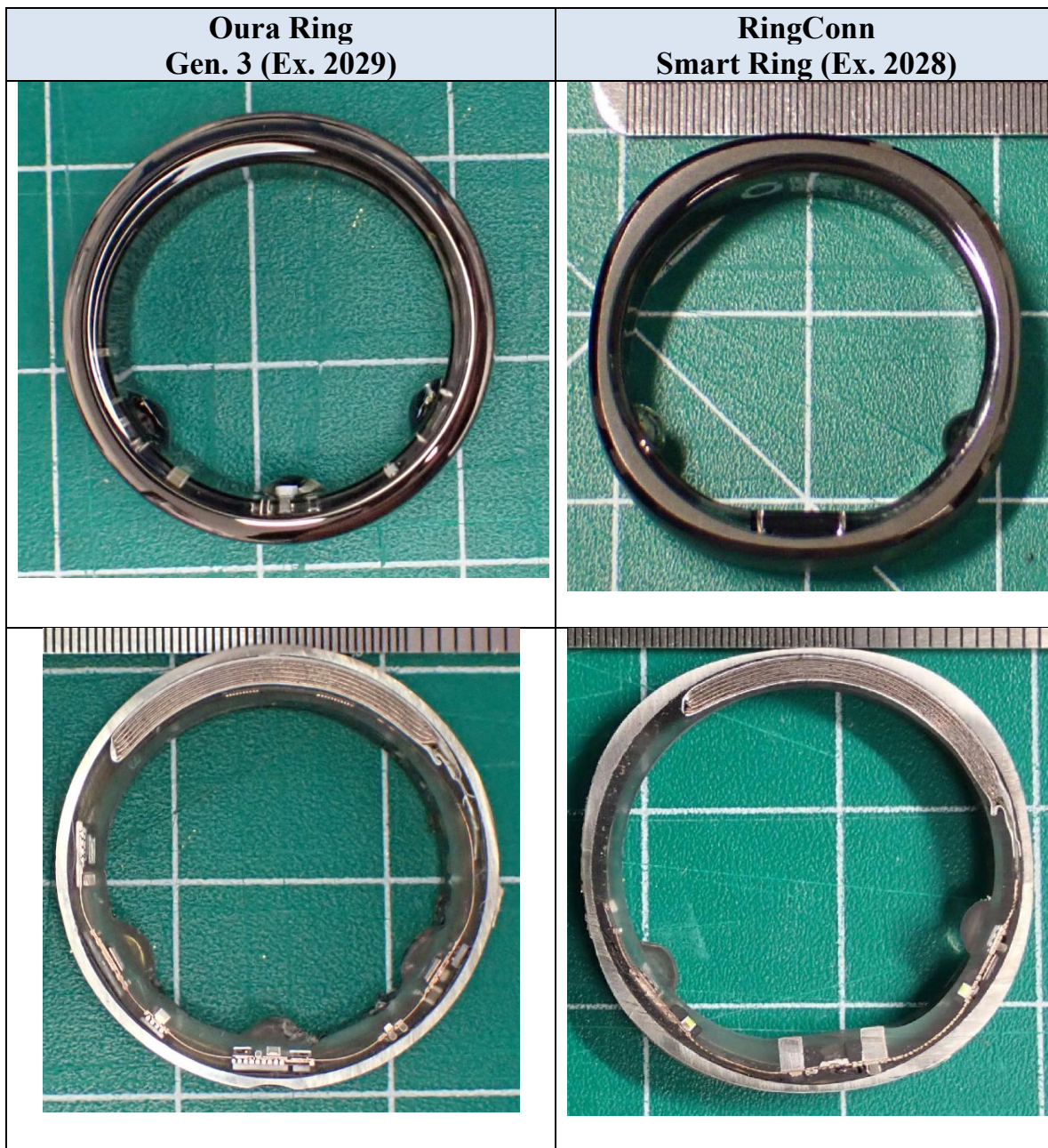
Oura	Ultrahuman
 Ex. 2032	 Ex. 2113
The '178 Patent	
 '178 Patent (Ex-1001) at Fig. 8	

248. 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—

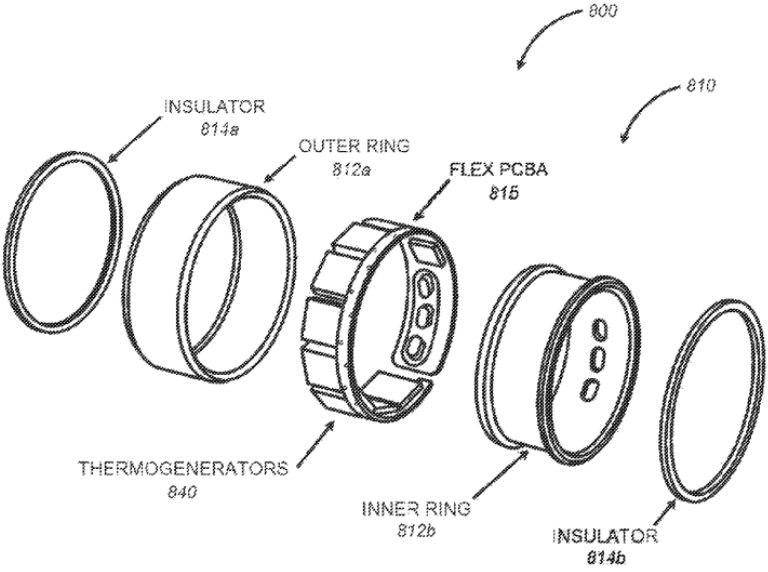
years before he founded Ultrahuman in 2019. Ex. 2024 (Kumar) 683:19-21, 686:15-24. Kumar bought a Gen. 2 product in 2018. *Id.* 685:16-24. Ultrahuman bought another 5-10 Oura Ring Gen. 3 for analysis later. *Id.* 692:19-693:8. And Ultrahuman's entire R&D team, including the hardware, software, and firmware teams, analyzed Oura Rings to learn their structure and design. *Id.* 695:1-21, 698:3-24. Ultrahuman also reviewed video teardowns of the Gen. 3 product. *Id.* 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. *Id.* 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

249. I understand from counsel that another respondent in the pending 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:



250. 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 '178 patent:

Oura	RingConn
 Ex. 2031	 Ex. 2114 at 8
The '178 Patent	
 '178 Patent (Ex-1001) at Fig. 8	

C. The '178 patent fulfilled a long felt need for a company and comfortable wearable finger ring.

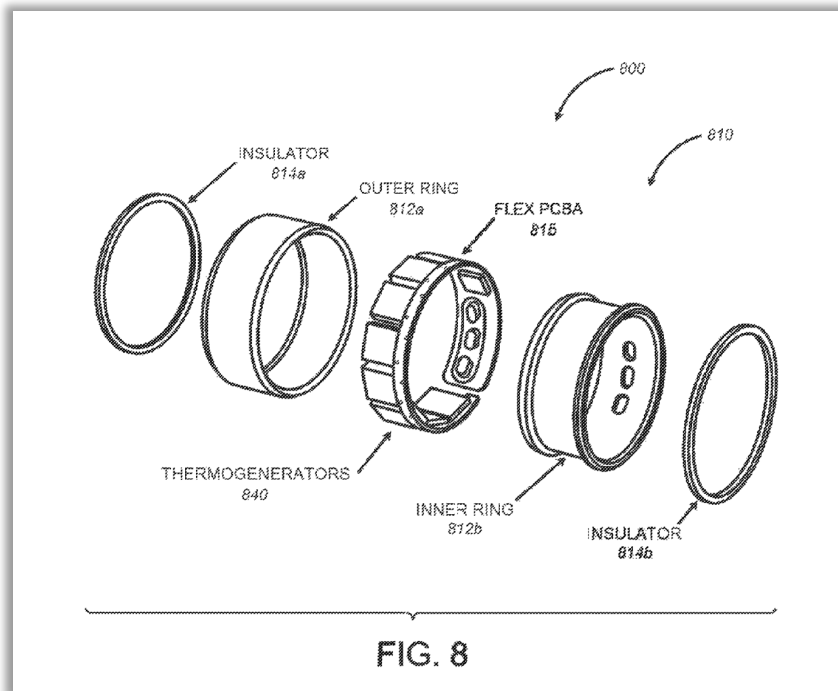
251. The world's leading wearable ring researcher Asada recognized the advantages a wearable ring has over wearables worn on other parts of the body a

decade prior to the '178 patent. Ex-1025 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 band, 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.”).

252. The development of wearable rings did not fulfill these needs until the '178 patent. The prior art largely followed Asada's lead, bunching components at the top of the ring in an attempt 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 battery atop 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.

253. Even Oura followed the Superbowl ring-type design with its first generation product, released after the priority date of the '178 patent. Ex. 2034. It

was not until the '178 patent that wedding band-like comfort and compactness were achieved with the following inventive design:



Ex-1001 at Fig. 8.

254. This arrangement finally satisfied the long felt need for a finger-ring wearable device that the user would actually want to wear around the clock. I personally was surprised that Oura managed to fit all the components and functionality into a wedding band-type ring. The satisfaction of this long felt need is validated by the considerable commercial success enjoyed by the commercial embodiment as well as competitors copying this layout in the market.

IX. SUPPLEMENTATION

255. 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.

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

Dr. Patrick Mercier

Dated: April 15, 2025

EXHIBIT B

Patrick Mercer Declaration Materials Considered

In addition to the materials I have cited in this Declaration, I also considered the following materials in connection with my opinions in this Declaration:

Hearing Transcripts

Inv. No. 337-TA-1398, Hearing Transcript Day 1 (p. 173-241) (Open Session), dated December 11, 2024

Inv. No. 337-TA-1398, Hearing Transcript Day 2 (p.288-611) (Open Session), dated December 12, 2024

Inv. No. 337-TA-1398, Hearing Transcript Day 3 (p. 612 - 882) (Open Session), dated December 13, 2024

Inv. No. 337-TA-1398, Hearing Transcript Day 4 (p. 833 - 1138) (Open Session), dated December 16, 2024

Inv. No. 337-TA-1398, Hearing Transcript Day 5 (p. 1139-1308) (Open Session), dated December 17, 2024

Deposition Transcripts

PGR2024-00030, Deposition Transcript of Brian W. Anthony, Ph.D., dated February 25, 2025

PGR2024-00030, Deposition Transcript of Brian W. Anthony, Ph.D., dated February 26, 2025

Filings

PGR2024-00030 Petition for Post Grant Review, dated May 31, 2024 Exhibits:

Exhibit 1001 - U.S. Patent No. 11,868,178 (“the ’178 Patent”)

Exhibit 1002 - Declaration of Dr. Brian W. Anthony

Exhibit 1003 - Curriculum Vitae of Dr. Brian W. Anthony

Exhibit 1004 - Prosecution History of the ’178 Patent (Application No. 18/323,385)

Exhibit 1005 - U.S. Patent Publication No. 20120016245 to Niwa (“Niwa”)

Exhibit 1006 - U.S. Patent No. 8,954,135 to Yuen (“Yuen”)

Exhibit 1007 - U.S. Patent No. 10,303,867 to Schröder (“Schröder”)

Exhibit 1008 - Certified Translation of DE 102013012339.9 to Schröder

- Exhibit 1009** - Original DE 102013012339.9 to Schröder
- Exhibit 1010** - U.S. Patent Publication No. 20140244009 to Mestas (“Mestas”)
- Exhibit 1011** - U.S. Provisional Patent Application No. 61/768,279 to Mestas
- Exhibit 1012** - U.S. Patent No. 8,700,111 to LeBoeuf (“LeBoeuf”)
- Exhibit 1013** - U.S. Patent Publication No. 20120218184 to Wissmar (“Wissmar”)
- Exhibit 1020** - Claim Mapping Table
- Exhibit 1022** - Parallel Citations (Schröder ’867 to Certified Translation of DE 102013012339.9)
- Exhibit 1023** - *Dynamic Drinkware*-type analysis for Mestas
- Exhibit 1024** - U.S. Patent No. 4,830,014 to Goodman (“Goodman”)
- Exhibit 1025** - U.S. Patent No. 6,745,061 to Hicks (“Hicks”)
- Exhibit 1026** - U.S. Patent No. 7,190,986 to Hannula (“Hannula”)
- Exhibit 1027** - Volker Konig et al., *Reflectance Pulse Oximetry – Principles and Obstetric Application in the Zurich System*, 14 Journal of Clinical Monitoring (Aug. 1998) (“Konig”)
- Exhibit 1028** - U.S. Patent No. 6,608,562 to Kimura (“Kimura”)
- Exhibit 1029** - Kevin K. Tremper et al., *Pulse Oximetry*, 70 Journal of American Society of Anesthesiologists, Inc. (Jan. 1989) (“Tremper”)
- Exhibit 1030** - Y. Mendelson et al., *A Wearable Reflectance Pulse Oximeter for Remote Physiological Monitoring*, Proceedings of 28th IEEE EMBS Annual International Conference (Aug. 30-Sept. 3, 2006) (“Mendelson 2006”)
- Exhibit 1031** - Sokwoo Rhee et al., *Artifact-Resistant, Power-Efficient Design of Finger-Ring Plethysmographic Sensors Part I: Design and Analysis*, IEEE (2000) (“Rhee 2000 Part I”)
- Exhibit 1032** - Sokwoo Rhee et al., *Artifact-Resistant, Power-Efficient Design of Finger-Ring Plethysmographic Sensors Part II: Prototyping and Benchmarking*, IEEE Proceedings of 22nd Annual EMBS Int’l Conference (July 23-28, 2000) (“Rhee 2000 Part II”)
- Exhibit 1033** - Sokwoo Rhee et al., *Artifact-Resistant Power-Efficient Design of Finger-Ring Plethysmographic Sensors*, 48 IEEE Transactions of Biomedical Engineering (July 2001) (“Rhee 2001”)

Exhibit 1034 - U.S. Patent No. 6,699,199 to Asada (“Asada ’199”)

Exhibit 1035 - Sokwoo Rhee, *Design and Analysis of Artifact-Resistive Finger Photoplethysmographic Sensors for Vital Sign Monitoring*, MIT (June 2000) (“Rhee Thesis 2000”)

Exhibit 1036 - C.T. Olofson et al., *Machining of Titanium Alloys* (1965) (“Olofson”)

Exhibit 1037 - H. Harry Asada et al., *Mobile Monitoring with Wearable Photoplethysmographic Biosensors*, IEEE Engineering in Medicine & Biology Magazine 28 (May-June 2003) (“Asada 2003”)

Exhibit 1038 - Denisse Castaneda et al., *A review on wearable photoplethysmography sensors and their potential future applications in health care*, Int J Biosens Bioelectron (2018)

Exhibit 1039 - U.S. Patent No. 7,468,036 to Rulkov et al. (“Rulkov”)

Exhibit 1040 - U.S. Patent Publication No. 2006/0211924 to Dalke et al. (“Dalke”)

Exhibit 1041 - *Guidelines To Enhancing The Heart-Rate Monitoring Performance Of Biosensing Wearables* (2014)

Exhibit 1042 - U.S. Patent No. 4,880,304 to Jaeb et al. (“Jaeb”)

Exhibit 1043 - Tom Lister et al., *Optical Properties of human skin*, Journal of Biomedical Optics (2012)

Exhibit 1044 - John G. Webster, *Design of Pulse Oximeters*, CRC Press (1997)

Exhibit 1045 - U.S. Patent Publication No. 20130211291 to Tran (“Tran”)

Exhibit 1046 - WO 2001/017421A1 to Lindberg (“Lindberg”)

Exhibit 1047 - WO 2011/132009 to Nyiradi (“Nyiradi”)

Exhibit 1048 - U.S. Patent Application Publication No. 2014/0361945 to Misra et al. (“Misra”)

Exhibit 1049 - U.S. Patent Application Publication No. 2014/0361934 to Ely et al. (“Ely”)

Exhibit 1050 - European Patent No. 2281205 (Chen)

Exhibit 1051 - Lawrence K. Au et al., *Episodic Sampling: Towards Energy-Efficient Patient Monitoring with Wearable Sensors*, Annual International Conference of the IEEE Engineering in Medicine and Biology Society (2009)

Exhibit 1052 - Anastasios Petropoulos et al., *Flexible PCB-MEMS flow sensor*, Procedia Engineering 47 236-239 (2012) (“Petropoulos”)

Exhibit 1053 - Tianjia Sun et al., *Wireless Power Transfer for Medical Microsystems*, Springer (2013) (“Sun”)

Exhibit 1054 - U.S. Patent Pub. No. 2014/0187160 to Prencipe (“Prencipe”)

Exhibit 1055 - H. Ardebili and Michael G. Pecht, *Encapsulation Technologies for Electronic Applications*, William Andrew (2009) (“Ardebili”)

Exhibit 1056 - Ciprian Ciofu et al., *Injection and Micro Injection of Polymeric Plastics Materials: A Review*, Int’l J. Modern Mfg. Techs. 49 (2013)

Exhibit 1057 - Richard J. Ross, *LCP Injection Molded Packages—Keys to JEDEC 1 Performance*, IEEE, 2004 Electronic Components and Technology Conference 1807 (2004)

Exhibit 1058 - Tadamoto Sakai, *Encapsulation Process for Electronic Devices Using Injection Molding Method*, 12 Advances in Polymer Technology 61 (1993)

Exhibit 1059 - N.J. Teh et al., *Embedding of Electronics within Thermoplastic Polymers using Injection Moulding Technique*, IEEE, 2000 Int’l Electronics Manufacturing Technology Symposium 10 (2000)

Exhibit 1060 - U.S. Patent No. 6,201,698 to Hunter (“Hunter”)

Exhibit 1061 - U.S. Patent No. 4,012,629 to Simms (“Simms”)