

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.
OURARING, INC.,
Patent Owner

Case No. PGR2024-00031
U.S. Patent No. 11,868,179

**PETITION FOR POST-GRANT REVIEW
OF U.S. PATENT NO. 11,868,179**

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LIST OF EXHIBITS¹

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Ex-1004	Prosecution History of U.S. Patent No. 11,868,179
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Ex-1007	U.S. Patent No. 10,303,867 to Schröder (“Schröder”)
Ex-1008	Certified Translation of DE 102013012339.9 to Schröder
Ex-1009	Original DE 102013012339.9 to Schröder
Ex-1010	U.S. Patent Publication No. 20140244009 to Mestas (“Mestas”)
Ex-1011	U.S. Provisional Patent Application No. 61/768,279 to Mestas
Ex-1012	U.S. Patent No. 8,700,111 to LeBoeuf (“LeBoeuf”)
Ex-1013	U.S. Patent Publication No. 20120218184 to Wissmar (“Wissmar”)
Ex-1014	INTENTIONALLY LEFT BLANK
Ex-1015	INTENTIONALLY LEFT BLANK
Ex-1016	INTENTIONALLY LEFT BLANK
Ex-1017	INTENTIONALLY LEFT BLANK
Ex-1018	INTENTIONALLY LEFT BLANK

¹ Four-digit pin citations that begin with 0 are to the page stamps added by Samsung in the bottom right corner of the exhibits. All other pin citations are to original page, column, paragraph, and/or line numbers.

Ex-1019	INTENTIONALLY LEFT BLANK
Ex-1020	Claim Mapping Table
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Ex-1023	INTENTIONALLY LEFT BLANK
Ex-1024	U.S. Patent No. 4,830,014 to Goodman (“Goodman”)
Ex-1025	U.S. Patent No. 6,745,061 to Hicks (“Hicks”)
Ex-1026	U.S. Patent No. 7,190,986 to Hannula (“Hannula”)
Ex-1027	Volker Konig et al., <i>Reflectance Pulse Oximetry – Principles and Obstetric Application in the Zurich System</i> , 14 Journal of Clinical Monitoring (Aug. 1998) (“Konig”)
Ex-1028	U.S. Patent No. 6,608,562 to Kimura (“Kimura”)
Ex-1029	Kevin K. Tremper et al., <i>Pulse Oximetry</i> , 70 Journal of American Society of Anesthesiologists, Inc. (Jan. 1989) (“Tremper”)
Ex-1030	Y. Mendelson et al., <i>A Wearable Reflectance Pulse Oximeter for Remote Physiological Monitoring</i> , Proceedings of 28 th IEEE EMBS Annual International Conference (Aug. 30-Sept. 3, 2006) (“Mendelson 2006”)
Ex-1031	Sokwoo Rhee et al., <i>Artifact-Resistant, Power-Efficient Design of Finger-Ring Plethysmographic Sensors Part I: Design and Analysis</i> , IEEE (2000) (“Rhee 2000 Part I”)
Ex-1032	Sokwoo Rhee et al., <i>Artifact-Resistant, Power-Efficient Design of Finger-Ring Plethysmographic Sensors Part II: Prototyping and Benchmarking</i> , IEEE Proceedings of 22 nd Annual EMBS Int’l Conference (July 23-28, 2000) (“Rhee 2000 Part II”)
Ex-1033	Sokwoo Rhee et al., <i>Artifact-Resistant Power-Efficient Design of Finger-Ring Plethysmographic Sensors</i> , 48 IEEE Transactions of Biomedical Engineering (July 2001) (“Rhee 2001”)

Ex-1034	U.S. Patent No. 6,699,199 to Asada (“Asada ’199”)
Ex-1035	Sokwoo Rhee, <i>Design and Analysis of Artifact-Resistive Finger Photoplethysmographic Sensors for Vital Sign Monitoring</i> , MIT (June 2000) (“Rhee Thesis 2000”)
Ex-1036	C.T. Olofson et al., <i>Machining of Titanium Alloys</i> (1965) (“Olofson”)
Ex-1037	H. Harry Asada et al., <i>Mobile Monitoring with Wearable Photoplethysmographic Biosensors</i> , IEEE Engineering in Medicine & Biology Magazine 28 (May-June 2003) (“Asada 2003”)
Ex-1038	Denisse Castaneda et al., <i>A review on wearable photoplethysmography sensors and their potential future applications in health care</i> , Int J Biosens Bioelectron (2018)
Ex-1039	U.S. Patent No. 7,468,036 to Rulkov et al. (“Rulkov”)
Ex-1040	U.S. Patent Publication No. 2006/0211924 to Dalke et al. (“Dalke”)
Ex-1041	<i>Guidelines To Enhancing The Heart-Rate Monitoring Performance Of Biosensing Wearables</i> (2014)
Ex-1042	U.S. Patent No. 4,880,304 to Jaeb et al. (“Jaeb”)
Ex-1043	Tom Lister et al., <i>Optical Properties of human skin</i> , Journal of Biomedical Optics (2012)
Ex-1044	John G. Webster, <i>Design of Pulse Oximeters</i> , CRC Press (1997)
Ex-1045	U.S. Patent Publication No. 20130211291 to Tran (“Tran”)
Ex-1046	WO 2001/017421A1 to Lindberg (“Lindberg”)
Ex-1047	WO 2011/132009 to Nyiradi (“Nyiradi”)
Ex-1048	U.S. Patent Application Publication No. 2014/0361945 to Misra et al. (“Misra”)
Ex-1049	U.S. Patent Application Publication No. 2014/0361934 to Ely et al. (“Ely”)
Ex-1050	European Patent No. 2281205 (Chen)

Ex-1051	Lawrence K. Au et al., <i>Episodic Sampling: Towards Energy-Efficient Patient Monitoring with Wearable Sensors</i> , Annual International Conference of the IEEE Engineering in Medicine and Biology Society (2009)
Ex-1052	Anastasios Petropoulos et al., <i>Flexible PCB-MEMS flow sensor</i> , Procedia Engineering 47 236-239 (2012) (“Petropoulos”)
Ex-1053	Tianjia Sun et al., <i>Wireless Power Transfer for Medical Microsystems</i> , Springer (2013) (“Sun”)
Ex-1054	U.S. Patent Pub. No. 2014/0187160 to Prencipe (“Prencipe”)
Ex-1055	H. Ardebili and Michael G. Pecht, <i>Encapsulation Technologies for Electronic Applications</i> , William Andrew (2009) (“Ardebili”)
Ex-1056	Ciprian Ciofu et al., <i>Injection and Micro Injection of Polymeric Plastics Materials: A Review</i> , Int’l J. Modern Mfg. Techs. 49 (2013)
Ex-1057	Richard J. Ross, <i>LCP Injection Molded Packages—Keys to JEDEC 1 Performance</i> , IEEE, 2004 Electronic Components and Technology Conference 1807 (2004)
Ex-1058	Tadamoto Sakai, <i>Encapsulation Process for Electronic Devices Using Injection Molding Method</i> , 12 Advances in Polymer Technology 61 (1993)
Ex-1059	N.J. Teh et al., <i>Embedding of Electronics within Thermoplastic Polymers using Injection Moulding Technique</i> , IEEE, 2000 Int’l Electronics Manufacturing Technology Symposium 10 (2000)
Ex-1060	U.S. Patent No. 6,201,698 to Hunter (“Hunter”)
Ex-1061	U.S. Patent No. 4,012,629 to Simms (“Simms”)

I. INTRODUCTION

Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. (collectively, “Petitioner”) request post-grant review (“PGR”) of Claims 1-16 of U.S. Patent No. 11,868,179 (“the ’179 Patent”) (Ex-1001), currently assigned to Ouraring, Inc., (“PO”).

II. MANDATORY NOTICES UNDER 37 C.F.R. §42.8

Real Parties-in-Interest: Petitioner identifies the following real parties-in-interest: Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc.

Related Matters: PO has asserted the ’179 Patent against Ultrahuman Healthcare Pvt., Ltd. and Ultrahuman Healthcare Ltd. in *Oura Health Oy et al. v. Ultrahuman Healthcare Pvt. Ltd., et al.*, Case No. 2:23-cv-396 (E.D. Tex.); the ’179 Patent was also against Circular SAS, Guangdong Jiu Zhi Technology Co. Ltd., RingConn LLC, Ultrahuman Healthcare Ltd., Ultrahuman Healthcare Pvt., Ltd., and Ultrahuman Healthcare SP LLC in *Smart Wearable Devices, Systems, and Components Thereof*, Inv. No. 337-TA-1398 (Int’l Trade Comm’n).

Petitioner has filed a suit against PO seeking a declaratory judgment of noninfringement of the ’179 Patent: *Samsung Electronics Corporation, Ltd. et al v. Ōura Health Oy et al.*, No. 3:24-cv-03245 (N.D. Cal. filed May 30, 2024). There are no invalidity claims and therefore no overlap with this petition.

For the Board’s convenience, Petitioner notes that Petitioner is challenging

the following five patents, U.S. Patent Nos. 11,868,178, 11,868,179, 11,599,147, 9,582,034, and 10,893,833. The '833 Patent claims substantially the same subject matter as the '147 Patent. The '178 and '179 Patents claim related subject matter. The '034 Patent is from the same family as the '178, '179, and '147 Patents.

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III. FEE AUTHORIZATION

Pursuant to 37 C.F.R. §42.15(a) and §42.103(a), the PTO is authorized to charge any and all fees to Deposit Account No. LA500639.

IV. GROUNDS FOR STANDING

Petitioner certifies that the '179 Patent is available for review, and Petitioner is not barred or estopped from requesting review

V. PRECISE RELIEF REQUESTED

Petitioner requests cancellation of Claims 1-16 of the '179 Patent under AIA 35 U.S.C. § 103 on the following grounds, supported by a declaration from Dr. Brian W. Anthony. Ex-1002 ¶¶1-34, 40-128; Ex-1003.

Ground	Summary
1	Claims 1-5 and 11-16 are obvious by Niwa (Ex-1005).
2	Claims 6-10 are obvious by Niwa in view of Yuen (Ex-1006).
3	Claims 15-16 are obvious by Niwa in view of Schröder (Ex-1007).
4	Claims 1-12 are obvious by Yuen.
5	Claims 1-10, 13-16 are obvious by Yuen in view of Schröder.
6	Claims 11-12 are obvious by Yuen in view of Niwa.

VI. THE CHALLENGED PATENT

The '179 Patent relates to wearable computing devices (WCD) that monitors activity within the wearer's body. Ex-1001, 1:39-40. As shown in Figure 3, the WCD can take the form of a ring, but can also take the form of a bracelet or other wearable accessory that is worn close to the skin. *Id.*, 8:66-9:7.

As shown in Figure 2, WCD 110 includes “a processor module 210, a plurality of sensor modules 220, a status indicator module 230, a power generation and management module 240, a communication module 250, a memory 260, and miscellaneous modules 270.” Ex-1001, 10:19-23.

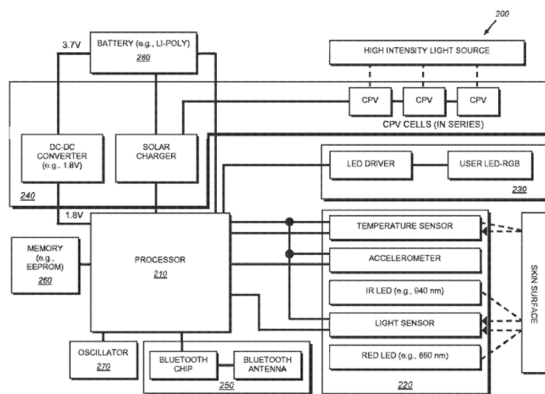


FIG. 2

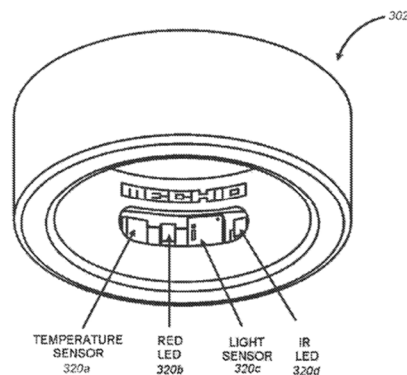


FIG. 3B

Id., Figs. 2-3B.

The '179 Patent states that the wearing computer device comprises sensor modules which can include various temperature and LED sensors. Ex-1001, 11:13-16. As shown in Figure 3B, “those sensors (e.g., sensors 320a-320d) which are directly related to biological sign monitoring 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.*, 11:16-20.

As discussed in further detail below, the challenged claims are obvious over prior art describing the same capabilities.

VII. PATENT PROSECUTION HISTORY

The '179 Patent was filed on May 24, 2023, and claims priority to a series of continuations and divisional applications to provisional App. No. 61/910,201 filed November 29, 2013. Ex-1001, Cover. The patent was granted prioritized examination and a first action Notice of Allowance was issued on September 21, 2023. Ex-1004, 0155, 1170.

VIII. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art at the relevant time (“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 person of ordinary skill in the art would have also been familiar with, for example, sensor system design and signal processing. This description is approximate, and a higher level of education or skill might make up for less experience, and vice versa. Ex-1002 ¶¶26-30.

IX. PRIORITY DATE

For purposes of this proceeding only, Petitioner applies the earliest alleged priority date of the '179 Patent, November 29, 2013. Accordingly, post-AIA 35 U.S.C. §102 applies.²

X. CLAIM CONSTRUCTION

Petitioner interprets the claims according to *Phillips*. 37 C.F.R. §42.100(b). To resolve this Petition, Petitioner does not believe that any term requires express construction.³ CTPG, 44; Ex-1002 ¶¶31-33.

XI. THE BOARD SHOULD NOT EXERCISE ITS DISCRETION UNDER §325(D) TO DENY HEARING THESE INVALIDITY ISSUES FOR THE FIRST TIME IN THIS PETITION

In considering its discretion under §325(d), “the Board uses the following two-part framework: (1) whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments

² Petitioner respectfully reserves the right to challenge the priority date in other proceedings, to the extent necessary.

³ There is a pending declaratory judgment action between PO and Petitioner. There are no invalidity claims and therefore no overlap with this petition. Should the circumstances regarding validity change, Petitioner will respectfully request leave to brief any discretionary denial issues, to the extent raised. Moreover Petitioner respectfully reserves all rights to raise claim construction and other arguments in district court and will request leave to submit the district court’s claim construction as soon as it becomes available. Additionally, should PO raise express or implied claim construction arguments in its Preliminary Response, Petitioner will respectfully seek a Preliminary Reply to respond. CTPG, 44-45 (permitting petitioner to respond to claim construction raised by patent owner).

previously were presented to the Office; and (2) if either condition of first part of the framework is satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims.” *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 at 8 (PTAB Feb. 13, 2020) (precedential).

Here, the first *Advanced Bionics* prong is not met. While the Yuen (Ex-1006) reference (Grounds 2-4) was listed in an Information Disclosure Statement (IDS), this would not be sufficient to satisfy the first prong of *Advanced Bionics*, because the record is silent as to the examiner’s consideration or understanding of Yuen’s teachings.⁴

Even if Yuen was considered as indicated by the IDS, under the second prong, which need not be reached, it was a material error for the examiner not to have considered the disclosures of Yuen. That is because Yuen, cited on an IDS with 139 other references (Ex-1004, 632-638), clearly teaches a “wearable electronic device” (Ex-1006, 2:7-8) with a “plurality” of light-emitting components each emitting a different wavelength (*id.*, 10:22-24), contrary to the Notice of

⁴ Although only a proposed rule, under the April 19, 2024 Notice of Proposed Rulemaking on discretionary denials, §325(d) is not applied to references not “meaningfully considered,” which is defined as situations “where the Office has evaluated the art or arguments and articulated its consideration of the art or arguments in the record of the application....”. 89 Fed. Reg. 28693, 28700 (Apr. 19, 2024).

Allowance providing the “wearable electronic device” with a “plurality of sensors comprising one or more light-emitting components that each emit two or more wavelengths, at least one associated with infrared light and one associated with visible light, along with one or more light receiving components” as a reason for the allowance. Ex-1004, 1175. Because the record is silent as to the examiner’s consideration and understanding of Yuen, the examiner must have overlooked it (assuming the examiner understood Claims 1-16 as being taught by the prior art) because Yuen teaches all of the claim limitations, alone or in combination with Niwa and/or Schröder. *See K/S HIMPP v. Bragi GmbH*, IPR2023-01205, Paper 8 at 20-21 (PTAB Mar. 19, 2024). In view of the foregoing, the Board should not exercise its discretion under §325(d) to deny institution because Niwa and Schröder were not before the office and alone render a majority of the claims unpatentable.

XII. BRIEF DESCRIPTION OF THE APPLIED PRIOR ART REFERENCES

A. Niwa (Ex-1005)

Niwa (U.S. Patent Publication No. 2012/0016245) was filed July 13, 2011, and published January 19, 2012. Niwa qualifies as prior art under at least AIA 35 U.S.C. §102(a)(1) and §102(a)(2). Petitioner is unaware of any facts supporting an exception under §102(b). Ex-1002 ¶¶132-134.

Niwa teaches a wearable electronic sensing device with light-emitting and

light-receiving components to acquire a plethysmogram—e.g., information relating to blood volume—of the wearer. *See* Ex-1005. Figures 22 and 26 depict Niwa’s ring-shaped device that surrounds “the ball side of the finger 2 (i.e., palm side) when the finger ring type housing 40 is worn” for the plethysmogram measurement. Ex-1005 ¶192.

FIG.22

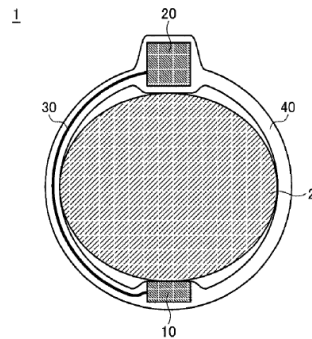
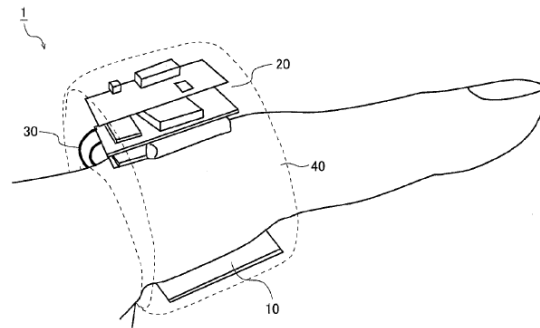


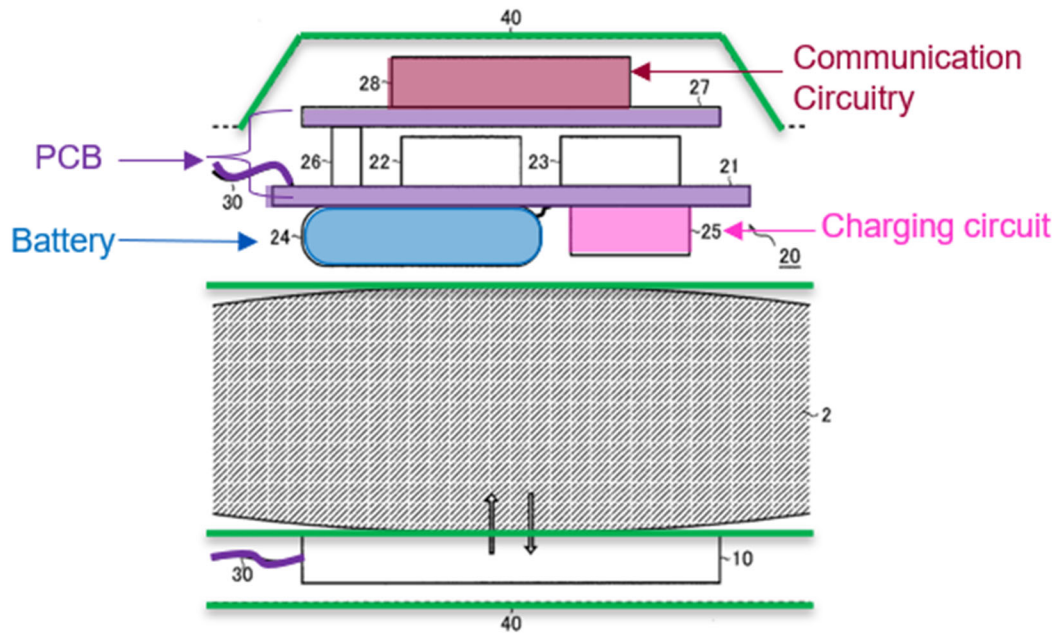
FIG.26



Id., Figs. 22, 26.

As shown below in Figure 28, cable 30 (purple) is disposed within finger ring type housing 40 to electrically connect first unit 10 and second unit 20. Ex-1005 ¶¶62, 194-95. Cable 30 may be a “FPC [Flexible Printed Circuits].” *Id.* ¶194. Niwa explains that second unit 20 “supplies” power to the first unit and includes battery 24 which is charged from an outside energy source by charging circuit 25. *Id.* ¶¶62, 193, 213, 218.

FIG.28

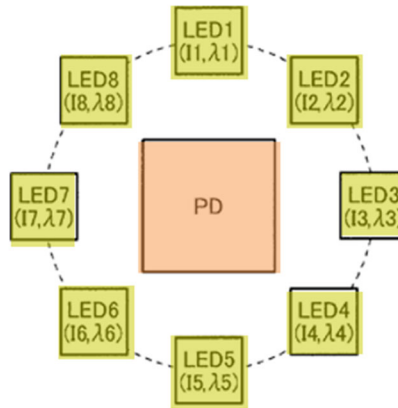


Id., Fig. 28.⁵

Niwa also teaches various configurations for light-emitting portions (e.g., wavelengths) and light-receiving portions (e.g., positions) in the first unit 10. Ex-1005 ¶¶120, 147. As shown below in Figure 3, each LED is associated with an output wave length denoted as $\lambda 1$ to $\lambda 8$ and are values different from one another and each LED is placed at different radial positions. *Id.* ¶147.

⁵ Throughout this Petition, all annotations and emphasis have been added, unless otherwise noted.

FIG.3

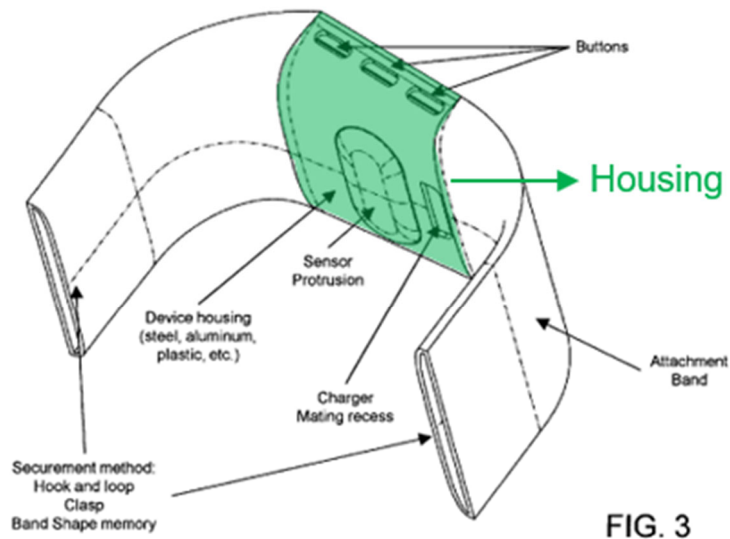


Id., Fig. 3.

B. Yuen (Ex-1006)

Yuen (U.S. Patent No. 8,954,135) was filed June 24, 2013, and issued February 10, 2015. Yuen qualifies as prior art under at least AIA 35 U.S.C. §102(a)(2). Petitioner is unaware of any facts supporting an exception under §102(b). Ex-1002 ¶¶136-139.

Yuen teaches a biometric monitoring device, depicted in Figure 4 below, configured to be worn on an appendage of the user's body, for example, on the user's "arm, wrist, leg and/or ankle." Ex-1006, 12:50-52. Yuen biometric monitoring device has a housing (green) that "may [] consist of a metal material (for example, steel, stainless steel, aluminum, magnesium, or titanium)." *Id.*, 14:33-37.



Id., Fig. 3. Inside the housing of Yuen’s device is “an optical sensor having one or more light sources” (such as LEDs) that emit “light into the user’s body” and light detectors (such as photodiodes and/or phototransistors) that “sample, measure and/or detect a response or reflection” from the user’s body, which is used by a PPG [photoplethysmography] to determine the user’s stress level, blood pressure and/or heart rate. *Id.*, 6:23-31. The LEDs, photodetectors, and other electronics may be provided on a [regular] or a flexible PCB. *Id.*, 2:38-39, 12:35-42.

As shown in Figure 11, Yuen further describes “a plurality of photodetectors and photoemitters [yellow] placed along the circumference of the interior of the band.” Ex-1006, 19:8-10.

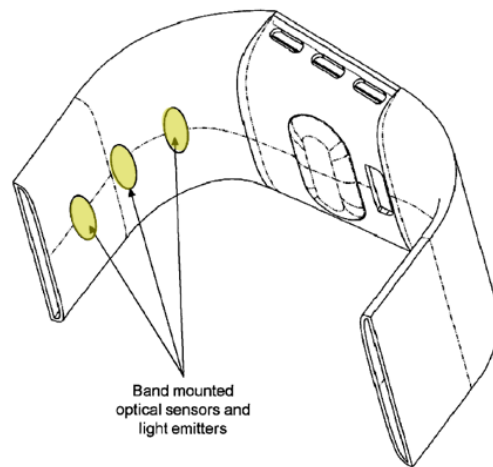


FIG. 11

Ex-1006, Fig. 11.

C. Schröder (Ex-1007)

Schröder (U.S. Patent No. 10,303,867) was filed January 25, 2016 as the U.S. national stage application of International Patent Application PCT/EP2014/001693 filed June 18, 2014, which claims priority to foreign application DE 102013012339 filed July 25, 2013. Schröder qualifies as prior art under AIA 35 U.S.C. §102(a)(2). Petitioner is unaware of any facts supporting an exception under §102(b). Schröder's German counterpart is essentially identical to the U.S. filing. *See generally* Ex-1007 (U.S. issued patent); Ex-1009 (German application); Ex-1008 (certified translation of German application). The figures are identical, and the specification is equivalent. Ex-1002 ¶¶139-141. Because the described subject matter is identical, Schröder's '867 Patent should be considered to have been effectively filed as of its German priority date of July 25, 2013,

because the '867 Patent is entitled to claim a right of priority to DE 102013012339 under §365. AIA 35 U.S.C. §102(a)(2) and (d)(2); MPEP §2152. Ex-1002 ¶¶140-142.

Schröder teaches a biometric sensing device, depicted in Figures 1 and 5 below, which is a finger ring “worn by a user, e.g., permanently on the finger.” Ex-1007, 3:61-63,⁶ Fig. 1 (finger ring 2 communicating with smartphone 4); Ex-1008, 8:4-5, Fig. 1.

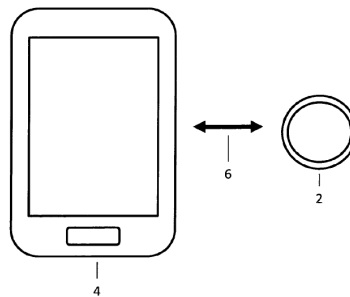


Fig. 1

As shown in Figure 7 below, Schröder’s finger ring consists of “two ring halves 16 and 18” with a recess so that “inlay 12 is inserted.” Ex-1007, 12:7-9. Inlay 12 consists of “flexible carrier material” like PET and Kapton (*id.*, 12:28-29) and can have a “chip module 10 with at least one antenna coil 8.” *Id.*, 12:61-65. Schröder explains that a battery powers chip module 10 and is charged wirelessly. *Id.*, 11:46-50, 11:55-56. Schröder’s finger ring also has “biometric sensors” such

⁶ Parallel citations to Schröder’s German counterpart for all Schröder ’867 Patent citations herein are provided in Ex-1022.

as an infrared diode and sensor to “capture[] e.g., at least a partial vein image in the finger while the finger-ring 2 is being pushed over a finger.” *Id.*, 9:62-10:4.



Fig. 7

XIII. DETAILED EXPLANATION OF THE UNPATENTABILITY GROUNDS

A. Ground 1: Claims 1-5 and 11-16 Are Obvious Over Niwa (Ex-1005)

1. Independent Claim 1

a. Element 1[pre]: A wearable computing device, comprising:

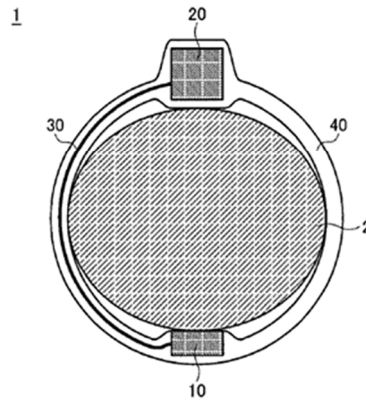
Niwa teaches⁷ the preamble of Claim 1, to the extent it is limiting. Ex-1002

¶¶143-144.

As shown in Figure 22 below, Niwa’s plethysmogram sensor 1 has a “finger ring construction” to be “worn on the third joint of the finger 2.” Ex-1005 ¶191.

⁷ Petitioner uses the term “teaches” as including both express teachings or those fairly suggested to a person of ordinary skill in the art. *In re Baird*, 16 F.3d 380, 383 (Fed. Cir. 1994); *In re Keller*, 642 F.2d 413, 425 (CCPA, 1981) (“The test for obviousness is...what the combined teachings of the references would have suggested to those of ordinary skill in the art.” (citations omitted))

FIG.22



Id., Fig. 22.

b. Element 1[a]: a housing comprising an interior wall and an exterior wall of the wearable computing device

Niwa teaches Element 1[a]. Ex-1002 ¶¶145-148.

As shown in Figures 22 and 27 below, Niwa’s plethysmogram sensor provides a “finger ring type housing 40 [green].” Ex-1005 ¶191. The finger ring housing has an interior wall that surrounds “the ball side of the finger 2 (i.e., palm side) when the finger ring type housing 40 is worn” for the plethysmogram measurement. *Id.* ¶192. Niwa explains that the finger ring housing “cover[s]” the interior components within the ring. *Id.* ¶201. A POSITA would have understood that the wall surrounding finger 2 is the interior wall and the wall exposed to the environment, the outward facing surface of housing 40, is the exterior wall. Ex-

1002 ¶¶146-147. Accordingly, Niwa's plethysmogram sensor provides a finger ring type housing with an interior wall and exterior wall. *Id.*

FIG.22

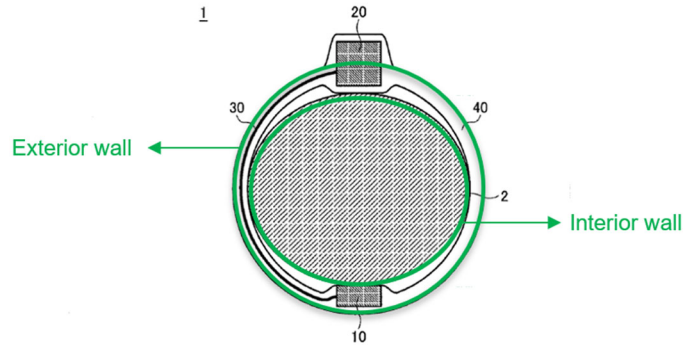
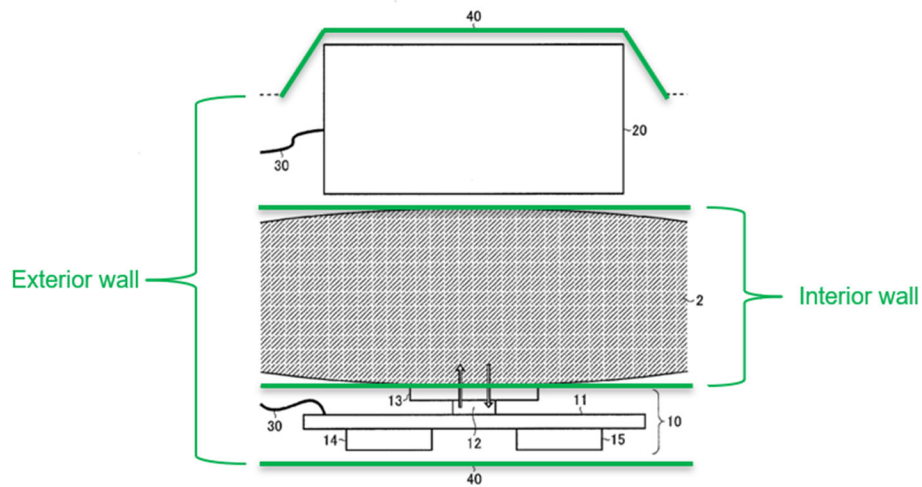


FIG.27



Id., Figs. 22, 27.

- c. **Element 1[b]: a printed circuit board disposed within the housing;**

Niwa teaches Element 1[b]. Ex-1002 ¶¶149-151.

As shown below in Figures 27 and 28, Niwa's substrates (purple) are printed circuit boards with various sensors and circuits "mounted" to their surfaces. Ex-1005 ¶¶68-69, 194, 200, 214, 219; Ex-1002 ¶¶150-151. Moreover, cable 30 "include[s]..., FPC [Flexible Printed Circuits]" and is connected to the substrates to establish an electrical connection between first unit 10 and second unit 20 "contained within the finger ring type housing 40." *Id.* ¶¶29, 62, 194-95.

FIG.27

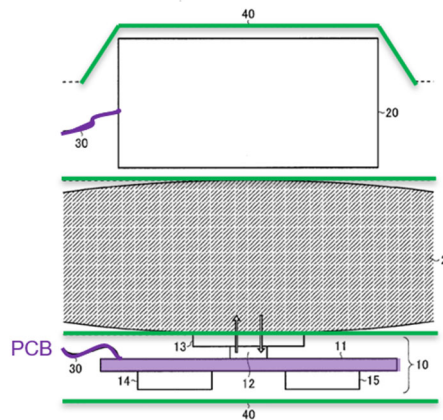
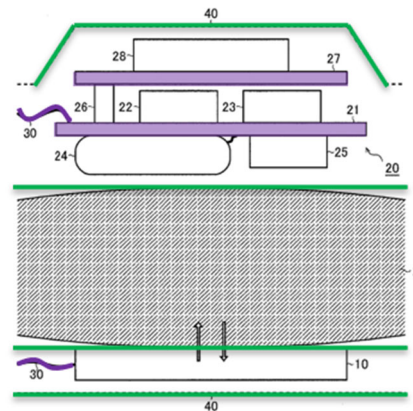


FIG.28



Id., Figs. 27, 28.

- d. **Element 1[c(i)]: a plurality of sensors electrically coupled with the printed circuit board, the plurality of sensors configured to acquire data from a user, the plurality of sensors comprising:**

Niwa teaches Element 1[c(i)]. Ex-1002 ¶¶152-156.

Niwa's first unit 10, which measures the plethysmogram, has various sensors and circuits "mounted" to substrate 11 (purple) (the claimed printed circuit board). Ex-1005 ¶¶68-69, 194, 200, 214, 219.

As shown in Figures 3 and 27, Niwa's first unit 10 includes light sensor 12 to acquire data from a plurality of sensors "[b]y means of emitting the light from the *light emitting portion* to the third joint of the finger 2 and detect[ing] the intensity of the light which penetrates the living body by the *light receiving portion*." Ex-1005 ¶209.

FIG.27

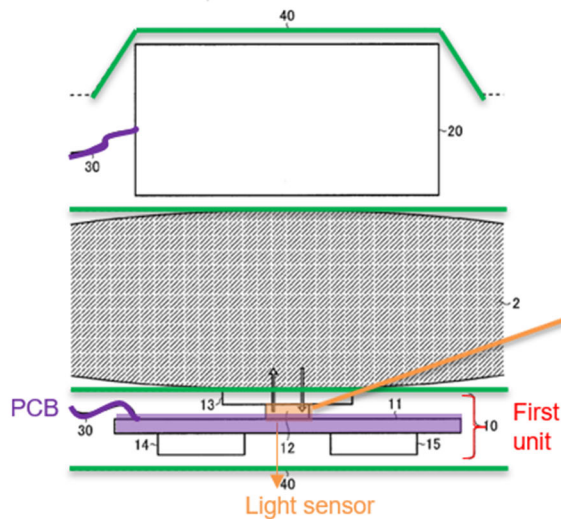
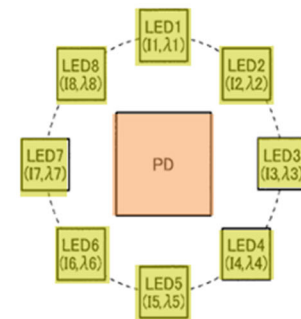


FIG.3



Id., Figs. 3, 27. Although Figure 3 shows the arrangement of one light sensor module 12, Niwa explains that module 12 is not restricted to this construction. *Id.* ¶164. Niwa teaches in Figure 14 that several light sensor modules (i.e., each surrounded by a dotted rectangle) can be provided at different locations, each module being constructed with the light emitting portion “LED#” and the light

receiving portion “PD#” as shown in Figures 14 and 27. *Id.*, see also Figs. 15A-16B.

FIG.27

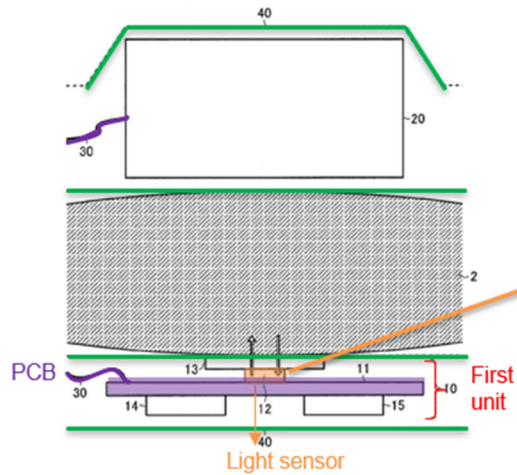
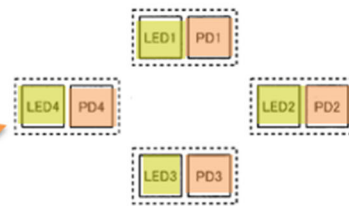


FIG.14



Id., Figs. 14, 27.

- e. **Element 1[c(ii)]: one or more light-emitting components configured to emit light associated with two or more wavelengths, wherein the two or more wavelengths include a first wavelength associated with infrared light and a second wavelength associated with visible light; and**

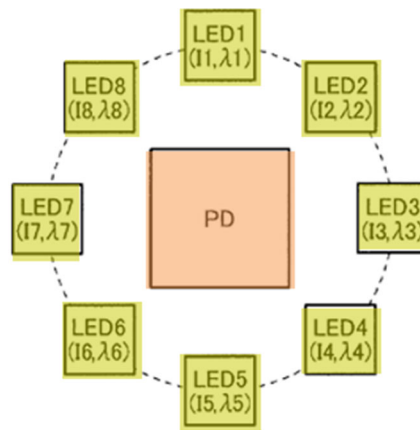
Niwa teaches Element 1[c(ii)]. Ex-1002 ¶¶157-164.

As discussed in the previous section, Niwa’s light sensor 12 acquires data “[b]y means of emitting the light from the light emitting portion to the third joint of the finger [] and detect[ing] the intensity of the light which penetrates the living body by the light receiving portion.” Ex-1005 ¶209. Figure 3 illustrates the

plethysmogram sensor's "light emitting portion and the light receiving portion."

Id. ¶120.

FIG.3



Id., Fig. 3. Niwa's light emitting portion has "eight light emitting portions LED1 to LED8 (i.e., a light emitting diode) [yellow] equally spaced from one another and placed on a circumference." *Id.* ¶120. Each LED is associated with an output wavelength denoted as $\lambda 1$ to $\lambda 8$ and "are values different from one another (i.e., from a visible light region to a near-infrared region)." *Id.* ¶147. A POSITA would have understood that Niwa's near-infrared LED emits infrared light because the infrared radiation of the electromagnetic spectrum is usually divided into three regions; the near-, mid- and far- infrared light. Ex-1002 ¶¶160, 161-164.

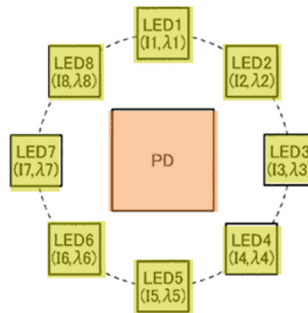
As discussed in Section XIII.A.1.d, the plethysmogram sensors in Figure 3 can include several light sensor modules constructed with the light emitting portion LED and the light receiving portion PD provided at different places. Ex-1005 ¶164. Niwa explains that “the number of the light emitting portions is simply an example” and a number other than eight can be adopted. *Id.* ¶120. In view of the non-limiting example, a POSITA would have understood that Niwa can have two or more LEDs that emit light at different wavelengths including visible light to near-infrared and can include an additional LED associated with infrared light in order to offset noise and improve the sensor’s readings. Ex-1002 ¶161.

f. Element 1[c(iii)] one or more light-receiving components configured to receive the light associated with the two or more wavelengths;

Niwa teaches Element 1[c(iii)]. Ex-1002 ¶¶165-167.

As shown in Figure 3, Niwa’s plethysmogram sensor “includes a single light receiving portion PD (i.e., a photo diode or a photo transistor) [orange].” Ex-1005 ¶120. Niwa’s sensor receives light from the “eight light emitting portions LED1 to LED8 (i.e., a light emitting diode) [yellow] equally spaced from one another and placed on a circumference with a central focus on the light receiving portion PD.” *Id.*

FIG.3



Id., Fig. 3. Niwa teaches that light receiving portion PD is configured to receive each wavelength of light associated with each of the LED1 to LED8 sequentially at intervals:

[T]he light emitting portions LED1 to LED8 with different output wave lengths are turned ON sequentially for several laps, *the intensities of the lights which penetrate the body emitted from the respective light emitting portions LED1 to LED8 and go back to the light receiving portion PD are acquired separately* as the first cycle measured values DATA1-1(t) to DATA8-1(t), as the second cycle measured values DATA1-2(t) to DATA8-2(t), and as the third cycle measured values DATA1-3(t) to DATA8-3(t).

Id. ¶156.

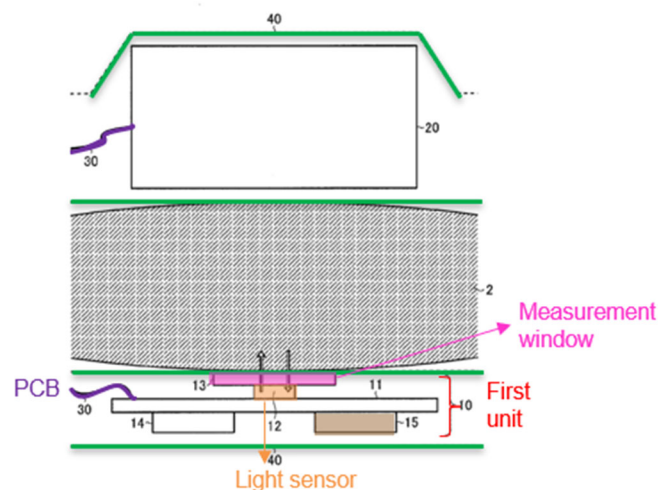
- g. Element 1[d]: one or more processors configured to process the data acquired by the plurality of sensors based at least in part on a reflectance, an absorbance, or both of the received light associated with the two or more wavelengths; and**

Niwa teaches Element 1[d]. Ex-1002 ¶¶168-171.

Niwa's plethysmogram sensor includes processing circuit 15 (below, brown) which "controls [the] entire operation of the plethysmogram sensor" and acquires

and processes various information about the plethysmogram of the user based on a measured value from the light receiving portion. Ex-1005 ¶212. As illustrated in Figure 27 below, when the user's finger is pressed to the measurement window (pink) and the light emitting and receiving portions are provided at the same side against the finger, the LED's light is emitted with an intensity to penetrate through the finger's tissue. *Id.* ¶¶117, 209. Niwa explains that the light is reflected, and the reflected light is detected by the light receiving portion. *Id.* This construction is called a "reflection type" and allows the light receiving portion to detect the amount of light absorbed by the user's peripheral arterial to acquire the value of the absorption coefficient. *Id.* ¶209. The processing circuit extracts the output intensities of the light emitting portion and "adopts a sum value or an average value as the pulse intensity." *Id.* ¶46.

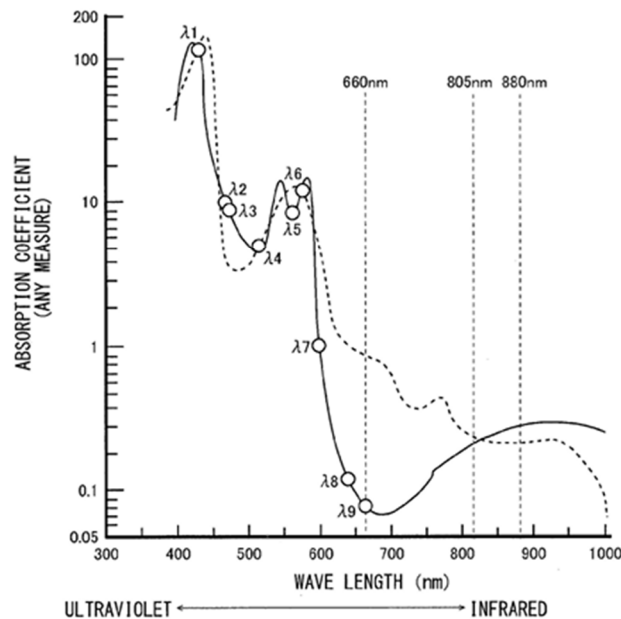
FIG.27



Id., Fig. 27.

As shown in Figure 18, there is relationship between the wavelength of the light from the LEDs and the absorption coefficient of oxyhemoglobin HbO₂. Ex-1005 ¶169. Niwa explains that it is easier to use “the visible light region whose wave length is shorter than or equal to 600 nm as the output wave length of the light emitting portion.” *Id.* ¶170.

FIG.18



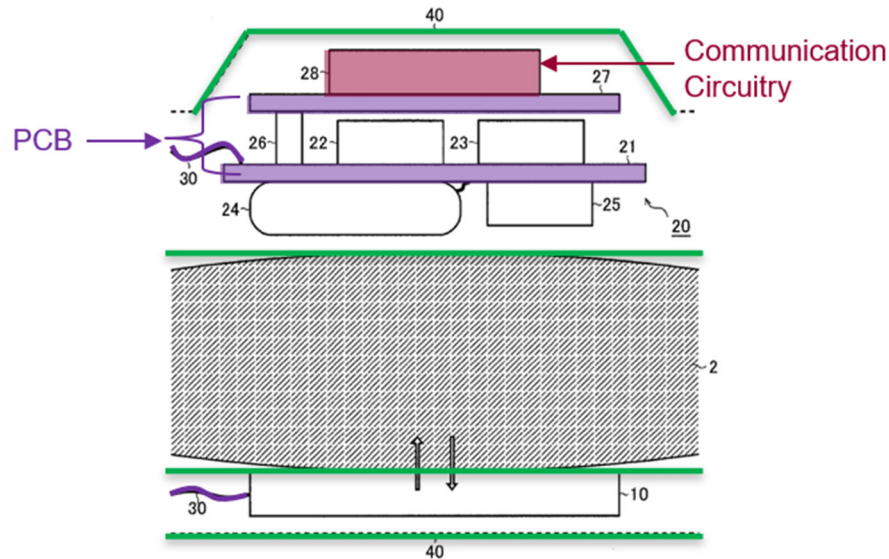
Id., Fig. 18.

- h. Element 1[e]: a communication module communicatively coupled with the plurality of sensors, the one or more processors, or both, the communication module configured to transmit the data acquired by the plurality of sensors, an analysis of the data generated by the one or more processors, or both, to a user device.**

Niwa teaches Element 1[e]. Ex-1002 ¶¶172-173.

Niwa's finger ring housing has wireless communication circuit 28 in second unit 20 that "transmits the measurement data acquired at the first unit 10" such as "the raw data provided from the amplifier circuit 14, the processed data various processes has performed at the processing circuit 15, or the stored data provided from the memory 23" to an outside apparatus such as a user's personal computer or a cell phone. Ex-1005 ¶¶185, 220. The wireless communication circuit can use a "Bluetooth (the registered trademark) module IC." *Id.* As described above, cable 30 "connect[s] the first unit and the second unit electrically." *Id.* ¶62. Therefore, the communication circuitry in second unit 20 is electrically "coupled" to the plurality of sensors and processor in the first unit 10 by cable 30 to transmit the data acquired from the sensor and processed by the processing circuit 15 to an external device. Ex-1005, Fig. 28; Ex-1002 ¶173.

FIG.28



2. Dependent Claims 2-5 and 11-16

- a. **Claim 2: The wearable computing device of claim 1, wherein the one or more light-emitting components comprise a first light-emitting component configured to emit light associated with the first wavelength, a second light-emitting component configured to emit light associated with the second wavelength, and a third light-emitting component configured to emit light associated with a third wavelength, wherein the first light-emitting component, the second light-emitting component, and the third light-emitting component are physically separated from one another.**

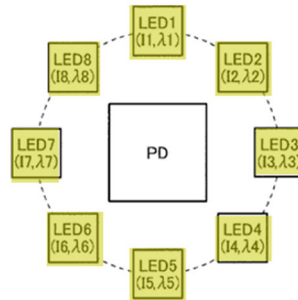
Niwa teaches Claim 2. Ex-1002 ¶¶174-175.

As discussed in Section XIII.A.1.e (Element 1[c(ii)]), Niwa's plethysmogram sensor has "eight light emitting portions LED1 to LED8 (i.e., a

light emitting diode) equally spaced from one another and placed on a circumference with a central focus on the light receiving portion PD.” Ex-1005

¶120. Niwa explains that each LED is associated with an output wavelength denoted as $\lambda 1$ to $\lambda 8$ which “different from one another (i.e., from a visible light region to a near-infrared region).” *Id.* ¶147. Niwa also explains that “the number of the light emitting portions is simply an example” and a number other than eight can be adopted. *Id.* ¶120. In view of the non-limiting example, a POSITA would have understood that Niwa can have two or more LEDs that emit light at different wavelengths including visible light to near-infrared in order to offset noise and improve the sensor’s readings. Ex-1002 ¶175. Thus, a POSITA would have understood the Niwa’s LEDs are configured to have a first wavelength associated with infrared light, a second wavelength associated with visible light, and an LED associated with a third wavelength in order to gather various body information of the user. Ex-1002 ¶175; Ex-1005 ¶118.

FIG.3



Id., Fig. 3.

- b. **Claim 3: The wearable computing device of claim 1, wherein the one or more light-emitting components comprise a single light-emitting module configured to emit the light associated with the first wavelength, the second wavelength, and a third wavelength.**

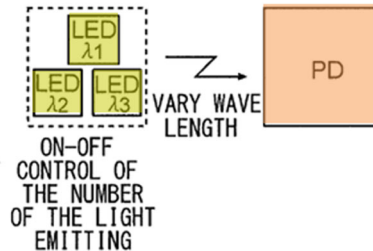
Niwa teaches Claim 3. Ex-1002 ¶¶176.

As described above in Section XIII.A.1.e (Element 1[c(ii)]), light sensor module 12 has eight LED emitters, emitting light of eight different wavelengths.

Id. Niwa also explains that “the number of the light emitting portions is simply an example” and a number other than eight can be adopted. Ex-1005 ¶120.

Moreover, Figure 16B, Niwa illustrates a “single light emitting portion” associated with several light emitting elements (LEDs) with different output wavelengths. *Id.* ¶167.

FIG.16B



Id., Fig. 16B.

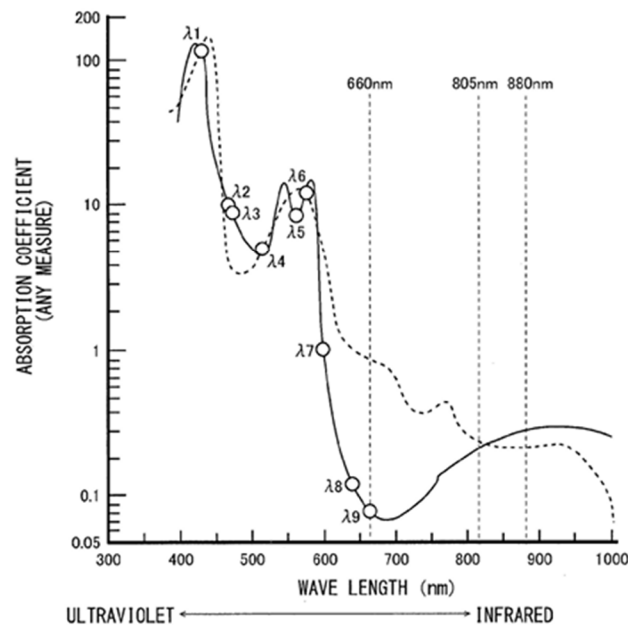
- c. **Claim 4: The wearable computing device of claim 1, wherein the one or more processors are further configured to: determine a first absorbance of the first wavelength, and a second absorbance associated with the second wavelength; and determine one or more characteristics of blood of the user based at least in part on the first absorbance and the second absorbance.**

Niwa teaches Claim 4. Ex-1002 ¶¶177-178.

Niwa's processor determines an absorbance of the first and second wavelengths. *Id.* As discussed in Section XIII.A.1.g (Element 1[d]), Niwa's plethysmogram sensor includes processing circuit 15 that acquires and processes various information about the plethysmogram sensor, such as the absorption coefficient. Ex-1005 ¶¶169, 212. A POSITA would have understood that the absorption coefficient determines how far a particular wavelength of light can penetrate through the body before it is absorbed. Ex-1002¶177. As shown in Figure 18, a POSITA would have understood that Niwa's first wavelength λ_1 is

associated with a first absorbance coefficient (e.g., 100) and Niwa's second wavelength $\lambda 2$ is associated with a second absorbance coefficient (e.g., 10). *Id.*

FIG.18



Ex-1005, Fig. 18.

Based on the absorbance of the first or second wavelengths, Niwa's determines a characteristic of the user's blood. Specifically, the solid line of Niwa's Figure 18 illustrates the relationship between the "LED wave length and the absorption coefficient" of oxyhemoglobin (HbO_2) detected by the plethysmogram sensor. Ex-1005 ¶169. Based on the oxyhemoglobin absorption coefficients, "the oxygen saturation of the arterial blood" of the user can be

determined. *Id.* ¶¶170, 190. As the next claim demonstrates, oxygen saturation (oxygenation) is a characteristic of the blood.

- d. Claim 5: The wearable computing device of claim 4, wherein the one or more characteristics of the blood of the user comprise a blood alcohol level, a blood glucose level, a blood oxygenation level, or any combination thereof.**

Niwa teaches Claim 5. Ex-1002 ¶179.

As discussed in the previous section, the absorbance coefficients are used to determine a characteristic of the blood's oxygenation level: "pulse oxymeter to detect the oxygen saturation of the arterial blood." Ex-1005 ¶170.

- e. Claim 11: The wearable computing device of claim 1, wherein the wearable computing device comprises a finger-worn wearable ring device, wherein the one or more light-emitting components comprise a first light-emitting component positioned within the housing of the finger-worn wearable ring device at a first radial position, and a second light-emitting component positioned within the housing of the finger-worn wearable ring device at a second radial position different from the first radial position.**

Niwa teaches Claim 11. Ex-1002 ¶¶180-186.

Niwa's plethysmogram sensor is a "finger ring" "worn on the third joint of the finger 2." Ex-1005 ¶191. As discussed in Sections XIII.A.1.e-f (Element 1[c(ii)] and 1[c(iii)]), Niwa's finger ring housing has a light emitting portion with eight light emitting components (LED1 to LED8) centrally focused around the light receiving portion PD as shown in Figure 3. Ex-1005 ¶120, Fig. 3.

Niwa's light sensor 12 (the claimed light emitting component) has various light emitting components at different radial positions because Niwa describes Figure 3 as the "Layout of the Light Emitting Portion and the Light Receiving Portion" of the first unit's light sensor 12. Ex-1005 ¶120. As shown below in Figure 27 and Figure 3, the first unit 10 which houses the light sensor 12 (annotated), faces the user's skin (finger 2). *Id.* ¶¶50, 200. Light sensor 12, which is part of first unit 10, "can be located at the vicinity of the finger 2 as much as possible" to improve measurement accuracy. *Id.* ¶208. A POSITA would have understood that the light sensor (or any PPG sensor) would be placed tangentially or flushed against the user's finger. Ex-1002 ¶182.

FIG.27

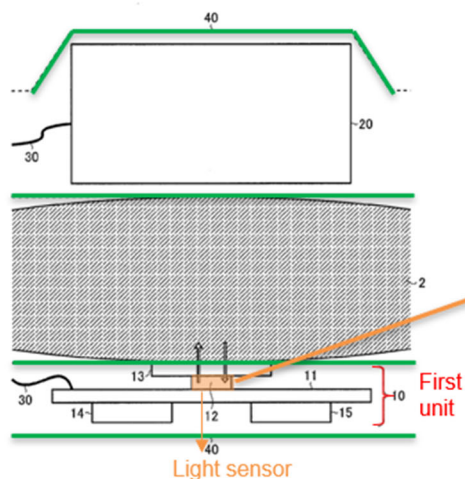
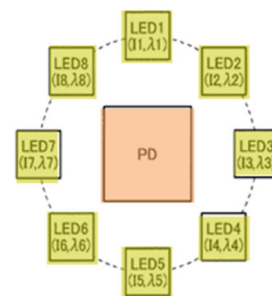


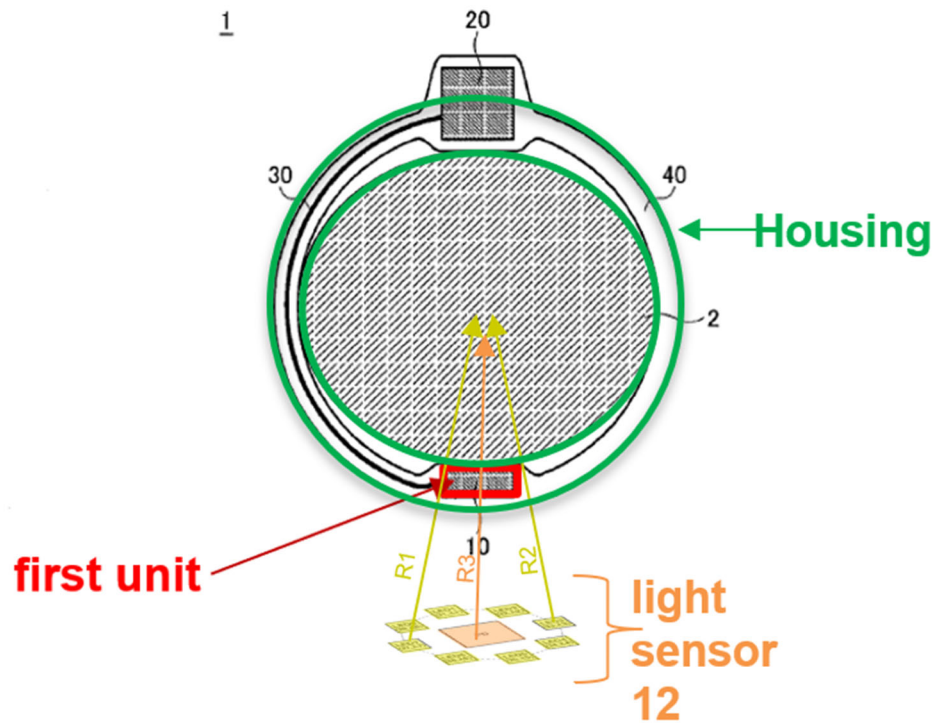
FIG.3



Modified Figure 22' below superimposes the light emitting components and photodetector of Figure 3 in the light emitting portion first unit 10's light sensor

12. Ex-1002 ¶183. As annotated in modified Figure 22', Niwa's LED7 (yellow) is positioned at a first radial position (R1) and LED3 (yellow) is positioned at a second radial position (R2) within the housing of the sensor (green). *Id.* A POSITA would have understood LED7 and LED3 are positioned at different radial positions because the LEDs are located at different circumferential positions along the curve of the ring, (i.e., the claimed "radial position"), just like the in '179 Patent. Ex-1001, Figs. 3B, 3C. Ex-1002 ¶183. A POSITA would have further understood that the LEDs would be at different radial positions because separation between the LEDs is important to enhance the quality of the plethysmogram signal and for redundancy within the device. Ex-1002 ¶183. A POSITA would have also understood that other LEDs in this specific orientation or variations would be in different radial positions. *Id.* Further, a POSITA would have been motivated to have the LEDs in a central circumference and away from the edges of the device, prevents light leakage from visible LEDs and interference from ambient light. *Id.*

As explained above, the LEDs are arranged to emit different wavelengths. *See* Section XIII.A.1.e (element 1[c(ii)]). Thus, a POSITA would have understood to have an LED that emits infrared light be positioned at a different radial position than an LED that emits visible light in order to capture different segments of tissues or for redundancy. Ex-1002 ¶186.



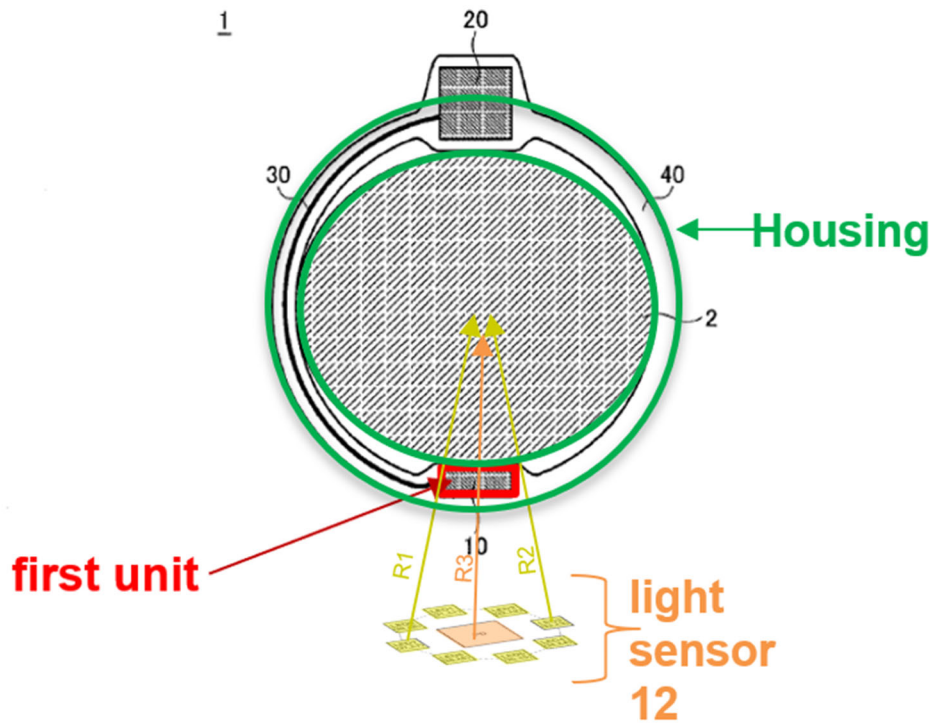
Id., Fig. 22'.

- f. **Claim 12: The wearable computing device of claim 11, wherein at least one light-receiving component is positioned within the housing at a third radial position that is between the first radial position and the second radial position.**

Niwa teaches Claim 12. Ex-1002 ¶¶187-188.

Niwa's light-receiving component is positioned within the housing at a third radial position that is between the first radial position and the second radial position. *Id.* Niwa discloses "multiple light emitting portions provided at different places [and] at least a single light receiving portion to detect each intensity of lights emitted from each of the multiple light emitting portions." Ex-1005 ¶32; *see*

also id. ¶¶43, 117, Fig. 1. As shown in modified Figure 22', Niwa's light receiving portion PD (orange) is positioned at a third radial position (R3) that is between the first radial position (R1) of LED7 (yellow) and second radial position (R2) of LED3 (yellow) within the housing of the sensor (green). Ex-1002 ¶¶187-188.



Id., Fig. 22'. A POSITA would further understand that Niwa teaches LEDs and light receiver configurations with varying radial positions. *See, e.g., id.* ¶¶32, 43, 117, Figs. 1, 14-16.

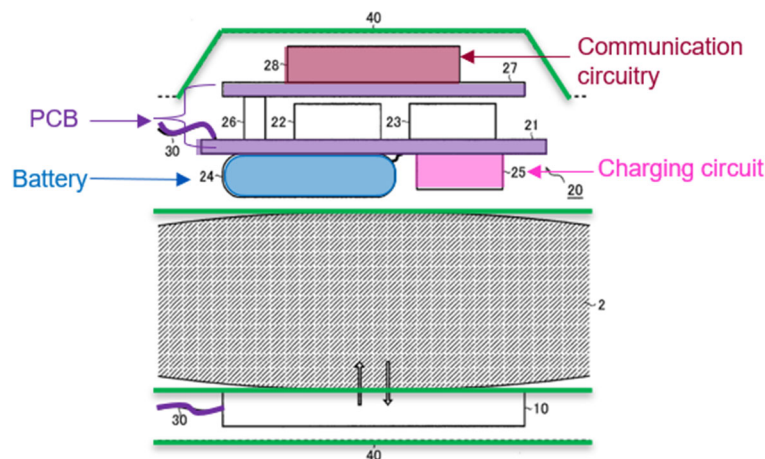
- g. Claim 13: The wearable computing device of claim 1, further comprising: a power management module disposed within a cavity between the interior wall and the exterior wall, the power management module configured to wirelessly transfer energy from an external energy source to a battery of the wearable computing device through the interior wall, the exterior wall, or both.**

Niwa teaches Claim 13. Ex-1002 ¶¶189-193.

Niwa has a power management module within a cavity between the interior and exterior wall. *Id.* Niwa’s finger ring has a “charging circuit 25” inside of second unit 20 that charges battery 24 with an outside power source supply. Ex-1005 ¶218; *see also id.* ¶221. As shown in Figure 28 below, a POSITA would have understood that Niwa’s charging circuit 25 is disposed in a “cavity” formed between the exterior wall and interior wall because the second unit (including the charging circuit) is covered by ring housing 40 (green, comprising the external wall that is exposed to the environment and the internal wall that touches the user’s finger). Ex-1002 ¶¶189-193. A POSITA would have designed the ring housing in Niwa to have a cavity sized to accommodate the charging circuit and other electronic components—otherwise these components would be crushed or compressed because the solid ring and circuit components cannot simultaneously occupy the same space. *Id.* Niwa also describes that the exterior wall and interior wall of finger ring should be “water-proof” so that it is “possible to measure the

plethysmogram without breaking down even if it is soaked [in] water (e.g., rain) or sweat.” Ex-1005 ¶205. A POSITA would have understood that all the components in Niwa exist within a protected cavity inside the finger ring type housing 40, which is comprised of exterior wall and interior wall because the finger ring housing 40 “covers” and “water-proofs” the components. Ex-1002 ¶¶189-193.

FIG.28



Niwa's power management module is configured to wirelessly charge the battery through the finger ring's walls. Ex-1002 ¶¶192-193. Niwa explains that charging circuit 25 receives power by a non-contact method such as "an electromagnetic induction method, an electric field connection method, or an electric field resonance method." Ex-1005 ¶218. Niwa states that the charging circuit "performs the *charge control of the battery 24* according to the power

source supply from outside.” *Id.* Thus, a POSITA would have understood the Niwa’s charging circuit is the “power management module” that wirelessly transfers energy from an outside power supply to the battery using a noncontact electromagnetic induction method. Ex-1002 ¶¶192-193.

- h. Claim 14: The wearable computing device of claim 13, wherein the power management module comprises an inductive charging component configured to transfer energy from the external energy source to the battery via an inductive charging process.**

Niwa teaches Claim 14. Ex-1002¶¶194-195.

As discussed in the previous section, Niwa’s charging circuit can use an electromagnetic induction method which is configured to transfer energy from a power supply outside to the battery. Ex-1005 ¶218.

- i. Claim 15: The wearable computing device of claim 1, wherein the housing comprises: an internal housing component defining the interior wall; and an external housing component defining the exterior wall, the external housing component coupled to the internal housing component, wherein one of the internal housing component or the external housing component further defines a first side wall and a second side wall that extend between the internal housing component and the external housing component.**

Niwa teaches Claim 15. Ex-1002¶¶196-199.

As explained above in Section XIII.A.1.b (Element 1[a]), Niwa has a housing with interior and exterior walls. Specifically, as shown in Figure 26,

Niwa's "finger ring type housing 40" has an inner portion (green) that surrounds "the ball side of the finger 2 (i.e., palm side) when the finger ring type housing 40 is worn" for the plethysmogram measurement. Ex-1005 ¶192. A POSITA would have understood that the inner portion is the internal housing component defining an interior wall of Niwa's finger ring. Ex-1002¶¶196-199.

FIG.22

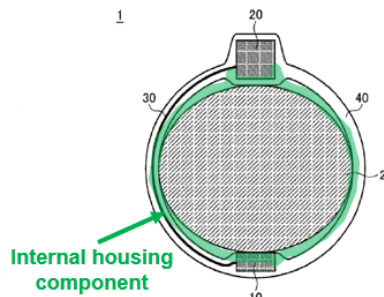
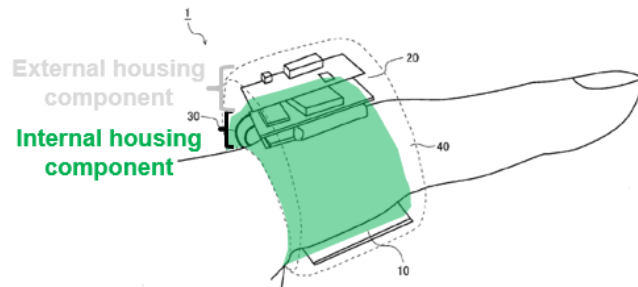


FIG.26



Ex-1005, Figs. 22, 26.

Niwa's "finger ring type housing 40" also has an "external housing component" which is the outer portion of the housing that is exposed to the environment and does not touch the user's finger. Ex-1002 ¶197. As shown in annotated Figures 22 and 26, the inner portion (green) is coupled with the outer portion to form Niwa's circular "finger ring type housing 40." Ex-1002 ¶197; Ex-1005, Figs. 22, 28.

FIG.22

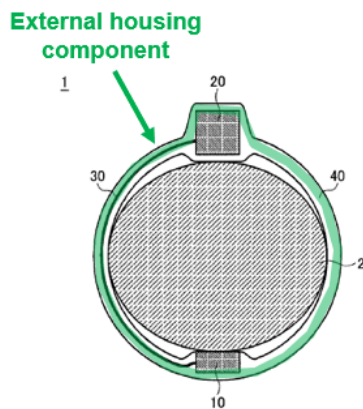
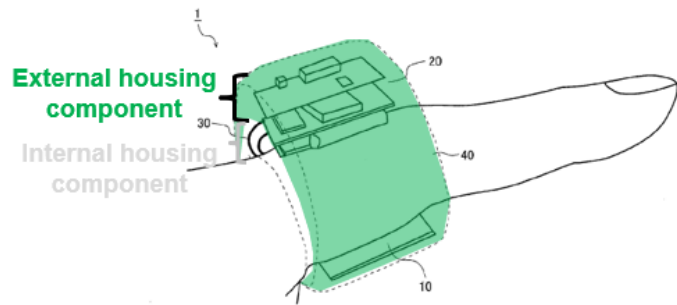
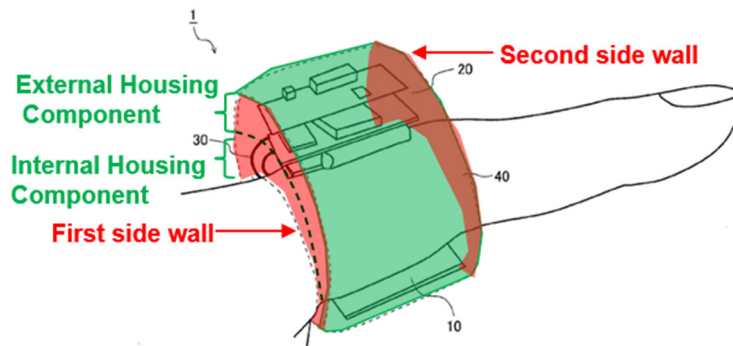


FIG.26



Niwa's finger ring has a first side wall and a second side wall that extend between the internal housing component and the external housing component. Ex-1002 ¶198. Niwa explains that the thickness of the finger ring type housing 40 “covers” the first unit and the second unit. Ex-1005 ¶¶200-201. Niwa also teaches that finger ring type housing has “elastic elements (e.g., silicon rubber).” *Id.* ¶204. As shown in annotated Figure 26 below, side walls (red) extend between the internal and external housing components (green) and correspond to the claimed side walls because they are the material that connects the external and internal housing components at a thickness that “covers” the first and second units inside the ring. Ex-1002 ¶198; Ex-1005, Fig. 26. A POSITA would have found it obvious for Niwa's side walls to be extended between the internal and external housing components to maintain the housing structure to cover the first unit and second unit of the sensor. Ex-1002 ¶¶198-199.

FIG.26



- j. **Claim 16: The wearable computing device of claim 15, wherein the first side wall, the second side wall, or both, are substantially perpendicular to the interior wall, the exterior wall, or both.**

Niwa teaches Claim 16. Ex-1002¶200.

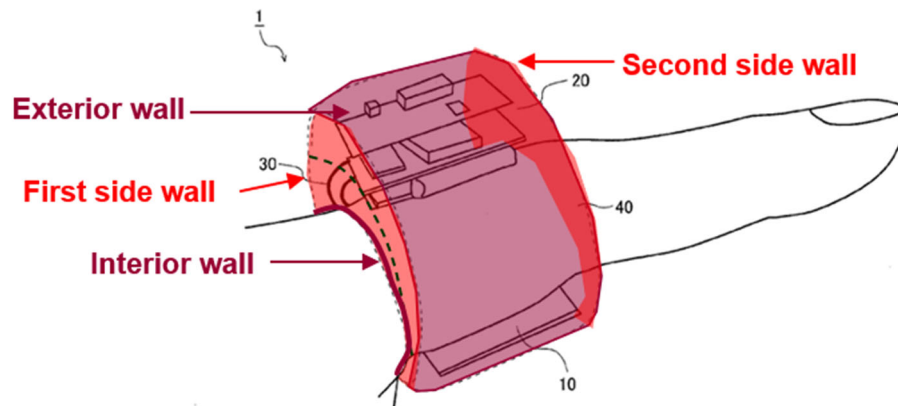
As described in the section above, Niwa's interior wall is the portion of the finger ring that maintains contact with the user's finger and the exterior wall is the portion of the finger ring that is exposed to the environment and does not directly contact the user's finger. *Id.* Niwa describes that these surfaces allow the finger ring to be "water-proof" so that it is "possible to measure the plethysmogram without breaking down even if it is soaked to water (e.g., rain) or sweat." Ex-1005 ¶205. As shown in Figure 26 below, a POSITA would have understood that Niwa's first and second side walls (red) are substantially perpendicular to the interior wall and exterior wall (dark red) in order to "cover" and "water-proof"

components so that the finger ring may continue to measure the plethysmogram.

Ex-1002 ¶200. A POSITA would have found it obvious for the side walls in Niwa's finger ring to be perpendicular to the interior and exterior wall in order to extend the longevity of the device and cover the components as plethysmogram sensors are "shared by many persons (e.g., when used as rental at sports gym)."

Ex-1002 ¶200; Ex-1005 ¶205.

FIG.26



Id., Fig. 26.

B. Ground 2: Claims 6-10 Are Obvious Over Niwa (Ex-1005) in view of Yuen (Ex-1006)

- 1. A POSITA would have been motivated to combine the teachings of Niwa and Yuen, and would have had a reasonable expectation of doing so**

A POSITA would have been motivated to combine the teachings of Niwa

and Yuen (“Niwa-Yuen”) and would have had a reasonable expectation of success in doing so because each relates to the same well-known technologies. Ex 1002 ¶¶201-206. Both are directed to wearable biometric sensing devices having similar structural components including, for example, a housing which includes light emitting sources and a light receiving portion disposed within the walls of the device. *See, e.g.*, Ex-1005 ¶¶191, 209; Ex-1006, 14:33-37, 6:24-31.

Yuen’s biometric monitoring device can be worn on an appendage of the user’s body, for example, on the user’s “arm, wrist, leg and/or ankle.” Ex-1006, 2:7-17, 12:50-52. Yuen also teaches that the device can be “worn in any number of ways including, but not limited to” a chest band, necklace, patch, bra, earring, glasses, “or toe band.” *Id.*, 24:35-40. Niwa teaches that its wearable computing device has a finger ring construction which “worn on the third joint of the finger.” Ex-1005 ¶191.

A POSITA would have been motivated to combine the functionality of Yuen’s biometric monitoring device with Niwa’s finger ring construction because a POSITA would have found it beneficial to implement Yuen’s device in a more compact form that is not intrusive or obtrusive and is easier for the user to remember to wear. Ex 1002 ¶¶201-206. Yuen teaches that the device housing should enable the device to be worn by the user without “measurably or appreciably impact[ing] the user’s activity.” Ex-1006, 23:63-67. Moreover, an

exemplary structure that Yuen teaches for its device is a “toe band,” which a POSITA would have understood is structurally equivalent and/or identical to a “finger ring.” Ex 1002 ¶¶203. Niwa teaches that a finger ring is desirable because the finger ring construction allows the plethysmogram to be measured which is worn on the third joint of the finger. Ex-1005 ¶191. Thus, design incentives and market forces would have motivated a POSITA to apply the teachings of Niwa to Yuen. Ex 1002 ¶203; *DyStar Textilfarben GmbH v. C.H. Patrick Co.*, 464 F.3d 1356, 1368 (Fed. Cir. 2006) (making things stronger, cheaper, lighter, smaller, more durable, or more efficient are universal motivators to combine/modify prior art).

Niwa’s wearable plethysmogram sensor “includes a single light receiving portion PD (i.e., a photo diode or a photo transistor) and [up to] eight light emitting portions LED1 to LED8 (i.e., a light emitting diode) equally spaced from one another.” Ex-1005 ¶120. Niwa explains that the LEDs are “placed on a circumference with a central focus on the light receiving portion PD.” *Id.* Yuen similarly explains a wearable computing device that has an optical sensor which includes “a light source [that] emits light upon the skin of the user” and “light detector [that] samples, acquires and/or detects a response or scattered/reflected light from the skin.” Ex-1006, 10:8-11. Yuen’s optical sensor “may obtain data related to the ambient light conditions of the environment.” *Id.*, 10:5-6. Moreover,

Yuen's light detector "may incorporate a transimpedance amplifier stage with variable gain" to "avoid or minimize saturation from bright ambient light and/or bright emitted light from the light source." *Id.*, 10:5-6, 16:56-60.

A POSITA would have been motivated to combine Niwa with Yuen because Yuen offers additional benefits of having a light receiving component that obtains data related to the ambient light conditions of the environment and selectively adjusts one or more operational parameters of the one or more light-emitting components based at least in part on the ambient light level. Ex-1002 ¶205.

Additionally, Yuen's biometric monitoring device also provides real time feedback to the user in multiple ways. For example, Yuen's biometric monitoring device gives "real-time feedback of heart rate, heart rate variability, and/or stress to the user" and displays this data on a secondary device. Ex-1006, 26:48-49.

Yuen's biometric device may also convey information to a user through "the use of audio tones, voice, songs, or other sounds." *Id.*, 25:44-45. A POSITA would have been motivated to include the real time feedback for the healthcare benefits such as inviting the user to use relaxation exercises, assessing the spread of a particular disease, or notifying the user of their calorie intake to maintain or achieve a goal weight. Ex-1002 ¶206; *see also* Ex-1006, 29:57-30:54. A POSITA would have been motivated to combine Niwa with Yuen's benefit of providing the user with real time feedback and would have had a reasonable expectation of success of

doing so. Ex-1002 ¶¶201-206.

2. Dependent Claims 6-10

- a. **Claim 6: The wearable computing device of claim 1, wherein the one or more processors are configured to: determine an ambient light level based at the one or more light-receiving components; and selectively adjust one or more operational parameters of the one or more light-emitting components based at least in part on the ambient light level, wherein processing the data is based at least in part on selectively adjusting the one or more operational parameters.**

Niwa-Yuen teaches Claim 6. Ex-1002 ¶¶207-210.

As discussed in Section XIII.A.1.g (Element 1[d]), Niwa's processing circuit 15 is the claimed processor that "controls [the] entire operation of the plethysmogram sensor 1." Ex-1005 ¶212. Specifically, Niwa's processor receives data based on the detected visible light to determine "the oxygen saturation of the arterial blood" because it is easier to use "the visible light region." *Id.* ¶170.

A POSITA would have been motivated for Niwa's processor to "determine an ambient light level based at the one or more light-receiving components" because it was well-known, as taught in Yuen. Ex-1002 ¶208. Yuen's biometric monitoring device determines ambient light level in order to control or adjust screen backlighting. Ex-1006, 29:57-30:54. Specifically, Yuen's biometric monitoring device has a processor with applications that "utilize sensor data" from "physiological, environmental and/or activity sensors." Ex-1006, 22:62-66.

Yuen's physiological sensor includes "a light source [that] emits light upon the skin of the user and, in response, a light detector samples, acquires and/or detects a response or scattered/reflected light from the skin." *Id.*, 10:8-11. The light detector further "obtain[s] data related to the ambient light conditions of the environment." *Id.*, 10:5-6.

Yuen's processor further selectively adjusts one or more operational parameters of the one or more light-emitting components based at least in part on the ambient light level. Ex-1002 ¶209. Yuen's "light detector module may incorporate a transimpedance amplifier stage with variable gain" to "avoid or minimize saturation from bright ambient light and/or bright emitted light from the light source." Ex-1006, 16:56-60. For example, the light detector module amplifier modulates the intensity of the light source and "demodulat[es] the output of the light detector" when there is "no optical shielding from ambient light." *Id.*, 16:64-67. Further, if the ambient light is bright enough to obtain a heart rate signal, the light source may be reduced in brightness or turned off. *Id.*, 17:1-4.

A POSITA would have been motivated to determine an ambient light level and selectively adjust an operation parameter based thereon, into Niwa's wearable computing device, in order to adjust the light emission from Niwa's light sensor for more efficient and accurate plethysmogram reading in view of the ambient light conditions. Ex-1002 ¶210.

- b. Claim 7: The wearable computing device of claim 6, wherein the one or more operational parameters comprise an intensity of the light emitted by the one or more light-emitting components.**

Niwa-Yuen teaches Claim 7. Ex-1002 ¶211.

As discussed in the previous section (Claim 6), Yuen’s biometric monitoring device specifically adjusts the intensity of the light source. *Id.* Yuen’s “light detector module may incorporate a transimpedance amplifier stage with variable gain” to “avoid or minimize saturation from bright ambient light and/or bright emitted light from the light source.” Ex-1006, 16:56-60. For example, the light detector module amplifier modulates the intensity of the light source and “demodulat[es] the output of the light detector” when there is “no optical shielding from ambient light.” *Id.*, 16:64-67. Further, if the ambient light is bright enough to obtain a heart rate signal, the light source may be reduced in brightness or turned off. *Id.*, 17:1-4.

- c. Claim 8: The wearable computing device of claim 1, wherein the one or more processors are configured to: determine whether or not the user is wearing the wearable computing device based at least in part on the data acquired by the plurality of sensors; and selectively adjust one or more operational parameters of the plurality of sensors based at least in part on whether or not the user is wearing the wearable computing device.**

Niwa-Yuen teaches Claim 8. Ex-1002 ¶212.

As discussed in Section XIII.A.1.g (Element 1[d]), Niwa's processing circuit 15 is the claimed processor that "controls [the] entire operation of the plethysmogram sensor 1." Ex-1005 ¶212. Specifically, Niwa's processor receives data based on the detected visible light to determine information about the user. *See, e.g.*, Ex-1005 ¶170. A POSITA would have understood that Niwa's processor would determine whether the user is wearing the finger ring based on the lack of data received by the sensors. Ex-1002 ¶212.

A POSITA would have been motivated to determine whether the user is wearing the wearable computing device based on the data acquired by the plurality of sensors in Niwa, because it was well-known, as taught in Yuen. Ex-1002 ¶213. Yuen's biometric monitoring device "may automatically detect or determine whether it is or is not attached to, disposed on and/or being worn by the user." Ex-1006, 9:15-17. For example, Yuen explains that "if at a given light intensity setting, one or more light detectors provides a low return signal, the biometric monitoring device may interpret the data is indicative of the device not being worn." *Id.*, 9:27-30.

Based on the data returned indicating that the user is not wearing the monitoring device, Yuen's processors selectively adjusts an operational parameter of the plurality of sensors. Ex-1002 ¶214. Specifically, upon such a determination, Yuen reduces its power consumption by "disabling or adjusting" the

“light source(s) and/or detector(s). Ex-1006, 9:30-35.

A POSITA would have been motivated to implement Yuen’s determination of whether the user is wearing the computing device and operational parameter adjustment based on that determination, into Niwa’s plethysmogram sensor in order “reduce its power consumption” and save battery life. Ex-1006, 9:30-35; Ex-1002 ¶215.

- d. **Claim 9: The wearable computing device of claim 1, further comprising: a feedback component communicatively coupled with the one or more processors, wherein the feedback component is configured to provide feedback to the user based at least in part on the data acquired by the plurality of sensors.**

Claim 10: The wearable computing device of claim 9, wherein the feedback comprises visual feedback, audible feedback, haptic feedback, or any combination thereof.

Niwa-Yuen teaches Claims 9 and 10. Ex-1002 ¶216.

Niwa teaches a feedback component communicatively coupled to the processor to provide the user visual feedback. *Id.* Niwa teaches using an outside apparatus for displaying “a graph of the plethysmogram data,... a numeric number, or much more data analysis.” Ex-1005 ¶185. Moreover, Yuen further teaches a secondary device to display “real-time feedback of heart rate, heart rate variability, and/or stress to the user” based on the information from the biometric monitoring device that the user is wearing. Ex-1006, 26:48-49. Yuen’s biometric monitoring

device also conveys sensed data directly to the user through “audio tones, voice, songs, or other sounds.” *Id.*, 25:44-45, 25:8-16 (using LEDs to indicate user’s heart rate or goal), 25:46-26:23 (examples of information indicated to the user using visual, motion, and auditory communication methods). As discussed in Section XIII.B.1, a POSITA would have understood the benefit of including real time feedback to the user and would have had a reasonable expectation of success of combining Yuen’s feedback in Niwa’s finger ring. Ex-1002 ¶¶206, 216.

C. Ground 3: Claims 15-16 Are Obvious Over Niwa in view of Schröder (Ex-1007)

1. A POSITA would have been motivated to combine the teachings of Niwa and Schröder, and would have had a reasonable expectation of doing so

A POSITA would have been motivated to apply the teachings of Schröder and Niwa (“Niwa-Schröder”) and would have had a reasonable expectation of success in doing so because each relates to the same well-known technologies. Ex-1002 ¶¶217-222.

A POSITA would have been motivated to combine Niwa with Schröder because they are analogous art and teach improvements to the same type of devices. Ex-1002 ¶218. Both Niwa and Schröder are directed to wearable biometric sensing devices having similar structural components including, for example, inner and outer housing components, a cavity, and electronic components (e.g., battery and PCB) within the cavity. *See, e.g.*, Ex-1007, 11:46-48 (battery),

12:26-42 (PCB), Figs. 4-10 (showing device's structure); Ex-1005 ¶¶ 67-68 (circuits and substrate), 194-95 (FPC [Flexible Printed Circuits]), 213 (battery), Figs. 22, 26-29 (showing device's structure).

Further, Schröder's teachings involve methods of capturing information about finger veins. Ex-1002 ¶219. This methodology specifically targets the patterns of veins within the finger. *Id.* Building on this understanding, a POSITA would have recognized that Niwa teachings, which discuss the capture of pulse oximetry data, also indirectly involve capturing information about veins. *Id.* Pulse oximetry is a non-invasive method used to measure the oxygen saturation level of the blood and heart rate through photoplethysmography (PPG), a technique that detects blood volume changes in the microvascular bed of tissue. *Id.* PPG technology is sensitive to changes in blood volume within tissues, which includes the venous structures targeted by Schröder's vein image. *Id.* A POSITA would have understood that both Schröder's and Niwa's techniques involve data collection from veins. *Id.* 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. *Id.*

Schröder's also teaches that its finger-ring has two halves 16 and 18 that are

manufactured by casting, milling, or embossing and are “interconnected by a suitable technology, e.g., by plugging, gluing, screwing, crimping, etc.” Ex-1007, 12:10-22. Schröder provides various designs for the shape of the ring halves, such as a U-shape with inlay 12 being arranged between the components 16 and 18. *Id.*, 12:45-55. Schröder further teaches using injection-molding to cover the electronic part and cavity with a resin or plastic to form “a ring-shaped body.” Ex-1007, 14:38-49. Depending on the POSITA’s design criteria, it would have been obvious to implement either arrangement in Niwa. Ex-1002 ¶¶219-220.

A POSITA would have been motivated to combine the design of Niwa’s finger ring construction with Schroder’s finger-ring structure because a POSITA would have found it beneficial to have multiple components that are “simple, fast and inexpensive to manufacture.” Ex-1007, 12:15-17; Ex-1002 ¶221. Further, Schröder explains that the components can be “adapted to different dimensions and accordingly manufactured.” Ex-1007, 12:17-20. Thus, design incentives and market forces would have motivated a POSITA to apply Schröder’s teachings to Niwa. Ex-1002 ¶221.

A POSITA would have had a reasonable expectation of success in combining Schröder and Niwa. Ex-1002 ¶¶222. A POSITA would have understood that these wearable electronic devices, specifically a ring shape, are restricted by form factors. *Id.* Therefore, a POSITA would have understood that

these references disclose interrelated teachings based on routine technologies that would have been amenable to various well-understood and predictable combinations to provide smaller and more comfortable wearable devices. *Id.*; *DyStar*, 464 F.3d at 1368.

2. Dependent Claims 15-16

- a. **Claim 15: The wearable computing device of claim 1, wherein the housing comprises: an internal housing component defining the interior wall; and an external housing component defining the exterior wall, the external housing component coupled to the internal housing component, wherein one of the internal housing component or the external housing component further defines a first side wall and a second side wall that extend between the internal housing component and the external housing component.**

Niwa-Schröder teaches Claim 15. Ex-1002 ¶¶223-227.

As discussed in Section XIII.A.2.i (Claim 15), Niwa's finger ring construction has a housing comprising an external housing component coupled to an internal housing component that further defines a first side wall and second side wall. *Id.* ¶223. Niwa's housing components also includes an internal housing component that defines the interior wall and an external housing component that defines the exterior wall. *Id.*

A POSITA would have been motivated for Niwa's internal housing component to define the interior wall and coupled to the external housing component

which defines the exterior wall, as taught in Schroder. Ex-1002 ¶224. Schröder's finger-ring is made of coupled ring halves 16, and 18. Ex-1007, 12:43-45 (components 16, 18). Specifically, as shown in Figures 4 and 7, Schröder's finger-ring consists of an internal housing component defining an interior wall that touches the user's finger and an external housing component defining an exterior wall that is exposed to the environment. *Id.*, 12:7-8.



Fig. 7

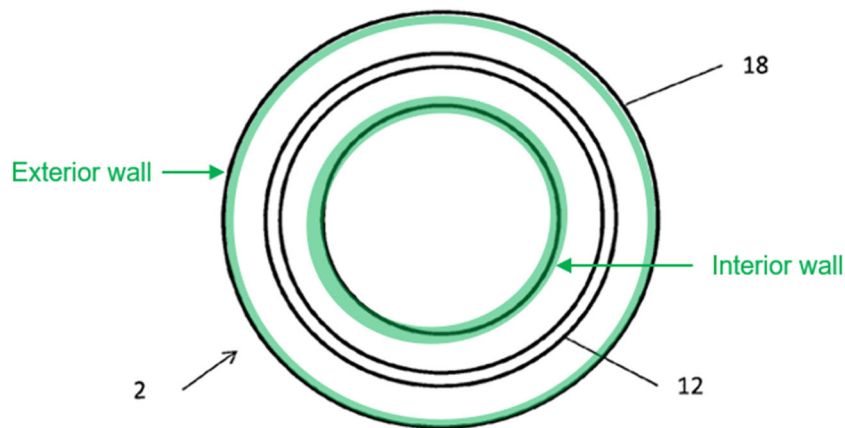
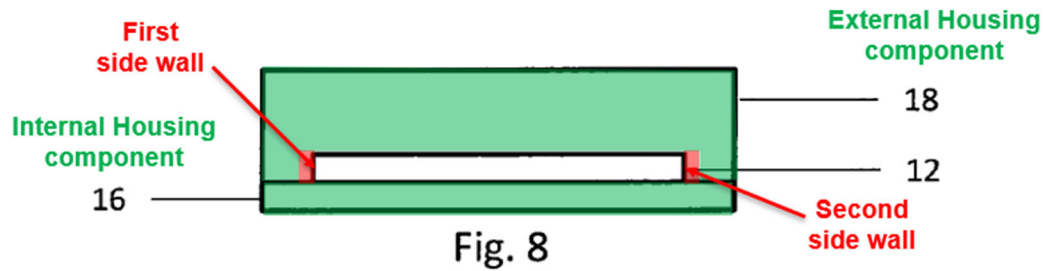
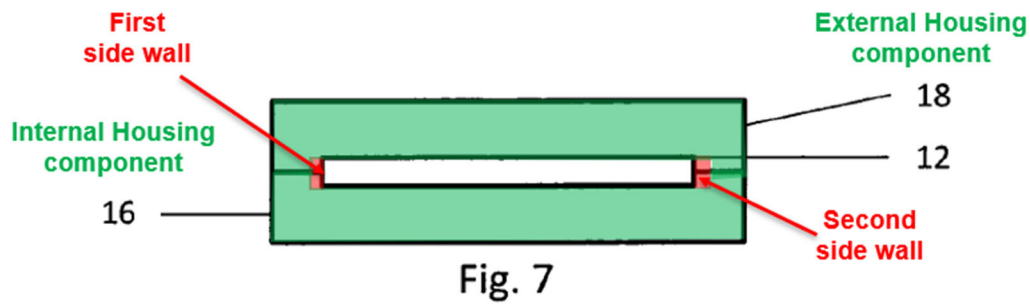


Fig. 4

Ex-1007, Figs. 4, 7.

A POSITA would have been motivated for the internal or external housing components in Niwa's finger ring to define a first and a second side wall that extend between the internal and external housing components, as taught by Schröder. Ex-1002 ¶225. Schröder states that ring halves 16 and 18 are manufactured by casting, milling, or embossing and are "interconnected by a suitable technology, e.g., by plugging, gluing, screwing, crimping, etc." Ex-1007, 12:10-22. Schröder provides various designs for the shape of the ring halves, such as a U-shape with inlay 12 being arranged between the components 16 and 18. *Id.*, 12:45-55. As shown in Figure 7 below, a POSITA would have understood that the U-shaped housing components are connected to each other and thus form "side walls" (red) that extend from external housing component 18 to internal housing component 16 and surround the cavity (occupied by inlay 12). Ex-1002 ¶225. A POSITA would have understood that both housing components thus define a first side wall and a second side wall because both components are U-shaped. *Id.*



Ex-1007, Figs. 7, 8.

Similarly, in Figure 8, external housing portion 18 is a U-shape component that extends and connects to internal housing component 16 and defines the cavity by surrounding inlay 12 therefore having “side walls” (red) to form the connection. Ex-1002 ¶226. A POSITA would have understood that the external housing component defines the first and second side wall because it is U-shaped. *Id.*

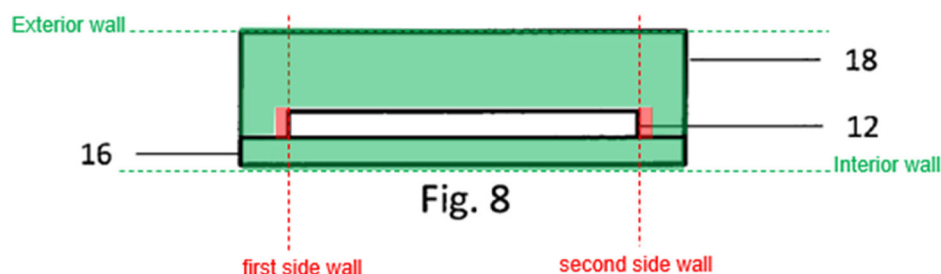
A POSITA would have been motivated to implement Schroder’s finger ring structure with its internal and external housing components that provide side walls into Niwa’s finger ring in order to improve the structure of the cavity and extend the longevity of the components by protecting Niwa’s first and second units by a rigid external housing component. Ex-1002 ¶227.

- b. Claim 16: The wearable computing device of claim 15, wherein the first side wall, the second side wall, or both, are substantially perpendicular to the interior wall, the exterior wall, or both.**

Niwa-Schröder teaches Claim 16. Ex-1002 ¶¶228-229.

As discussed in Section XIII.A.1.j (Claim 16), Niwa's finger ring construction includes first and second side walls that are substantially perpendicular to the interior wall and exterior wall. Ex-1002 ¶¶200, 228.

Further, Niwa-Schröder's first and second side walls are substantially perpendicular to the interior and exterior walls. Ex-1002 ¶229. As stated above for Claim 15, the side walls are the part of the U-shaped components that extend from external housing component 18 to internal housing component 16 and surround the cavity to connect the housing components. *Id.* As shown in Figure 8, a POSITA would have understood that Schröder's first and second side walls (red) are substantially perpendicular to the interior and exterior wall (green) because they are portions of the U-shaped components that extend to connect the housing components. *Id.*



Ex-1007, Fig. 8. A POSITA would have been motivated to implement side walls that are substantially perpendicular to the interior and exterior wall to improve the structure of the cavity and extend the longevity of the components. Ex-1002 ¶229.

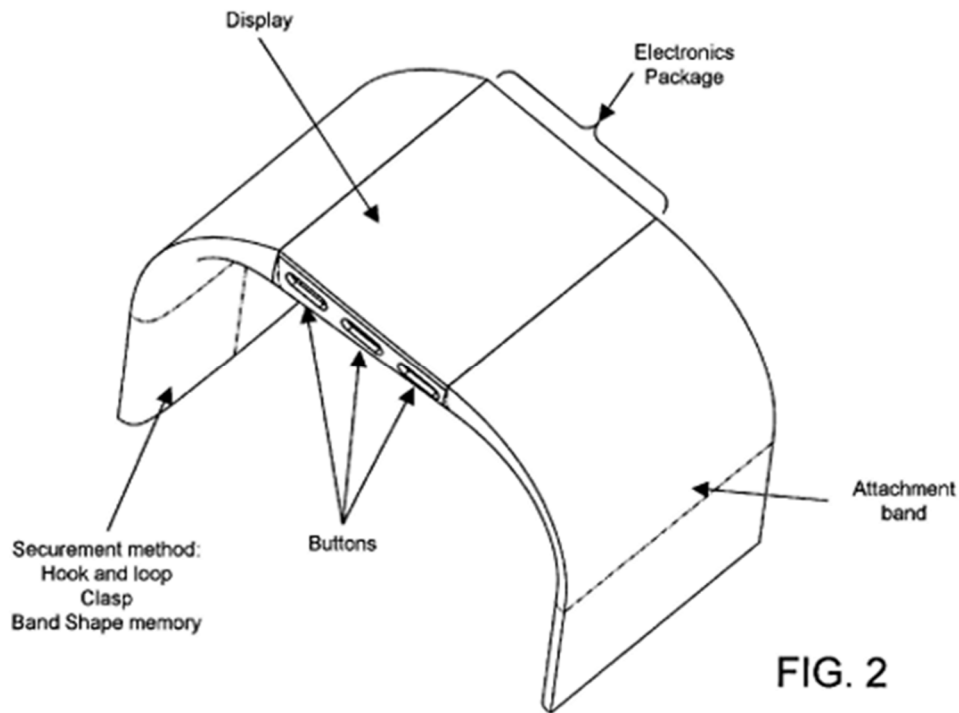
D. Ground 4: Claims 1-12 Are Obvious Over Yuen (Ex-1006)

1. Independent Claim 1

a. Element 1[pre]: A wearable computing device, comprising:

Yuen teaches the preamble of Claim 1, to the extent it is limiting. Ex-1002 ¶¶ 230-231.

As shown below in Figure 2, Yuen’s “portable biometric monitoring device [] may be secured to the user through the use of a band.” Ex-1006, 2:7-9, Fig. 2. Yuen explains that device is configured to be worn on an appendage of the user’s body, for example, on the user’s “arm, wrist, leg and/or ankle.” *Id.*, 12:50-52.



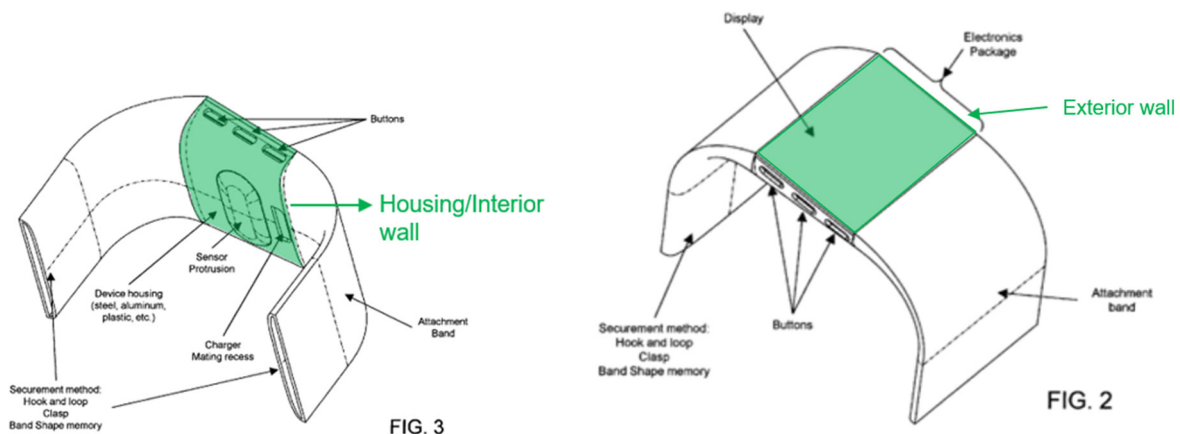
b. Element 1[a]: a housing comprising an interior wall and an exterior wall of the wearable computing device

Yuen teaches Element 1[a]. Ex-1002 ¶¶232-234.

Yuen teaches that its biometric monitoring device includes “two major components—a body (containing the ‘electronics’)” and a band that allows the device to be attached to the user. Ex-1006, 24:14-17. As shown below, Yuen’s Figure 2 depicts the exterior wall of the biometric monitoring device and Figure 3 depicts the interior wall of the device. *Id.*, 2:7-11, Fig. 2, Fig. 3.

Yuen’s biometric monitoring device has a housing made of “a metal material (for example, steel, stainless steel, aluminum, magnesium, or titanium).” Ex-1006, 14:33-37. Yuen describes “an interior or skin side” as the side of the housing

“whereby the surface of the device contacts, touches and/or faces the skin of the user.” *Id.*, 9:57-62. Yuen further teaches that a device “back made out of a metal” or plastic material provides a stiff-enough structure to maintain the device’s structural integrity, while also providing “a watertight seal for the sensor package.” *Id.*, 14:66-15:4. Yuen describes the other side as a side or “face” that is exposed to the “ambient environment (environmental side).” *Id.*, 9:64-65. A POSITA would have understood that the wall (green) exposed to the user’s skin is an interior wall because it is not exposed to the environment while the outer portion of the housing exposed to the environment is the exterior wall. Ex-1002 ¶234.

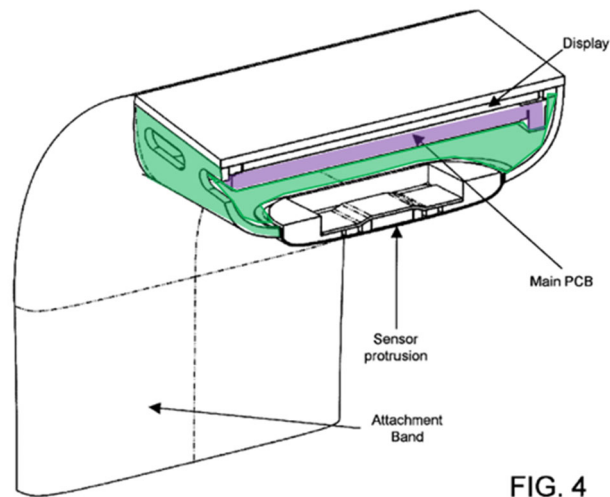


Ex-1006, Fig. 2, 3.

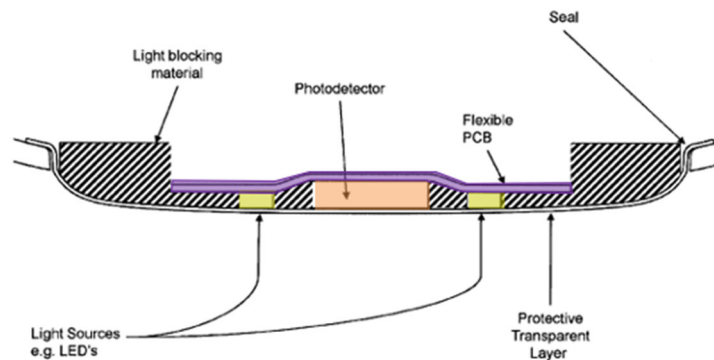
c. Element 1[b]: a printed circuit board disposed within the housing;

Yuen teaches Element 1[b]. Ex-1002 ¶¶235-237.

As shown in Figure 4, Yuen's biometric monitoring device contains a printed circuit board (purple) or "PCB" for short disposed within the housing (green) of the device. Ex-1002 ¶236.



Yuen's sensor protrusion also includes light sources and associated detectors disposed on a "flexible PCB" within the housing of the device. Ex-1006, 12:35-42, Fig. 5.



- d. **Element 1[c(i)]: a plurality of sensors electrically coupled with the printed circuit board, the plurality of sensors configured to acquire data from a user, the plurality of sensors comprising:**

Yuen teaches Element 1[c(i)]. Ex-1002 ¶¶238-239.

Yuen's biometric monitoring device has a plurality of sensors electrically coupled with the printed circuit board in order to acquire user data. Ex-1002 ¶238. As shown in Figure 5, Yuen's biometric monitoring device includes an "optical sensor having one or more light sources (LED, laser, etc.) [yellow] to emit or output light into the user's body" and "light detectors (photodiodes, phototransistors, etc.) [orange] to sample, measure and/or detect a response or reflection and provide data used to determine data which is representative of stress [], blood pressure and/or heart rate of a user." Ex-1006, 6:24-31. Yuen's light sources and photodetector are placed on a flexible PCB (purple) to enable PPG. *Id.*, 12:36-38, *see also* 2:29-39. Although one photodetector is shown in Figure 5, Yuen teaches that the "the biometric monitoring device may consist of a *plurality of photodetectors* and photoemitters distributed along the surface of the device that touches the user's skin." *Id.*, 19:3-17; *see also id.*, 10:7-15.

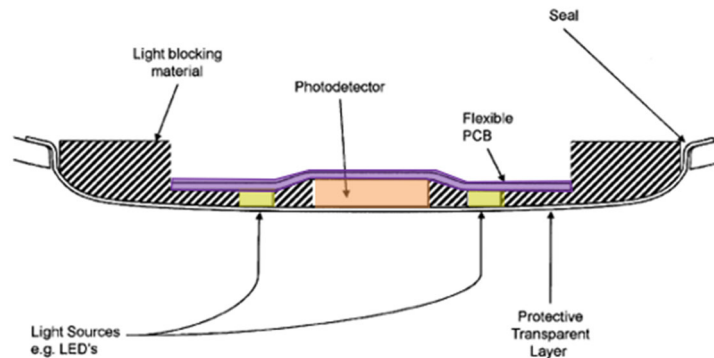


FIG. 5

Id., Fig. 5.

- e. **Element 1[c(ii)]: one or more light-emitting components configured to emit light associated with two or more wavelengths, wherein the two or more wavelengths include a first wavelength associated with infrared light and a second wavelength associated with visible light; and**

Yuen teaches Element 1[c(ii)]. Ex-1002 ¶¶240-241.

Yuen's biometric monitoring device includes "source(s) [that] may emit light having one or more wavelengths which are specific or directed to a type of physiological data to be collected" and are associated with visible and infrared light. Ex-1006, 10:22-24; Ex-1002 ¶241. For example, Yuen discusses "an LED that emits light having wavelengths corresponding to the red spectrum" and another "LED that emits light having wavelengths corresponding to the IR spectrum." Ex-1006, 10:34-39. IR is short for "infrared." Ex-1002 ¶241.

f. Element 1[c(iii)] one or more light-receiving components configured to receive the light associated with the two or more wavelengths;

Yuen teaches Element 1[c(iii)]. Ex-1002 ¶¶242-243.

As shown in Figure 5, Yuen's "light detectors (photodiodes, phototransistors, etc.)" (orange) are light-receiving components that "sample, measure and/or detect one or more wavelengths" of light associated with the specific "physiological data to be collected and physiological parameter (of the user) to be assessed or determined." Ex-1006, 9:26, 10:24-42 (describing sensor configured to receive green and red light wavelengths). This teaching in Yuen refers to the embodiments shown in Figures 2-7. *Id.*, 9:57-61.

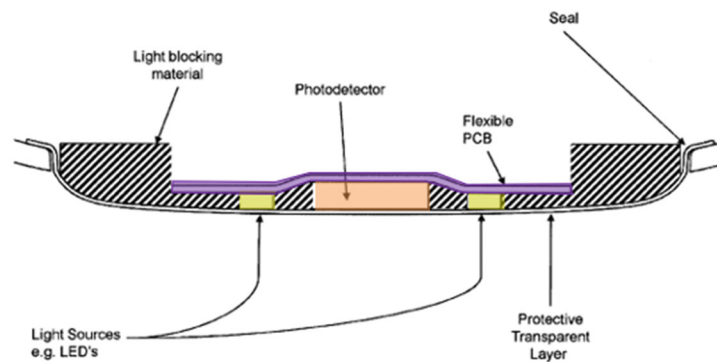


FIG. 5

g. Element 1[d]: one or more processors configured to process the data acquired by the plurality of sensors based at least in part on a reflectance, an absorbance, or both of the received light associated with the two or more wavelengths; and

Yuen teaches Element 1[d]. Ex-1002 ¶¶244-246.

Yuen's biometric monitoring device has a processor to process the sensor data based on the received light. Ex-1002 ¶244. Specifically, Yuen's processor has applications that "utilize sensor data" from "physiological, environmental and/or activity sensors." Ex-1006, 22:62-66. As shown in Figure 5 below, Yuen's optical sensors are arranged on the device's skin side so that "a light source emits light upon the skin of the user and, in response, a light detector samples, acquires and/or detects a response or *scattered/reflected* light from the skin (and/or from inside the body)." *Id.*, 10:7-12. Yuen explains the sampled, acquired, or detected physiological data may then be processed or analyzed by the processing circuitry. *Id.*, 10:15-18, 22:60-66 ("For example, an independent application processor may be used to store and execute applications that utilize sensor data acquired and processed by *one or more sensor processors (processor(s) that process data from physiological, environmental and/or activity sensors)*"). Therefore, Yuen's processor processes data from the sensors based on the reflectance of the received light. Ex-1002 ¶246.

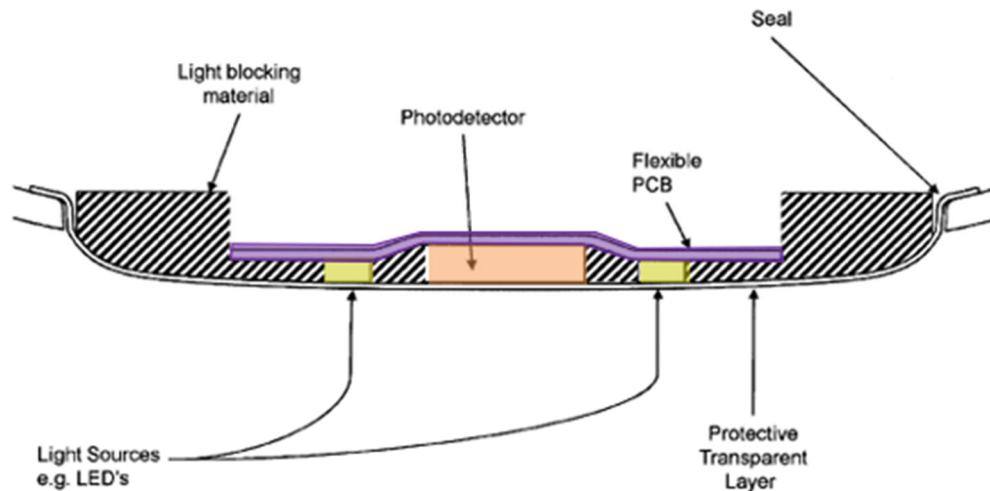


FIG. 5

Ex-1006, Fig. 5.

- h. Element 1[e]: a communication module communicatively coupled with the plurality of sensors, the one or more processors, or both, the communication module configured to transmit the data acquired by the plurality of sensors, an analysis of the data generated by the one or more processors, or both, to a user device.**

Yuen teaches Element 1[e]. Ex-1002 ¶¶247-248.

Yuen's biometric monitoring device includes a wireless communication circuitry that displays data "via Bluetooth Low Energy in order to give real-time feedback of heart rate, heart rate variability, and/or stress to the user." Ex-1006, 26:45-49. Yuen also teaches other communications means are available. *Id.*, 27:34-59 ("ANT, WLAN, power-line networking..."). As shown in Figure 25, the

communication module is communicatively coupled to the plurality of sensors and one or more processors to transmit the sensor data. Ex-1002 ¶248.

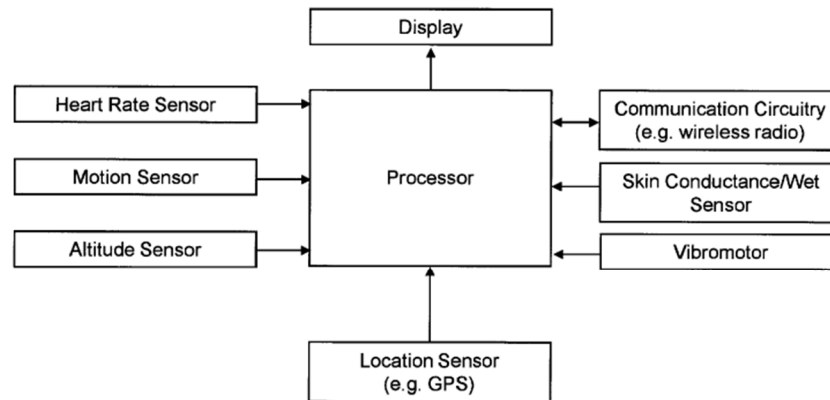


FIG. 25

Id., Fig. 25.

2. Dependent Claims 2-12

- a. **Claim 2: The wearable computing device of claim 1, wherein the one or more light-emitting components comprise a first light-emitting component configured to emit light associated with the first wavelength, a second light-emitting component configured to emit light associated with the second wavelength, and a third light-emitting component configured to emit light associated with a third wavelength, wherein the first light-emitting component, the second light-emitting component, and the third light-emitting component are physically separated from one another.**

Yuen teaches Claim 2. Ex-1002 ¶¶249-250.

As discussed in Section XIII.D.1.e (Element 1[c(ii)]), Yuen's biometric monitoring device includes "source(s) [that] may emit light having one or more

wavelengths which are specific or directed to a type of physiological data to be collected” and are associated with visible and infrared light. Ex-1006, 10:22-24; Ex-1002 ¶¶241, 249. For example, Yuen discusses three light sources separate from one another emitting different wavelengths of light: “an LED that emits light having wave lengths corresponding to the green spectrum,” “an LED that emits light having wavelengths corresponding to the red spectrum,” and “an LED that emits light having wavelengths corresponding to the IR spectrum.” *Id.*, 10:29-31, 10:34-39. Yuen also states that the device may use some or all of the sensors to acquire physiological data, including the physiological data representative of “a user’s heart rate, respiration, heart rate variability, oxygen saturation (SpO2), blood volume, blood glucose, skin moisture and/or skin pigmentation level.” *Id.*, 5:32-34, 10:19-21. Thus, a POSITA would have understood that sensors, such as the LEDs may emit light associated with one or more wavelengths at the same time for redundancy and improved accuracy. Ex-1002 ¶249.

Furthermore, as shown in Figure 11, “there may be a plurality of photodetectors and photoemitters placed along the circumference of the interior of the band.” Ex-1006, 19:8-10. These may also be placed on the interior surface of the housing in Figure 3. *Id.*, 9:57-61. Thus, a POSITA would have understood that the three light emitters could have one or more wavelengths which are directed to a type of physiological data. Ex-1002 ¶250. Specifically because Yuen explains that

“the color or wavelength of the light emitted by the LED (or set of LEDs) may be modified, adjusted and/or controlled” in order “to [] enhance the ‘quality’ of the physiological data obtained and/or sampled by the detector.” Ex-1006, 10:43-50.

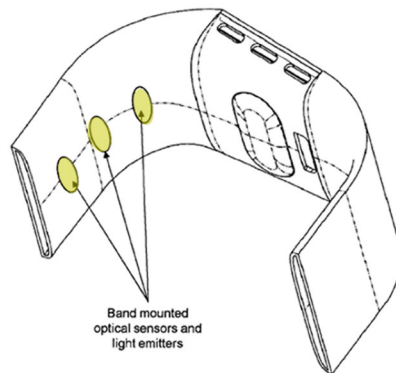


FIG. 11

Id., Fig. 11.

- b. Claim 3: The wearable computing device of claim 1, wherein the one or more light-emitting components comprise a single light-emitting module configured to emit the light associated with the first wavelength, the second wavelength, and a third wavelength.**

Yuen teaches Claim 3. Ex-1002 ¶251.

As discussed in Section XIII.D.1.e (Element 1[c(ii)]), Yuen’s biometric monitoring device includes “source(s) [that] may emit light having one or more wavelengths which are specific or directed to a type of physiological data to be collected” and are associated with visible and infrared light. Ex-1006, 10:22-24. Yuen further explains that the LED’s color or wavelength of the light may be modified and adjusted to enhance the quality of the physiological data. *Id.*, 10:43-

50. For example, the LED's color may be switched "from infrared to green when the user's skin temperature or the ambient temperature is cool in order to enhance the signal corresponding to cardiac activity." *Id.*, 10:50-54. Thus, a POSITA would have understood that a single LED in Yuen may switch to emit the light associated with the first wavelength (infrared light), the second wavelength (visible colored light), and a third wavelength (another visible colored light) to enhance the quality of detected physiological data. Ex-1002 ¶251.

Further, according to Yuen, the light sensors may be arranged in a package or module. Ex-1006, 15:5-7. A POSITA would have recognized that the arrangement of emitters and sensors, as shown in Figure 11, could be arranged in a module or package, and assembled or purchased in order to improve performance, redundancy, sensitivity to failure, or to simplify device assembly. Ex-1002 ¶251.

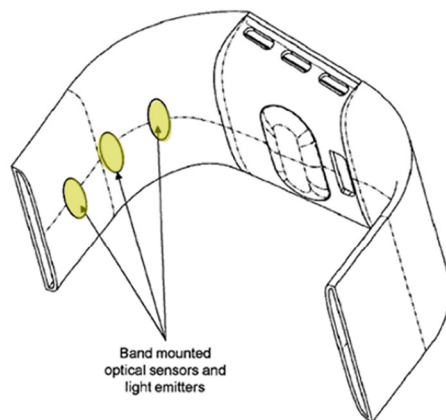


FIG. 11

Ex-1006, Fig. 11.

- c. **Claim 4: The wearable computing device of claim 1, wherein the one or more processors are further configured to: determine a first absorbance of the first wavelength, and a second absorbance associated with the second wavelength; and determine one or more characteristics of blood of the user based at least in part on the first absorbance and the second absorbance.**

Yuen teaches Claim 4. Ex-1002 ¶¶252-258.

Yuen's processor determines a first and second absorbance associated with the first and second wavelengths. *Id.* ¶252. As discussed in Section XIII.D.1.e (Element 1[c(ii)]), Yuen's biometric monitoring device includes light sources that may emit light corresponding to a first and second wavelength. *Id.* ¶¶240-241. Yuen explains that the "light source emits light upon the skin of the user and, in response, a light detector samples, acquires and/or detects a response or scattered/reflected light from the skin." Ex-1006, 10:8-11. A POSITA would have understood that scattered/reflected light corresponds to the absorbance of wavelengths detected by the light detector and is representative of physiological data of the user as light scattering increases the absorbance of light. Ex-1002 ¶¶252-253.

Yuen's processor determines a characteristic of the user's blood based on the determined absorbance(s). Ex-1002 ¶254. Yuen explains the data obtained is "processed or analyzed (for example, by resident processing circuitry)" and is "representative of, for example, a user's heart rate, respiration, heart rate variability,

oxygen saturation (SpO₂), blood volume, blood glucose.” Ex-1006, 10:16-20. Therefore, a POSITA would have understood that Yuen determines a characteristic of the user’s blood based on the absorbance of infrared or visible light (the claimed first and second wavelengths). Ex-1002 ¶254.

- d. Claim 5: The wearable computing device of claim 4, wherein the one or more characteristics of the blood of the user comprise a blood alcohol level, a blood glucose level, a blood oxygenation level, or any combination thereof.**

Yuen teaches Claim 5 for the same reason discussed in the previous section (Claim 4). Ex-1002 ¶259. Specifically, Yuen determines characteristics of the user’s blood such as oxygen saturation (SpO₂), blood volume, and blood glucose. Ex-1006, 10:16-20.

- e. Claim 6: The wearable computing device of claim 1, wherein the one or more processors are configured to: determine an ambient light level based at the one or more light-receiving components; and selectively adjust one or more operational parameters of the one or more light-emitting components based at least in part on the ambient light level, wherein processing the data is based at least in part on selectively adjusting the one or more operational parameters.**

Yuen teaches Claim 6 for the same reason discussed in Section XIII.B.2.a (Ground 2). Ex-1002 ¶¶207-210, 260.

- f. Claim 7: The wearable computing device of claim 6, wherein the one or more operational parameters comprise an intensity of the light emitted by the one or more light-emitting components.**

Yuen teaches Claim 7 for the same reason discussed in Section XIII.B.2.b

(Ground 2). Ex-1002 ¶¶211, 261.

- g. Claim 8: The wearable computing device of claim 1, wherein the one or more processors are configured to: determine whether or not the user is wearing the wearable computing device based at least in part on the data acquired by the plurality of sensors; and selectively adjust one or more operational parameters of the plurality of sensors based at least in part on whether or not the user is wearing the wearable computing device.**

Yuen teaches Claim 8 for the same reason discussed in Section XIII.B.2.c

(Ground 2). Ex-1002 ¶¶212-215, 262.

- h. Claim 9: The wearable computing device of claim 1, further comprising: a feedback component communicatively coupled with the one or more processors, wherein the feedback component is configured to provide feedback to the user based at least in part on the data acquired by the plurality of sensors.**

Claim 10: The wearable computing device of claim 9, wherein the feedback comprises visual feedback, audible feedback, haptic feedback, or any combination thereof.

Yuen teaches Claims 9 and 10 for the same reason discussed in Section

XIII.B.2.d (Ground 2). Ex-1002 ¶¶216, 263.

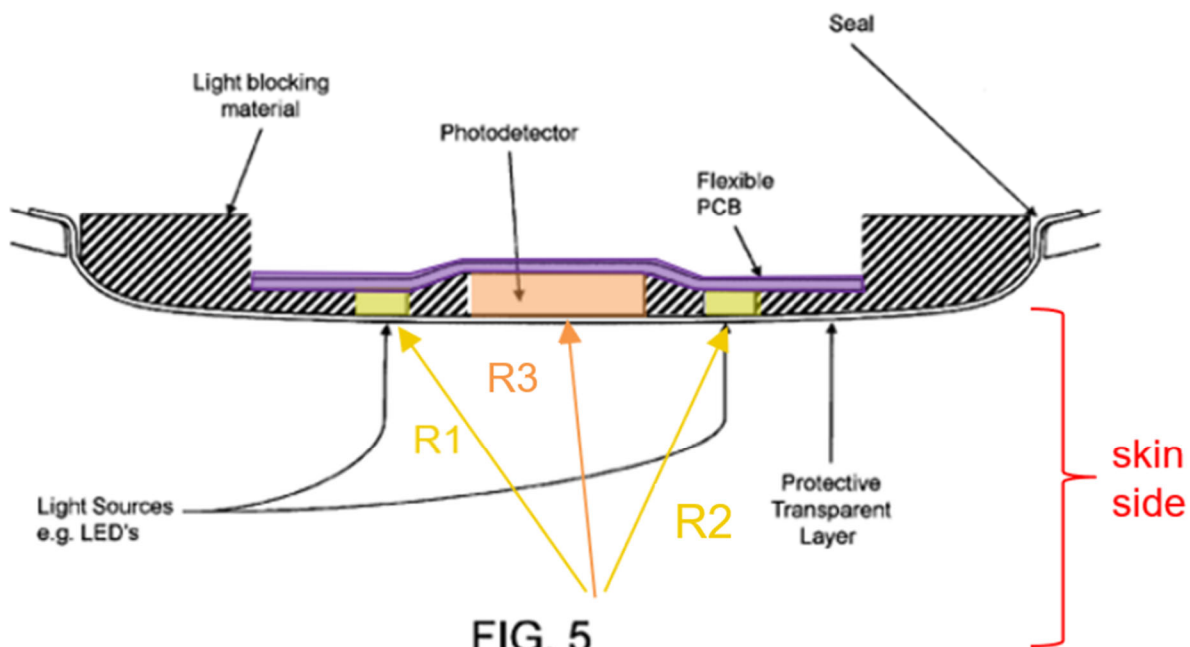
- i. **Claim 11: The wearable computing device of claim 1, wherein the wearable computing device comprises a finger-worn wearable ring device, wherein the one or more light-emitting components comprise a first light-emitting component positioned within the housing of the finger-worn wearable ring device at a first radial position, and a second light-emitting component positioned within the housing of the finger-worn wearable ring device at a second radial position different from the first radial position.**

Yuen teaches Claim 11. Ex-1002 ¶¶264-267.

Yuen teaches a “wearable computing device compris[ing] a finger-worn wearable ring device.” *Id.* ¶264. Yuen describes that this device can be worn many ways on the user’s body, for example, on the user’s “arm, wrist, leg and/or ankle.” Ex-1006, 12:50-52. Further, Yuen’s device may be integrated into a “necklace, chest band, bra, patch, glasses, earring, or toe band.” *Id.*, 24:35-37. Because Yuen’s device can be integrated into an “earring” or “toe band”, a POSITA would have found it obvious that Yuen’s device could be worn as a “finger-ring” because a “toe band” and “earring” is structurally equivalent to a “finger ring.” *Id.*, 24:35-40; Ex-1002 ¶¶264-265 (explaining the similarities between fingers and toes and the known advantages of a finger ring-construction). Further, Yuen teaches that “the user may touch an optical window[] with a finger on the opposing hand to initiate a heart rate measurement.” Ex-1006, 12:65-13:1; *see also id.* 13:5-9. Thus, a POSITA would have understood that integrating the

device in a finger ring would allow the optical window to already be touching the finger of the user. Ex-1002 ¶264.

Yuen also teaches the light emitting components positioned within the housing of the finger-worn wearable device. Ex-1002 ¶266. As shown below in Figure 5, Yuen's "light sources [(yellow)] and photodetector [(orange)] are placed on a flexible PCB [(purple)]." Ex-1006, 2:38-39; *see also id.*, 12:35-42.



Id., Fig. 5.

Yuen teaches a first light emitting component at a first radial position and a second light emitting component at a second radial position. Ex-1002 ¶267. Yuen explains that the "light sources (e.g. LEDs)" in Figure 5 may be "located on one or more sides of the photodetector (for example, either side or opposing sides of a photodetector) to enable photoplethysmography (PPG)." Ex-1006, 2:31-35. As

shown in Figure 5 above, a POSITA would have understood that Yuen's first light source (yellow) is positioned at a first radial position (R1) and second light source is positioned at a second radial position (R2) within the housing of the device and from the center of the user's wrist, when the light sources are placed on "either side or opposing sides of a photodetector." Ex-1002 ¶267.

Moreover, a POSITA would have understood that Yuen's light emitting components are positioned at two different radial positions when Yuen's biometric monitoring device is arranged as a ring because Yuen's light sources and photodetectors can adapt a circumferential and curvilinear orientation to facilitate skin contact with the user's finger. Ex-1002 ¶268. For example, Yuen explains that the light sources and associated detectors are disposed on a "flexible or pliable substrate which facilitates the skin side of the device to conform... to the shape of the user's body part" so that there is "little to no gap between the skin side of the device and the juxtaposed surface of the skin of the user." Ex-1006, 12:24-42. Thus, the light sources disposed on the flexible PCB are conformed to contact the user's finger in the same way as the light sources in Yuen's sensor protrusion contact the user's skin in Figure 5. Ex-1002 ¶268. Therefore, a POSITA would have understood Yuen's light sources in the ring construction are positioned at different radial positions because the light sources are located at different circumferential positions along the curve of the ring, (i.e., the claimed "radial

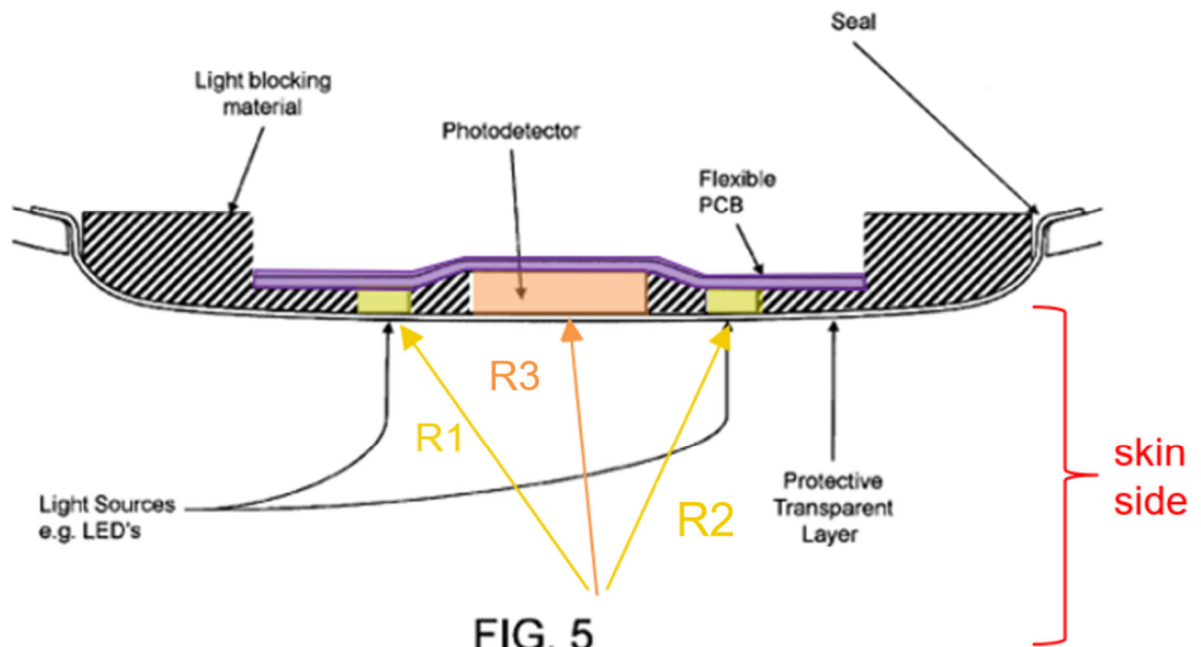
position”), like in the ’179 Patent. Ex-1001, Figs. 3B, 3C; Ex-1002 ¶268. A POSITA would have further understood that the light sources would be at different radial positions because separation between the light sources is important to enhance the quality of the plethysmogram signal and for redundancy within the device. Ex-1002 ¶268. Also, having the LEDs in a central circumference and away from the edges of the device, prevents light leakage from visible LEDs and interference from ambient light. *Id.*

- j. Claim 12: The wearable computing device of claim 11, wherein at least one light-receiving component is positioned within the housing at a third radial position that is between the first radial position and the second radial position.**

Yuen teaches Claim 12. Ex-1002 ¶¶269-272.

As discussed in Section XIII.D.2.i (Claim 11), A POSITA would have understood that Yuen’s light sources and photodetector can be shaped to facilitate skin contact with the user’s finger. Ex-1002 ¶¶268, 269.

Yuen teaches a “light-receiving component is positioned within the housing at a third radial position that is between the first radial position and the second radial position.” Ex-1002 ¶270. As shown below in Figure 5, Yuen’s sensor protrusion includes light sources and photodetector disposed on a “flexible PCB” within the housing of the device at different radial positions (R1, R2, and R3). Ex-1006, 12:35-42, Fig. 5.



As shown in Figure 5, Yuen's photodetector (orange) is positioned at a third radial position (R3) that is between the first and second radial position (R1, R2) of the light sources (yellow) within the housing of the device. Ex-1002 ¶271; Ex-1006, Fig. 5. As discussed above, Yuen explains that the "light sources (e.g. LEDs) may be located on one or more sides of the photodetector (for example, either side or opposing sides of a photodetector) to enable photoplethysmography." Ex-1006, 2:31-35. Thus, a POSITA would have understood that photodetector is at third radial position when the light sources are placed on "either side or opposing sides of a photodetector." Ex-1002 ¶271.

Further, as previously discussed, the light sources disposed on the flexible PCB can also conform to contact the user's finger in the same way as the light

sources in Yuen's sensor protrusion contact the user's skin in Figure 5. Ex-1002

¶272. A POSITA would have understood that Yuen's photodetector is positioned within the housing at a third radial position that is between the first radial position and the second radial position because the photodetector is located at different circumferential position along the curve of the ring (i.e., the claimed "radial position"), like in the '179 Patent. Ex-1001, Figs. 3B, 3C; Ex-1002 ¶272. A POSITA would have further understood that the photodetector would be at different a radial position than the light sources because separation between the LEDs and the photodetector is important to enhance the quality of the plethysmogram signal. Ex-1002 ¶272. Also, having the light sources in a central circumference and away from the edges of the device, prevents light leakage from visible LEDs and interference from ambient light. *Id.*

E. Ground 5: Claims 1-10, 13-16 Are Obvious Over Yuen (Ex-1006) in view of Schröder (Ex-1007)

1. A POSITA would have been motivated to combine Yuen's teachings with Schröder's teachings and would have had a reasonable expectation of success.

A POSITA would have been motivated to combine the teachings of Yuen and Schröder ("Yuen-Schröder") and would have had a reasonable expectation of success in doing so because each relates to the same well-known technologies. Ex-1002 ¶¶273-281. For example, both are directed to wearable biometric sensing devices having similar structural components including, inner and outer surfaces

and an electronic component (such as batteries and microprocessors). *See, e.g.*, Ex 1006, 12:50-52, Fig. 7; Ex 1007, 9:54-10:9, Figs. 6-10.

Schröder's teachings involve methods of capturing information about finger veins, which is crucial for applications such as biometric identification or medical diagnostics. Ex-1002 ¶274. This methodology specifically targets the patterns of veins within the finger. *Id.*

Building on this understanding, a POSITA would have recognized that Yuen's teachings, which discuss the capture of pulse oximetry data, also indirectly involve capturing information about veins. Ex-1002 ¶275. Pulse oximetry is a non-invasive method used to measure the oxygen saturation level of the blood and heart rate through PPG, a technique that detects blood volume changes in the microvascular bed of tissue. *Id.*

PPG technology is sensitive to changes in blood volume within tissues, which includes the venous structures targeted by Schröder's vein image. Ex 1002 ¶276. A POSITA would understand that both Schröder's and Yuen's techniques involve data collection from veins. *Id.* 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. *Id.*

Yuen's biometric monitoring device can be worn on an appendage of the user's body, for example, on the user's "arm, wrist, leg and/or ankle." Ex-1006, 2:7-17, 12:50-52. Yuen also teaches that the device can be "worn in any number of ways including, but not limited to" a chest band, necklace, patch, bra, earring, glasses, "or toe band." Ex-1006, 24:35-40. Schröder teaches that its biometric sensing device is "a finger-ring," which "is worn by a user e.g., permanently on the finger." Ex-1007, 2:60-64, 3:61-62.

A POSITA would have been motivated to combine the functionality of Yuen's biometric monitoring device with Schröder's finger ring structure because a POSITA would have found it beneficial to implement Yuen's device in a more compact form that is not intrusive or obtrusive and is easier for the user to remember to wear. Ex 1002 ¶278. Yuen teaches that the device housing should enable the device to be worn by the user without "measurably or appreciably impact[ing] the user's activity." Ex-1006, 23:63-67. Moreover, an exemplary structure that Yuen teaches for its device is a "toe band," which a POSITA would have understood is structurally equivalent and/or identical to a "finger ring." Ex 1002 ¶¶279-280. Schröder teaches that a finger ring is desirable because it cannot be easily lost or taken without authorization because it is worn on the user's finger. Ex-1007, 4:15-18. Thus, design incentives and market forces would have

motivated a POSITA to apply the teachings of Schröder to Yuen. Ex 1002 ¶279; *DyStar*, 464 F.3d at 1368.

A POSITA would have been motivated to implement orienting Schröder's finger ring using Yuen because wireless charging increases a device's longevity is more convenient for users. Ex-1002 ¶280. A POSITA would have also understood that implementing Yuen's device with Schröder's finger ring structure would ensure a tighter fit than a device worn, for example, on the user's wrist, which would reduce motion artifact, provide better shielding against ambient light, and allow for a higher quality reading from any sensors on the device (e.g., heart rate, temperature, etc.). *Id.* Yuen acknowledges these motivations because it teaches the desirability for "light source(s) and/or associated detector(s)" to be "close to the skin of the user (i.e., with little to no gap between the skin side of the device and the juxtaposed surface of the skin of the user)." Ex-1006, 12:24-35. Moreover, Yuen teaches that improving "sustained and/or fixed contact between the biometric monitoring device and the user's skin" is desirable because it "may reduce the amount of stray light measured by the photodetector, decrease motion between the biometric monitoring device and the user, and/or provide improved local pressure to the user's skin; all of which may increase the quality of the cardiac signal of interest." *Id.*, 13:54-62; *see also id.*, 14:25-32 ("[T]he use of a protrusion and/or friction may improve measurement accuracy of data acquisition

corresponding to certain parameters (e.g., heart rate, heart rate variability, galvanic skin response, skin temperature, skin coloration, heat flux, blood pressure, blood glucose, etc.) by reducing motions of the sensor relative to the user's skin during operation, especially whilst the user is in motion.”). Ex 1002 ¶280; Ex-1006 14:25-29.

A POSITA would also have been motivated to implement Schröder's wireless inductive charging to replace the wired connection charging in Yuen's device. Ex-1002 ¶281. A POSITA would have realized the many benefits of wireless charging, such as simplicity of use, reliability, and no need for cords or cables. *Id.*

A POSITA would have had a reasonable expectation of success in combining Yuen and Schröder. Ex 1002 ¶282. Yuen and Schröder are analogous prior art as they both involve biometric sensing devices having similar structural components such as inner and outer surfaces and a cavity housing an electronic part. *Id.* Moreover, a POSITA would have understood that the electronic components of Yuen and Schröder's biometric sensing devices are similar such that they are programmable using standard processors and are interchangeable regardless of whether the devices are in the form of, for example, a toe band or a finger ring. *Id.* A POSITA would have understood, therefore, that these references disclose interrelated teachings based on routine technologies that would have been

amenable to various well-understood and predictable combinations to provide more features and enhance user interest. *Id.*

2. Independent Claim 1

a. Element 1[pre]: A wearable computing device, comprising:

Yuen in view of Schröder teaches Element 1[pre] for the same reasons discussed in Section XIII.D.1.a (Ground 4). Ex-1002 ¶¶230-231, 283.

b. Element 1[a]: a housing comprising an interior wall and an exterior wall of the wearable computing device

Yuen in view of Schröder teaches Element 1[a] for the same reasons discussed in Section XIII.D.1.b (Ground 4). Ex-1002 ¶¶232-234, 284-286.

Further, as shown in Figures 4 and 8, Schröder's finger-ring consists of an interior wall and an exterior wall. Ex-1007, 12:7-8. A POSITA would have understood that the interior wall is the wall touching the finger of the user and the exterior wall is exposed to the environment. Ex-1002 ¶¶285-286.

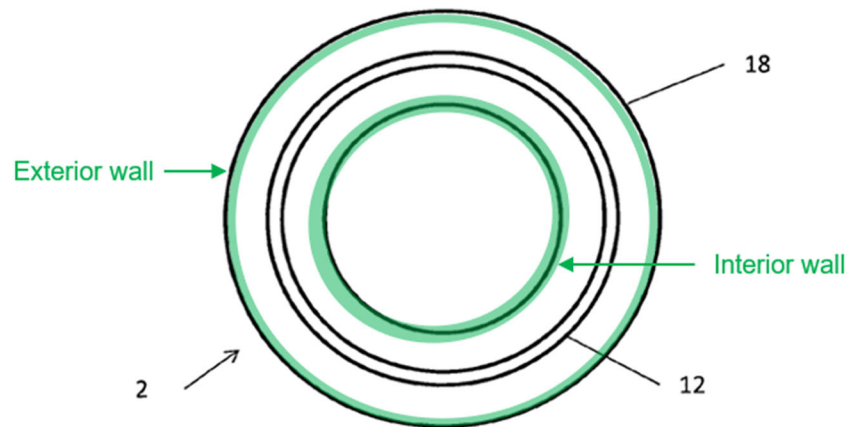


Fig. 4



Fig. 8

Ex-1007, Figs. 4 and 8.

- c. **Element 1[b]: a printed circuit board disposed within the housing;**

Yuen-Schröder teaches Element 1[b] for the same reasons discussed in Section XIII.D.1.c (Ground 4). Ex-1002 ¶¶235-237, 287.

- d. **Element 1[c(i)]: a plurality of sensors electrically coupled with the printed circuit board, the plurality of sensors configured to acquire data from a user, the plurality of sensors comprising:**

Yuen-Schröder teaches Element 1[c(i)] for the same reasons discussed in Section XIII.D.1.d (Ground 4). Ex-1002 ¶¶238-239, 288.

- e. **Element 1[c(ii)]: one or more light-emitting components configured to emit light associated with two or more wavelengths, wherein the two or more wavelengths include a first wavelength associated with infrared light and a second wavelength associated with visible light; and**

Yuen-Schröder teaches Element 1[c(ii)] for the same reasons discussed in Section XIII.D.1.e (Ground 4). Ex-1002 ¶¶240-241, 289.

- f. **Element 1[c(iii)] one or more light-receiving components configured to receive the light associated with the two or more wavelengths;**

Yuen-Schröder teaches Element 1[c(iii)] for the same reasons discussed in Section XIII.D.1.f (Ground 4). Ex-1002 ¶¶242-243, 290.

- g. **Element 1[d]: one or more processors configured to process the data acquired by the plurality of sensors based at least in part on a reflectance, an absorbance, or both of the received light associated with the two or more wavelengths; and**

Yuen-Schröder teaches Element 1[d] for the same reasons discussed in Section XIII.D.1.g (Ground 4). Ex-1002 ¶¶244-246, 291.

- h. Element 1[e]: a communication module communicatively coupled with the plurality of sensors, the one or more processors, or both, the communication module configured to transmit the data acquired by the plurality of sensors, an analysis of the data generated by the one or more processors, or both, to a user device.**

Yuen-Schröder teaches Element 1[e] for the same reasons discussed in Section XIII.D.1.h (Ground 4). Ex-1002 ¶¶247-248, 292.

3. Dependent Claims 2-10, 13-16

- a. Claim 2: The wearable computing device of claim 1, wherein the one or more light-emitting components comprise a first light-emitting component configured to emit light associated with the first wavelength, a second light-emitting component configured to emit light associated with the second wavelength, and a third light-emitting component configured to emit light associated with a third wavelength, wherein the first light-emitting component, the second light-emitting component, and the third light-emitting component are physically separated from one another.**

Yuen-Schröder teaches Claim 2 for the same reasons discussed in Section XIII.D.2.a (Ground 4). Ex-1002 ¶¶249-250, 293.

- b. Claim 3: The wearable computing device of claim 1, wherein the one or more light-emitting components comprise a single light-emitting module configured to emit the light associated with the first wavelength, the second wavelength, and a third wavelength.**

Yuen-Schröder teaches Claim 3 for the same reasons discussed in Section XIII.D.2.b (Ground 4). Ex-1002 ¶¶251, 294.

- c. **Claim 4: The wearable computing device of claim 1, wherein the one or more processors are further configured to: determine a first absorbance of the first wavelength, and a second absorbance associated with the second wavelength; and determine one or more characteristics of blood of the user based at least in part on the first absorbance and the second absorbance.**

Yuen-Schröder teaches Claim 4 for the same reasons discussed in Section XIII.D.2.c (Ground 4). Ex-1002 ¶¶252-258, 295.

- d. **Claim 5: The wearable computing device of claim 4, wherein the one or more characteristics of the blood of the user comprise a blood alcohol level, a blood glucose level, a blood oxygenation level, or any combination thereof.**

Yuen-Schröder teaches Claim 5 for the same reasons discussed in Section XIII.D.2.d (Ground 4). Ex-1002 ¶¶259, 296.

- e. **Claim 6: The wearable computing device of claim 1, wherein the one or more processors are configured to: determine an ambient light level based at the one or more light-receiving components; and selectively adjust one or more operational parameters of the one or more light-emitting components based at least in part on the ambient light level, wherein processing the data is based at least in part on selectively adjusting the one or more operational parameters.**

Yuen-Schröder teaches Claim 6 for the same reasons discussed in Section XIID.2.e (Ground 4). Ex-1002 ¶¶260, 297.

- f. Claim 7: The wearable computing device of claim 6, wherein the one or more operational parameters comprise an intensity of the light emitted by the one or more light-emitting components.**

Yuen-Schröder teaches Claim 7 for the same reasons discussed in Section XIII.D.2.f (Ground 4). Ex-1002 ¶¶261, 298.

- g. Claim 8: The wearable computing device of claim 1, wherein the one or more processors are configured to: determine whether or not the user is wearing the wearable computing device based at least in part on the data acquired by the plurality of sensors; and selectively adjust one or more operational parameters of the plurality of sensors based at least in part on whether or not the user is wearing the wearable computing device.**

Yuen-Schröder teaches Claim 8 for the same reasons discussed in Section XIII.D.2.g (Ground 4). Ex-1002 ¶¶262, 299.

- h. Claim 9: The wearable computing device of claim 1, further comprising: a feedback component communicatively coupled with the one or more processors, wherein the feedback component is configured to provide feedback to the user based at least in part on the data acquired by the plurality of sensors.**

Claim 10: The wearable computing device of claim 9, wherein the feedback comprises visual feedback, audible feedback, haptic feedback, or any combination thereof.

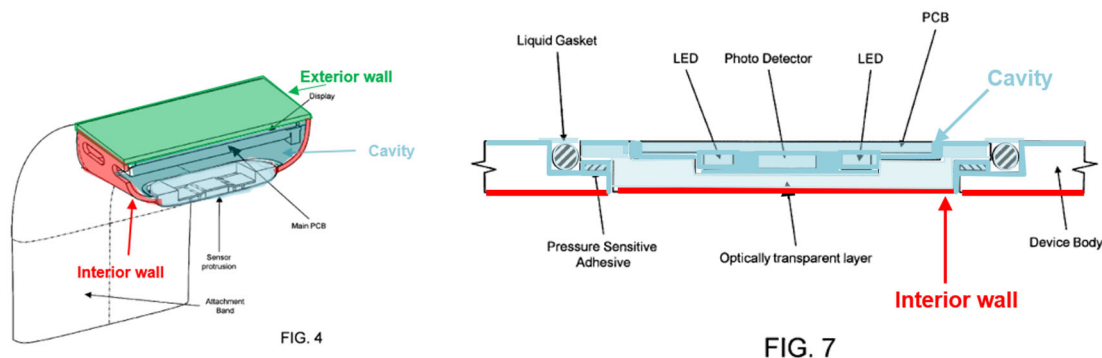
Yuen-Schröder teaches Claims 9 and 10 for the same reasons discussed in Section XIII.D.2.h (Ground 4). Ex-1002 ¶¶263, 300.

- i. **Claim 13: The wearable computing device of claim 1, further comprising: a power management module disposed within a cavity between the interior wall and the exterior wall, the power management module configured to wirelessly transfer energy from an external energy source to a battery of the wearable computing device through the interior wall, the exterior wall, or both.**

Yuen-Schröder teaches Claim 13. Ex-1002 ¶¶301-305.

Yuen teaches a cavity between the interior and exterior walls. *Id.*

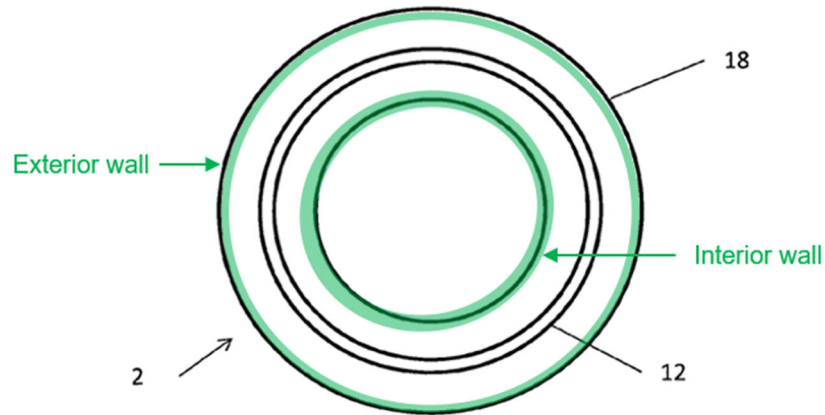
Specifically, Yuen teaches that a cavity is formed on the inner (skin-facing) surface (red) of the biometric monitoring device, as shown in blue in Figures 4 and 7 (depicting a cross-sectional view of a PPG sensor). Ex-1006, Figs. 4, 7; Ex-1002¶ 301.



Similarly, Schröder's finger-ring consists of "two ring halves 16 and 18" with a recess so that "inlay 12 is inserted." Ex-1007, 12:7-9; *see also id.*, 8:56-57 (inlay 12 "arranged" in the interior). Like Yuen, Schröder's finger-ring consist of an interior wall and an exterior wall as shown in Figure 4 and 8 below. Ex-1007, 12:7-8. A POSITA would have understood that Schröder's interior wall is the wall

touching the finger of the user and the exterior wall is exposed to the environment.

Ex-1002 ¶302.



Ex-1007, Figs. 4 and 8.

Yuen-Schröder teaches a power management module disposed within a cavity between the interior and exterior walls. Ex-1002 ¶303. Schröder explains that inlay 12 can have a “chip module 10 with at least one antenna coil 8, with at least one further electronic device.” Ex-1007, 12:61-65. Schröder also explains that an “energy storage device is connected to the chip module 10 in order to supply the chip module 10 with energy outside an electromagnetic field of a

reader.” *Id.*, 11:48-50. Schröder’s “energy storage devices, e.g., an accumulator or a battery” is “charged by means of the reader’s electromagnetic field.” *Id.*, 11:46-55. Thus, A POSITA would have understood that the battery being connected to chip module is arranged inside the finger-ring’s cavity to power the interior electrical components. Ex-1002 ¶303.

Yuen-Schröder’s power management module wirelessly transfers energy from an external energy source to the finger ring’s battery through a wall. Ex-1002 ¶304. Schröder’s battery (energy storage device) is “connected directly to the antenna coil 8 via a rectifier circuit” for charging. Ex-1007, 11:63-67. A POSITA would have understood that antenna coil 8 is the inductive charging component that is configured to wirelessly transfer energy from the “reader’s magnetic field” to the battery. Ex-1002 ¶304. As described in Section XIII.E.1, a POSITA would have been motivated to implement Schröder’s wireless inductive charging to replace the wired connection charging in Yuen’s device. Ex-1002 ¶¶280-281-304.

- j. **Claim 14: The wearable computing device of claim 13, wherein the power management module comprises an inductive charging component configured to transfer energy from the external energy source to the battery via an inductive charging process.**

Yuen-Schröder teaches Claim 14. Ex-1002 ¶¶306-207.

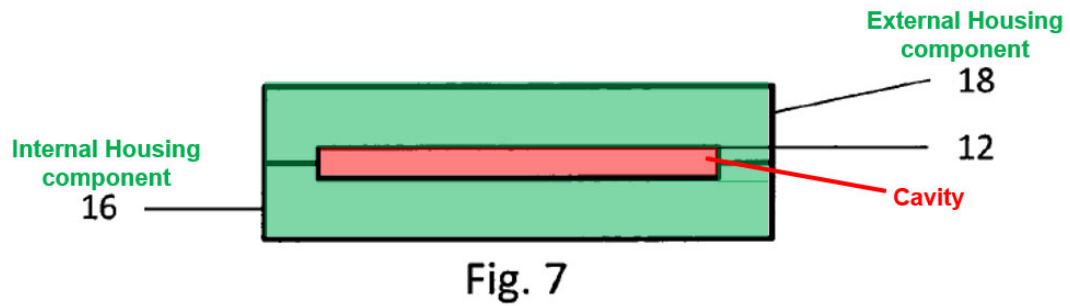
As discussed in Section XIII.E.3.i (Claim 13) Schröder’s is “connected directly to the antenna coil 8 via a rectifier circuit” and configured to wirelessly

transfer energy from the “reader’s magnetic field” to the battery. Ex-1007, 11:63-67. A POSITA would have understood that the charging process described in Schröder involves an inductive charging process. Ex-1002 ¶¶306-307.

- k. **Claim 15: The wearable computing device of claim 1, wherein the housing comprises: an internal housing component defining the interior wall; and an external housing component defining the exterior wall, the external housing component coupled to the internal housing component, wherein one of the internal housing component or the external housing component further defines a first side wall and a second side wall that extend between the internal housing component and the external housing component.**

Yuen-Schröder teaches Claim 15. Ex-1002 ¶¶308-312.

Yuen-Schröder’s internal housing component defines the interior wall and is coupled to the external housing component which defines the exterior wall. *Id.* Specifically, Schröder’s finger-ring is defined by coupled external and internal housing components. *Id.* As discussed above in Section XIII.E.3.i (Claim 13), Schröder’s finger-ring has a cavity between the internal and external housing components which houses and thus surrounds Schröder’s inlay 12. Ex-1002 ¶¶303, 308.



Ex-1007, Fig. 7.

Also as discussed in Section XIII.C.2.a (Claim 15, Ground 3), Schröder’s finger-ring consists of an internal housing component defining an interior wall and an external housing component defining an exterior wall. Ex-1007, 12:7-8.

Schröder’s finger-ring also includes internal and external housing components having a first and second side wall that extend between the internal and external housing components. Ex-1002 ¶¶225, 309.

Schröder states that ring halves 16 and 18 are manufactured by casting, milling, or embossing and are “interconnected by a suitable technology, e.g., by plugging, gluing, screwing, crimping, etc.” Ex-1007, 12:10-22. Schröder provides various designs for the shape of the ring halves, such as a U-shape with inlay 12 being arranged between the components 16 and 18. *Id.*, 12:45-55. As shown in Figure 7 below, a POSITA would have understood that the U-shaped housing components are connected to each other and thus form “side walls” (red) that

extend from external housing component 18 to internal housing component 16 and surround the cavity (occupied by inlay 12). Ex-1002 ¶310.

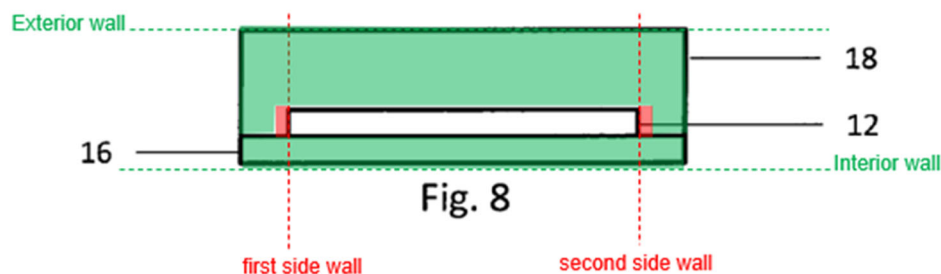
A POSITA would have understood that both housing components thus define a first side wall and a second side wall because both components are U-shaped. Ex-1002 ¶¶311-312. Similarly, in Figure 8, external housing portion 18 is a U-shape component that extends and connects to internal housing component 16. *Id.* External housing portion 18 also defines the cavity by surrounding inlay 12 therefore having “side walls” (red) to form the connection. *Id.* A POSITA would have understood that the external housing component defines the first and second side wall because it is U-shaped. *Id.*



Ex-1007, Figs. 7, 8.

- I. **Claim 16: The wearable computing device of claim 15, wherein the first side wall, the second side wall, or both, are substantially perpendicular to the interior wall, the exterior wall, or both.**

Yuen-Schröder teaches Claim 16. Ex-1002 ¶¶313-314. Yuen-Schröder's first and second side walls are substantially perpendicular to the interior and exterior walls. *Id.* As stated above for Claim 15, the side walls are the parts of the U-shaped components that extend from external housing component 18 to internal housing component 16 and surround the cavity to connect the housing components. As shown in Figure 8, a POSITA would have understood that Schröder's first and second side walls (red) are substantially perpendicular to the interior and exterior walls (green) because they are portions of the U-shaped components that extend to connect the housing components. Ex-1002 ¶313.



Ex-1007, Fig. 8. A POSITA would have been motivated to implement side walls that are substantially perpendicular to the interior and exterior walls to improve the structure of the cavity and extend the longevity of the components. Ex-1002 ¶314.

F. Ground 6: Claims 11-12 Are Obvious Over Yuen (Ex-1006) in view of Niwa (Ex-1005)

1. A POSITA would have been motivated to combine the teachings of Yuen and Niwa, and would have had a reasonable expectation of doing so

A POSITA would have been motivated to combine the teachings of Yuen and Niwa (“Yuen-Niwa”) and would have had a reasonable expectation of success in doing so because each relates to the same well-known technologies. Ex 1002 ¶¶315-319. Both are directed to wearable biometric sensing devices having similar structural components including, for example, a housing that includes light emitting sources and a light receiving portion disposed within the walls of the device. *See, e.g.*, Ex-1005 ¶191, ¶209; Ex-1006, 14:33-37, 6:24-31.

Yuen’s biometric monitoring device can be worn on an appendage of the user’s body, for example, on the user’s “arm, wrist, leg and/or ankle.” Ex-1006, 2:7-17, 12:50-52. Yuen also teaches that the device can be “worn in any number of ways including, but not limited to” a chest band, necklace, patch, bra, earring, glasses, or “toe band.” *Id.*, 24:35-40. Niwa discloses that its wearable computing device has a finger ring construction “worn on the third joint of the finger.” Ex-1005 ¶191.

A POSITA would have been motivated to combine the functionality of Yuen’s biometric monitoring device with Niwa’s finger ring construction because a POSITA would have found it beneficial to implement Yuen’s device in a more

compact form that is not intrusive or obtrusive and is easier for the user to remember to wear. Ex 1002 ¶317. Yuen teaches that the device housing should enable the device to be worn by the user without “measurably or appreciably impact[ing] the user’s activity.” Ex-1006, 23:63-67. Moreover, an exemplary structure that Yuen teaches for its device is a “toe band,” which a POSITA would have understood is structurally equivalent and/or identical to a “finger ring.” Ex 1002 ¶317. Niwa teaches that a finger ring is desirable because the finger ring construction allows the plethysmogram to be measured to fit the third joint of the finger. Ex-1005 ¶191. Thus, design incentives and market forces would have motivated a POSITA to apply the teachings of Niwa to Yuen. Ex 1002 ¶317, *DyStar*, 464 F.3d at 1368.

Niwa also teaches various constructions of the plethysmogram sensor. Ex 1002 ¶317. For example Niwa’s plethysmogram sensor can include several light sensor modules with the light emitting portion and light receiving portion at different locations. Ex-1005 ¶164. Similarly, Yuen teaches that “the biometric monitoring device may consist of a plurality of photodetectors and photoemitters distributed along the surface of the device” such that the photodetectors and photoemitters touch the user’s skin. Ex-1006, 19:3-7. A POSITA would have understood that having a wearable biometric sensing device that includes multiple light emitters and light receivers is beneficial to provide accurate and real-time

information to the user about the user's health. Ex 1002 ¶318. Having multiple light emitters and light receivers also allows for redundancy, avoids the risk of an emitter or receiver being blocked by a skin occlusion, allows for better visualization of vascular tissue (because visualization is enabled at multiple locations), enhances signal-to-noise ratio, and helps to offset noise due to ambient light and sunlight. *Id.*

Thus, a POSITA would have understood that these references disclose interrelated teachings based on routine technologies that would have been amenable to various well-understood and predictable combinations to provide more features and enhance user interest. Ex 1002 ¶319.

2. Dependent Claims 11-12

- a. Claim 11: The wearable computing device of claim 1, wherein the wearable computing device comprises a finger-worn wearable ring device, wherein the one or more light-emitting components comprise a first light-emitting component positioned within the housing of the finger-worn wearable ring device at a first radial position, and a second light-emitting component positioned within the housing of the finger-worn wearable ring device at a second radial position different from the first radial position.**

Yuen-Niwa teaches Claim 11. Ex-1002 ¶¶320-323.

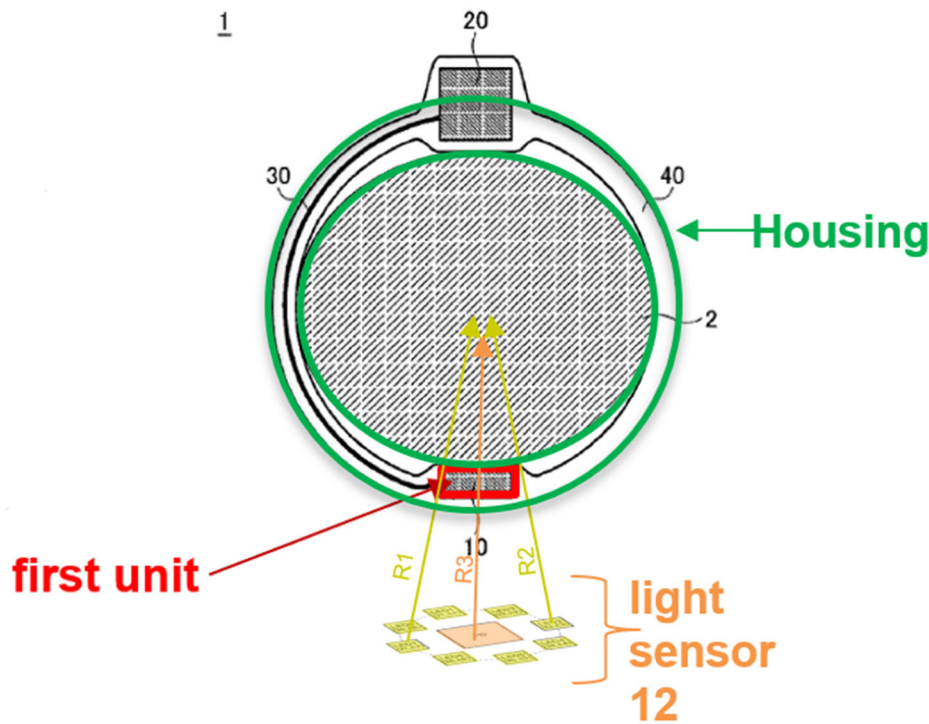
As discussed in Section XIII.F.1, Yuen's biometric monitoring device is a ring. *Id.* A POSITA would have been motivated to implement Yuen's monitoring device as a finger ring, because it is an obvious design choice, as taught by Niwa.

Id. Niwa discloses that its wearable computing device has a finger ring construction that is “worn on the third joint of the finger.” Ex-1005 ¶191. A POSITA would have been motivated to combine the teachings of Yuen and Niwa and would have had a reasonable expectation of success in doing so for the same reasons discussed in Section XIII.F.1. Ex 1002 ¶¶315-319.

Yuen-Niwa’s finger ring device comprises a first light-emitting component positioned within the finger ring’s housing at a first radial position and a second light-emitting component positioned at a second radial position. Ex-1002 ¶321. As discussed in Section XIII.D.2.i (Claim 11, Ground 4), a POSITA would have understood Yuen’s light sources are positioned at a first and second radial position. Ex-1002 ¶¶ 264-268, 321.

Further, Niwa explains its plethysmogram sensor can have multiple light emitting and light receiving portions arranged in the finger ring’s housing. Ex 1002 ¶¶152-167, 322. As discussed in Section XIII.A.2.e (Claim 11, Ground 1) and shown in Figure 3, Niwa’s light sensor 12 (the claimed light emitting component) has various light emitting components at a first and second radial position. *Id.* ¶¶180-186, 322. When Figure 3 is in light sensor 12 (as exemplified below in modified Figure 22’), Niwa’s LED7 (yellow) is positioned at a first radial position (R1) and LED3 (yellow) is positioned at a second radial position (R2) within the housing of the sensor (green). As explained above, LED7 and LED 3

are positioned at different radial positions because the LEDs are located at different circumferential positions along the curve of the ring, (i.e., the claimed “radial position”), just like in the ’179 Patent. Ex-1001, Figs. 3B, 3C.



A POSITA would have further understood that the LEDs would be at different radial positions because separation between the LEDs is important to enhance the quality of the plethysmogram signal and for redundancy within the device. Ex-1002 ¶322. A POSITA would have further understood that the LEDs would be at different radial positions because separation between the LEDs is important to enhance the quality of the plethysmogram signal and for redundancy within the device. *Id.*

A POSITA would have been motivated to modify Yuen's biometric monitoring device to include Niwa's light sensors with LEDs at different radial to provide more accurate and real-time information to the user about the user's health. Ex-1002 ¶323. A POSITA would have understood that having an LED that emits infrared light positioned at a different radial position than an LED that emits visible light is important to capture different segments of tissues or for redundancy. *Id.* ¶323. Having multiple light emitting sources and light receiving portions also helps to enable an offset of noise caused by ambient light and sunlight. As described in Section XIII.F.1, a POSITA would have been motivated to implement Niwa's light sensor with its different radial positions into Yuen's device with a reasonable expectation of success. Ex-1002 ¶¶315-319, 323. A POSITA would have also understood that having the LEDs in a central circumference and away from the edges of the device, prevents light leakage from visible LEDs and interference from ambient light. *Id.*

- b. Claim 12: The wearable computing device of claim 11, wherein at least one light-receiving component is positioned within the housing at a third radial position that is between the first radial position and the second radial position.**

Yuen-Niwa teaches Claim 12. Ex-1002 ¶¶324-325.

Yuen-Niwa teaches a light-receiving component positioned within the housing at a third radial position between the first and second radial positions. *Id.*

As discussed in Section XIII.D.2.j (Claim 12, Ground 4), a POSITA would have understood Yuen's photodetector is positioned within the housing at a third radial position that is between the first and second radial positions. *Id.* Niwa similarly has a photodetector positioned within the finger ring's housing at a third radial position that is between the first and second radial positions, as explained above in Section XIII.A.2.f (Claim 12, Ground 1). Niwa discloses "multiple light emitting portions provided at different places [and] at least a single light receiving portion to detect each intensity of lights emitted from each of the multiple light emitting portions." Ex-1005 ¶32; *see also id.* ¶¶43, 117, Fig. 1. As shown above in modified Figure 22', Niwa's light receiving portion PD (orange) is positioned at a third radial position (R3) that is between the first radial position (R1) of LED7 (yellow) and second radial position (R2) of LED3 (yellow) within the housing of the sensor (green). Ex-1002¶324.

A POSITA would have been motivated to modify Yuen's biometric monitoring device to include Niwa's light sensors with a light receiving portion at third radial position to provide more accurate and real-time information to the user about the user's health. Further, a POSITA would be motivated to have a photodetector positioned at a third radial position in Yuen, as taught in Niwa in order to receive the light emitted by the multiple LEDs for redundancy and to offset noise caused by ambient light or sunlight. Ex-1002 ¶325. A POSITA would

have been motivated to combine the teachings of Yuen and Niwa and would have had a reasonable expectation of success in doing so for the same reasons discussed in Section XIII.E.1. *Id.*

XIV. THE BOARD SHOULD NOT USE ITS DISCRETION TO DENY INSTITUTION UNDER *FINTIV*.

The Board should decline to exercise its discretion to deny institution under 35 U.S.C. §314(a) because while there is a pending declaratory judgment action between PO and Petitioner, there are no invalidity claims and therefore no overlap with this petition. Should the circumstances regarding validity change, Petitioner will respectfully request leave to brief any discretionary denial issues, to the extent raised.

XV. CONCLUSION

The unpatentability grounds presented above are reasonably likely to prevail, post-grant review should be instituted, and Claims 1-16 should be cancelled as unpatentable over the prior art.

Respectfully Submitted,

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CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), Petitioner certifies that this petition includes 18,044 words, as measured by Microsoft Word, exclusive of the table of contents, mandatory notices under § 42.8, certificates of service, word count, and exhibits.

CERTIFICATE OF SERVICE (37 C.F.R. §42.6(e)(1))

The undersigned hereby certifies that the above document was served on May 31, 2024, by filing this document through the Patent Trial and Appeal Board P-TACTS System, as well as delivering a copy via express mail upon the following attorneys of record for the Patent Owner:

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