UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

RINGCONN LLC
Petitioner

v.

OURARING, INC.
Patent Owner.

Case No. IPR2025-00412
U.S. Patent No. 11,868,178

PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 11,868,178

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LIST OF EXHIBITS[1]

Ex. No.	Description
Ex-1001	U.S. Patent No. 11,868,178 (“the ’178 Patent”)
Ex-1002	Declaration of Dr. Brian W. Anthony
Ex-1003	Curriculum Vitae of Dr. Brian W. Anthony
Ex-1004	Prosecution History of the ’178 Patent (Application No. 18/323,385)
Ex-1005	U.S. Patent Publication No. 20120016245 to Niwa (“Niwa”)
Ex-1006	U.S. Patent No. 8,954,135 to Yuen (“Yuen”)
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

[1] Four-digit pin citations that begin with 0 are to the branded numbers added in the bottom right corner of the exhibits. All other pin citations are to original page, column, paragraph, or line numbers.

Ex. No.	Description
Ex-1017	INTENTIONALLY LEFT BLANK
Ex-1018	INTENTIONALLY LEFT BLANK
Ex-1019	INTENTIONALLY LEFT BLANK
Ex-1020	Claim Mapping Table
Ex-1021	INTENTIONALLY LEFT BLANK
Ex-1022	Parallel Citations (Schröder ’867 to Certified Translation of DE 102013012339.9)
Ex-1023	*Dynamic Drinkware*-type analysis for Mestas
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., *Reflectance Pulse Oximetry – Principles and Obstetric Application in the Zurich System*, 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., *Pulse Oximetry*, 70 Journal of American Society of Anesthesiologists, Inc. (Jan. 1989) (“Tremper”)
Ex-1030	Y. Mendelson et al., *A Wearable Reflectance Pulse Oximeter for Remote Physiological Monitoring*, Proceedings of 28th IEEE EMBS Annual International Conference (Aug. 30-Sept. 3, 2006) (“Mendelson 2006”)
Ex-1031	Sokwoo Rhee et al., *Artifact-Resistant, Power-Efficient Design of Finger-Ring Plethysmographic Sensors Part I: Design and Analysis*, IEEE (2000) (“Rhee 2000 Part I”)

Ex. No.	Description
Ex-1032	Sokwoo Rhee et al., *Artifact-Resistant, Power-Efficient Design of Finger-Ring Plethysmographic Sensors Part II: Prototyping and Benchmarking*, IEEE Proceedings of 22nd Annual EMBS Int'l Conference (July 23-28, 2000) ("Rhee 2000 Part II")
Ex-1033	Sokwoo Rhee et al., *Artifact-Resistant Power-Efficient Design of Finger-Ring Plethysmographic Sensors*, 48 IEEE Transactions of Biomedical Engineering (July 2001) ("Rhee 2001")
Ex-1034	U.S. Patent No. 6,699,199 to Asada ("Asada '199")
Ex-1035	Sokwoo Rhee, *Design and Analysis of Artifact-Resistive Finger Photoplethysmographic Sensors for Vital Sign Monitoring*, MIT (June 2000) ("Rhee Thesis 2000")
Ex-1036	C.T. Olofson et al., *Machining of Titanium Alloys* (1965) ("Olofson")
Ex-1037	H. Harry Asada et al., *Mobile Monitoring with Wearable Photoplethysmographic Biosensors*, IEEE Engineering in Medicine & Biology Magazine 28 (May-June 2003) ("Asada 2003")
Ex-1038	Denisse Castaneda et al., *A review on wearable photoplethysmography sensors and their potential future applications in health care*, 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	*Guidelines To Enhancing The Heart-Rate Monitoring Performance Of Biosensing Wearables* (2014)
Ex-1042	U.S. Patent No. 4,880,304 to Jaeb et al. ("Jaeb")
Ex-1043	Tom Lister et al., *Optical Properties of human skin*, Journal of Biomedical Optics (2012)
Ex-1044	John G. Webster, *Design of Pulse Oximeters*, CRC Press (1997)

Ex. No.	Description
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., *Episodic Sampling: Towards Energy-Efficient Patient Monitoring with Wearable Sensors*, Annual International Conference of the IEEE Engineering in Medicine and Biology Society (2009)
Ex-1052	Anastasios Petropoulos et al., *Flexible PCB-MEMS flow sensor*, Procedia Engineering 47 236-239 (2012) ("Petropoulos")
Ex-1053	Tianjia Sun et al., *Wireless Power Transfer for Medical Microsystems*, Springer (2013) ("Sun")
Ex-1054	U.S. Patent Pub. No. 2014/0187160 to Prencipe ("Prencipe")
Ex-1055	H. Ardebili and Michael G. Pecht, *Encapsulation Technologies for Electronic Applications*, William Andrew (2009) ("Ardebili")
Ex-1056	Ciprian Ciofu et al., *Injection and Micro Injection of Polymeric Plastics Materials: A Review*, Int'l J. Modern Mfg. Techs. 49 (2013)
Ex-1057	Richard J. Ross, *LCP Injection Molded Packages—Keys to JEDEC 1 Performance*, IEEE, 2004 Electronic Components and Technology Conference 1807 (2004)

Ex. No.	Description
Ex-1058	Tadamoto Sakai, *Encapsulation Process for Electronic Devices Using Injection Molding Method*, 12 Advances in Polymer Technology 61 (1993)
Ex-1059	N.J. Teh et al., *Embedding of Electronics within Thermoplastic Polymers using Injection Moulding Technique*, IEEE, 2000 Int'l Electronics Manufacturing Technology Symposium 10 (2000)
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

RingConn LLC ("Petitioner") requests inter-partes review ("IPR") of Claims 1-18[1] of U.S. Patent No. 11,868,178 ("the '178 Patent") (Ex-1001), currently assigned to Ouraring Inc. ("PO").

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

<u>Real Parties-in-Interest</u>: Petitioner identifies the following real party-in-interest: RingConn, LLC.

<u>Related Matters</u>:

PO has asserted the '178 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.); PO has also asserted the '178 Patent 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). PO has asserted the '178 Patent against Petitioner RingConn in *Ouraring, Inc. v. RingConn LLC*, 1-24-cv-01020 (D. Del.).

[1] Petitioner RingConn understands that prior to institution of PGR2024-00030, Patent Owner disclaimed claim 11. In order to maintain synchronicity with the PGR2024-00030 proceedings, challenges to claim 11 are retained in this copycat Petition. But to the extent that Patent Owner's disclaimer of claim 11 is effective, Petitioner RingConn does not challenge claim 11 here.

Samsung filed a suit against PO seeking a declaratory judgment of noninfringement of the ’178 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).

On January 3, 2025, RingConn filed a petition for Post-Grant Review of the ’178 Patent. A motion to withdraw that petition in favor of the present petition is forthcoming.

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III. FEE AUTHORIZATION

The PTO is authorized to charge any fees due during this proceeding to Deposit Account No. 50-3013.

IV. GROUNDS FOR STANDING

Petitioner certifies that the ’178 Patent is available for review, and Petitioner is not barred or estopped from requesting review.

V. PRECISE RELIEF REQUESTED

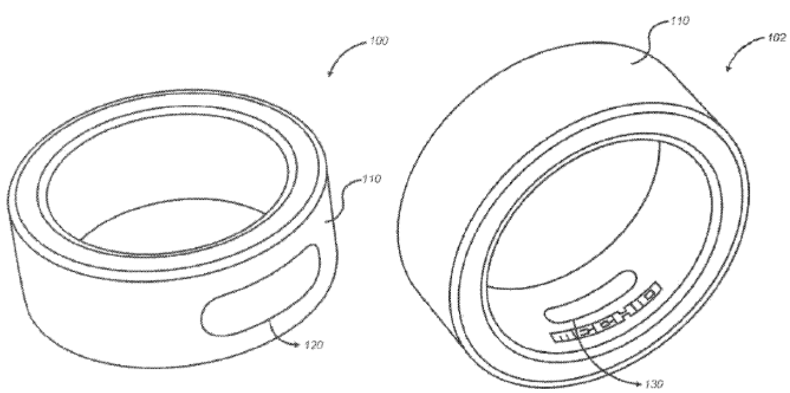
Petitioner requests review and cancellation of Claims 1-18 as unpatentable based on the following grounds supported by a declaration from Dr. Brian W. Anthony. Ex-1002 ¶¶1-131; Ex-1003.

Ground	Summary
1	Claims 1-3 and 17-18 are obvious over Schröder (Ex-1007).
2	Claims 1-3 and 13-16 are obvious over Schröder in view of Niwa (Ex-1005).
3	Claim 12 is obvious over Schröder in view of Mestas (Ex-1010).
4	Claims 1, 4-11 and 13-16 are obvious over Schröder in view of Yuen (Ex-1006).

VI. THE CHALLENGED PATENT

The challenged claims are directed to a finger-worn electronic device. The '178 Patent touts the convenience and versatility of wearable electronics. Ex-1001, 1:39-42. The patent suggests that the prior art wearable devices were uncomfortable or intrusive and proposes a wearable electronic device "in the shape of a ring" that allows a user to wear a device for an extensive period of time. *Id.*, 1:50-55.

An example of a finger-worn electronic device is illustrated on the cover of the '178 Patent (which corresponds to Figures 1A-1B). As shown below, the ring has an interior wall facing the skin. *Id.*, 11:20.



All challenged claims require a finger-worn wearable ring device. Independent Claim 1 recites "a finger-worn wearable ring device" with an external and internal housing component, a battery, a printed circuit board or "PCB", and one or more sensors. The battery and PCB are located in a cavity "formed between the internal housing component and the external housing component."

The ’178 Patent recognizes that wearable electronic devices had “many applications for the wearer” and “help[ed] monitor activity within the wearer’s body.” *Id*., 1:39-42. The claimed device allegedly overcomes the disadvantages of other wearable devices and can be worn for extended periods of time and perform measurements on the finger. *Id*., 1:50-55. As explained below, the ’178 Patent claims are obvious in view of the prior art.

VII. PROSECUTION HISTORY OF THE ’178 PATENT

The ’178 Patent was filed May 24, 2023, and claims priority through a series of continuation and divisional applications to U.S. Application Serial No. 14/556,062, filed November 28, 2014. Ex-1001. It also claims priority to two provisional applications, U.S. Application No. 62/006,835, filed June 2, 2014, and No. 61/910,201, filed November 29, 2013.

The patent was granted prioritized examination under 1.102(e)(1). Ex-1004, 1307. A Notice of Allowance was issued on November 15, 2023. *Id*., 1309.

This Petition presents new arguments and prior art not considered during prosecution, and nothing precludes considering them in the first instance under 35 U.S.C. §325(d). All challenged claims are invalid as obvious.

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 POSITA would have also been familiar with, for example, sensor system design and signal processing. A higher level of education or skill might make up for less experience, and vice versa. Ex-1002 ¶¶18-22.

IX. PRIORITY DATE

For purposes of this proceeding only, Petitioner assumes that the '178 Patent is entitled to its earliest alleged priority date, November 29, 2013, and thus applies AIA 35 U.S.C. §102.[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 ¶¶15-17.

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

[3] There is a pending declaratory judgment action involving Samsung.

XI. BRIEF DESCRIPTION OF THE APPLIED PRIOR ART

A. 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.[4] Ex-1002 ¶134. 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

[4] Accordingly, parallel citations for Schröder '867 citations are provided in Ex-1022.

claim a right of priority to DE 102013012339 under §365. AIA 35 U.S.C. §102(a)(2) and (d)(2); MPEP §2152. 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, Fig. 1 ("finger-ring" communicating with smartphone 4).

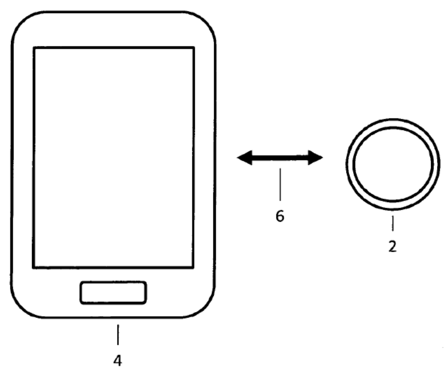


Fig. 1

As shown in Figure 7 below in the cross-section, Schröder's "finger-ring" consists of "two ring halves 16 and 18" with a recess so that "inlay 12 is inserted."[5] Ex-1007, 12:7-9. Inlay 12 consists of "flexible carrier material" like PET and Kapton and can have a "chip module 10 with at least one antenna coil 8." Ex-1007, 12:18-29, 12:61-65. A battery powers chip module 10 and is charged wirelessly. Ex-1007, 11:46-50, 11:55-56. The "finger-ring" also has "biometric sensors" such

[5] Throughout, emphasis and annotations are added unless otherwise specified.

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." Ex-1007, 9:62-10:4.

Fig. 7

B. 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 AIA §102(a)(1) and §102(a)(2). Petitioner is unaware of any facts supporting an exception under §102(b).

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. Ex-1005. Figures 22 and 26 depict Niwa's "finger ring type housing" that surrounds the user's finger and contains light-emitting and light-receiving components located at first unit 10 and a battery at second unit 20. *Id.* ¶¶29, 192. Cable 30 electrically connects the first and second units. Ex-1005 ¶¶62, 194-195. Second unit 20's battery supplies power to the first unit. *Id.* ¶¶62.

FIG.22

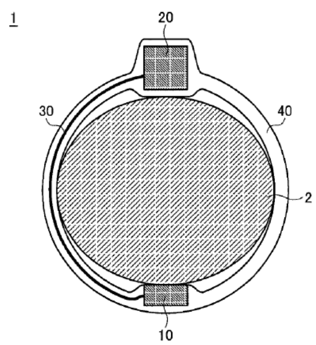
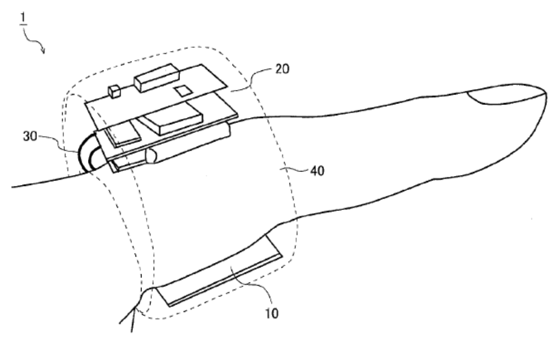
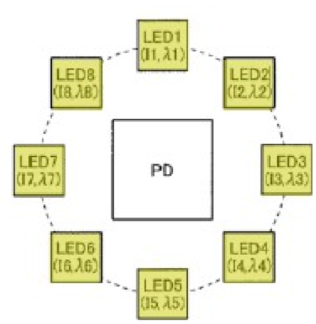


FIG.26



Niwa's first unit 10 can have various configurations for light-emitting portions and light-receiving portions. Ex-1005 ¶¶120, 147. As shown in Figure 3, the light-emitting portions may have "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.

FIG.3



C. Mestas (Ex-1010)

Mestas (U.S. Pat. Pub. No. 2014/0244009) was filed February 21, 2014, claiming priority to Provisional App. No. 61/768,279, filed February 22, 2013. Mestas was published August 28, 2014, and qualifies as prior art to the '178 Patent under AIA 35 U.S.C. §102(a)(2). Petitioner is unaware of any facts supporting an exception under AIA §102(b). Mestas's provisional application is essentially identical to the published application. *See generally* Ex-1010 (published Mestas application); Ex-1011 (provisional). The figures and the specification are identical.[6] Ex-1002 ¶142. Because the described subject matter is identical, Mestas's disclosures were effectively filed as of Mestas's provisional application, and Mestas is thus available as a patent prior art reference under 35 U.S.C. §102(a)(2) as of its provisional filing date of February 22, 2013. *See* AIA 35 U.S.C. §102(d)(2).[7]

Mestas teaches a wearable electronic device, depicted in Figure 1 below, which is an arm-band or a wrist-band, and can be used to monitor user biometrics such as heart rate. Ex-1010 ¶148. Mestas teaches that the "wearable athletic device

[6] The only difference between the two is the Mestas published application separately numbers all paragraphs in the Brief Description of Drawings, whereas the provisional does not. *Compare* Ex-1010 ¶¶9-137 *with* Ex-1011 ¶7.

[7] *See Penumbra, Inc. v. RapidPulse, Inc.*, IPR2021-01466, Paper 34 (PTAB Mar. 10, 2023) (precedential as to section II.E.3). For completeness, a pre-AIA *Dynamic Drinkware* analysis is included in Ex-1023.

may be worn in a variety of locations on a user's body including on a user's chest (e.g., a chest strap), around a user's wrist, around a user's arm, on a user's head, on a user's ankle or thigh, and the like." *Id*. ¶143.

FIG. 1

As shown below in Figures 14-16, Mestas's wearable computing device has housing 12 that includes an inner spine member 22 to support the internal components. Ex-1010 ¶151. PCB member 140 (purple) is "wrapped around and mounted to the spine member 22." *Id*. ¶164. Curved batteries are "positioned in the recessed compartments 50,52" of the spine member so that the battery's contacts "engage the PCB member 140 to provide power to the device 10." *Id*. ¶¶168, 177.

FIG. 14

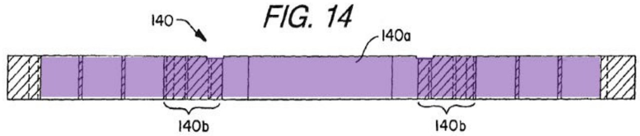
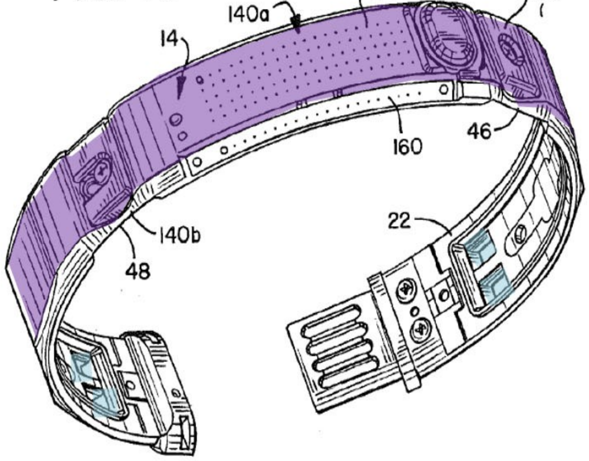


FIG. 15



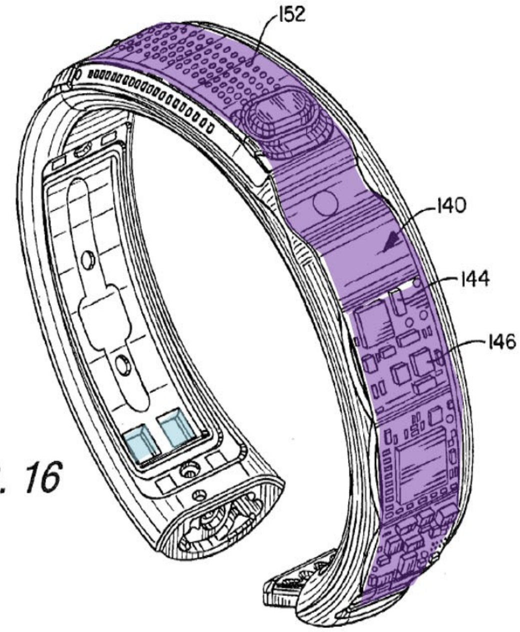


FIG. 16

D. 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 AIA 35 U.S.C. §102(a)(2). Petitioner is unaware of any facts supporting an exception under §102(b).

Yuen teaches a wearable electronic device that monitors physiological and/or environmental data from or on the wearer. Ex-1006, 1:19-27. Yuen's device has a battery and a processor. *Id.*, 12:18-61, 14:42-16. Yuen describes using magnets to align the device to a charger or dock. *Id.*, 14:42-49, 28:40-49.

Yuen also describes adjusting a sensor's operation based on information derived from the sensor data, e.g., heart rate, sleep state, or user activity. *Id.*, 6:57-

7:6, 10:14-25, 21:14-45. Yuen further teaches adjusting "operating conditions" of a sensor upon the device or sensor being placed in "a lower power mode." *Id.*, 9:15-35. Figure 15 below shows a flow chart of how a sensor's operation changes based on detected user activity or heart rate. *See id.*, 3:52-62.

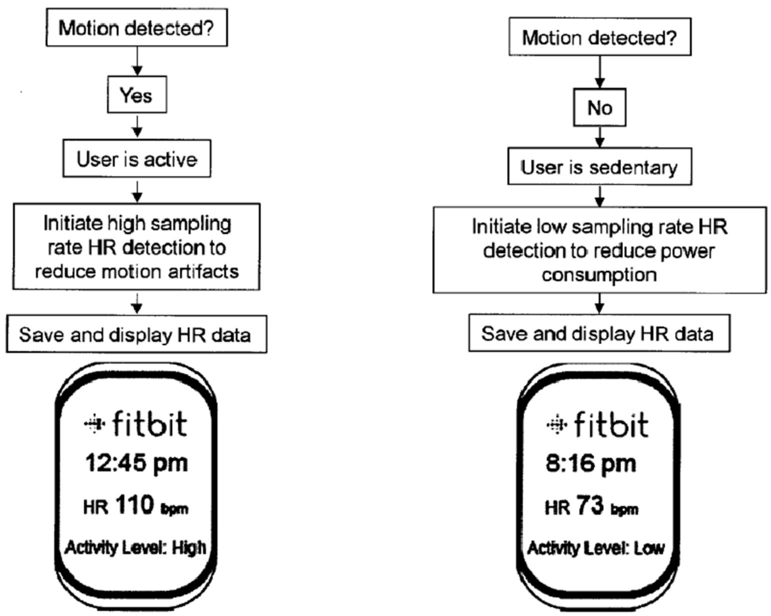


FIG. 15

Yuen further describes a sensor with "two light sources (e.g., LED's)…located on one or more sides of the photodetector." *Id.*, 2:29-39.

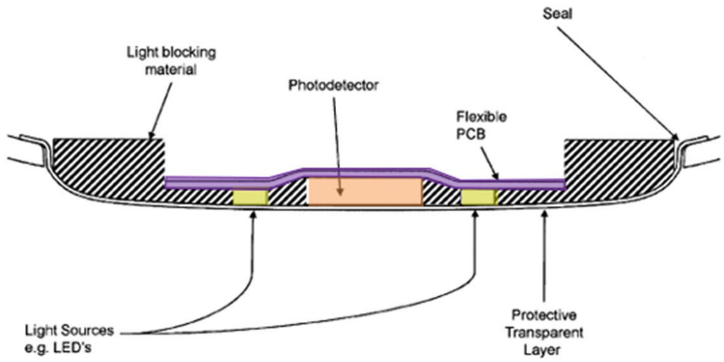


FIG. 5

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

Under 35 U.S.C. §325(d), the Board asks: (1) whether the same or substantially the same art or arguments previously were presented to the Office; and (2) if the first part 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 prong is not met. While Yuen (Ex-1006, Grounds 4 and 7) was listed in an IDS, the record is silent as to the examiner's consideration or understanding of Yuen's teachings.[8]

[8] Under the April 19, 2024 Notice of Proposed Rulemaking, §325(d) is not applied to references not "meaningfully considered," situations "where the Office has

Even if Yuen was considered, under the second prong, it was a material error for the examiner not to have considered the disclosures of Yuen. Yuen—cited on an IDS with 138 other references (Ex-1004, 751-57), clearly teaches the additional features of Dependent Claims 4-11. *See infra* §§XIII.D, XIII.G. Thus, the examiner must have overlooked Yuen because Yuen, in combination with Niwa or Schröder, teaches these claim limitations. *See K/S HIMPP v. Bragi GmbH*, IPR2023-01205, Paper 8 at 20-21 (PTAB March 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.

XIII. DETAILED EXPLANATION OF THE UNPATENTABILITY GROUNDS

A. Ground 1: Claims 1-3 and 17-18 are obvious over Schröder in view of knowledge of a POSITA.

1. Independent Claim 1

a. Element 1[pre]: A finger-worn wearable ring device, comprising:

Schröder teaches[9] the preamble, to the extent limiting. Ex-1002 ¶¶149-151.

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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).

[9] The term “teaches” includes both express teachings or those fairly suggested to a POSITA. *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.”).

Schröder's finger-worn wearable ring device is an "external secure unit" worn as a "finger-ring." Ex-1007, 2:60-65, Fig. 1.

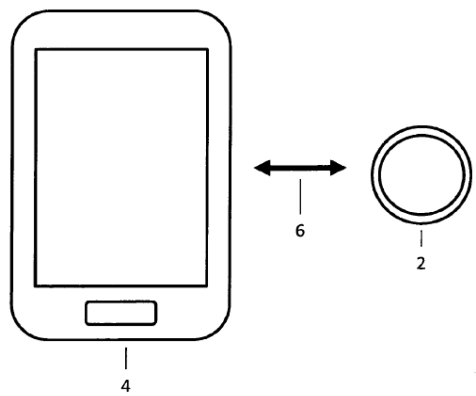


Fig. 1

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

Schröder teaches Element 1[a]. Ex-1002 ¶¶152-154.

Schröder's "finger-ring" has an external housing that defines the outer circumferential surface. Ex-1002 ¶¶153-154. Schröder's "finger-ring" consists of "two ring halves 16 and 18." Ex-1007, 12:7-9. As shown below in Figure 4, ring half 18 is the claimed external housing component (green) that defines an outer circumferential surface of the finger-worn wearable ring device because it is the side of Schröder's "finger-ring" that is exposed to the outside environment. *Id.*

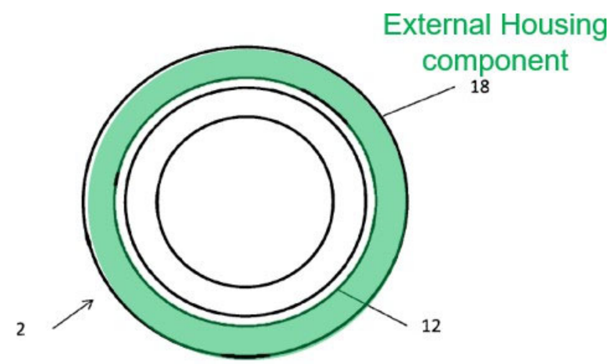


Fig. 4

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

Schröder teaches Element 1[b(i)]. Ex-1002 ¶¶155-158.

Schröder teaches an internal housing component defining an inner circumferential surface. Ex-1002 ¶156. Schröder's "finger-ring 2 is worn by a user, e.g., permanently on the finger." Ex-1007, 3:61-62, 7:38-39 ("directly on his body"), 10:52-56 ("continually worn on the body, e.g., on the finger."). Schröder's "finger-ring" consists of "two ring halves 16 and 18." *Id.*, 12:7-9. As shown in Figure 4 below, ring half 16 (green) is the internal housing component defining an inner circumferential surface of the finger-worn wearable ring device because it is the inside ring that contacts the user's skin. Ex-1002 ¶156.

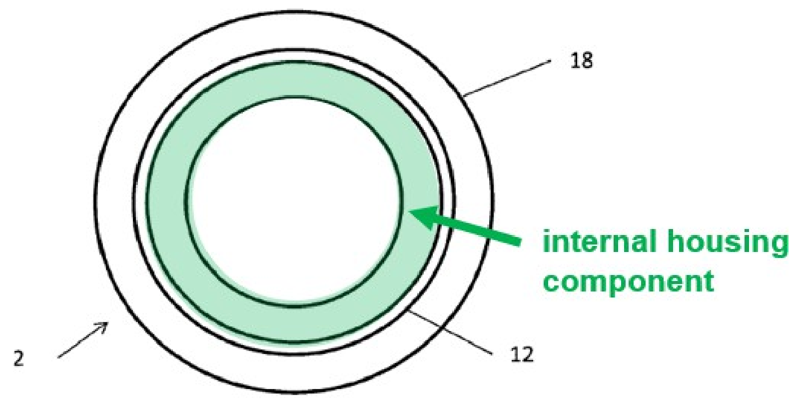


Fig. 4

Schröder's internal housing component is coupled with the external housing component to form the "finger-ring." As shown below in Figure 5, Schröder's inner ring half 16 and outer ring half 18 "are interconnected by a suitable technology, e.g., by plugging, gluing, screwing, crimping, etc." Ex-1007, 12:20-22. Schröder's coupling is illustrated by the abutting components 16 and 18 forming the "finger-ring" in Figure 5. Ex-1002 ¶157.

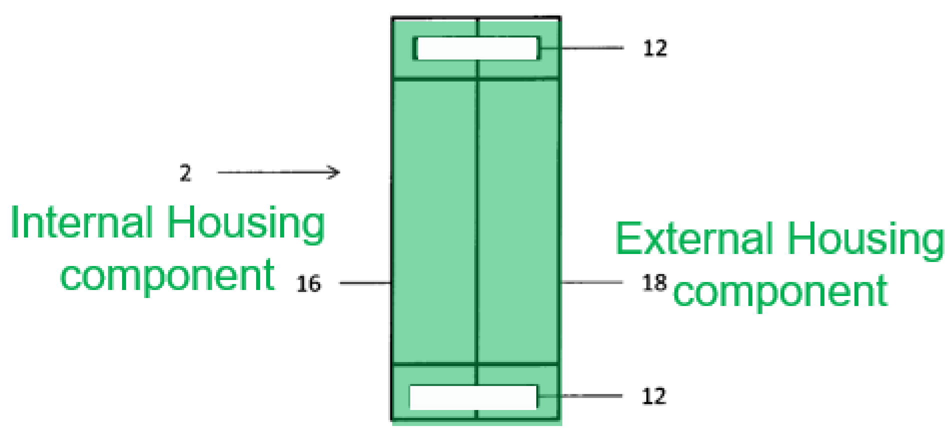


Fig. 5

d. Element 1[b(ii)]: wherein at least a portion of the inner circumferential surface of the internal housing component is configured to contact a tissue of a user when the finger-worn wearable ring device is being worn by the user;

Schröder teaches Element 1[b(ii)]. Ex-1002 ¶¶159-160.

A POSITA would have understood that Schröder's internal housing component contacts the user's tissue when the finger-worn wearable ring device is being worn. *Id*. Schröder's "finger-ring 2 is worn by a user e.g., permanently on the finger." Ex-1007, 3:61-62, 7:38-39 ("directly on his body"), 10:52-56 ("continually worn on the body, e.g., on the finger"); Ex-1002 ¶160.

e. Element 1[c]: a battery positioned within a cavity formed between the internal housing component and the external housing component, wherein the battery comprises a shape and size configured to fit within the cavity between the outer circumferential surface of the external housing component and the inner circumferential surface of the internal housing component, and wherein the battery extends through at least a first portion of the cavity of the finger-worn wearable ring device;

Schröder teaches Element 1[c]. Ex-1002 ¶¶161-168.

Schröder's "finger-ring" has a battery positioned within a cavity between the internal and external housing components. Ex-1002 ¶¶162-165. 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; 8:56-57. Inlay 12 has a "chip module 10 with at least one antenna coil 8, with at least one further electronic device." *Id.*, 12:61-65, 8:58-60 ("chip module 10 is inserted into a recess of the finger-ring 2"); Ex-1002 ¶¶165-168.

Fig. 7

Schröder teaches a battery positioned within a first portion of the cavity of the "finger-ring." Ex-1002 ¶168. Schröder's "finger-ring" has a battery "connected to the chip module 10." Ex-1007, 11:46-50, 11:58-61 (powering a display). Schröder's battery is charged wirelessly "by means of the reader's electromagnetic field." *Id.*, 11:54-55. It would have been obvious that because the energy storage unit (i.e., battery) powers chip module 10 and chip module 10 resides in inlay 12, the battery is also positioned inside the ring. Ex-1002 ¶¶166-168. In order to fit inside the "finger-ring," the battery must be configured in size and shape to fit within the cavity because it must be arranged between the internal and external housing components. *Id.* ¶¶166-168. The battery's location within the cavity defines the "first portion" of the cavity because a battery necessarily takes up a portion of the cavity. *Id.* ¶168.

f. Element 1[d]: a printed circuit board disposed between the internal housing component and the external housing component, wherein the printed circuit board extends through at least a second portion of the cavity of the finger-worn wearable ring device different from the first portion; and

Schröder teaches Element 1[d]. Ex-1002 ¶¶169-176.

Schröder's "finger-ring" has a PCB in the cavity between the internal and external housing components. *Id.* As described in Section XIII.A.1.d, a POSITA would have understood that a cavity exists between the internal and external housing components. *Id.* ¶¶170-171. Schröder's inlay 12 is explicitly arranged "in the interior of the finger-ring" and "serves as a carrier." Ex-1007, 8:54-57, 12:61-65. Inlay 12 consists of "flexible carrier material" like PET and Kapton, which are common PCB materials. *Id.*, 12:28-29; Ex-1002 ¶171. A POSITA would have understood that Schröder's inlay corresponds to the claimed PCB disposed between the internal and external housings. Ex-1002 ¶171.

Schröder teaches a PCB that extends through a second portion of the cavity different than the first portion (where the battery is located).[10] As discussed in the

[10] Because of the cavity requirements of Claims 2 and 3 (discussed below), a POSITA would have understood Claim 1 as to encompass the narrowed scopes of Claims 2 and 3. Claim 1 therefore covers the universe of overlapping possibilities between the two portions of the cavity. *See Multilayer Stretch Cling Film Holdings, Inc. v. Berry Plastics Corp.*, 831 F.3d 1350, 1362 (Fed. Cir. 2016).

previous section, by existing inside a "finger-ring," the battery is disposed in a portion of the cavity. A POSITA would have understood that two solid components cannot simultaneously occupy the same space so that a portion occupied by any other component is different from the portion where the other resides. Ex-1002 ¶¶172-175. It would have been obvious that the PCB—existing within the "finger-ring"—extends through a "portion of the cavity" that is necessarily different from the "portion of the cavity" occupied by the battery. *Id.* ¶¶172-176. Figure 7 (cross-section) below illustrates how a POSITA would have understood that Schröder's PCB (not pictured) extends through at least a second portion of a cavity (Schröder's "recess," light purple below) that is between inner and outer housing components (green) but does not extend through the entire cavity of "finger-ring" 2 to allow space for other electrical components, e.g., the battery. *Id.* ¶176.

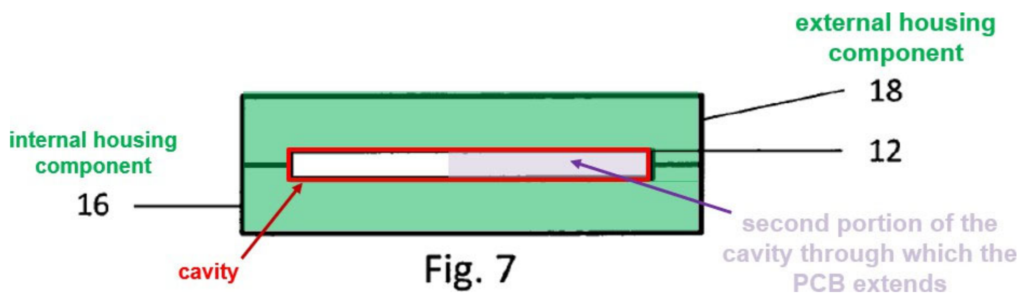


Fig. 7

g. Element 1[e]: one or more sensors electrically coupled with the printed circuit board and the battery and configured to acquire data from the user through the internal housing component.

Schröder teaches Element 1[e]. Ex-1002 ¶¶177-180.

Schröder's "finger-ring" has a sensor electrically coupled to the PCB and battery to acquire user data. *Id.* ¶¶178-180. Schröder has "biometric sensors…integrated into the finger-ring" to "capture[] e.g., at least a partial vein image in the finger while the finger-ring 2 is being pushed over a finger." Ex-1007, 9:62-10:4. A POSITA would have understood that the sensor would be electrically coupled to the PCB and battery because the sensor needs power to operate. *See id.*, 9:60-62; Ex-1002 ¶178. Moreover, because the biometric sensor "captures" a finger vein image, the sensor "acquire[s] data from the user through the internal housing component" by acquiring information through the ring half 16 that touches the finger. Ex-1002 ¶¶178-180.

2. Dependent Claims 2-3 and 17-18

a. Claim 2: The finger-worn wearable ring device of claim 1, wherein the first portion of the cavity of the finger-worn wearable ring device is non-overlapping with the second portion of the cavity of the finger-worn wearable ring device.

Schröder teaches Claim 2. Ex-1002 ¶¶181-84.

Schröder teaches that the first portion of the cavity does not overlap with the second portion of the cavity of the finger-worn wearable ring device. *Id.* A POSITA would have understood that there were a finite number of ways—here, only two ways—to design the cavity in a ring device and each would have been obvious to try. *Id.* ¶¶183-184. The Supreme Court set forth the standard for when something may be obvious to try: "When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007).

Here, there are only two ways to position the battery and PCB—i.e., position them within overlapping portions of the cavity or within non-overlapping portions of the cavity, and each would have been obvious to try. Ex-1002 ¶183. For example, a POSITA would have been motivated to design the first portion of the cavity that has the battery to not overlap with the portion of the cavity that has the PCB to have a thinner, more compact finger-worn wearable ring device that saves on material costs, reduces the volume of the cavity, and makes the ring more comfortable. *Id.* ¶184; *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). The non-overlap of cavity portions is not the product of innovation, but of ordinary skill and common sense. *KSR*, 550 U.S. at 421; Ex-1002 ¶¶183-184.

As described in the above sections addressing Elements 1[c] and 1[d], Schröder teaches that the battery is located in a first portion of the cavity and the

PCB is located in a different portion of the cavity. This would have been an obvious design choice, as evidenced by Niwa. As described below in Sections XIII.B.2, XIII.E.3.a, Niwa explicitly teaches that the PCB and battery do not overlap. Ex-1002 ¶¶207-213.

b. Claim 3: The finger-worn wearable ring device of claim 1, wherein the first portion of the cavity of the finger-worn wearable ring device at least partially overlaps with the second portion of the cavity of the finger-worn wearable ring device.

Schröder teaches Claim 3 for the same reasons, as described above in Elements 1[c] and 1[d], and Claim 2. Ex-1002 ¶¶185-188; *see supra* §§XIII.A.1.e-f, XIII.A.2.a.

A POSITA would have been motivated to design the first portion of the cavity that has the battery to partially overlap with the portion of the cavity that has the PCB in order to reduce the risk of electrical components and the PCB losing mechanical or electrical connections to each other and to reduce the device's diameter. Ex-1002 ¶188; *DyStar,* 464 F.3d at 1368. The overlap of the portions of the cavity is not the product of innovation, but of ordinary skill and common sense. *KSR*, 550 U.S. at 421; Ex-1002 ¶188.

This also would have been an obvious design choice, as evidenced by Mestas. Ex-1002 ¶187. As described below in Section XIII.C.2.a, Mestas explicitly teaches that the PCB and battery overlap; thus allowing the first portion of the cavity (battery) to partially overlap with the second portion of the cavity (PCB). Ex-1002 ¶¶242-45.

c. Claim 17: The finger-worn wearable ring device of claim 1, wherein the external housing component and the internal housing component define the cavity configured to at least partially surround the battery, and the printed circuit board, wherein one of the external housing component or the internal housing component comprises: a first side wall and a second side wall that extend between the internal housing component and the external housing component, wherein the cavity is defined at least in part by the outer circumferential surface, the inner circumferential surface, the first side wall, and the second side wall.

Schröder teaches Claim 17. Ex-1002 ¶¶189-190.

The cavity of Schröder's "finger-ring" is defined by the external and internal housing components. *Id.* ¶190. To the extent Claim 17 is referencing the cavity recited in Claim 1, Schröder's "finger-ring" has a cavity between the internal and external housing components that houses and thus surrounds Schröder's inlay 12 (PCB) and battery. *See* §XIII.A.1.e-f (elements 1[c]-1[d]); Ex-1002 ¶¶162-165, 171, 190.

Schröder's "finger-ring" has internal and external housing components that have a first and second side wall that extend between the internal and external housing components to further define the cavity. Ex-1002 ¶¶190. 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. The ring halves may be U-shaped with inlay 12 being arranged between. *Id.*, 12:45-55. As shown in Figure 7 below, the U-shaped housing components are connected 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 ¶180. Similarly, in Figure 8, external housing portion 18 is a U-shape component and connects to internal housing component 16 and defines the cavity by surrounding inlay 12, therefore forming "side walls" (red). *Id.*

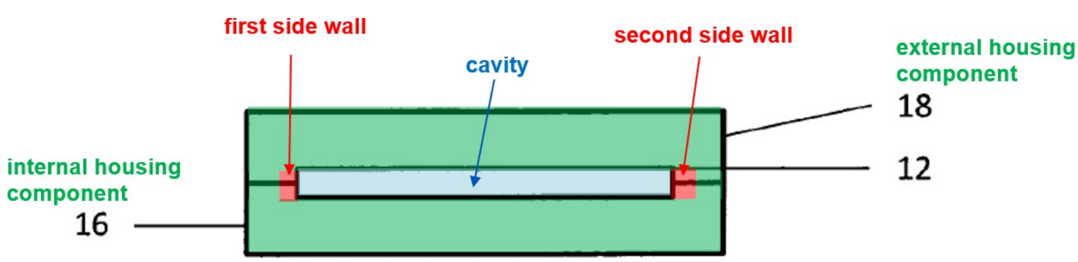


Fig. 7

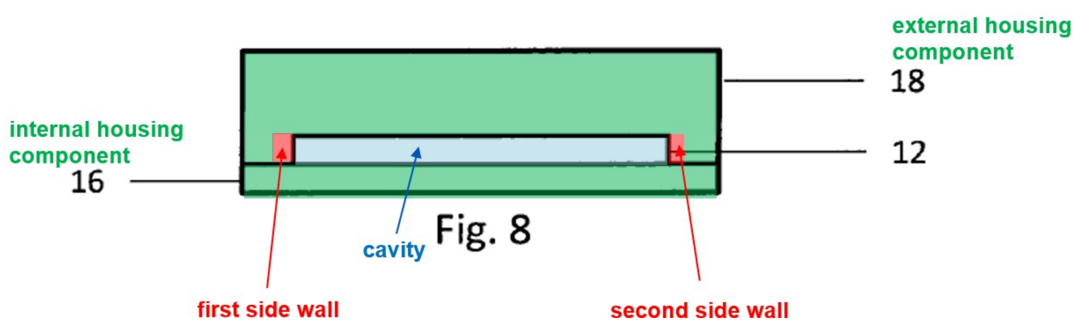
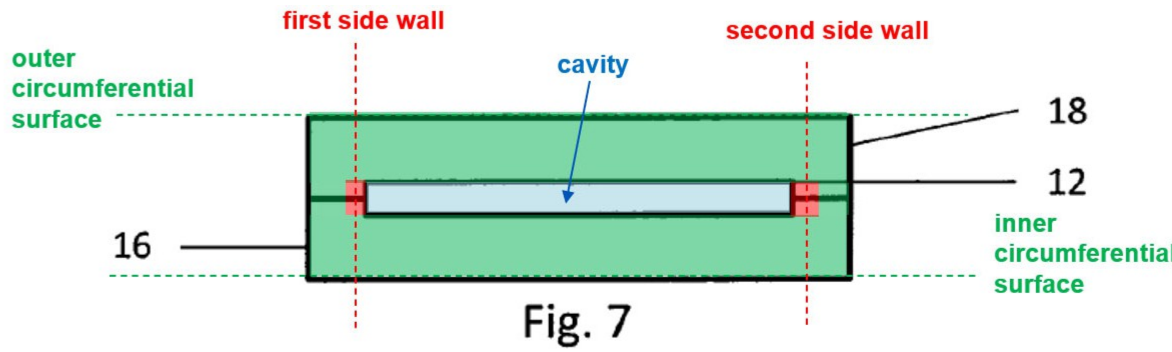


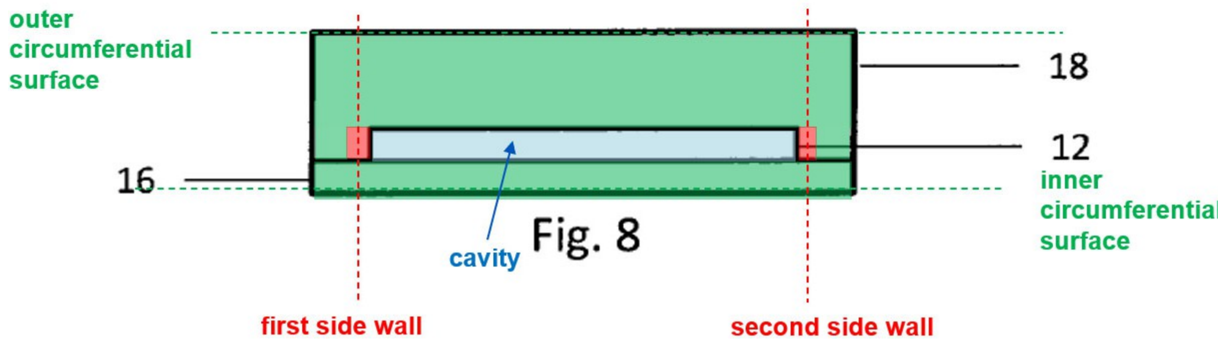
Fig. 8

d. Claim 18: The finger-worn wearable ring device of claim 17, wherein the first side wall, the second side wall, or both, are substantially perpendicular to the inner circumferential surface, the outer circumferential surface, or both.

Schröder teaches Claim 18. Ex-1002 ¶¶191-193.

Schröder's first and second side walls are substantially perpendicular to the inner and outer circumferential surfaces. *Id.* ¶¶192-193. As stated above for Claim 17, 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. As shown in Figures 7 and 8 below, the side walls (red) are substantially perpendicular to the inner and outer circumferential surfaces, i.e., outside surfaces of the internal and external housing components (green).





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

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

A POSITA would have been motivated to apply the teachings of Niwa to Schröder ("Schröder-Niwa"), and would have had a reasonable expectation of success in doing so because each relates to the same well-known technologies. Ex-1002 ¶¶194-198.

A POSITA would have been motivated to combine Schröder with Niwa because they are analogous art and teach improvements to the same type of devices—wearable biometric sensing devices having similar structural components including 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; Ex-1005 ¶¶67-68 (circuits and substrate), 194-95 (a PCB), 213 (battery), Figs. 22, 26-29. Schröder's "finger-ring" includes a "recess" (i.e., cavity) within at least one of its components (16, 18) where an electronic part (e.g., chip module 10 and/or inlay 12) is inserted. Ex-1007, 12:10-32, 15:26-28. 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. Niwa likewise teaches a cavity that houses electrical components. Ex-1005 ¶¶201, 205. Niwa further teaches a battery and a PCB arranged in non-overlapping portions of a cavity, as well as partially overlapping portions of a cavity. Ex-1005, Figs. 27, 28. Depending on the POSITA's design criteria, it would have been obvious to implement either arrangement in Schröder. Ex-1002 ¶¶195-196.

Niwa further offers additional design and manufacturing benefits to Schröder's "finger-ring." Niwa explains that, for the comfort of the ring's wearer, "it is desirable to restrain the largeness of the first unit 10 and the second unit 20 not to protrude from the third joint of the finger 2." Ex-1005 ¶206. Furthermore, a POSITA would have been motivated to avoid overlap between the first and second portions of the cavity for many reasons: material costs, ease of assembly, thermal management, or smaller form factor. Ex-1002 ¶196; *see also* Ex-1007, 3:9-11; Ex-1005 ¶206.

Moreover, Niwa provides beneficial configurations for Schröder's sensor. Ex-1002 ¶197. Schröder's teachings involve methods of capturing information from the finger, specifically targeting patterns of veins within the finger. Ex-1007, 8:30- 53, 9:54-10:11. Niwa further teaches a sensor with multiple light emitting portions with different wavelengths and positioning. Ex-1005 ¶¶32, 34, 35. Building on this understanding, a POSITA would have recognized that Niwa's teachings, which discuss capturing pulse oximetry data, also indirectly involves capturing information about veins. Ex-1002 ¶¶58-61, 197. A POSITA would have understood that both Schröder's and Niwa's techniques involve data collection from veins. This understanding would indicate that advances or techniques developed in one application (like pulse oximetry) could potentially inform or enhance methodologies in the other (like vein pattern biometrics), highlighting the interconnectedness of these imaging and sensing technologies in capturing venous information. Based on this understanding, it would have been obvious to modify Schröder's sensor based on Niwa's teachings to emit different wavelengths from different light emitting components and/or place the light emitting components and photodetector at different positions. *Id*. ¶197. A POSITA would have been motivated to make this modification to capture a broader range or more accurate data and better utilization of the limited space inside the "finger-ring." *Id*.

A POSITA would have had a reasonable expectation of success in combining Schröder and Niwa. *Id.* ¶198. A POSITA would have understood that these wearable electronic devices, specifically rings, are restricted by form factors. *Id.* ¶¶72-73, 198. 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 smaller and more comfortable wearable devices. *Id.* ¶¶194-198.

2. Independent Claim 1

a. Elements 1[pre]-1[c], 1[e]

Schröder teaches Elements 1[pre]-1[c] and 1[e]. *See* Ex-1002 ¶199; *supra* §XIII.A.1.

b. Element 1[d]: a printed circuit board disposed between the internal housing component and the external housing component, wherein the printed circuit board extends through at least a second portion of the cavity of the finger-worn wearable ring device different from the first portion

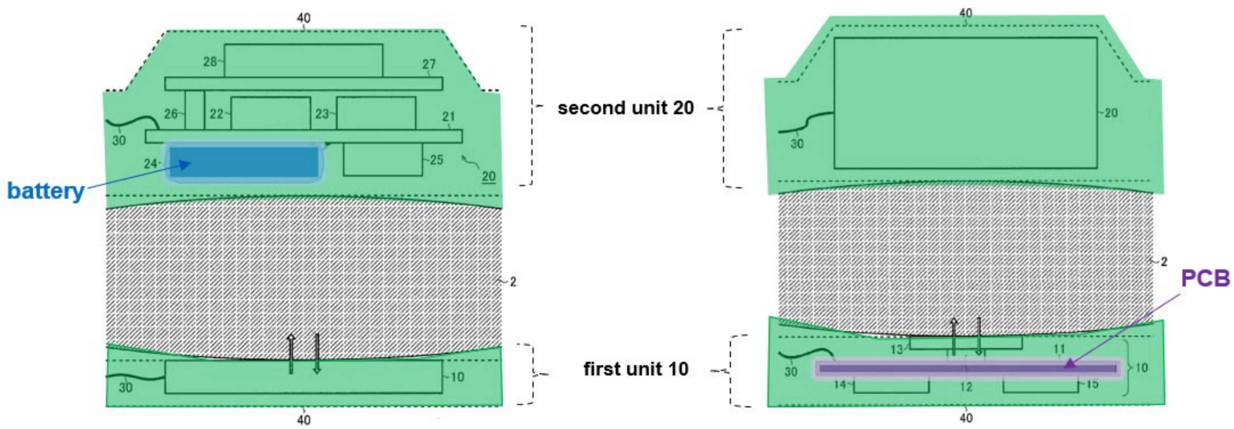
Schröder-Niwa also teaches Element 1[d]. Ex-1002 ¶¶200-206; *supra* §XIII.B.1 (motivation and expectation of success).

Niwa's finger ring has a PCB disposed between internal and external housing components. Ex-1002 ¶¶202-203. Niwa describes components and circuits that are "mounted" onto the surface of a "substrate." *See, e.g.*, Ex-1005 ¶¶68, 69, 213. A POSITA would have understood Niwa's substrate to be a PCB because an "electrical connection" is "established between the surface and back side of the…substrate…by means of the through hole and the via hole." Ex-1005 ¶214; *see id*. ¶194 (describing "FPC"); Ex-1002 ¶¶202-203.

Niwa's PCB is disposed inside the ring. As shown in Figures 27 and 28 (cross-sections) below, Niwa's ring housing 40 utilizes substrates in first unit 10 and second unit 20. Ex-1005 ¶¶194-95, 207. The claimed PCB corresponds to a substrate in Niwa because its substrate is a PCB disposed in a cavity and connects components and circuits. Ex-1002 ¶203.

Niwa's PCB extends through at least a second portion of the cavity of the ring device different from the first portion. *Id.* ¶¶204-205. For example, Figures 27 and 28 (cross-sections) below show how a first portion (light blue) surrounding battery 24 (blue) in second unit 20 is different than a second portion (light purple) surrounding PCB 11 (purple). *Id.*

FIG.28 FIG.27



Niwa's first portion and second portion correspond with the respective locations of the battery and PCB. *Id.*

Moreover, Schröder's "finger-ring" combined with Niwa's PCB configuration has the battery and PCB in their respective portions of the cavity that are separate from each other. Modified Figure 5 illustrates the combination, with Schröder's "finger-ring" having the battery in the first portion of the cavity where second unit 20 would be in Niwa and the PCB in the second portion where a first unit would be in Niwa.

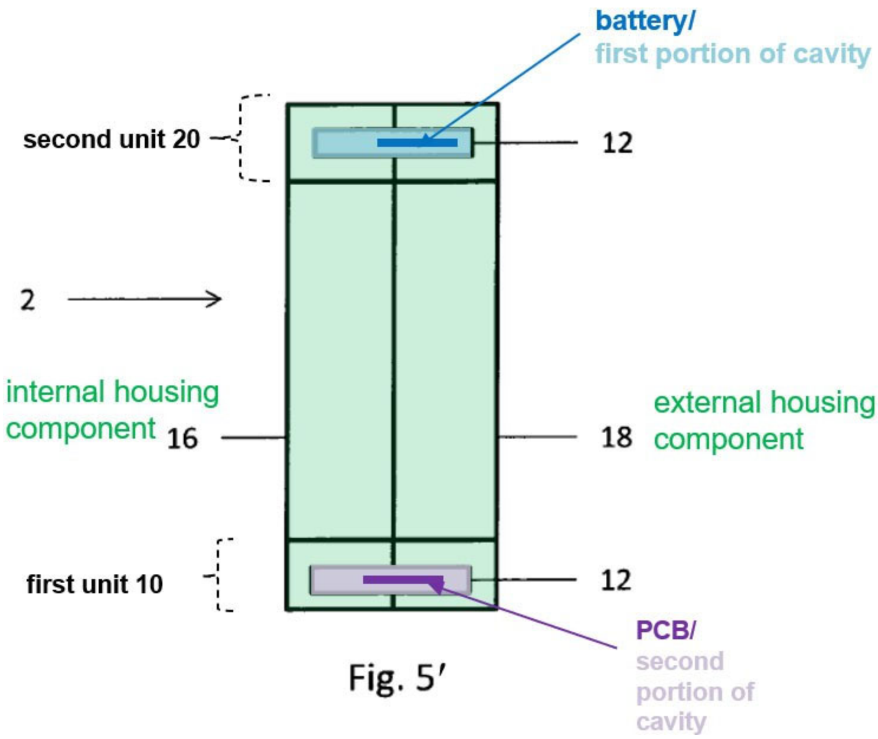


Fig. 5′

It would have been obvious to use Niwa's PCB configuration in Schröder as to separate a battery and PCB that are in the same ring housing. *Id.* ¶206.

3. Dependent Claims 2-3 and 13-16

a. Claim 2: The finger-worn wearable ring device of claim 1, wherein the first portion of the cavity of the finger-worn wearable ring device is non-overlapping with the second portion of the cavity of the finger-worn wearable ring device.

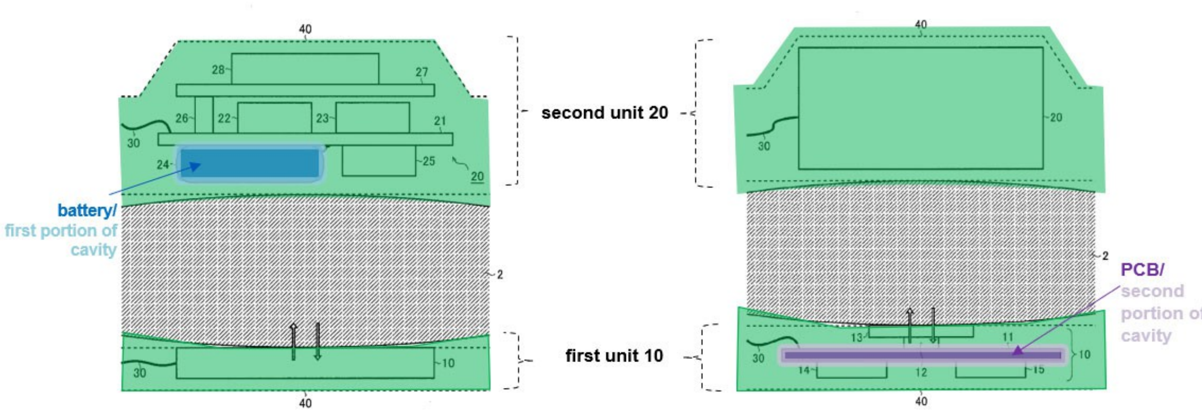
Schröder-Niwa teaches Claim 2. Ex-1002 ¶¶208-211; *see supra* §XIII.B.1 (motivation and reasonable expectation of success).

A POSITA would have found it obvious to design Schröder's first and second portions of the cavity to not overlap for the reasons explained above in Section

XIII.A.2.a. *Id*. Moreover, a POSITA would have been motivated to have the first portion and the second portion of the cavity not overlap because it was well-known, as taught in Niwa.

As shown in Figure 28 (cross-section) below, Niwa's finger ring type housing 40 (green) (disposed upon the wearer's finger 2) includes battery 24 (blue) in a first portion of the cavity (light blue) in second unit 20. Ex-1005 ¶¶193, 217; Ex-1002 ¶210. Also shown below in Figure 27 (cross-section) is substrate 11 (purple), which extends through a second portion of the cavity (light purple) in first unit 10. Ex-1002 ¶210; Ex-1005 ¶¶200, 207. Niwa's substrate is a PCB. Ex-1002 ¶¶202-203. Accordingly, Figures 27 and 28 illustrate a first portion of the cavity (light blue) with the battery (blue) that does not overlap with a second portion of the cavity (light purple) with the PCB (purple). *Id*. ¶210.

FIG.28 FIG.27

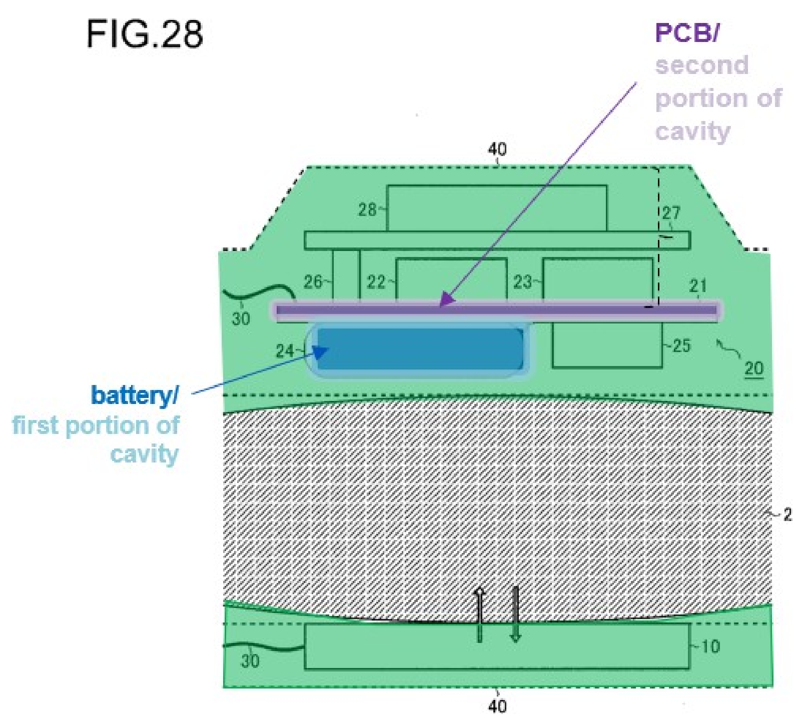


In addition to the reasons explained in §XIII.B.1, a POSITA would have been motivated to prevent overlap, like in Niwa, when implementing Schröder's "finger-ring" because doing so allows for a thinner, more compact finger-worn wearable ring device which saves on material costs and reduces the volume of the cavity, making the ring more comfortable. Ex-1002 ¶211; *DyStar,* 464 F.3d at 1368; Ex-1005 ¶206.

b. Claim 3: The finger-worn wearable ring device of claim 1, wherein the first portion of the cavity of the finger-worn wearable ring device at least partially overlaps with the second portion of the cavity of the finger-worn wearable ring device.

Schröder-Niwa teaches Claim 3. Ex-1002 ¶¶212-214; *see supra* §XIII.B.1 (motivation and reasonable expectation of success).

A POSITA would have found it obvious to design first and second portions of Schröder's cavity to partially overlap for the same reasons explained above in Sections XIII.A.1.e-f, XIII.A.2.b. Ex-1002 ¶214. Moreover, a POSITA would have been motivated to partially overlap the first portion and the second portion of the cavity because it was well-known, as taught in Niwa. Figure 28 illustrates battery 24 (blue) in a first portion of the cavity (light blue) in second unit 20. *See supra* §XIII.A.2.a. Also shown below in Figure 28 is PCB 11 (purple), which extends through a second portion of the cavity (light purple) in first unit 10. Ex-1002 ¶213; Ex-1005 ¶¶200, 207.



Thus Niwa teaches a first portion of the cavity with the battery that partially overlaps with a second portion of the cavity with a PCB. Ex-1002 ¶213.

It would have been obvious to have the cavity portions at least partially overlap. A POSITA would have been motivated to partially overlap the first portion of the cavity with the battery and the second portion of the cavity with the PCB, as disclosed in Niwa, when implementing Schröder's "finger-ring" because doing so permits more components to fit inside the limited volume. *Id.* ¶214; *DyStar,* 464 F.3d at 1368.

c. Claim 13: The finger-worn wearable ring device of claim 1, wherein the one or more sensors comprise a first light-emitting component configured to emit light associated with a first wavelength, and a second light-emitting component configured to emit light associated with a second wavelength different from the first wavelength.

Schröder-Niwa teaches Claim 13. Ex-1002 ¶¶215-220; *see supra* §XIII.B.1 (motivation and reasonable expectation of success).

Schröder-Niwa teaches one or more sensors comprising two light-emitting components that emit light associated with two different wavelengths. As described in Section XIII.A.1.g (Element 1[e]), Schröder's "finger-ring" includes biometric sensors, e.g., an infrared diode and sensor. Ex-1007, 9:62-10:4. Niwa's sensors comprise a first light-emitting component configured to emit light of a first wavelength, and a second light-emitting component configured to emit light of a second wavelength different from the first wavelength. *Id*. Niwa's first unit 10 contains a light emitting portion, a light receiving portion, and a processing unit "to acquire information" about the user's plethysmogram. Ex-1005 ¶¶12, 27, 209-10. First unit 10's light-emitting portion can include "***LED1 to LED8***" with "***output wave lengths λ1 to λ8…different from one another***." *Id*. ¶147; Ex-1002 ¶216.

d. Claim 14: The finger-worn wearable ring device of claim 13, wherein the first wavelength is associated with visible light, and wherein the second wavelength is associated with infrared light.

Schröder-Niwa teaches Claim 14. Ex-1002 ¶¶221-223; *see supra* §XIII.B.1 (motivation and reasonable expectation of success).

Schröder-Niwa's first light-emitting component emits visible light and another emits infrared light. *Id*. Schröder's light-emitting diode emits infrared radiation. Ex-1007, 9:62-10:4. Niwa's first light-emitting component emits visible light, and the second light-emitting component emits infrared light. Niwa describes that the "output wave lengths" from the LEDs range "from a visible light region to a near-infrared region." Ex-1005 ¶147. A POSITA would have understood that first wavelength λ1 from first light-emitting component (LED1) is associated with visible light. Ex-1002 ¶222. A POSITA would have found it obvious to extend the wavelength of Niwa's LED from "a near-infrared region" to an infrared region for redundancy, to expand the type of information collected, or to use a non-visible light. *Id.* ¶222; Ex-1005 ¶147. A POSITA would thus understand that a second wavelength λ8 from LED8 in Niwa is associated with infrared light. Ex-1002 ¶¶222- 223.

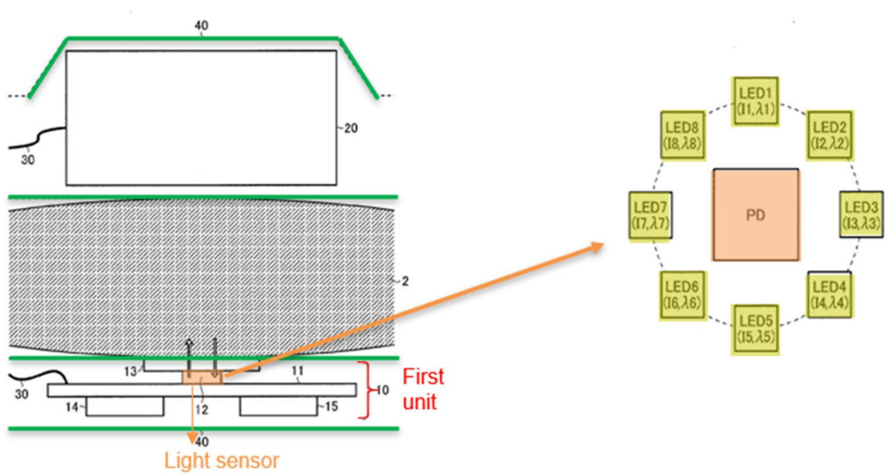
e. Claim 15: The finger-worn wearable ring device of claim 13, wherein the first light-emitting component is positioned within the finger-worn wearable ring device at a first radial position, and the second light-emitting component is positioned within the finger-worn wearable ring device at a second radial position different from the first radial position.

Schröder-Niwa teaches Claim 15. Ex-1002 ¶¶224-233; *see supra* §XIII.B.1 (motivation and reasonable expectation of success).

Schröder-Niwa's first light-emitting component is positioned within the ring device at a first radial position, and the second light-emitting component is positioned within the ring device at a second radial position different from the first radial position. *Id.* Niwa teaches a "finger ring" "worn on the third joint of the finger 2." Ex-1005 ¶191. Niwa's finger ring has a light-emitting portion with eight light-emitting components centrally focused around photodetector PD. *See id.* ¶120, Fig. 3. Niwa further teaches two light-emitting components at different radial positions. Ex-1002 ¶227. 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 ¶119. Niwa states that "first unit 10 is a unit to measure the plethysmogram mainly, which is contained within the finger ring type housing 40 to be set to the ball side of the finger 2 (i.e., palm side)." *Id.* ¶192. 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 flush against the finger. Ex-1002 ¶¶226-227.

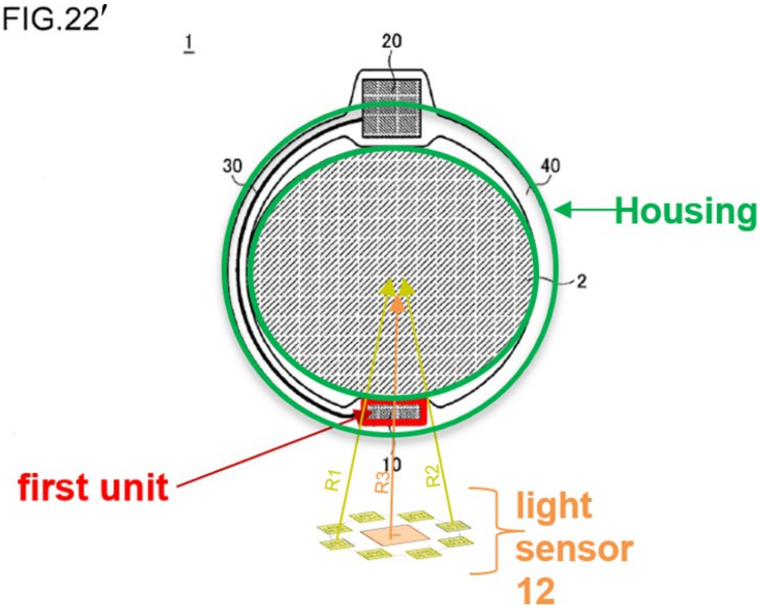
Niwa further describes "a single light receiving portion PD (i.e., a photo diode or a photo transistor) and ***eight light emitting portions LED1 to LED8*** (i.e., a light emitting diode) ***equally spaced from one another and placed on a circumference with a central focus on the light receiving portion PD***." *Id.* ¶120. As shown below in Figure 27, the first unit 10 houses the light sensor 12 (annotated), which faces the user's skin (finger 2). *See id.* ¶¶50, 200.

FIG.27 FIG.3



A POSITA would have understood that the light emitters (LEDs) are at different radial positions. Ex-1002 ¶¶228-231. Modified Figure 22′ below superimposes the light emitting components and photodetector of Figure 3 within the light-emitting portion of first unit 10's light sensor 12. *Id.* ¶¶228-229. As shown in modified Figure 22′ below, 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 finger-worn wearable ring device (green). *Id.* ¶¶229-230.

FIG.22′



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 in the '178 Patent. Ex-1001, Figs. 3B, 3C; Ex-1002 ¶¶229-230. 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 ¶232. A

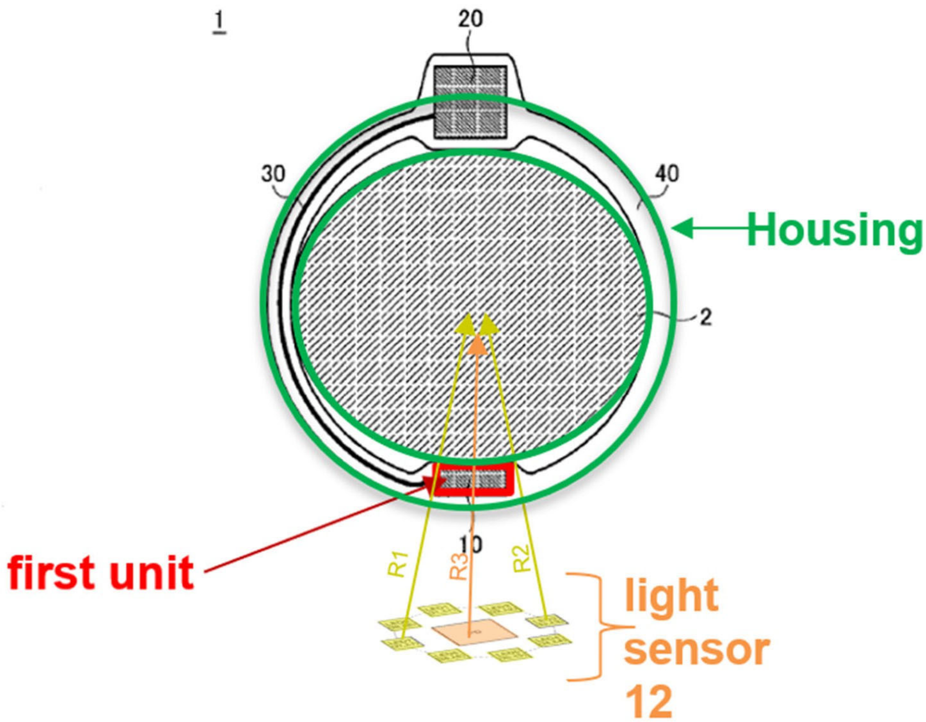
POSITA would have been motivated to have LEDs centrally located along the ring's interior and away from the edges of the device, to prevent light leakage from visible LEDs and interference from ambient light. *Id.* ¶233.

f. Claim 16: The finger-worn wearable ring device of claim 15, wherein the one or more sensors further comprise a photodetector positioned within the finger-worn wearable ring device at a third radial position that is between the first radial position and the second radial position.

Schröder-Niwa teaches Claim 16. Ex-1002 ¶¶234-238; *see supra* §XIII.B.1 (motivation and reasonable expectation of success).

Schröder-Niwa teaches a photodetector positioned within the ring device at a third radial position that is between the first and second radial positions. *Id.* Schröder teaches a light-emitting component and light-receiving component "arranged e.g., opposite each other such that e.g., a[] finger bone located therebetween has no adverse effect" measuring the user's vein. Ex-1007, 9:62-10:4. Niwa's sensor in its ring device has a photodetector positioned at a third radial position that is between the first radial position and the second radial position. Ex- 1002 ¶236. 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 finger-worn wearable ring device (green). Ex-1002 ¶¶236-238.



A POSITA would further understand that Niwa teaches light-emitter and photodetector configurations with varying radial positions. *See, e.g.*, *id.* ¶¶32, 43, 117, Figs. 1, 14-16.

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

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

A POSITA would have been motivated to apply the teachings of Mestas to Schröder ("Schröder-Mestas"), and would have had a reasonable expectation of success because each relates to the same well-known technologies. Ex-1002 ¶¶239-242.

A POSITA would have been motivated to combine Schröder with Mestas because they are analogous art and teach improvements to the same type of devices—wearable biometric sensing devices having similar structural components, including inner and outer surfaces, a cavity, and a battery and PCB within the cavity. *See, e.g.*, Ex-1007, 11:46-48 (battery), 12:26-42 (PCB), Figs. 4-10 (structure); Ex-1010 ¶¶150 (cavity, battery), 151 (structure), 154 (cavity), 157 (structure), 164 (PCB), 168 (battery), Figs. 4, 6 (structure). Mestas teaches these portions of the cavity partially overlapping. Ex-1010 ¶177, Figs. 14-16. Schröder's "finger-ring" includes a "recess" (i.e., cavity) within at least one of its components (16, 18) where an electronic part is inserted. Ex-1007, 12:10-32, 15:26-28. 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. Mestas likewise teaches a cavity that houses electrical components. Ex-1010 ¶151. Mestas further teaches a battery and a PCB arranged in overlapping portions of a cavity. Ex-1010 ¶¶164, 168, 177. Based on Mestas's teachings, it would have been obvious to have the first and second portion of the cavity in Schröder at least partially overlap. Ex-1002 ¶240.

Mestas further offers additional design and manufacturing benefits to Schröder's "finger-ring." A POSITA would have been motivated to have the first and second portions of the cavity at least partially overlap, as taught by Mestas, to reduce the risk of electrical components losing mechanical or electrical connection to the other and to allow other parts of the ring to be thinner for the wearer's comfort. *Id.* ¶241; *see also* Ex-1007, 3:9-11; Ex-1010 ¶206. A POSITA would have been motivated to implement Mestas's curved battery in Schröder's "finger-ring" because a curved battery allows a larger battery to conform to a ring's circular shape without stressing the battery or ring housing. Ex-1002 ¶241.

A POSITA would have had a reasonable expectation of success in combining Schröder and Mestas. *Id.* ¶242. Mestas contemplates different sizing, stating that its "wearable athletic device may be worn in a variety of locations on a user's body including on a user's chest (e.g., a chest strap), around a user's wrist, around a user's arm, on a user's head, on a user's ankle or thigh, and the like." Ex-1010 ¶143; Ex-

1002 ¶242. As miniaturization of electronic components improved, a POSITA would have found it trivial to implement Mestas's teachings into a ring like Schröder's "finger-ring." Ex-1002 ¶242. A POSITA would have understood that wearable electronic devices, specifically ring, are restricted by form factors. Ex-1002 ¶¶70-86, 242. A POSITA would have understood that these references disclose interrelated teachings based on routine technologies that would have been amenable to well-understood, predictable combinations to provide smaller and more comfortable wearable computing devices. *Id.* ¶¶239-242.

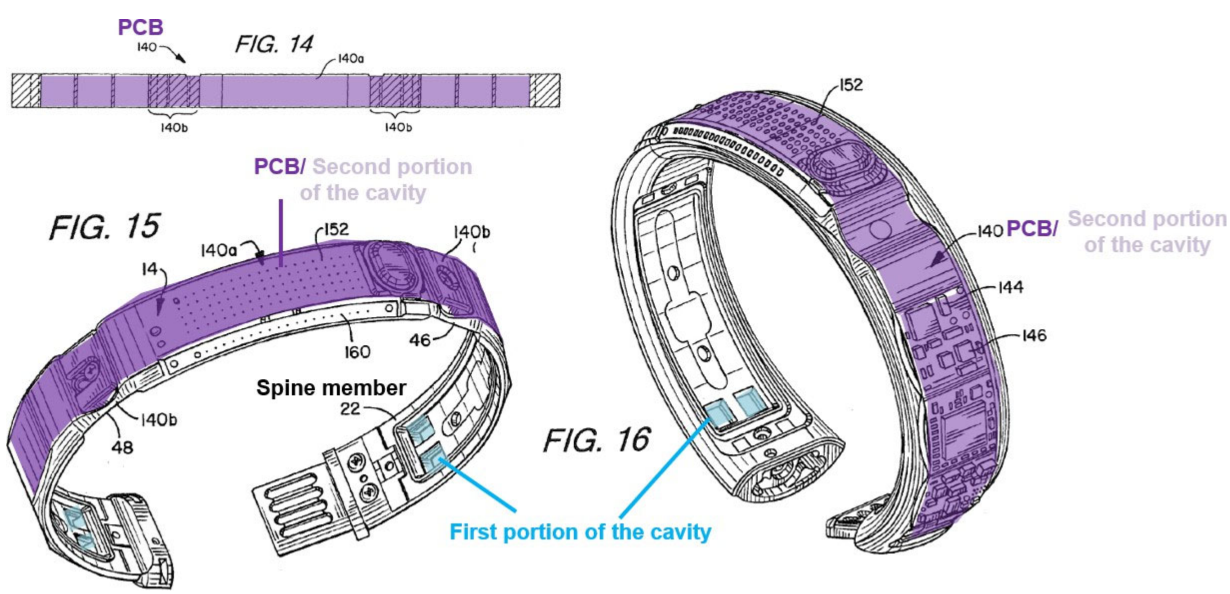
2. Dependent Claims 3 and 12

a. Claim 3: The finger-worn wearable ring device of claim 1, wherein the first portion of the cavity of the finger-worn wearable ring device at least partially overlaps with the second portion of the cavity of the finger-worn wearable ring device.

Schröder-Mestas teaches Claim 3. Ex-1002 ¶¶243-246; *see supra* §XIII.C.1 (motivation and reasonable expectation of success).

A POSITA would have found it obvious to design Schröder's first and second portions of the cavity to partially overlap for the same reasons explained above in Section XIII.A.2.b. Ex-1002 ¶¶185-188. Moreover, a POSITA would have been motivated to at least partially overlap the first portion and the second portion of the cavity because it was well-known, as taught in Mestas. *Id*. ¶¶239-242. Mestas's wearable computing device has housing 12 that includes inner spine member 22 that supports internal components. Ex-1010 ¶151. A POSITA would have understood that the space inside housing 12 occupied by spine member 22 is Mestas's "cavity." Ex-1002 ¶¶244-246.

As shown in Figures 14-16 (below), Mestas's wearable electronic device has PCB member 140 (purple) "wrapped around and mounted to the spine member 22" to "follow[] the contours of the spine member 22." Ex-1010 ¶164. Mestas's batteries are "positioned in the recessed compartments 50,52 [light blue] wherein the contacts 150 [not labelled] extend through the openings 59 [not labelled] in the compartments 50,52 and engage the PCB member 140 to provide power to the device 10." Ex-1010 ¶168. The battery contacts "are biased against mating contacts associated with PCB member 140." Ex-1010 ¶177.

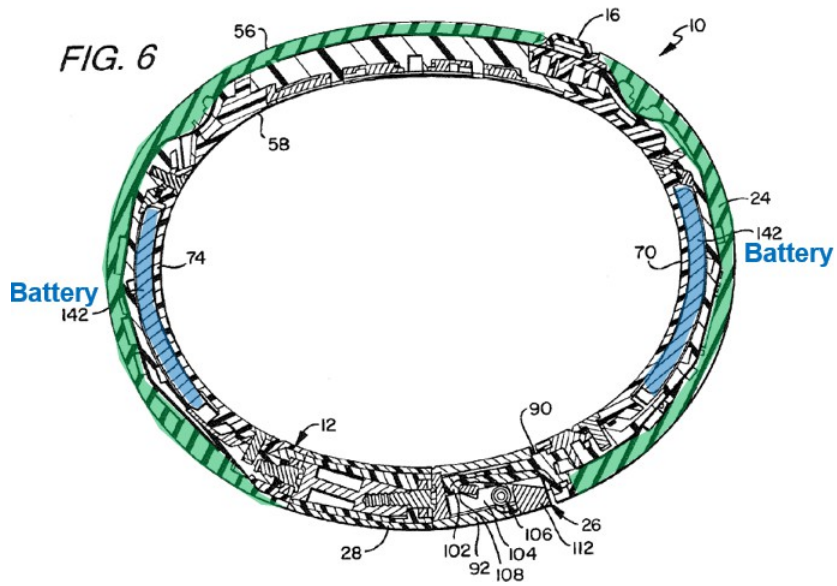


Mestas's wearable electronic device has two different portions of the cavity: the portion that the PCB occupies and the portion that the batteries occupy. Ex-1002 ¶246. A first portion of the cavity overlaps with a second portion of the cavity because the PCB member wraps around the entire length of the spine member (defining second portion) and the first portion (with batteries) is positioned on the spine member's interior side. *Id.*

b. Claim 12: The finger-worn wearable ring device of claim 1, wherein the battery comprises a curved battery, wherein an arc of the curved battery approximates a corresponding arc of the external housing component.

Schröder-Mestas teaches Claim 12. Ex-1002 ¶¶247-249; *see supra* §XIII.C.1 (motivation and reasonable expectation of success).

Schröder-Mestas teaches "the battery compris[ing] a curved battery, wherein an arc of the curved battery approximates a corresponding arc of the external housing component." *Id.* Schröder and Mestas each disclose a battery. Ex-1007, 11:46-48; Ex-1010 ¶143. Mestas's Figure 6 (below) shows "batteries 142 [blue] have a ***curvilinear or curved configuration***." Ex-1010 ¶¶157, 168. A POSITA would have understood that the arc of Mestas's "***curved battery***" (blue) approximates a corresponding arc of the external housing component (green). Ex-1001, Cl. 12. It would have been obvious, in view of Mestas, that this shape allows the batteries to be positioned in recessed compartments 50, 52 without increasing the wearable device's thickness and to allow for an elongated battery without stressing the battery or the housing. Ex-1010 ¶168; Ex-1002 ¶248.



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

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

A POSITA would have been motivated to apply the teachings of Yuen to Schröder ("Schröder-Yuen"), and would have had a reasonable expectation of success because each relates to the same well-known technologies. Ex-1002 ¶¶250-261.

A POSITA would have been motivated to combine Schröder with Yuen because they are analogous art and both teach improvements to electronic wearable devices. *Id.*; Ex-1007, 3:9-11, 3:61-62; Ex-1006, 12:50-52. Both describe the devices having a processor, battery, and one or more sensors. Ex-1007, 1:45 (processor), 1:50-51 (processor), 9:54-10:11 (sensor), 11:46-48 (battery); Ex-1006, 4:3-6 (processor, sensor), 12:18-61 (sensor), 14:42-46 (battery), 14:60-66 (sensor), 28:40-43 (battery), Figs. 17-25 (processor, sensor).

Yuen offers additional design and manufacturing benefits to Schröder's "finger-ring." First, Yuen teaches a flexible PCB. Ex-1006, 2:38-39, 12:35-38. A POSITA would have been motivated to implement a flexible PCB for Schröder's inlay because flexible PCBs are lightweight, save space, and are easier to assemble into curved constructions. Ex-1002 ¶255.

Second, Yuen improves Schröder's wireless charging. Schröder's battery "is preferably charged by means of [a] reader's electromagnetic field." Ex-1007, 11:46-55. Yuen teaches charging a battery using magnetic properties of its device or docking station. Ex-1006, 14:42-49. Based on Yuen's teachings, it would have been obvious to use a magnetic alignment mechanism within a charger to orient Schröder's finger-ring to facilitate wireless charging. Ex-1002 ¶¶256. A POSITA would have been motivated to implement an alignment mechanism for Schröder's "finger-ring" using Yuen's teachings for easier, more convenient wireless charging. *See id.* Thus, design incentives and market forces would have motivated a POSITA to combine the teachings of Schröder and Yuen to result in a wearable electronic device with alignment for wireless charging.

Third, it would have been obvious to a POSITA to apply Yuen's sensor configurations—e.g., the wavelength and positioning parameters—to Schröder's sensor because both Schröder's and Yuen's techniques relate to data collection from veins. Ex-1002 ¶¶256-257. Both teach a sensor comprising a light-emitting component. Ex-1007, 8:30-53; Ex-1006, 2:29-33, Fig. 5. Schröder captures information about finger veins, which is crucial for biometric identification or medical diagnostics. Ex-1002 ¶259. A POSITA would have recognized that Yuen, which discusses the capture of pulse oximetry data, also indirectly captures information about veins. *Id.* Both Schröder's and Yuen's techniques involve data collection from veins. This understanding would indicate that advances or techniques developed in one application (like pulse oximetry) could enhance methodologies in the other (like vein pattern biometrics), highlighting the interconnectedness of these sensing technologies. *Id.*

Yuen adjusts the operational parameters or measurement periodicity of various sensors based on data related to a user's activity, heart rate, sleep state, and power level. Ex-1002 ¶¶257-258. Based on Yuen's teachings, it would have been obvious to modify a sensor's operational parameter or measurement periodicity in Schröder's "finger-ring." *Id.* ¶¶259; Ex-1006, 7:19-38; 17:5-16. A POSITA would have understood from Yuen that a higher sampling rate or sampling resolution may "enable more accurate adaptive filtering" on the sensor data. Ex-1002 ¶257; Ex-1006, 7:1-6. Thus, it would have been obvious to adjust the operational parameters and measurement periodicity of a sensor based in part on the information from the sensor. Ex-1002 ¶259. A POSITA also would have been motivated to make these adjustments for reasons of redundancy, improved accuracy, and reduced power consumption. *Id*.

A POSITA would have had a reasonable expectation of success in combining Schröder and Yuen. *Id.* ¶242. A POSITA would have understood that the electronic components of Yuen and Schröder's devices are similar and are interchangeable regardless of whether the devices are in the form of a toe-band or a "finger-ring." *Id.* For example, the '178 Patent acknowledges that a device "can be subjected to [a] magnetic field to produce a current that can charge the onboard battery in accordance with known electromagnetic principles." Ex-1001, 30:45-48. Schröder and Yuen teach the same. Ex-1007, 11:50-55; Ex-1006, 14:42-46, 28:41-50. Moreover, a POSITA would have understood that different wearable electronic devices contain similar components that can be scaled appropriately in size and power to obtain interchangeable function. Ex-1002 ¶261. While Yuen does not explicitly state that its device can be worn as a "finger ring," a POSITA would have found it obvious that Yuen's device could be worn in such a manner because an "earring" or "toe band" are structurally equivalent and/or identical t o a "finger ring" and would be worn and/or function in a similar manner. Ex-1006, 24:35-40; Ex-1002 ¶261 (explaining the similarities between fingers and toes and the known advantages of a finger-ring structure). 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. Ex-1002 ¶261.

2. Independent Claim 1

a. Elements 1[pre]-1[c] and 1[e]

As described above, Schröder teaches Elements 1[pre]-1[c] and 1[e]. *See* Ex-1002 ¶262; *supra* §XIII.A.1.

b. Element 1[d]: a printed circuit board…

Schröder-Yuen also teaches Element 1[d]. Ex-1002 ¶¶263-266; *supra* §XIII.A.1.f (element 1[d]); *see supra* §XIII.D.1 (motivation and reasonable expectation of success).

Yuen's monitoring device has sensors disposed on a "***flexible PCB***." Ex-1006, 2:38-39, 12:35-38. A POSITA would understand that the PCB could be applied to Schröder's inlay, which extends through a second portion of the cavity different from the first portion. Ex-1002 ¶¶265-266.

3. Dependent Claims 4-11 and 13-16

a. Claim 4: The finger-worn wearable ring device of claim 1, further comprising: one or more magnetic components configured to magnetically interact with one or more additional magnetic components of a charger device to orient the finger-worn wearable ring device within a charging position on or within the charger device to facilitate charging of the finger-worn wearable ring device.

Schröder-Yuen teaches Claim 4. Ex-1002 ¶¶267-270; *see supra* §XIII.D.1 (motivation and reasonable expectation of success).

Schröder's "finger-ring" comprises one or more magnetic components configured to magnetically interact with one or more additional magnetic components of a charger device. *Id.* ¶268. Schröder's "finger-ring" is "***charged by means of [a] reader's electromagnetic field***." Ex-1007, 11:54-55. A POSITA would have understood that the "finger-ring" and the charger in Schröder have magnetic components to allow for inductive charging. Ex-1002 ¶268.

Schröder-Yuen teaches orienting the finger-worn wearable ring device within a charging position on or within the charger device. *Id.* ¶269. Yuen teaches "using magnetic properties to secure" an electronic device to a charger. Ex-1006, 14:42-49. Yuen's biometric monitoring device uses "***magnets to help the user align the device*** to the dock." *Id.* Yuen teaches that the "magnetic field of magnets in the dock or cable and the magnets in the device itself could be strategically ***oriented [so] as to force the device to self-align*** and provide ***a force that holds the device to the dock or cable***." *Id.*, 28:40-49.

b. Claim 5: The finger-worn wearable ring device of claim 4, further comprising: a charging component configured to wirelessly transfer energy from an additional charging component of the charger device to the battery when the finger-worn wearable ring device is oriented in the charging position.

Schröder-Yuen teaches Claim 5. Ex-1002 ¶¶271-272; *see supra* §XIII.D.1 (motivation and reasonable expectation of success).

Schröder-Yuen teaches a charging component configured to wirelessly transfer energy from a charger device when the finger-worn wearable ring device is oriented in the charging position. Ex-1002 ¶272. Schröder's "finger-ring" is "charged by means of…electromagnetic field." Ex-1007, 11:54-55. Schröder's battery is "connected directly to the antenna coil 8 via a rectifier circuit" for charging. *Id.*, 11:63-67. A POSITA would have understood that antenna coil 8 is the charging component that is configured to wirelessly transfer energy from the "reader's magnetic field" to the battery. Ex-1002 ¶272.

c. Claim 6: The finger-worn wearable ring device of claim 1, further comprising: one or more processors communicatively coupled to the battery and the one or more sensors, wherein the one or more processors are configured to: selectively adjust one or more operational parameters of the one or more sensors based at least in part on the data acquired by the one or more sensors.

Schröder-Yuen teaches Claim 6. Ex-1002 ¶¶273-275; *see supra* §XIII.D.1 (motivation and reasonable expectation of success).

Schröder-Yuen teaches one or more processors communicatively coupled to the battery and the one or more sensors. Ex-1002 ¶274. Schröder and Yuen each disclose a device with a processor, battery, and one or more sensors. *See supra* §XIII.D.1. Yuen further describes a device having a "sensor processor" that "***process[es] data from physiological, environmental and/or activity sensors***" or an "application processor" that "may be used to store and execute applications that ***utilize sensor data acquired*** and processed by" a sensor processor, while such an application process may also have sensors directly connected. Ex-1006, 22:60-23:15. A POSITA would find it obvious that one or more processors in the device are coupled to the battery and one or more sensors. Ex-1002 ¶274.

Schröder-Yuen teaches one or more processors are configured to: selectively adjust one or more operational parameters of the one or more sensors based at least in part on the data acquired by the one or more sensors. *Id.* ¶275. Yuen describes "***adjust[ing] or modify[ing] the sampling rate and/or resolution mode of the motion sensor(s) during…periods of user activity or motion*** (for example, periods where the amount of user motion exceeds a certain threshold)." Ex-1006, 6:64-7:1. Whether the user motion exceeds a threshold amount would be based on data acquired by the sensor(s). Ex-1002 ¶275.

d. Claim 7: The finger-worn wearable ring device of claim 6, wherein the data acquired by the one or more sensors comprises heart rate data associated with a heart rate of the user, wherein the one or more processors are further configured to: selectively adjust a measurement periodicity used by the one or more sensors to acquire the heart rate data based at least in part on the heart rate of the user.

Schröder-Yuen teaches Claim 7. Ex-1002 ¶¶276-279; *see supra* §XIII.D.1 (motivation and reasonable expectation of success).

Schröder-Yuen teaches that data acquired by one or more sensors comprises heart rate data associated with a heart rate of the user. Ex-1002 ¶277. Yuen describes "obtain[ing] ***data which is representative of, for example, a user's heart rate***, respiration, ***heart rate variability***, oxygen saturation (SpO2)." Ex-1006, 10:14- 25; *see also id*., 21:14-45. Yuen explains that "***data indicative of user activity or motion*** may be employed ***to adjust*** or ***modify the sampling rate and/or resolution mode of sensors which acquire heart rate data***." *Id.*, 6:57-7:6.

Schröder-Yuen also teaches that its processors selectively adjust a measurement periodicity used by the one or more sensors to acquire the heart rate data based at least in part on the heart rate of the user. Ex-1002 ¶278. Yuen explains that optical detectors can obtain data representative of "a user's heart rate," and that these detectors "may sample, measure and/or detect one or more wavelengths that are also specific or directed to a type of physiological data to be collected and physiological parameter (of the user) to be assessed or determined." Ex-1006, 10:7-28. Thus, a processor could selectively adjust a measurement period (e.g., sampling rate) of a sensor acquiring heart rate data based at least in part on the user's heart rate (e.g., motion or user activity). Ex-1002 ¶278. For example, whether a user is sedentary can be determined, at least in part, from the user's heart rate, and that a processor can decrease the sampling rate for the heart rate sensor when the user is sedentary. Ex-1002 ¶278.

e. Claim 8: The finger-worn wearable ring device of claim 6, wherein the data acquired by the one or more sensors comprises activity data associated with one or more activities engaged in by the user, wherein the one or more processors are further configured to: selectively adjust a measurement periodicity used by the one or more sensors to acquire the activity data based at least in part on the one or more activities engaged in by the user.

Schröder-Yuen teaches Claim 8. Ex-1002 ¶¶280-282; *see supra* §XIII.D.1 (motivation and reasonable expectation of success).

Schröder-Yuen's processor selectively adjusts a measurement periodicity used by the one or more sensors to acquire the activity data based at least in part on the one or more activities engaged in by the user. Ex-1002 ¶281. Yuen teaches that its device "may ***adjust or modify the sampling rate and/or resolution mode of the motion sensor(s)*** during such ***periods of user activity or motion*** (for example, periods where the amount of user motion exceeds a certain threshold)." Ex-1006, 6:57-7:6.

As discussed in *supra* Section XIII.D.2.e, it would have been obvious that a processor could selectively adjust a measurement period of a sensor acquiring user activity data based on the user's activity. Ex-1002 ¶282.

f. Claim 9: The finger-worn wearable ring device of claim 6, wherein the data acquired by the one or more sensors is associated with one or more sleep states of the user, wherein the one or more processors are further configured to: selectively adjust a measurement periodicity used by the one or more sensors to acquire the data based at least in part on the one or more sleep states of the user.

Schröder-Yuen teaches Claim 9. Ex-1002 ¶¶283-285; *see supra* §XIII.D.1 (motivation and reasonable expectation of success).

Schröder-Yuen teaches that the data acquired by the one or more sensors is associated with one or more sleep states of the user. Ex-1002 ¶284. Yuen teaches that a device can determine a user is asleep based on the user's motion. Ex-1006, 7:19-25.

Schröder-Yuen also teaches one or more processors further configured to selectively adjust a measurement periodicity used by the one or more sensors to acquire the data based at least in part on the one or more sleep states of the user. Ex-1002 ¶285. Yuen's device "may ***adjust and/or reduce the sampling rate of optical heart rate sampling*** when…the biometric monitoring device determines [that] the ***user is*** sedentary or ***asleep***." Ex-1006, 7:19-25. It would have been obvious that a processor could selectively adjust a measurement period of a sensor acquiring data associated with one or more sleep states based at least in part on the one or more sleep states of the user. Ex-1002 ¶285.

g. Claims 10/11: The finger-worn wearable ring device of claim 1, further comprising: one or more processors communicatively coupled to the battery [and]/[anil] the one or more sensors, wherein the one or more processors are configured to: selectively adjust one or more operational parameters of [the]/[she] one or more sensors based at least in part on a power level of the battery, a power usage of the one or more sensors, or both.

Schröder-Yuen teaches Claims 10 and 11.[11] Ex-1002 ¶¶286-290; *see supra* §XIII.D.1 (motivation and reasonable expectation of success).

Schröder-Yuen's processors selectively adjust one or more operational parameters of the one or more sensors based at least in part on a power level of the battery, a power usage of the one or more sensors, or both. Ex-1002 ¶288. Yuen describes that a "monitoring device (or selected portions thereof) may implement or be placed in a lower power mode of operation—for example, ***the optical heart rate sensor and/or circuitry may be placed in an off or disabled state or a lower power or sleep mode***." Ex-1006, 9:15-24. Yuen further describes that "[u]pon such a determination, the device may ***reduce its power consumption***—for example, ***'disable' or adjust the operating conditions of the stress and/or heart rate detection***

[11] Claim 11 is identical to Claim 10, except for the use of terms "anil" and "she," instead of "and" and "the" respectively. *See infra* §XIII.H. To the extent Claim 11's language is not indefinite and is understood to be identical to Claim 10, Schröder-Yuen teaches Claim 11 for the same reasons it teaches Claim 10.

sensors and/or circuitry (for example, reduce duty cycle of or disable the light source(s) and/or detector(s), and/or disable or attenuate associated circuitry or portions thereof)." *Id.*, 9:30-35. Schröder-Yuen therefore adjusts the operating conditions of heart rate sensors based on the device being placed in a lower power mode of operation. Ex-1002 ¶288.

h. Claim 13: The finger-worn wearable ring device of claim 1, wherein the one or more sensors comprise a first light-emitting component configured to emit light associated with a first wavelength, and a second light-emitting component configured to emit light associated with a second wavelength different from the first wavelength.

Schröder-Yuen teaches Claim 13. Ex-1002 ¶¶291-93; *see supra* §XIII.D.1 (motivation and reasonable expectation of success).

Schröder-Yuen teaches one or more sensors comprising two light-emitting components configured to emit light associated with two different wavelengths. As described above, in Section XIII.A.1.g (Element 1[e]), Schröder's "finger-ring" includes biometric sensors, such as an infrared diode and sensor. Ex-1007, 9:62-10:4. Yuen further describes a sensor with "***a light source emitting light having a wavelength in the red spectrum***" (the claimed "first light-emitting component associated with a first wave length"), and "***a light source emitting light having a wavelength in the infrared spectrum***" (the claimed "second light-emitting component associated with a second wavelength different than the first wavelength"). Ex-1006, 10:34-42.

i. Claim 14: The finger-worn wearable ring device of claim 13, wherein the first wavelength is associated with visible light, and wherein the second wavelength is associated with infrared light.

Schröder-Yuen teaches Claim 14. Ex-1002 ¶¶294-296; *see supra* §XIII.D.1 (motivation and reasonable expectation of success).

Schröder-Yuen's first light-emitting component emits visible light and another emits infrared light. Ex-1002 ¶295. Schröder's light-emitting diode emits infrared radiation. Ex-1007, 9:62-10:4. Yuen's sensor has "a light source emitting light having ***a wavelength in the red spectrum***" (the "first wavelength associated with visible light"), and "a light source emitting light having ***a wavelength in the infrared spectrum***" (the "second wavelength…associated with infrared light"). Ex-1006, 10:34-42; Ex-1002 ¶295.

j. Claim 15: The finger-worn wearable ring device of claim 13, wherein the first light-emitting component is positioned within the finger-worn wearable ring device at a first radial position, and the second light-emitting component is positioned within the finger-worn wearable ring device at a second radial position different from the first radial position.

Schröder-Yuen discloses Claim 15. Ex-1002 ¶¶297-300; *see supra* §XIII.D.1 (motivation and reasonable expectation of success).

Schröder-Yuen's first light-emitting component is positioned within the finger-worn wearable ring device at a first radial position, and the second light-emitting component is positioned within the finger-worn wearable ring device at a second radial position different from the first radial position. Ex-1002 ¶298.

Yuen teaches first and second light-emitting components positioned within the finger-worn wearable device. Ex-1002 ¶299. Figure 5 below shows Yuen's "light sources [(yellow)] and photodetector [(orange)] are placed on a flexible PCB [(purple)]." Ex-1006, 2:38-39. Yuen states 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)." *Id.*, 2:31-35. As shown in Figure 5, 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 device from the center of the user's wrist, when the LEDs are placed on "either side or opposing sides of a photodetector." Ex-1002 ¶¶298-300.

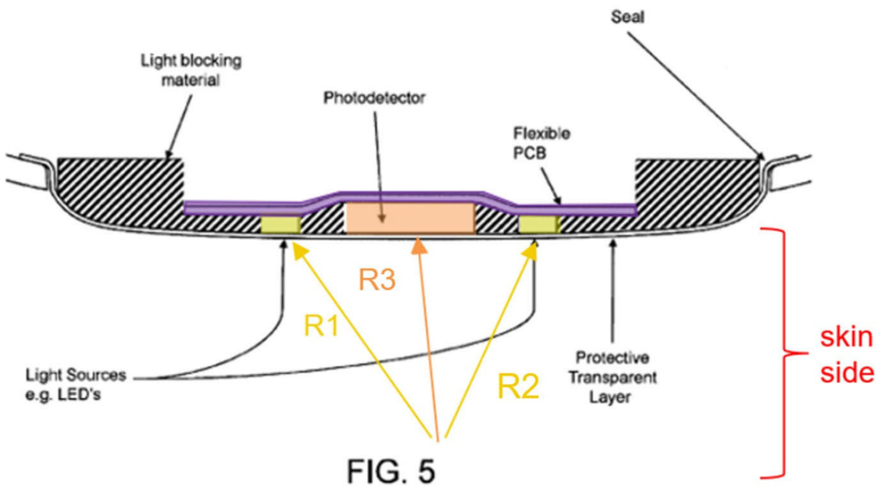


FIG. 5

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 assume a circumferential and curvilinear orientation to facilitate skin contact with the user's finger. *Id.* For example, Yuen explains that the light emitters 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 arranged 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 ¶299. Therefore, a POSITA would have understood Yuen's light sources in the ring construction 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"), like in the '178 Patent. Ex-1001, Figs. 3B, 3C.

A POSITA would have been motivated to implement Yuen's light emitters at a first and second radial positions in Schröder's "finger-ring" to enhance the quality of the plethysmogram signal and for redundancy within the device because LEDs at different radial positions—and thus physically separated from one another—provide additional readings along the user's tissue. Ex-1002 ¶300. A POSITA would have understood that the use of multiple LEDs is beneficial in case of LED malfunctions or noise interference. *Id.* ¶300.

k. Claim 16: The finger-worn wearable ring device of claim 15, wherein the one or more sensors further comprise a photodetector positioned within the finger-worn wearable ring device at a third radial position that is between the first radial position and the second radial position.

Schröder-Yuen teaches Claim 16. Ex-1002 ¶¶301-305; *see supra* §XIII.D.1 (motivation and reasonable expectation of success).

Schröder-Yuen teaches a photodetector positioned within the finger-worn wearable ring device at a third radial position that is between the first and second radial positions. Ex-1002 ¶302. Schröder teaches a light-emitting component and light-receiving component "arranged e.g., opposite each other such that e.g., a[]

finger bone located therebetween has no adverse effect" measuring the user's vein. Ex-1007, 9:62-10:4. Yuen further teaches a photodetector in a third radial position. Ex-1002 ¶303. Yuen describes light emitting diodes and a photodetector positioned "on a flexible or pliable substrate," which allows the inner surface of the device to adapt to the shape of the user's appendage (e.g., arm, wrist, ankle, or leg) that the device is secured to 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. As shown in Figure 5 below, 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 ¶303. 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 (PPG)." Ex-1006, 2:31-35. Thus, a POSITA would have understood that LEDs are positioned at a first radial position and a second radial position when placed on "either side or opposing sides of a photodetector." Ex-1002 ¶303.

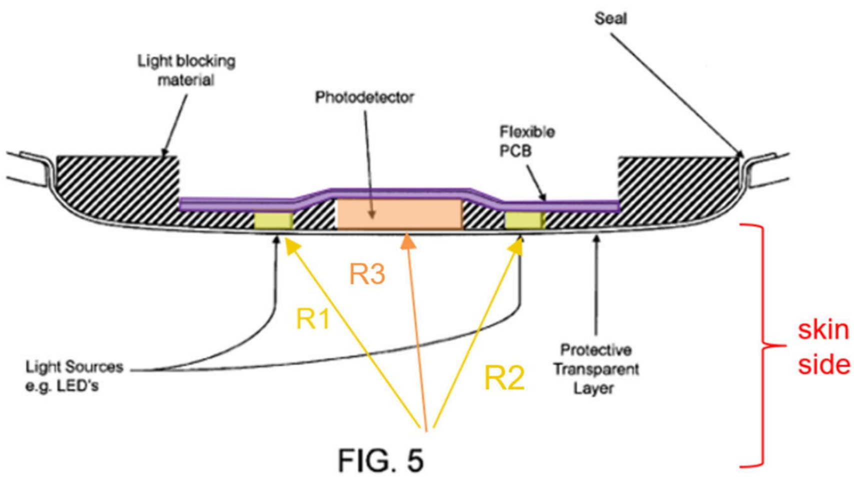


FIG. 5

Further, as previously discussed, the light sources disposed on the flexible PCB could be arranged to conform to the user's finger as the light sources in Yuen's sensor protrusion contact the user's skin in Figure 5. A POSITA would have understood 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 '178 Patent. Ex-1001, Figs. 3B, 3C. A POSITA would have further understood that the photodetector would be at a different radial position than the LEDs because separation between the LEDs and the photodetector enhances the plethysmogram signal's quality. Ex-1002 ¶¶303, 305.

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 the district court litigation between Patent Owner and Petitioner RingConn is stayed.

XV. CONCLUSION

Petitioner requests institution of IPR for Claims 1-18 of the '178 Patent based on each of the grounds in this Petition.

Dated: January 6, 2025

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CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. §42.24(d), Petitioner certifies that this petition includes 12,300 words, as measured by Microsoft Word, exclusive of the table of contents, mandatory notices under §42.8, certificates of service, word count, and exhibits.

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

The undersigned hereby certifies that the above document and accompanying Motion for Joinder/Consolidation and all exhibits were served on January 6, 2025, 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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