

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.

OURARING INC.
Patent Owner.

Case No. IPR2024-00930
U.S. Patent No. 11,599,147

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 11,599,147**

TABLE OF CONTENTS

	Page
I. INTRODUCTION	1
II. MANDATORY NOTICES UNDER 37 C.F.R. §42.8.....	1
III. FEE AUTHORIZATION	3
IV. GROUNDS FOR STANDING.....	3
V. PRECISE RELIEF REQUESTED	3
VI. THE CHALLENGED PATENT	4
VII. PROSECUTION HISTORY OF THE '147 PATENT.....	7
VIII. LEVEL OF ORDINARY SKILL IN THE ART	7
IX. PRIORITY DATE	8
X. CLAIM CONSTRUCTION	8
XI. BRIEF DESCRIPTION OF THE APPLIED PRIOR ART	8
A. Yuen (Ex-1006).....	8
B. Schröder (Ex-1007)	10
C. Mestas (Ex-1010)	12
XII. DETAILED EXPLANATION OF THE UNPATENTABILITY GROUNDS	14
A. Ground 1: Claims 1-7 and 10-15 are obvious over Yuen.	14
1. Independent Claims 1 and 10.....	14
a. Elements 1[pre]/10[pre]: [A method for forming] A wearable electronic device comprising:	14
a. Element 1[a]/10[a]: [providing] a body part made of a material, having an inner surface and an outer surface,.....	15
b. Element 1[b]/10[b]: wherein a cavity is formed on the inner surface of the body part, the cavity extending from the inner surface of the body part towards the outer surface of the body part and having a depth arranged within the inner surface of the body part, ...	17

TABLE OF CONTENTS

(continued)

	Page
c. Elements 1[c]/10[c]: [disposing] an electronic part arranged in the cavity, wherein at least a portion of the electronic part has a thickness that is less than the depth of the cavity, and.....	19
d. Elements 1[d]/10[d]: [disposing] a coating made of a potting material on the inner surface of the body part, covering the electronic part and the cavity.	20
2. Dependent Claims 2-7, 11-15	22
a. Claim 2: The wearable electronic device according to claim 1, wherein the material is a titanium material.	22
b. Claim 3: The wearable electronic device according to claim 1, wherein the material is selected from a group consisting of: steel, platinum, gold, silver, aluminum, polymer, plastic, tungsten carbide and a metal alloy.	22
c. Claim 4: The wearable electronic device according to claim 1, wherein the electronic part is disposed proximate to a bottom of the cavity.....	22
d. Claims 5 and 13: The wearable electronic device according to claim 1/[The method according to claim 10], wherein the potting material is selected from a group consisting of: epoxy material, silicone, a resin, and a polymer.	24
e. Claims 6 and 14: The wearable electronic device according to claim 1/[The method according to claim 10], wherein the electronic part is selected from a group consisting of: a battery, an infrared transmitter, a microcontroller, a radio frequency transceiver, a temperature sensor, a haptic feedback device, a piezo actuator, and an infrared receiver.	26

TABLE OF CONTENTS

(continued)

	Page
f. Claim 7: The wearable electronic device according to claim 1, wherein the electronic part comprises a circuit board selected from a group consisting of: a rigid-flexible printed circuit board, a flexible printed circuit board..... g. Claim 11: The method according to claim 10, wherein the material is selected from a group consisting of: titanium, titanium alloy, steel, platinum, gold, silver, aluminum, polymer, plastic, tungsten carbide and a metal alloy. a. Claim 12: The method according to claim 10, wherein the electronic part is disposed proximate to a bottom of the cavity, and wherein the electronic part comprises a circuit board selected from a group consisting of: a rigid-flexible printed circuit board, a flexible printed circuit board. b. Claim 15: The method according to claim 14, wherein the potting material comprises a clear material and an opaque material.....	27 28 28 28
B. Ground 2: Claims 8-9 and 16-22 are obvious over Yuen in view of Schröder.	29
1. A POSITA would have been motivated to combine Yuen’s teachings with Schröder’s teachings and would have had a reasonable expectation of success..... 2. Dependent Claims 8 and 16: The wearable electronic device according to claim 1/[The method according to claim 10], wherein the body part comprises a ring configured to be worn on a finger..... 3. Dependent Claims 9 and 17: The wearable electronic device according to claim 1/[The method according to claim 10], wherein the electronic part comprises an electromagnetic induction charging coil..... 4. Independent Claim 18	29 32 34 34

TABLE OF CONTENTS

(continued)

	Page
a. Element 18[pre]: A wearable electronic device configured to be worn on a finger comprising:	34
b. Element 18[a]: a C-shaped body part made of a material, having an inner surface and an outer surface, ...	35
c. Element 18[b]: wherein a cavity is formed on the inner surface of the C-shaped body part, the cavity extending from the inner surface of the C-shaped body part towards the outer surface of the C-shaped body part and having a depth arranged within the inner surface of the C-shaped body part;	36
d. Element 18[c]: an electronic part arranged in the cavity, wherein at least a portion of the electronic part has a thickness that is less than the depth of the cavity, wherein the electronic part comprises:	36
e. Element 18[d]: a flexible printed circuit board having an electronic component disposed thereon, ...	37
a. Element 18[e]: wherein the electronic component is selected from a group consisting of: an infrared transmitter, a microcontroller, a radio frequency transceiver, a temperature sensor and an infrared receiver, and a battery coupled to the flexible printed circuit board; and	37
b. Element 18[f]: a coating made of a potting material on the inner surface of the body part, covering the electronic part and the cavity	37
5. Dependent Claims 19-20	37
a. Claim 19: The wearable electronic device according to claim 18, wherein the material is selected from a group consisting of: titanium, titanium alloy, steel, platinum, gold, silver, aluminum, polymer, plastic, tungsten carbide and a metal alloy.	37

TABLE OF CONTENTS

(continued)

	Page
b. Claim 20: The wearable electronic device according to claim 18, wherein the potting material is selected from a group consisting of: epoxy material, silicone, a resin, and a polymer.	38
6. Independent Claim 21	38
a. Element 21[pre]: A wearable electronic device configured to be worn on a finger comprising:	38
b. Element 21[a]: an external portion made of a first material and having an inner surface and an outer surface, wherein the outer surface of the external portion defines an exterior surface of the electronic device;.....	38
c. Element 21[b]: an interior portion coupled to the external portion, wherein the interior portion is disposed below the inner surface of the external portion, wherein the interior portion is made of a second material, and wherein the interior portion defines an interior surface of the electronic device;.....	39
d. Element 21[c]: an electronic part disposed within the interior portion, wherein the electronic part comprises:	41
e. Element 21[d]: a rigid-flex printed circuit board comprising at least a first rigid circuit board and a second rigid circuit board coupled via a flexible material; and	41
f. Element 21[e]: at least one electronic component disposed upon the first rigid printed circuit board, wherein the electronic component is selected from a group consisting of: a light emitting diode (LED), a microcontroller, a temperature sensor, a light sensor, an accelerometer, a wireless interface and a haptic feedback device.	42
7. Dependent Claim 22	43

TABLE OF CONTENTS

(continued)

	Page
a. Element 22[a]: The wearable electronic device according to claim 21, wherein the first material is selected from a group consisting of: titanium, titanium alloy, stainless steel, platinum, gold, silver, aluminum, polymer, plastic, tungsten carbide and a metal alloy;..... b. Element 22[b]: and wherein the second material is selected from a group consisting of: epoxy material, silicone, a resin, and a polymer.	43 44
C. Ground 3: Claims 21-22 are obvious over Yuen and Schröder in further view of Mestas.....	44
1. A POSITA would have been motivated to combine Yuen and Schröder's teachings with Mestas's teachings and would have had a reasonable expectation of success. 2. Independent Claim 21 a. Element 21[pre] b. Element 21[a]..... c. Element 21[b] d. Element 21[c]..... e. Element 21[d]: a rigid-flex printed circuit board comprising at least a first rigid circuit board and a second rigid circuit board coupled via a flexible material; and f. Element 21[e]: at least one electronic component disposed upon the first rigid printed circuit board, wherein the electronic component is selected from a group consisting of: a light emitting diode (LED), a microcontroller, a temperature sensor, a light sensor, an accelerometer, a wireless interface and a haptic feedback device. 3. Dependent Claim 22 a. Element 22[a].....	44 46 46 46 46 46 48 48 48

TABLE OF CONTENTS

(continued)

	Page
b. Element 22[b]	49
D. Ground 4: Claims 1-3, 5-11, 13-14, and 16-20 are obvious over Schröder.....	49
1. Independent Claims 1 and 10.....	49
a. Element 1[pre]/10[pre]: [A method for forming] A wearable electronic device comprising:	49
b. Elements 1[a]/10[a]: [providing] a body part made of a material, having an inner surface and an outer surface,.....	50
c. Elements 1[b]/10[b]: wherein a cavity is formed on the inner surface of the body part, the cavity extending from the inner surface of the body part towards the outer surface of the body part and having a depth arranged within the inner surface of the body part, ...	51
d. Elements 1[c]/10[c]: [disposing] an electronic part arranged in the cavity, wherein at least a portion of the electronic part has a thickness that is less than the depth of the cavity, and.....	53
e. Elements 1[d]/10[d]: [disposing] a coating made of a potting material on the inner surface of the body part, covering the electronic part and the cavity.	55
2. Dependent Claims 2-3, 5-9, 11, 13-14, 16-17	56
a. Claim 2: The wearable electronic device according to claim 1, wherein the material is a titanium material.	56
b. Claim 3: The wearable electronic device according to claim 1, wherein the material is selected from a group consisting of: steel, platinum, gold, silver, aluminum, polymer, plastic, tungsten carbide and a metal alloy.	56

TABLE OF CONTENTS

(continued)

	Page
c. Claims 5 and 13: The wearable electronic device according to claim 1/[The method according to claim 10], wherein the potting material is selected from a group consisting of: epoxy material, silicone, a resin, and a polymer.	57
d. Claim 6: The wearable electronic device according to claim 1/[The method according to claim 10], wherein the electronic part is selected from a group consisting of: a battery, an infrared transmitter, a microcontroller, a radio frequency transceiver, a temperature sensor, a haptic feedback device, a piezo actuator, and an infrared receiver.	57
e. Claim 7: The wearable electronic device according to claim 1, wherein the electronic part comprises a circuit board selected from a group consisting of: a rigid-flexible printed circuit board, a flexible printed circuit board.....	59
f. Claims 8 and 16: The wearable electronic device according to claim 1/[The method according to claim 10], wherein the body part comprises a ring configured to be worn on a finger.	60
g. Claims 9 and 17: The wearable electronic device according to claim 1/[The method according to claim 10], wherein the electronic part comprises an electromagnetic induction charging coil.	61
h. Claim 11: The method according to claim 10, wherein the material is selected from a group consisting of: titanium, titanium alloy, steel, platinum, gold, silver, aluminum, polymer, plastic, tungsten carbide and a metal alloy.	61
E. Ground 5: Claims 4, 7, 12, 15, and 18-22 are obvious over Schröder in view of Yuen.....	62
1. A POSITA would have been motivated to combine Schröder's teachings with Yuen's teachings and would	

TABLE OF CONTENTS

(continued)

	Page
have had a reasonable expectation of success.	62
2. Dependent Claim 4: The wearable electronic device according to claim 1, wherein the electronic part is disposed proximate to a bottom of the cavity.	65
3. Dependent Claim 7: The wearable electronic device according to claim 1, wherein the electronic part comprises a circuit board selected from a group consisting of: a rigid-flexible printed circuit board, a flexible printed circuit board.	66
4. Dependent Claim 12: The method according to claim 10, wherein the electronic part is disposed proximate to a bottom of the cavity, and wherein the electronic part comprises a circuit board selected from a group consisting of: a rigid-flexible printed circuit board, a flexible printed circuit board.	67
5. Dependent Claim 15: The method according to claim 14, wherein the potting material comprises a clear material and an opaque material.	68
6. Independent Claim 18.....	68
a. Element 18[pre]: A wearable electronic device configured to be worn on a finger comprising:	68
b. Element 18[a]: a C-shaped body part made of a material, having an inner surface and an outer surface,.....	68
c. Element 18[b]: wherein a cavity is formed on the inner surface of the C-shaped body part, the cavity extending from the inner surface of the C-shaped body part towards the outer surface of the C-shaped body part and having a depth arranged within the inner surface of the C-shaped body part;	69

TABLE OF CONTENTS

(continued)

	Page
d. Element 18[c]: an electronic part arranged in the cavity, wherein at least a portion of the electronic part has a thickness that is less than the depth of the cavity, wherein the electronic part comprises:	69
e. Element 18[d]: a flexible printed circuit board having an electronic component disposed thereon, ...	69
f. Element 18[e]: wherein the electronic component is selected from a group consisting of: an infrared transmitter, a microcontroller, a radio frequency transceiver, a temperature sensor and an infrared receiver, and a battery coupled to the flexible printed circuit board; and.....	70
g. Element 18[f]: a coating made of a potting material on the inner surface of the body part, covering the electronic part and the cavity.....	70
7. Dependent Claims 19-20.....	70
a. Claim 19: The wearable electronic device according to claim 18, wherein the material is selected from a group consisting of: titanium, titanium alloy, steel, platinum, gold, silver, aluminum, polymer, plastic, tungsten carbide and a metal alloy.	70
b. Claim 20: The wearable electronic device according to claim 18, wherein the potting material is selected from a group consisting of: epoxy material, silicone, a resin, and a polymer.	70
8. Independent Claim 21	70
a. Element 21[pre]: A wearable electronic device configured to be worn on a finger comprising:	71

TABLE OF CONTENTS

(continued)

	Page
b. Element 21[a]: an external portion made of a first material and having an inner surface and an outer surface, wherein the outer surface of the external portion defines an exterior surface of the electronic device;.....	71
c. Element 21[b]: an interior portion coupled to the external portion, wherein the interior portion is disposed below the inner surface of the external portion, wherein the interior portion is made of a second material, and wherein the interior portion defines an interior surface of the electronic device;.....	72
d. Element 21[c]: an electronic part disposed within the interior portion, wherein the electronic part comprises:	73
e. Element 21[d]: a rigid-flex printed circuit board comprising at least a first rigid circuit board and a second rigid circuit board coupled via a flexible material; and	74
f. Element 21[e]: at least one electronic component disposed upon the first rigid printed circuit board, wherein the electronic component is selected from a group consisting of: a light emitting diode (LED), a microcontroller, a temperature sensor, a light sensor, an accelerometer, a wireless interface and a haptic feedback device.....	74
9. Dependent Claim 22	75
a. Element 22[a]: The wearable electronic device according to claim 21, wherein the first material is selected from a group consisting of: titanium, titanium alloy, stainless steel, platinum, gold, silver, aluminum, polymer, plastic, tungsten carbide and a metal alloy;.....	75

TABLE OF CONTENTS

(continued)

	Page
b. Element 22[b]: and wherein the second material is selected from a group consisting of: epoxy material, silicone, a resin, and a polymer.	76
F. Ground 6: Claims 21-22 are obvious over Schröder in view of Mestas.....	76
1. A POSITA would have been motivated to combine Schröder’s teachings with Mestas’s teachings and would have had a reasonable expectation of success.	76
2. Independent Claim 21	78
a. Element 21[pre]	78
b. Element 21[a].....	78
c. Element 21[b]	78
d. Element 21[c].....	78
e. Element 21[d]: a rigid-flex printed circuit board comprising at least a first rigid circuit board and a second rigid circuit board coupled via a flexible material; and	78
f. Element 21[e]: at least one electronic component disposed upon the first rigid printed circuit board, wherein the electronic component is selected from a group consisting of: a light emitting diode (LED), a microcontroller, a temperature sensor, a light sensor, an accelerometer, a wireless interface and a haptic feedback device.	79
3. Dependent Claim 22	80
a. Element 22[a].....	80
b. Element 22[b]	80
XIII. THE BOARD SHOULD NOT USE ITS DISCRETION TO DENY INSTITUTION UNDER <i>FINTIV</i>	80
XIV. CONCLUSION.....	80

LIST OF EXHIBITS¹

Ex. No.	Description
Ex-1001	U.S. Patent No. 11,599,147 (“the ’147 Patent”)
Ex-1002	Declaration of Dr. Brian W. Anthony
Ex-1003	Curriculum Vitae of Dr. Brian W. Anthony
Ex-1004	Prosecution History of the ’147 Patent (Application No. 17/519,201)
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	INTENTIONALLY LEFT BLANK
Ex-1013	U.S. Patent Publication No. 20120218184 to Wissmar (“Wissmar”)
Ex-1014	INTENTIONALLY LEFT BLANK
Ex-1015	INTENTIONALLY LEFT BLANK
Ex-1016	INTENTIONALLY LEFT BLANK
Ex-1017	INTENTIONALLY LEFT BLANK

¹ Four-digit pin citations that begin with 0 are to the branded numbers added by Samsung 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-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	<i>Dynamic Drinkware</i> -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., <i>Reflectance Pulse Oximetry – Principles and Obstetric Application in the Zurich System</i> , 14 Journal of Clinical Monitoring (Aug. 1998) (“Konig”)
Ex-1028	U.S. Patent No. 6,608,562 to Kimura (“Kimura”)
Ex-1029	Kevin K. Tremper et al., <i>Pulse Oximetry</i> , 70 Journal of American Society of Anesthesiologists, Inc. (Jan. 1989) (“Tremper”)
Ex-1030	Y. Mendelson et al., <i>A Wearable Reflectance Pulse Oximeter for Remote Physiological Monitoring</i> , Proceedings of 28 th IEEE EMBS Annual International Conference (Aug. 30-Sept. 3, 2006) (“Mendelson 2006”)
Ex-1031	Sokwoo Rhee et al., <i>Artifact-Resistant, Power-Efficient Design of Finger-Ring Plethysmographic Sensors Part I: Design and Analysis</i> , IEEE (2000) (“Rhee 2000 Part I”)

Ex. No.	Description
Ex-1032	Sokwoo Rhee et al., <i>Artifact-Resistant, Power-Efficient Design of Finger-Ring Plethysmographic Sensors Part II: Prototyping and Benchmarking</i> , IEEE Proceedings of 22 nd Annual EMBS Int'l Conference (July 23-28, 2000) ("Rhee 2000 Part II")
Ex-1033	Sokwoo Rhee et al., <i>Artifact-Resistant Power-Efficient Design of Finger-Ring Plethysmographic Sensors</i> , 48 IEEE Transactions of Biomedical Engineering (July 2001) ("Rhee 2001")
Ex-1034	U.S. Patent No. 6,699,199 to Asada ("Asada '199")
Ex-1035	Sokwoo Rhee, <i>Design and Analysis of Artifact-Resistive Finger Photoplethysmographic Sensors for Vital Sign Monitoring</i> , MIT (June 2000) ("Rhee Thesis 2000")
Ex-1036	C.T. Olofson et al., <i>Machining of Titanium Alloys</i> (1965) ("Olofson")
Ex-1037	H. Harry Asada et al., <i>Mobile Monitoring with Wearable Photoplethysmographic Biosensors</i> , IEEE Engineering in Medicine & Biology Magazine 28 (May-June 2003) ("Asada 2003")
Ex-1038	Denisse Castaneda et al., <i>A review on wearable photoplethysmography sensors and their potential future applications in health care</i> , Int J Biosens Bioelectron (2018)
Ex-1039	U.S. Patent No. 7,468,036 to Rulkov et al. ("Rulkov")
Ex-1040	U.S. Patent Publication No. 2006/0211924 to Dalke et al. ("Dalke")
Ex-1041	<i>Guidelines To Enhancing The Heart-Rate Monitoring Performance Of Biosensing Wearables</i> (2014)
Ex-1042	U.S. Patent No. 4,880,304 to Jaeb et al. ("Jaeb")
Ex-1043	Tom Lister et al., <i>Optical Properties of human skin</i> , Journal of Biomedical Optics (2012)
Ex-1044	John G. Webster, <i>Design of Pulse Oximeters</i> , CRC Press (1997)

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

Ex. No.	Description
Ex-1058	Tadamoto Sakai, <i>Encapsulation Process for Electronic Devices Using Injection Molding Method</i> , 12 Advances in Polymer Technology 61 (1993)
Ex-1059	N.J. Teh et al., <i>Embedding of Electronics within Thermoplastic Polymers using Injection Moulding Technique</i> , IEEE, 2000 Int'l Electronics Manufacturing Technology Symposium 10 (2000)
Ex-1060	U.S. Patent No. 6,201,698 to Hunter (“Hunter”)
Ex-1061	U.S. Patent No. 4,012,629 to Simms (“Simms”)

I. INTRODUCTION

Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively, “Petitioner”) request *inter partes* review (“IPR”) of Claims 1-22 of U.S. Patent No. 11,599,147 (“the ’147 Patent”) (Ex-1001), currently assigned to Ouraring Inc. (“PO”).

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

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

Related Matters: Petitioner has filed a suit against PO seeking a declaratory judgment of noninfringement of the ’147 Patent: *Samsung Electronics Corporation, Ltd. et al v. Ōura Health Oy et al.*, No. 3:24-cv-03245 (N.D. Cal. filed May 30, 2024). There are no invalidity claims and therefore no overlap with this petition. For the Board’s convenience, Petitioner notes that Petitioner is challenging the following five patents: U.S. Patent Nos. 11,868,178, 11,868,179, 11,599,147, 9,582,034, and 10,893,833. The ’833 Patent claims substantially the same subject matter as the ’147 Patent. The ’178 and ’179 Patents claim related subject matter. The ’034 Patent is from the same family as the ’178, ’179, and ’147 Patents.

Lead and Back-Up Counsel:

- Lead Counsel:

William M. Fink (Reg. No. 72,332)
O’Melveny & Myers LLP

1625 Eye Street, NW
Washington, DC 20006
Telephone: (202) 383-5300
Fax: (202) 383-5414
E-Mail: tfink@omm.com

- Backup Counsel:

John Kappos (Reg. No. 37,861)
O'Melveny & Myers LLP
2801 North Harwood Street, Suite 1600
Dallas, TX 75201
Telephone: (972) 360-1900
Fax: (972) 360-1901
E-Mail: jkappos@omm.com

Benjamin M. Haber (Reg. No. 67,129)
O'Melveny & Myers LLP
400 South Hope Street, 18th Floor
Los Angeles, CA 90071
Telephone: (213) 430-6000
Fax: (213) 430-6407
E-Mail: bhaber@omm.com

Marc Pensabene (Reg. No. 37,416)
O'Melveny & Myers LLP
Times Square Tower, 7 Times Square
New York, NY 10036
Telephone: (212) 326-2070
Fax: (212) 326-2061
E-Mail: mpensabene@omm.com

Mark Liang (Reg. No. 81,045)
O'Melveny & Myers LLP
Two Embarcadero Center, 28th Floor
San Francisco, CA 94111
Telephone: (415) 984-8700
Fax: (415) 984-8701
E-Mail: mliang@omm.com

Sorin G. Zaharia (Reg. No. 75,662)
O'Melveny & Myers LLP
Two Embarcadero Center, 28th Floor
San Francisco, CA 94111
Telephone: (415) 984-8700
Fax: (415) 984-8701
E-Mail: szaharia@omm.com

Service Information: Petitioner consents to electronic service by email to the following addresses:

tfink@omm.com
jkappos@omm.com
bhaber@omm.com
mpensabene@omm.com
mliang@omm.com
szaharia@omm.com
omm-samsung-oura@omm.com

III. FEE AUTHORIZATION

The PTO is authorized to charge any fees due during this proceeding to Deposit Account No. LA500639.

IV. GROUNDS FOR STANDING

Petitioner certifies that the '147 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 1-22 as unpatentable based on the following grounds, supported by a declaration from Dr. Brian W. Anthony. Ex-1002; Ex-1003.

Ground	Summary
1	Claims 1-7 and 10-15 are obvious over Yuen (Ex-1006).
2	Claims 8-9 and 16-22 are obvious over Yuen in view of Schröder (Ex-1007).
3	Claims 21-22 are obvious over Yuen in view of Schröder in further view of Mestas (Ex-1010).
4	Claims 1-3, 5-11, 13-14, and 16-17 are obvious over Schröder.
5	Claims 4, 7, 12, 15, and 18-22 are obvious over Schröder in view of Yuen.
6	Claim 21-22 are obvious over Schröder in view of Mestas.

VI. THE CHALLENGED PATENT

The challenged claims are directed to a wearable electronic device having an inner and an outer surface, a cavity, an electronic part arranged in the cavity, and a potting material covering the electronic part and the cavity. Ex-1001, Cls. 1, 10, 18, 21.

An example of the device is illustrated in Figure 4 of the '147 Patent (below), showing the interior portion (annotated red) and the external portion (green).² Electronic components on a flexible printed circuit board (“PCB”) are inserted between the interior and external portions. *Id.*, Fig. 4, 13:19-21.

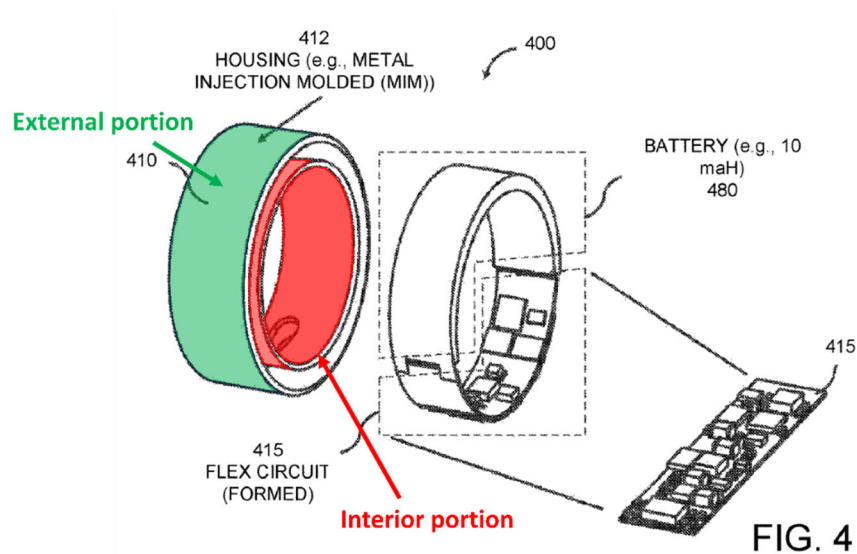


Figure 11, below, shows a cross-sectional view of the device with “external housing 1312 and an internal potting or encapsulant 1314.” *Id.*, 15:62-64, Fig. 11. Battery 1330, PCB 1340, and components 1350 (annotated purple) are “at least partially or completely disposed within the partially enclosed internal space 1320” (blue). *Id.*, 16:4-7. “The components can be encapsulated by the internal potting 1314” (yellow), which “can be transparent.” *Id.*, 16:10-19.

² Throughout, emphasis and annotations are added unless otherwise specified.

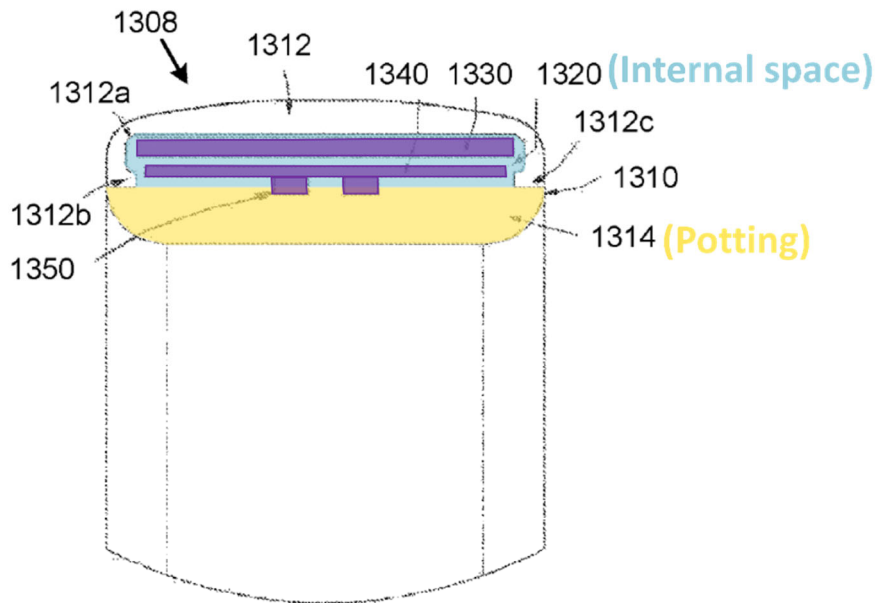


FIG. 11

The battery, PCB, and components on the PCB are annotated purple. The specification does not mention the words “body part” or “cavity” used in three of the four independent claims. *Id.*, Cls. 1, 10, 18.

The '147 specification states that “many current wearable electronics are bulky and can be intrusive,” and describes the patent’s purported innovation as “overcom[ing] the disadvantages of the prior art by providing a wearable computing device (WCD) in the shape of a ring.” *Id.*, 1:33-43. But a majority of the claims do not require a ring, and the specification recognizes that the device “can be in the form of a wrist band, bracelet, necklace, earring, or any other type of wearable

accessory.” *Id.*, 6:24-27. The device components include a processor module, sensor modules, power module, communication module, and memory. *Id.*, 7:43-46.

As explained in detail below, the ’147 claims are obvious in view of the prior art. Ex-1002 ¶¶144-439.

VII. PROSECUTION HISTORY OF THE ’147 PATENT

The ’147 Patent application, No. 17/519,201, was filed November 4, 2021. It claims priority through a chain of continuation and divisional applications to Application No. 14/556,062, filed November 28, 2014, now U.S. Pat. No. 9,582,034. Ex-1001 at 2. The ’147 Patent further claims priority to Provisional Application Nos. 62/006,835, filed June 2, 2014, and 61/910,201, filed November 29, 2013. *Id.*

This Petition presents arguments not considered during prosecution and the prior art in this Petition was not before the PTO during prosecution. *Id.*; Ex-1002 ¶¶41-42.

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, e.g., sensor system

design and signal processing. A higher level of education or skill might make up for less experience, and vice versa. Ex-1002 ¶29.

IX. PRIORITY DATE

For purposes of this proceeding only, Petitioner applies the earliest alleged priority date of the '147 Patent, November 29, 2013. Accordingly, AIA 35 U.S.C. §102 applies.

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 ¶142.

XI. BRIEF DESCRIPTION OF THE APPLIED PRIOR ART

A. Yuen (Ex-1006)

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

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

Yuen teaches a biometric monitoring device, depicted in Figures 4 and 7, configured to be worn on an appendage of the user's body, e.g., "arm, wrist, leg and/or ankle." Ex-1006, 12:50-52, Fig. 4 (cross-sectional device view), Fig. 7 (cross-sectional view of the device's photoplethysmography ("PPG") sensor).

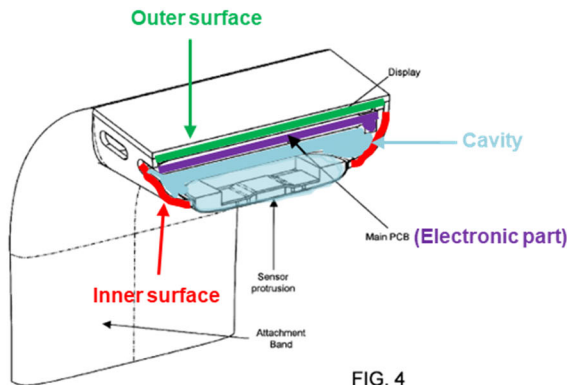


FIG. 4

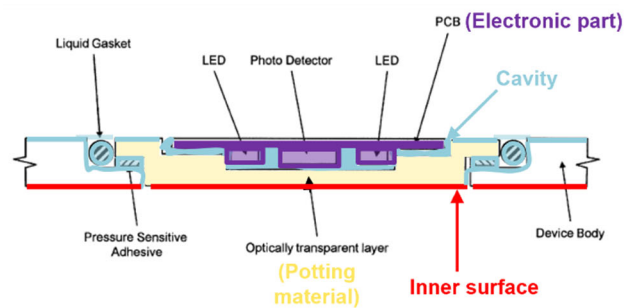


FIG. 7

As shown in the figures above, Yuen teaches that a cavity (annotated blue) is formed on the inner surface (red), extending to the device's outer surface (Fig. 4 (green), Fig. 7 (not shown)). *Id.* The cavity houses Yuen's electronic part (purple), including, e.g., "an optical sensor having one or more light sources" (e.g., LEDs) that emit "light into the user's body" and light detectors (e.g., photodiodes) that "sample, measure and/or detect a response or reflection" from the user's body, which is used by a PPG to determine the user's stress level, blood pressure and/or heart rate. *Id.*, 6:23-31. The LEDs, photodetectors, and other electronics may be provided on a [regular] or a flexible PCB. *Id.*, 2:38-39, 12:35-42. Yuen further teaches that an optically transparent layer (yellow) "may be formed through in-mold labeling"

on the device's inner surface, covering the unfilled cavity space and electronic part. Ex-1006, 2:44-45; Ex-1002 ¶¶132-134.

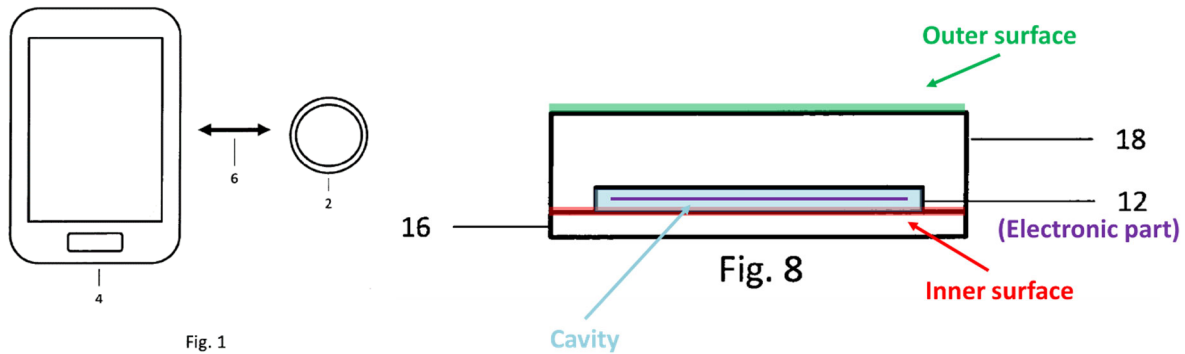
B. Schröder (Ex-1007)

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, claiming priority to foreign application DE 102013012339, filed July 25, 2013. Schröder qualifies as prior art under 35 U.S.C. §102(a)(2). Petitioner is unaware of any facts supporting a §102(b) exception. Schröder's German counterpart is essentially identical to the U.S. filing. *See generally* Ex-1007 (U.S. issued patent); Ex-1009 (German application); Ex-1008 (certified translation of German application). The figures are identical, and the specification is equivalent. Ex-1002 ¶135. Because the described subject matter is identical, Schröder's '867 Patent should be considered to have been effectively filed as of its German priority date of July 25, 2013, because the '867 Patent is entitled to claim a right of priority to DE 102013012339 under 35 U.S.C. §365. *See* AIA 35 U.S.C. §102(a)(2) and (d)(2).⁴

Schröder teaches a biometric sensing device, depicted in Figures 1 and 8, which is a ring “worn by a user[,] e.g., permanently on the finger.” Ex-1007, 3:61-

⁴ Parallel citations to Schröder's German counterpart for all Schröder '867 Patent citations are provided in Ex-1022.

63, Fig. 1 (“finger-ring” 2 communicating with smartphone 4), Fig. 8 (cross-sectional view of ring 2).



As shown in Figure 8, Schröder teaches that a cavity (annotated blue) is formed on the inner surface (component 16, red), extending to the device’s outer surface (component 18, green). *Id.*, Fig. 8. An electronic part such as inlay 12 (purple) and/or a chip module (not shown) is inserted into or within the ring’s cavity. Ex-1007, 12:10-12 (“The finger-ring 2 consists...of at least one component 16, 18 into which at least one inlay 12 is inserted, whereby one component can be a ring half 16, 18.”), 12:26-28 (“The inlay 12 is...inserted into at least one recess provided therefor within at least one component [].”); *see also id.*, 8:58-59 (a chip module is inserted into the recess). Schröder further teaches that the ring “can be manufactured by an injection-molding process,” resulting in “a ring-shaped body in whose interior the...electronic devices are arranged.” Ex-1007, 14:35-37, 14:46-49; Ex-1002 ¶¶136-137. Schröder further teaches the ring has a battery, which “is preferably

charged by means of [an] electromagnetic field,” using an antenna coil. Ex-1007, 11:46-67.

C. Mestas (Ex-1010)

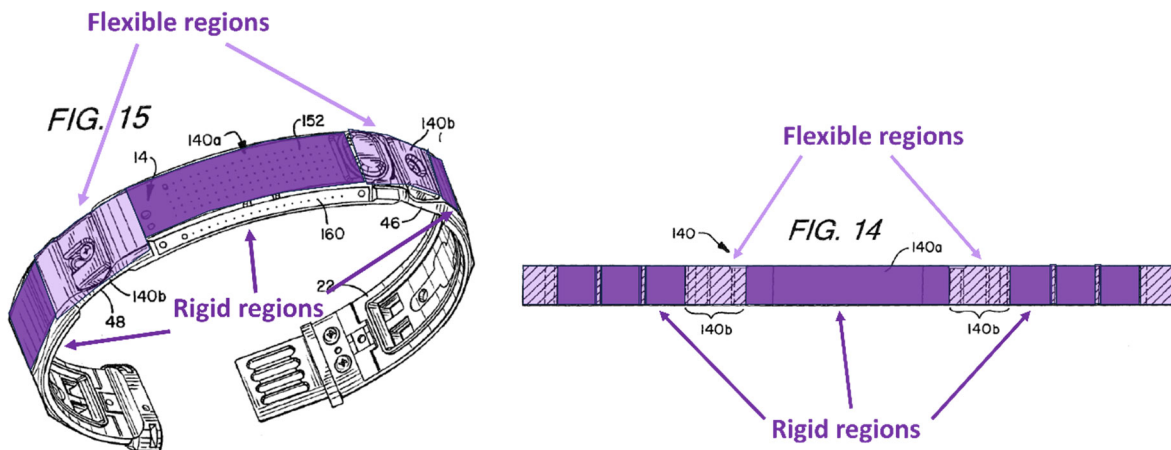
Mestas (U.S. Pat. Pub. No. 2014/0244009) was filed February 21, 2014, claiming priority to Provisional App. No. 61/768,279, filed February 22, 2013. Mestas was published August 28, 2014, and qualifies as prior art under 35 U.S.C. 102(a)(2). Petitioner is unaware of any facts supporting a §102(b) exception. 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 effectively identical.⁵ Ex-1002 ¶138. 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).⁶

⁵ 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.

⁶ *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.

Mestas teaches a wearable electronic device, depicted in Figure 15, which is an arm-band or a wrist-band, and can be used to monitor user biometrics such as heart rate. Ex-1010 ¶148, Figs. 1, 15. Mestas teaches the “wearable athletic device may be worn in a variety of locations... 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.

Mestas’s circular device has a cavity inside its housing where a spine member is disposed, “having substantially rigid portions and certain flexible portions or zones.” *Id.* ¶¶151, 153. A rigid-flex printed circuit board (PCB) is “wrapped around and mounted to the spine[s] member” and similarly includes rigid zones (annotated dark purple below) connected by flexible zones (light purple) for placing the various electronic components. *Id.*, Figs. 14, 15, ¶¶164, 177.



Mestas further teaches that electronics such as display or LEDs are placed on the rigid zones “to prevent breakage.” *Id.* ¶172; *see also id.* ¶170.

XII. DETAILED EXPLANATION OF THE UNPATENTABILITY GROUNDS

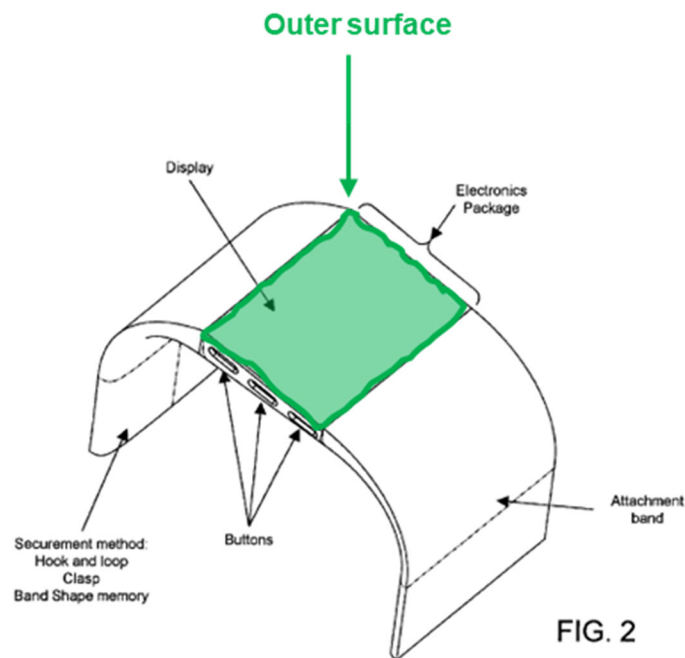
A. Ground 1: Claims 1-7 and 10-15 are obvious over Yuen.

1. Independent Claims 1 and 10

a. Elements 1[pre]/10[pre]: [A method for forming] A wearable electronic device comprising:

Yuen teaches⁷ the preamble, to the extent it is limiting. Ex-1002 ¶¶144-145.

Yuen teaches a portable biometric monitoring device, depicted in Figure 2, which is configured to be worn on an appendage of the user's body, e.g., "arm, wrist, leg and/or ankle." Ex-1006, 12:50-52, Fig. 2, 2:7-17.

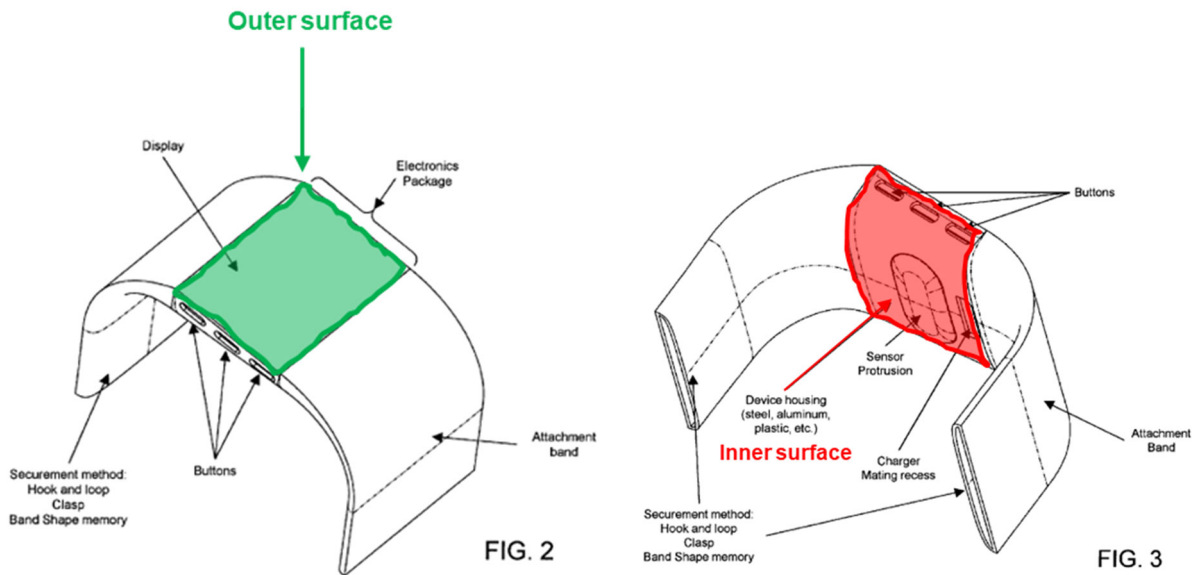


⁷ Petitioner uses the term "teaches" throughout this Petition as including both express teachings and those fairly suggested to a POSITA. *In re Baird*, 16 F.3d 380, 383 (Fed. Cir. 1994); *In re Keller*, 642 F.2d 413, 425 (CCPA 1981) ("The test for obviousness is...what the combined teachings of the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

a. Element 1[a]/10[a]: [providing] a body part made of a material, having an inner surface and an outer surface,

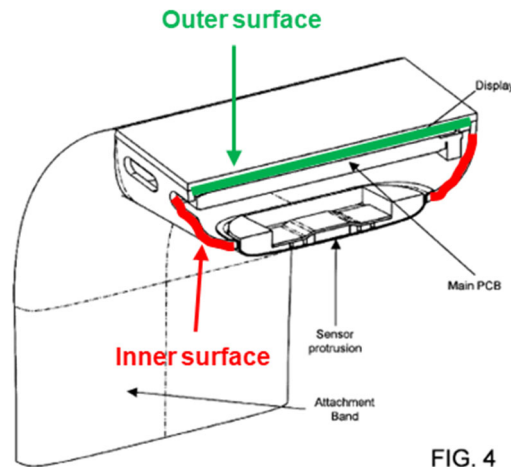
Yuen teaches Elements 1[a]/10[a]. Ex-1002 ¶¶146-150.

The '147 specification does not provide a definition for “body part” or even mention the term. Yuen teaches that its biometric monitoring device includes “two major components—a body (containing the ‘electronics’)” and a band allowing the device to be attached to the user. Ex-1006, 24:14-17. Yuen’s Figure 2 depicts the device’s outer surface and Figure 3 depicts its inner surface. *Id.*, 2:7-11, Fig. 2 (green), Fig. 3 (red). Yuen teaches that “[s]ome or all of the interior or skin side of the housing” for the device is made of “a metal material,” e.g., stainless steel, steel, magnesium, aluminum, or titanium. *Id.*, 14:33-36. Yuen further teaches that a device “back made out of a metal” or plastic material provides a stiff-enough structure to maintain the device’s structural integrity, while also providing “a watertight seal for the sensor package.” *Id.*, 14:66-15:4.



Yuen's body part has an inner surface and an outer surface as depicted in Figures 2-4. Ex-1002 ¶148. Figure 2 depicts the device's outer surface (green), which may include, e.g., a display. Ex-1006, 2:7-11, Fig. 2. Yuen's Figure 3 depicts the device's inner "skin facing" surface (red), which may include, e.g., the device housing, sensor protrusion, and charger mating recess. *Id.*, 2:18-22, Fig. 3.

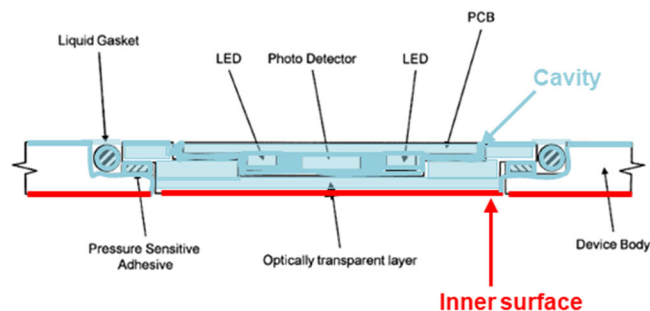
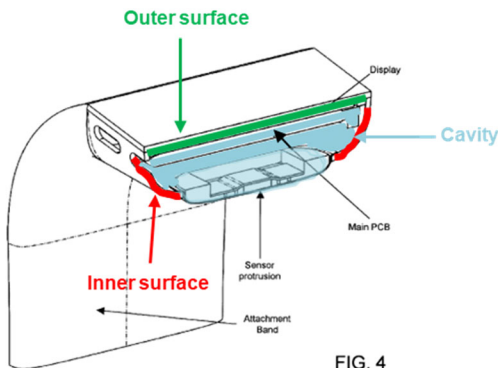
Figure 4 depicts the device in cross-section, including the outer and inner surfaces. *Id.*, 2:26-28, Fig. 4.



- b. **Element 1[b]/10[b]:** wherein a cavity is formed on the inner surface of the body part, the cavity extending from the inner surface of the body part towards the outer surface of the body part and having a depth arranged within the inner surface of the body part,

Yuen teaches Elements 1[b]/10[b]. Ex-1002 ¶¶151-158.

Yuen teaches a cavity formed on the inner (skin-facing) surface of the device (red), as shown in blue in Figures 4 (depicting a device cross-sectional view) and 7 (depicting a cross-sectional view of a photoplethysmography (“PPG”) sensor). Ex-1006, Figs. 4, 7.



A POSITA would have understood the area annotated blue in Figures 4 and 7 is a cavity formed on the device's inner surface because it is a depression formed on that surface. Ex-1002 ¶¶153.

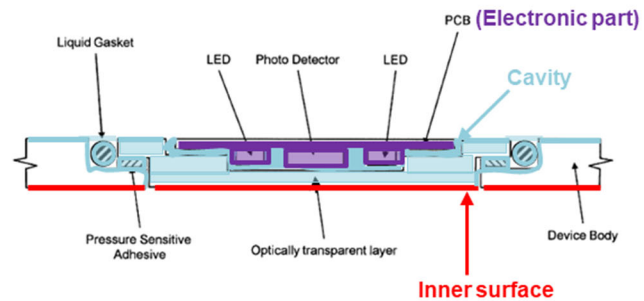
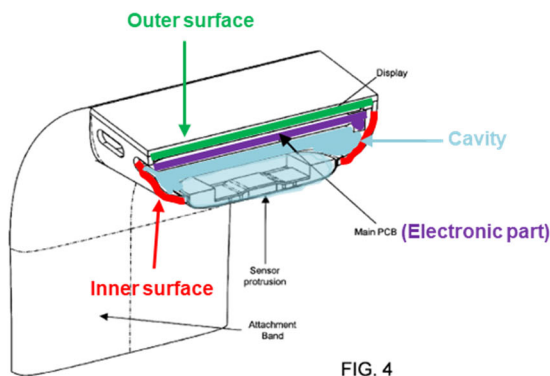
Yuen also teaches that the cavity (blue), which houses the electronic parts including the LEDs and photodetector, extends from the inner (skin-facing) surface of the device (red) towards its outer surface (green), as shown in Figures 4 and 7. Ex-1006, Figs. 4, 7 (outer surface not shown).

The cavity extending from the device's inner surface towards its outer surface has a depth arranged within the inner surface because the cavity is contained entirely within the device's inner surface, as shown in Fig. 7. Ex-1006; Ex-1002 ¶158. The cavity is designed to include electronic components, which are 3-dimensional objects with a certain length, width, and depth. *See, e.g.*, Ex-1006, 12:35-45 (“[T]he light source(s) and/or associated detector(s) are disposed on a Flat Flex Cable or ‘FFC’ or flexible PCB....Optical components of differing heights may be mounted to different ‘fingers’ of flexible substrate and pressed or secured to the housing surface such that the optical components are flush to the housing surface.”); Ex-1002 ¶158. Since the cavity must be large enough to house electronic components with a certain depth, the cavity must also have a corresponding greater depth (i.e., the cavity's vertical thickness (blue) in Figures 4 and 7). *Id.*

- c. **Elements 1[c]/10[c]: [disposing] an electronic part arranged in the cavity, wherein at least a portion of the electronic part has a thickness that is less than the depth of the cavity, and**

Yuen teaches Elements 1[c]/10[c]. Ex-1002 ¶¶159-164.

Yuen teaches the device includes “two major components,” one being the “body (containing the ‘electronics’).” Ex-1006, 24:14-17. As depicted in Figures 4 and 7, the electronic part (purple) is arranged in the cavity (blue). *Id.*, Figs. 4, 7.



The electronic part housed in the cavity includes, e.g., “an optical sensor having one or more light sources” (e.g., LEDs) that emit “light into the user’s body” and light detectors (e.g., photodiodes) that “sample, measure and/or detect a response or reflection” from the user’s body, which is used by a PPG to determine the user’s stress level, blood pressure, and heart rate. *Id.*, 6:23-31. The LEDs and photodetectors are provided on a flexible PCB. *Id.*, 2:38-39.

Yuen also teaches that at least a portion of the electronic part (purple) has a thickness less than the depth of the cavity (blue), as depicted in Figures 4 and 7.

Ex-1006, Figs. 4, 7. A POSITA would have understood that at least a portion of the electronic part, including the LEDs and photodetector attached to a PCB, has a thickness less than the cavity's depth because the electronic part must fit within the depth of the cavity to maintain the device's intended structural and functional integrity. Ex-1002 ¶163. Additionally, Yuen teaches the electronic part can be "disposed or placed flush to the surface of the device." Ex-1006, 14:59-66. A POSITA would have understood that the electronic part would have a thickness less than the cavity's depth to be flush with the device's surface. Ex-1002 ¶¶162-164.

d. Elements 1[d]/10[d]: [disposing] a coating made of a potting material on the inner surface of the body part, covering the electronic part and the cavity.

Yuen teaches Elements 1[d]/10[d]. Ex-1002 ¶¶165-176.

As depicted in Figure 7, Yuen teaches an optically transparent layer (yellow) on the inner surface of the device (red) that covers the electronic part (purple) and the cavity (blue). Ex-1006, Fig. 7.

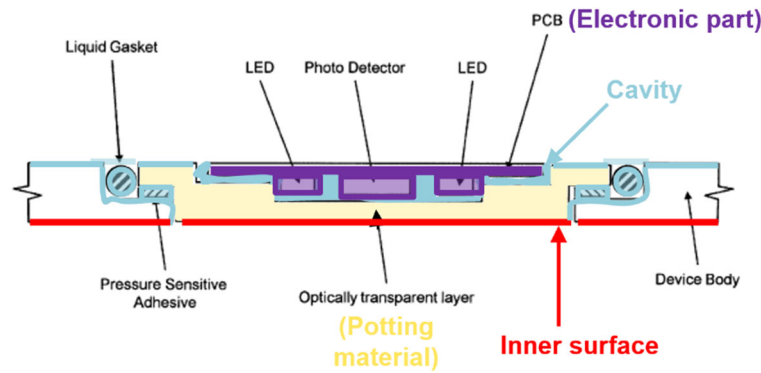


FIG. 7

Yuen teaches the optically transparent layer “may be formed through in-mold labeling or ‘IML.’” Ex-1006, 2:44-45. Yuen further teaches that its device may use “light transmissive structure having an optically opaque portion (including certain optical properties) and an optically transparent portion (including optical properties different from the optically opaque portion).” *Id.*, 11:29-33. The light transmissive structure may be created by “a double-shot or two step molding process wherein optically opaque material is injected and optically transparent material is injected.” *Id.*, 11:33-36.

A POSITA would have understood that Yuen’s optically transparent layer, formed by injection from moldable material having transparent and opaque portions, is a coating made of “potting material” covering the electronic part and cavity on the device’s inner surface, as claimed. Ex-1002 ¶¶169, Ex-1006, 11:33-36. A POSITA would have known that similar materials can be used for molding and for potting,

and would have understood that Yuen's molding material is a "potting material" that fills in the cavity and encapsulates the electronic part within. Ex-1002 ¶¶170-176.

2. Dependent Claims 2-7, 11-15

- a. Claim 2: The wearable electronic device according to claim 1, wherein the material is a titanium material.**

Yuen teaches Claim 2. Ex-1002 ¶¶177-178.

Yuen teaches the biometric monitoring device's housing is made of "a metal material (for example,...*titanium*).” Ex-1006, 14:33-36.

- b. Claim 3: The wearable electronic device according to claim 1, wherein the material is selected from a group consisting of: steel, platinum, gold, silver, aluminum, polymer, plastic, tungsten carbide and a metal alloy.**

Yuen teaches Claim 3. Ex-1002 ¶¶179-180.

Yuen teaches the biometric monitoring device's housing is made of "a metal material," e.g., "*steel*,...*aluminum*, magnesium, or titanium.” Ex-1006, 14:33-36.

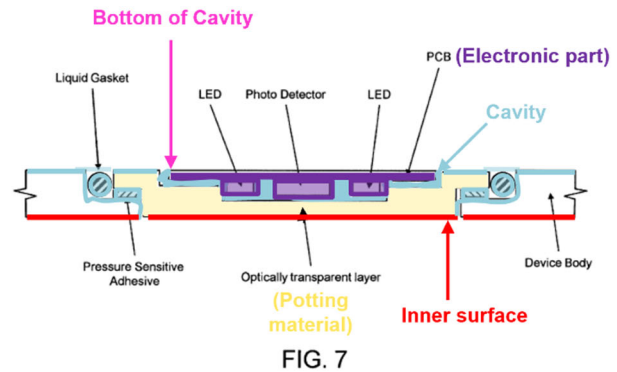
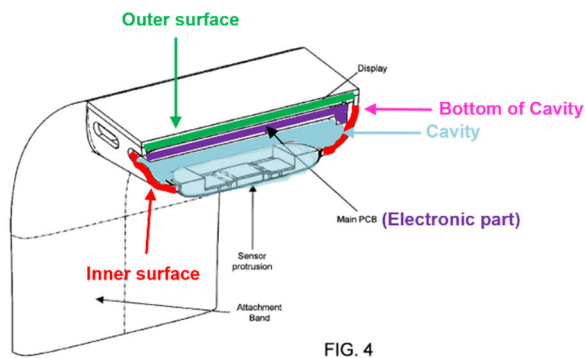
- c. Claim 4: The wearable electronic device according to claim 1, wherein the electronic part is disposed proximate to a bottom of the cavity.**

Yuen teaches Claim 4. Ex-1002 ¶¶181-189.

A POSITA would have understood that the "bottom of the cavity" is the end of the cavity that is away from the inner (skin-side) surface of the device. Ex-1002 ¶182.

Yuen teaches the electronic part is at the bottom of the cavity, i.e., away from the device's inner (skin-side) surface. Ex-1002 ¶183. Yuen's optical sensors including the LEDs and photodetector are positioned "on an interior or skin side of the biometric monitoring device (i.e., a side whereby the surface of the device contacts, touches and/or faces the skin of the user (hereinafter 'skin side')." Ex-1006, 9:57-61; *see also id.*, 12:55-61. The LEDs/photodetector are further positioned "on a flexible or pliable substrate," such as a flexible PCB, which allows the device's inner surface to adapt to the shape of the user's appendage (e.g., arm, wrist, ankle, or leg) the device is secured to so 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. Yuen teaches that "optical components of differing heights may be mounted to different 'fingers'" of the flexible PCB "and pressed or secured to the housing surface such that the optical components are flush to the housing surface." *Id.*, 12:42-45.

A POSITA would have understood, as depicted in Yuen's Figures 4 and 7, that the electronic part (purple) is disposed proximate to the bottom of the cavity (blue), i.e., away from the inner surface. Ex-1006, Figs. 4, 7, Ex-1002 ¶184. For example, Figure 4 shows that the main PCB (i.e., electronic part) is located at the base (bottom) portion of the cavity (blue). *Id.*



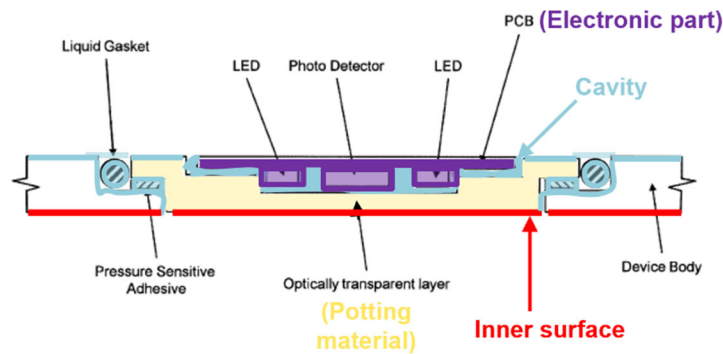
A POSITA would have understood that it would have been beneficial to have the electronic part disposed proximate to the cavity's bottom for several reasons, including because it would provide higher mechanical rigidity reducing the likelihood for relative motion, less variable sensor reading, noise reduction because of decreased pathways for “stray” light, vibration tolerance, and damage protection. Ex-1002 ¶185. Electronic devices including wearable ones are vulnerable to shock, damage, and vibrations, e.g., if they are dropped or hit against hard surfaces. *Id.* Placing the electronic part proximate to the bottom of the cavity of the device would have been an obvious design choice to protect against extreme vibrations that could damage the device. *Id.* ¶¶185-189.

- d. **Claims 5 and 13: The wearable electronic device according to claim 1/[The method according to claim 10], wherein the potting material is selected from a group consisting of: epoxy material, silicone, a resin, and a polymer.**

Yuen teaches Claims 5 and 13. Ex-1002 ¶¶190-195.

Yuen teaches the potting material on the device's inner surface covering the electronic part and the cavity consists of at least silicone or epoxy material. Specifically, as depicted in Figure 7, Yuen teaches an optical transparent layer (yellow), which “may be formed through in-mold labeling or ‘IML.’” Ex-1006, 2:44-45, Fig. 7. Yuen further teaches that this layer “disposed on the skin side” may be made of “a gel-like material such as *silicone*.” *Id.*, 14:10-11, 14:23-25 (“the protrusion portion may consist of or be coated with...*silicone*.”), Fig. 4.

Yuen further teaches that other sensors in addition to or instead of a heart rate sensor may be provided in “close proximity and/or secure contact to the user’s skin,” including, e.g., “a skin temperature sensor (e.g., noncontact thermopile that utilizes the optical window or thermistor joined with *thermal epoxy* to the outer surface of the protrusion).” Ex-1006, 13:62-14:3. Yuen teaches the “skin temperature *sensor may be physically and thermally coupled*, for example *with thermal epoxy, to the metal body* to detect or sense the temperature of the user.” *Id.*, 14:52-55.



A POSITA would thus have understood that the optically transparent layer, which is a coating made of potting material on the device's inner surface covering the electronic part and the cavity, may be silicone or epoxy material. Ex-1002 ¶¶193-195.

- e. **Claims 6 and 14: The wearable electronic device according to claim 1/[The method according to claim 10], wherein the electronic part is selected from a group consisting of: a battery, an infrared transmitter, a microcontroller, a radio frequency transceiver, a temperature sensor, a haptic feedback device, a piezo actuator, and an infrared receiver.**

Yuen teaches Claims 6 and 14. Ex-1002 ¶¶196-202.

Yuen's electronic part may be a temperature sensor. Yuen states that a "skin temperature sensor may be physically and thermally coupled, for example with thermal epoxy, to the metal body to detect or sense the temperature of the user." Ex-1006, 14:52-55; *see also id.*, 7:52-58, 13:62-14:3.

Yuen's electronic part may also be a microcontroller. Yuen teaches that its device comprises at least one application processor and sensor processor. Ex-1006, 22:60-23.6; *see also id.*, 23:26-29. Yuen's Figure 17 depicts an exemplary PPG sensor that includes "...ADC, processor, DAC/GPIOs." Ex-1006, 4:3-6, Fig. 17.

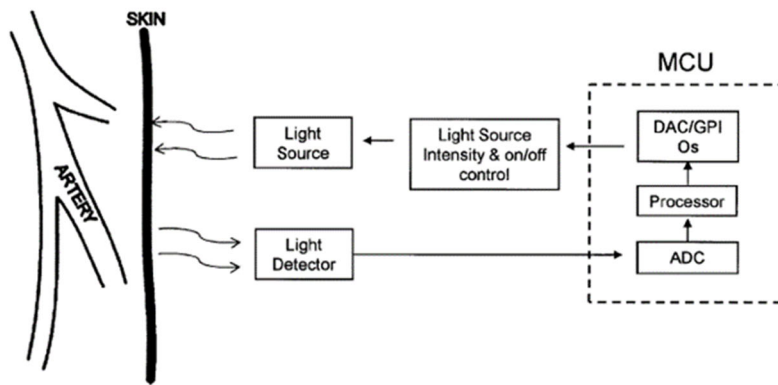


FIG. 17

Yuen additionally teaches that the main PCB may have electronics “such as...a microcontroller unit.” Ex-1006, 23:7-20.

Yuen’s electronic part may also be a battery. Yuen teaches that its device may have “a rechargeable energy source” such as a rechargeable battery. Ex-1006, 14:42-46. For example, the device “may use a wired connection to charge an internal rechargeable battery...” Ex-1006, 28:40-43.

- f. **Claim 7: The wearable electronic device according to claim 1, wherein the electronic part comprises a circuit board selected from a group consisting of: a rigid-flexible printed circuit board, a flexible printed circuit board.**

Yuen teaches Claim 7. Ex-1002 ¶¶203-204.

Yuen teaches that the electronic part in the cavity can be a flexible PCB or rigid-flex PCB (i.e., a flexible PCB connected to a regular (rigid) PCB). *Id.* ¶204. Yuen states, “[i]n one embodiment, the light source(s) and/or associated detector(s)

are disposed on a Flat Flex Cable or ‘FFC’ or *flexible PCB*...[T]he flexible or pliable substrate (for example, FFC or flexible PCB) *could connect to a second substrate (for example, PCB)* within the device having other components disposed thereon (for example, the data processing circuitry).” Ex-1006, 12:35-42, Fig. 5.

- g. **Claim 11: The method according to claim 10, wherein the material is selected from a group consisting of: titanium, titanium alloy, steel, platinum, gold, silver, aluminum, polymer, plastic, tungsten carbide and a metal alloy.**

Yuen teaches Claim 11. Ex-1002 ¶205. See Claims 2, 3, §§XII.A.2.a-XII.A.2.b.

- a. **Claim 12: The method according to claim 10, wherein the electronic part is disposed proximate to a bottom of the cavity, and wherein the electronic part comprises a circuit board selected from a group consisting of: a rigid-flexible printed circuit board, a flexible printed circuit board.**

Yuen teaches Claim 12. Ex-1002 ¶¶206. See Claims 4, 7, §§XII.A.2.c, XII.A.2.f.

- b. **Claim 15: The method according to claim 14, wherein the potting material comprises a clear material and an opaque material.**

Yuen teaches Claim 15. Ex-1002 ¶¶207-208.

Yuen teaches that its “biometric monitoring device may employ light transmissive structure having *an optically opaque portion* (including certain optical properties) and *an optically transparent portion* (including optical properties

different from the optically opaque portion). Such a structure may be provided via a double-shot or two step molding process wherein optically opaque material is injected and optically transparent material is injected.” Ex-1006, 11:29-36. A POSITA would have understood that Yuen’s coating made of potting material covering the electronic part and the cavity may comprise a clear material and an opaque material. Ex-1002 ¶208.

B. Ground 2: Claims 8-9 and 16-22 are obvious over Yuen in view of Schröder.

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

A POSITA would have been motivated to combine Yuen’s and Schröder’s teachings and would have had a reasonable expectation of success because each relates to the same well-known technologies. Ex-1002 ¶¶209. Both are directed to wearable biometric sensing devices having similar structural components, e.g., inner and outer surfaces, a cavity, and an electronic component (such as batteries and microprocessors) within the cavity. *See, e.g.*, Ex-1006, 2:26-28, 12:50-52, Figs. 4, 7; Ex-1007, 9:54-10:9, Figs. 6-10.

Yuen teaches that its biometric monitoring device can be worn on an appendage of the user’s body, e.g., “arm, wrist, leg and/or ankle.” Ex-1006, 2:7-17, 12:50-52. Yuen also teaches the device can be “worn in any number of ways including, but not limited to” a chest band, necklace, patch, bra, earring, glasses, “or

toe band.” Ex-1006, 24:35-40. Schröder teaches that its biometric sensing device is “a finger-ring,” which “is worn by a user e.g. permanently on the finger.” Ex-1007, 2:60-64, 3:61-62.

A POSITA would have been motivated to combine the functionality of Yuen’s biometric monitoring device with Schröder’s “finger-ring” because a POSITA would have found it beneficial to implement Yuen’s device in a more compact form that is not intrusive or obtrusive and is easier for the user to remember to wear. Ex-1002 ¶211. *See 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). Yuen teaches that the device housing enables the device to be worn without “measurably or appreciably impact[ing] the user’s activity.” Ex-1006, 23:63-67. Moreover, Yuen teaches that its device can be an “earring” or “toe band,” which a POSITA would have understood are structurally equivalent and/or functionally similar or identical to a “finger ring.” Ex-1006, 24:35-40; Ex-1002 ¶211. Schröder teaches that a “finger-ring” is desirable because it cannot be easily lost or taken without authorization because it is worn on the user’s finger. Ex-1007, 4:15-18. Thus, design incentives and market forces would have motivated a POSITA to apply Schröder’s teachings to Yuen. Ex-1002 ¶¶212.

A POSITA would have understood that implementing Yuen's device with Schröder's "finger-ring" would ensure a tighter fit than a device worn, e.g., on the user's wrist, which would reduce motion artifact, provide better shielding against ambient light, and allow for higher quality reading from device sensors (e.g., heart rate, temperature, etc.). Ex-1002 ¶213. Yuen acknowledges these motivations because it teaches the desirability for "light source(s) and/or associated detector(s)" to be "close to the user's skin (i.e., with little to no gap between the skin side of the device and the user's skin surface)." Ex-1006, 12:24-35. Moreover, Yuen teaches that improving "sustained and/or fixed contact between the biometric monitoring device and the user's skin" is desirable because it "may reduce the amount of stray light measured by the photodetector, decrease motion between the biometric monitoring device and the user, and/or provide improved local pressure to the user's skin; all of which may increase the quality of the cardiac signal of interest." Ex-1006, 13:54-62; *see also id.*, 14:25-32 ("[T]he use of a protrusion and/or friction may improve measurement accuracy of data acquisition corresponding to certain parameters (e.g., heart rate, heart rate variability, galvanic skin response, skin temperature, skin coloration, heat flux, blood pressure, blood glucose, etc.) by reducing sensor motions of the sensor relative to the user's skin during operation, especially whilst the user is in motion."). Ex-1002 ¶213.

A POSITA would also have been motivated to implement Schröder’s wireless inductive charging to replace the wired charging in Yuen’s device. *Id.* ¶214. A POSITA would have realized the many benefits of wireless charging, such as simplicity of use, reliability, and no need for cords or cables. *Id.*

A POSITA would have had a reasonable expectation of success in combining Yuen and Schröder, which are analogous prior art as they both involve biometric sensing devices having similar structural components, e.g., inner and outer surfaces and a cavity housing an electronic part. Ex-1002 ¶222. A POSITA would have understood that the electronic components of Yuen and Schröder’s biometric devices are similar such that they are programmable using standard processors and are interchangeable regardless of whether the devices are in the form of, e.g., a toe band or a “finger-ring.” *Id.* A POSITA would have understood that these references disclose interrelated teachings based on routine technologies amenable to various well-understood and predictable combinations to provide more features and enhance user interest. *Id.*

2. Dependent Claims 8 and 16: The wearable electronic device according to claim 1/[The method according to claim 10], wherein the body part comprises a ring configured to be worn on a finger.

Yuen in view of Schröder (“Yuen-Schröder”) teaches Claims 8 and 16. Ex-1002 ¶¶223-234.

Yuen teaches that its biometric monitoring device is secured to “an appendage of the user.” Ex-1006, 2:7-17. Specifically, Yuen teaches the device can be worn on the user’s body, e.g., on the user’s “arm, wrist, leg and/or ankle.” *Id.*, 12:50-52. Yuen also teaches the device can be “worn in any number of ways including, but not limited to” a chest band, necklace, patch, bra, earring, glasses, “or toe band.” *Id.*, 24:35-40. 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” and a “toe band” are structurally equivalent and/or identical to a “finger ring” and would be worn and function in a similar manner. Ex-1002 ¶¶224-232 (explaining the similarities between fingers and toes and the known advantages of a finger-ring). This limitation is also disclosed by Schröder.

Schröder teaches a “finger-ring” that “is worn by a user e.g. permanently on the finger” and utilizes biometric sensing to authenticate a user’s identity for security purposes. Ex-1007, 3:61-62.

A POSITA would have been motivated to combine Yuen’s and Schröder’s teachings and would have had a reasonable expectation of success for the reasons discussed in §XII.B.1. Ex-1002 ¶234.

3. Dependent Claims 9 and 17: The wearable electronic device according to claim 1/[The method according to claim 10], wherein the electronic part comprises an electromagnetic induction charging coil.

Yuen-Schröder teaches Claims 9 and 17. Ex-1002 ¶¶235-239.

Schröder teaches that the electronic part can be an electromagnetic induction charging coil. Schröder teaches that its “finger-ring” has an “energy storage devices, e.g. an accumulator or a battery” and that “[t]he energy storage device is preferably *charged by means of the reader’s electromagnetic field.*” Ex-1007, 11:46-55. Schröder further describes that the battery “can, for charging, be connected directly *to the antenna coil 8* via a rectifier circuit, with the chip module 10 connecting the energy storage device to the antenna coil 8 accordingly by means of a suitable connection device.” *Id.*, 11:63-67. Given these disclosures, A POSITA would understand that the antenna coil in Schröder is an induction charging coil, which uses energy from the reader’s electromagnetic field to inductively charge the ring’s battery. Ex-1002 ¶¶236-239.

4. Independent Claim 18

a. Element 18[pre]: A wearable electronic device configured to be worn on a finger comprising:

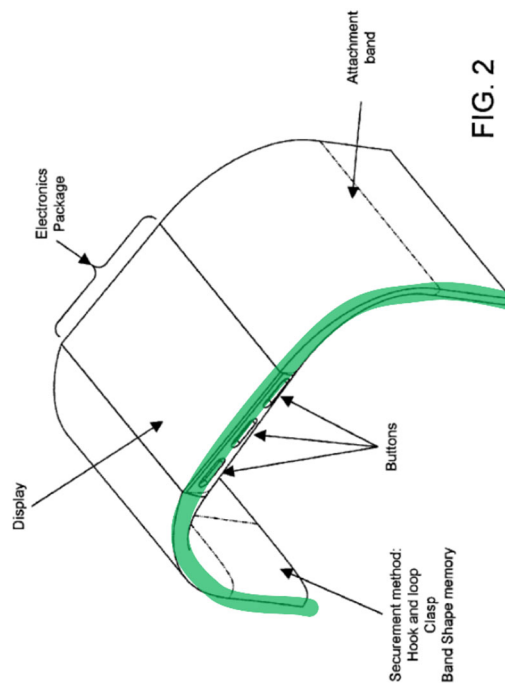
Yuen-Schröder teaches the preamble, to the extent it is limiting. Ex-1002 ¶¶240. *See* Claims 1[pre], 8.

b. Element 18[a]: a C-shaped body part made of a material, having an inner surface and an outer surface,

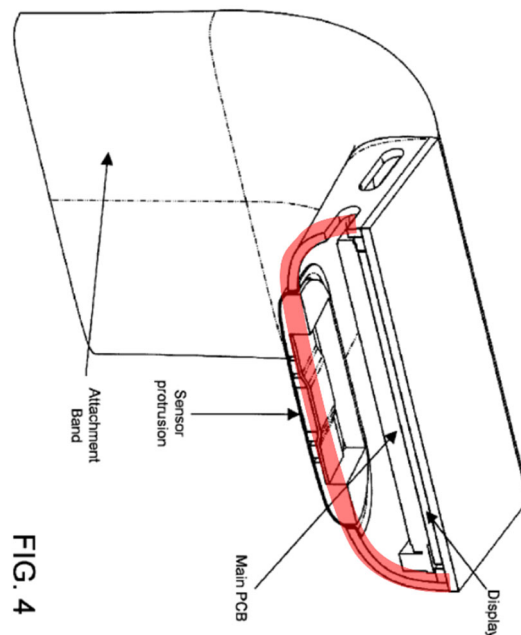
Yuen-Schröder teaches Element 18[a]. Ex-1002 ¶¶241-244.

As discussed at Element 1[a] (Ground 1), Yuen teaches a body part having an inner surface and an outer surface. §XII.A.1.a.

A POSITA would have understood that Yuen teaches a “C-shaped body part” in two ways. Ex-1002 ¶243. First, a POSITA would have understood that Figures 2, 3, 11, and 12 of Yuen show the entire device as being “C-shaped.” *Id.*; Ex-1006, Figs. 2, 3 (annotated green), 11, 12.



Second, a POSITA would also have understood that Yuen device’s cross-section is also C-shaped, as shown in Figure 4, rotated and annotated red below. Ex-1002 ¶244; Ex-1006, Fig. 4.



- c. **Element 18[b]:** wherein a cavity is formed on the inner surface of the C-shaped body part, the cavity extending from the inner surface of the C-shaped body part towards the outer surface of the C-shaped body part and having a depth arranged within the inner surface of the C-shaped body part;

Yuen-Schröder teaches Element 18[b]. Ex-1002 ¶245. See Element 1[b] (Ground 1), §XII.A.1.b.

- d. **Element 18[c]:** an electronic part arranged in the cavity, wherein at least a portion of the electronic part has a thickness that is less than the depth of the cavity, wherein the electronic part comprises:

Yuen-Schröder teaches Element 18[c]. Ex-1002 ¶246. See Element 1[c], §XII.A.1.c.

- e. **Element 18[d]: a flexible printed circuit board having an electronic component disposed thereon,**

Yuen-Schröder teaches Element 18[d]. Ex-1002 ¶247. See Claim 7, §XII.A.2.f.

- a. **Element 18[e]: wherein the electronic component is selected from a group consisting of: an infrared transmitter, a microcontroller, a radio frequency transceiver, a temperature sensor and an infrared receiver, and a battery coupled to the flexible printed circuit board; and**

Yuen-Schröder Element 18[e]. Ex-1002 ¶248. See Claim 6, §XII.A.2.e.

- b. **Element 18[f]: a coating made of a potting material on the inner surface of the body part, covering the electronic part and the cavity.**

Yuen-Schröder teaches Element 18[f]. Ex-1002 ¶249. See Element 1[d], §XII.A.1.d.

5. Dependent Claims 19-20

- a. **Claim 19: The wearable electronic device according to claim 18, wherein the material is selected from a group consisting of: titanium, titanium alloy, steel, platinum, gold, silver, aluminum, polymer, plastic, tungsten carbide and a metal alloy.**

Yuen-Schröder teaches Claim 19, because Yuen teaches the additional claim limitations in Claim 19. Ex-1002 ¶250. See Claims 2, 3, §§XII.A.2.a-XII.A.2.b.

- b. **Claim 20: The wearable electronic device according to claim 18, wherein the potting material is selected from a group consisting of: epoxy material, silicone, a resin, and a polymer.**

Yuen-Schröder teaches Claim 20, because Yuen teaches the additional claim limitations in Claim 20. Ex-1002 ¶251. *See* Claim 5, §XII.A.2.d.

6. **Independent Claim 21**

- a. **Element 21[pre]: A wearable electronic device configured to be worn on a finger comprising:**

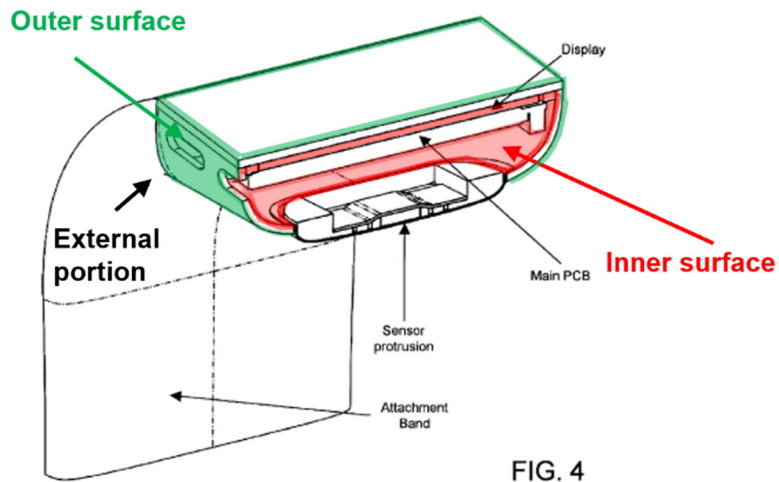
To the extent the preamble is limiting, Yuen-Schröder teaches the preamble.

Ex-1002 ¶252. *See* Claims 1[pre], 8, §§XII.A.1.a, XII.B.2.

- b. **Element 21[a]: an external portion made of a first material and having an inner surface and an outer surface, wherein the outer surface of the external portion defines an exterior surface of the electronic device;**

Yuen-Schröder teaches Element 21[a]. Ex-1002 ¶253-255.

Yuen's device has an external portion made of a first material with an inner surface (annotated red in Figure 4) and an outer surface (green). Ex-1002 ¶254. Yuen refers to the device's external portion as the "environmental side." Ex-1006, 19:52-53.

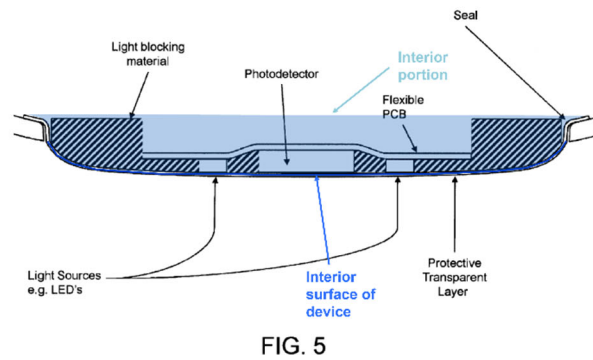
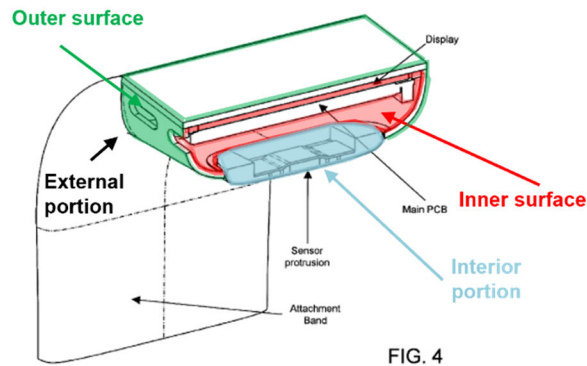


As seen in Figure 4, the external portion's outer surface defines an exterior surface of Yuen's device, facing the environment. Ex-1002 ¶255.

- c. **Element 21[b]: an interior portion coupled to the external portion, wherein the interior portion is disposed below the inner surface of the external portion, wherein the interior portion is made of a second material, and wherein the interior portion defines an interior surface of the electronic device;**

Yuen-Schröder teaches Element 21[b]. Ex-1002 ¶256-260.

Yuen's device has an interior portion, shown in blue in Figures 4 and 5, which is the portion of Yuen's device that is closest to the skin and contains the optical sensor module. *Id.* ¶257; Ex-1006, Figs. 4, 5.



The interior portion of Yuen’s device defines the device’s interior surface, as required by the claim. Ex-1006, Figs. 4, 5; *see also id.*, Fig. 3, 9:57-61 (“[T]he optical sensors (sources and/or detectors) may be disposed on an interior or skin side of the biometric device.”).

Yuen teaches that the device’s interior and external portions are made of different materials. Ex-1002 ¶259. Yuen teaches that the “interior or skin side of the housing of the biometric monitoring device may also consist of a metal material (for example, steel, stainless steel, aluminum, magnesium, or titanium).” Ex-1006, 14:33-36. Yuen further teaches that a “transparent layer may be formed through in-mold labeling or ‘IML’” and can be made of silicone. *Id.*, 2:44-45, 14:10-11. *See also* Ex-1006, 14:52-55 (disclosing use of epoxy). Yuen further teaches that the “housing” can be “made, for example, of a plastic or plastic-like material.” Ex-1006, 24:17-20; Ex-1002 ¶259.

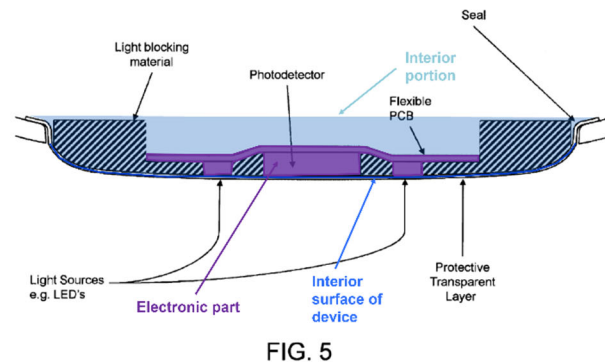
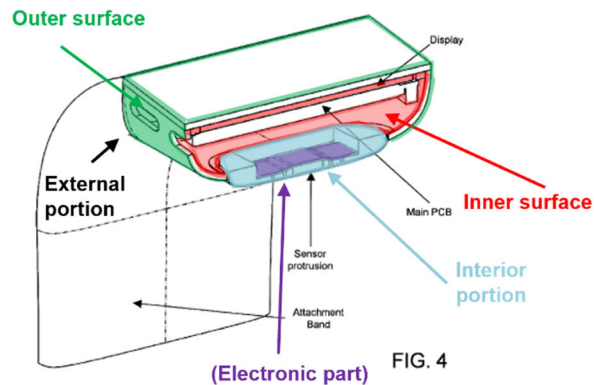
Further, Schröder teaches two portions of the device made of different materials. Ex-1007, 12:56-57 (“The components 16, 18 of the finger-ring 2 can be

manufactured from like or different materials.”); 15:9-10 (“A first component consists of metal and a second component consists of plastic.”).

- d. Element 21[c]: an electronic part disposed within the interior portion, wherein the electronic part comprises:**

Yuen-Schröder teaches Element 21[c]. Ex-1002 ¶¶261-262.

Yuen teaches an electronic part disposed within the interior portion, for example the PCB with LEDs and photodetector shown in Figures 4 and 5 (purple).



- e. Element 21[d]: a rigid-flex printed circuit board comprising at least a first rigid circuit board and a second rigid circuit board coupled via a flexible material; and**

Yuen-Schröder teaches Element 21[d]. Ex-1002 ¶¶263-264.

The electronic part in Yuen’s device may be a PCB, Ex-1006, Figs. 4, 6-7, or a flexible PCB. *Id.*, Fig. 5. Yuen also teaches a rigid-flex circuit board made of flexible PCB connected to [regular] PCB. Ex-1002 ¶264. “In one embodiment, the light source(s) and/or associated detector(s) are disposed on a Flat Flex Cable or

‘FFC’ or flexible PCB...[T]he flexible or pliable substrate (for example, FFC or *flexible PCB*) *could connect to a second substrate (for example, PCB)* within the device having other components disposed thereon (for example, the data processing circuitry).” Ex-1006, 12:35-42. A POSITA would have been motivated to add a second [regular/rigid] PCB (e.g., as shown in Yuen’s Figure 6) to produce a rigid-flex PCB made of two [regular/rigid] PCBs connected via a flexible material. Ex-1002 ¶264. This flexible structure allows for a more versatile assembly, which can conform to space constraints and mechanical requirements not feasible with solely rigid boards. *Id.*

- f. **Element 21[e]: at least one electronic component disposed upon the first rigid printed circuit board, wherein the electronic component is selected from a group consisting of: a light emitting diode (LED), a microcontroller, a temperature sensor, a light sensor, an accelerometer, a wireless interface and a haptic feedback device.**

Yuen-Schröder teaches Element 21[e]. Ex-1002 ¶¶265-266.

As discussed in Ground 1 for Claim 6, Yuen teaches that the electronic part may be a microcontroller or a temperature sensor. *See* §XII.A.2.e. Yuen also teaches that the electronic component on the PCB is an LED. Ex-1006, Figs. 5-7. A POSITA would have understood the desirability of having the LED, temperature sensor, or microcontroller in Yuen’s device disposed on a rigid part of the PCB, for stability and resilience. Ex-1002 ¶266. *See also* Ex-1006, Fig. 6, 2:50-51 (“the light

sources and photodetector are placed on a flat and/or rigid PCB.”); 12:39-42 (“the...flexible PCB[] could connect to a second substrate (for example, PCB)...having other components disposed thereon (for example, the data processing circuitry).”).

7. Dependent Claim 22

- a. Element 22[a]: The wearable electronic device according to claim 21, wherein the first material is selected from a group consisting of: titanium, titanium alloy, stainless steel, platinum, gold, silver, aluminum, polymer, plastic, tungsten carbide and a metal alloy;**

Yuen-Schröder teaches Element 22[a], because Yuen teaches that one of the device materials used for the “housing” (thus the external portion) can be titanium, steel, or aluminum. Ex-1002 ¶267. *See* Claims 2, 3, §§XII.A.2.a-XII.A.2.b. A POSITA would have understood these disclosed materials could be used on either the interior or external portion of the device. Ex-1002, ¶267. Design choice and system and manufacturing trade-offs would be considered by a POSITA when deciding how to choose among the disclosed materials relative to interior/external portions. *Id.*

- b. Element 22[b]: and wherein the second material is selected from a group consisting of: epoxy material, silicone, a resin, and a polymer.**

Yuen-Schröder teaches Element 22[b], because Yuen teaches its additional limitations. Ex-1002 ¶268. *See* Claim 5, §XII.A.2.d, Ex-1006, 2:44-45, 14:10-11 (Yuen disclosing a layer formed from in-mold labeling that can be made of silicone).

C. Ground 3: Claims 21-22 are obvious over Yuen and Schröder in further view of Mestas.

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

A POSITA would have been motivated to combine the teachings of Yuen-Schröder with Mestas’s teachings and would have had a reasonable expectation of success because each relates to the same well-known technologies. Ex-1002 ¶¶269-273. Yuen, Schröder, and Mestas are all directed to wearable biometric sensing devices having similar structural components, such as an inner and outer surfaces, a cavity, and an electronic component (such as batteries and microprocessors) within the cavity. *See, e.g.*, Ex-1006, 2:26-28, Figs. 4, 7; Ex-1007, 9:54-10:9, Figs. 6-10; Ex-1010 ¶¶151, 157, Figs. 4, 6.

Further, similar to Yuen’s teachings, Mestas contemplates different sizing of its generally circular wearable device, 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 ¶270.

Mestas teaches a rigid-flex PCB structure wrapped onto the spine of the device including rigid zones connected by flexible zones for placing the various components. Ex-1010, Figs. 14, 15, ¶¶164, 177. Mestas further teaches that electronics such as display or LEDs are placed on the rigid zones “to prevent breakage.” *Id.* ¶172; *see also id.* ¶170.

A POSITA would have been motivated to combine the functionality of the Yuen-Schröder biometric monitoring device with Mestas's rigid-flex PCB, because a POSITA would have found Mestas's rigid-flex PCB structure beneficial as providing both the flexibility to follow the device's contours and the ability to place sensitive or larger electronics on the PCB's rigid portions to offer better rigidity and connectivity and prevent breakage. Ex-1002 ¶272.

A POSITA would have had a reasonable expectation of success in combining Yuen, Schröder, and Mestas, which are analogous prior art as they all involve biometric sensing devices having similar structural components. *Id.* ¶273. A POSITA would have understood that their electronic components are similar such that they are programmable using standard processors and are interchangeable regardless of whether the devices are in the form of, e.g., a wrist- or toe-band (Yuen), a “finger-ring” (Schröder), or a wrist- or arm-band (Mestas). *Id.* A POSITA would

have understood that these references disclose interrelated teachings based on routine technologies amenable to various well-understood and predictable combinations to provide more features and enhance user interest. *Id.*

2. Independent Claim 21

a. Element 21[pre]

To the extent the preamble is limiting, Yuen in view of Schröder further in view of Mestas (“Yuen-Schröder-Mestas”) teaches the preamble for the reasons described above for Element 1[pre] and Claim 8. Ex-1002 ¶274. *See* §§XII.A.1.a, XII.B.2.

b. Element 21[a]

Yuen-Schröder-Mestas teaches Element 21[a] for the reasons described above for Element 21[a] (Ground 2). §XII.B.6.b, Ex-1002 ¶275.

c. Element 21[b]

Yuen-Schröder-Mestas teaches Element 21[b] for the reasons described above for Element 21[b] (Ground 2). §XII.B.6.c, Ex-1002 ¶276.

d. Element 21[c]

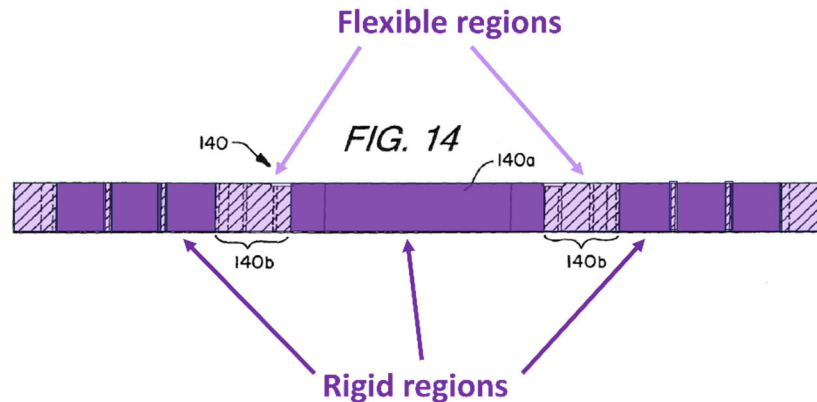
Yuen-Schröder-Mestas teaches Element 21[c] for the reasons described above for Element 21[c] (Ground 2). §XII.B.6.d, Ex-1002 ¶¶277.

e. Element 21[d]: a rigid-flex printed circuit board comprising at least a first rigid circuit board and a second rigid circuit board coupled via a flexible material; and

Yuen-Schröder-Mestas teaches Element 21[d]. Ex-1002 ¶¶278-282.

As discussed at Ground 2, Yuen teaches a rigid-flex circuit board made of flexible PCB connected to [regular] PCB. *Id.* ¶279; Ex-1006, 12:35-42.

Mestas explicitly teaches a sequence of rigid and flex PCBs. Ex-1002 ¶280. Mestas describes a rigid-flex PCB made of at least two rigid PCBs coupled via a flexible material. *Id.*; Ex-1010, Fig. 14. Figure 14 shows rigid PCB sections (annotated dark purple) connected via flexible PCB regions (light purple).



Mestas’s PCB member 140 “has a central region 140a where the display 18 and indicator system 20 are operable connected thereto. The PCB member also has *flex regions* 140b that will correspond in position to the flexible zones 46, 48 of the spine member 22.” Ex-1010 ¶164. *See also id.*, Fig. 21, ¶181 (“The spine member 22a has the *multiple flexible zones 46a, 48a* along with *the rigid or substantially rigid segments or zones 42a, 44a*....The display component may be disposed in an

additional central rigid zone generally extending between the rigid zones 42a, 44a supporting the batteries.”); ¶170.

A POSITA would have been motivated to combine Yuen-Schröder with Mestas and would have had a reasonable expectation of success for the reasons discussed in §XII.C.1.

- f. **Element 21[e]: at least one electronic component disposed upon the first rigid printed circuit board, wherein the electronic component is selected from a group consisting of: a light emitting diode (LED), a microcontroller, a temperature sensor, a light sensor, an accelerometer, a wireless interface and a haptic feedback device.**

Yuen-Schröder-Mestas teaches Element 21[e] for the reasons described above for Element 21[e] at Ground 2. Ex-1002 ¶¶283-284, §XII.B.6.f.

Additionally, Mestas teaches that an electronic component such as an LED is disposed on a rigid portion of a PCB. Ex-1010 ¶172 (“[T]he electronic components such as circuits and lighting elements (e.g., *LEDs*) *may be attached to more rigid portions* to prevent breakage.”).

3. Dependent Claim 22

a. Element 22[a]

Yuen-Schröder-Mestas teaches Element 22[a], because Yuen discloses its additional limitations, as discussed at Ground 2. Ex-1002 ¶285. *See* §XII.B.7.a.

b. Element 22[b]

Yuen-Schröder-Mestas teaches Element 22[b], because Yuen discloses its additional limitations, as discussed at Ground 2. Ex-1002 ¶286. *See* §XII.B.7.b.

D. Ground 4: Claims 1-3, 5-11, 13-14, and 16-20 are obvious over Schröder

1. Independent Claims 1 and 10

a. Element 1[pre]/10[pre]: [A method for forming] A wearable electronic device comprising:

Schröder teaches the preamble, to the extent it is limiting. Ex-1002 ¶¶287-289.

As shown in Figure 1, Schröder discloses an electronic device, i.e., “finger-ring” 2, which can function as an “external secure unit” and communicate with a smartphone. Ex-1007, 3:57-59.

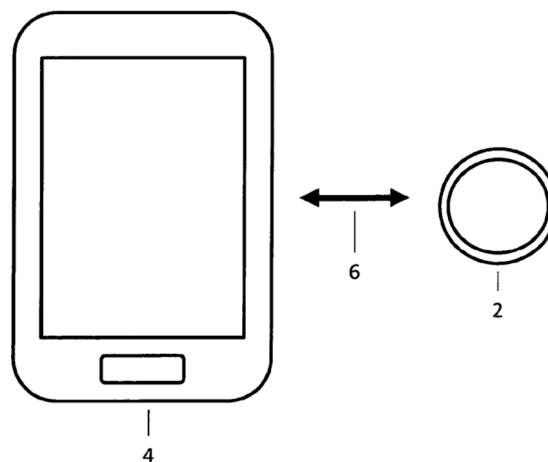


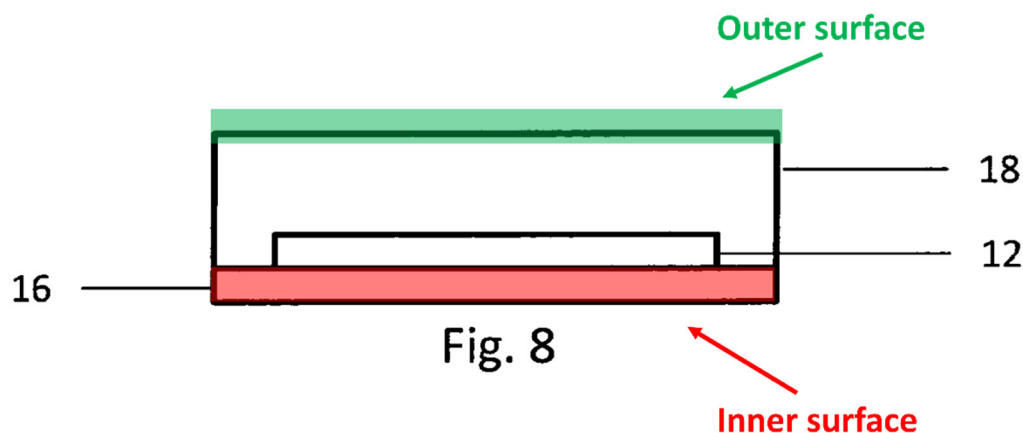
Fig. 1

Schröder's device is wearable: "[t]he finger-ring 2 is worn by a user, e.g. permanently on the finger." *Id.*, 3:61-63.

b. Elements 1[a]/10[a]: [providing] a body part made of a material, having an inner surface and an outer surface,

Schröder teaches Elements 1[a]/10[a]. Ex-1002 ¶¶290-294.

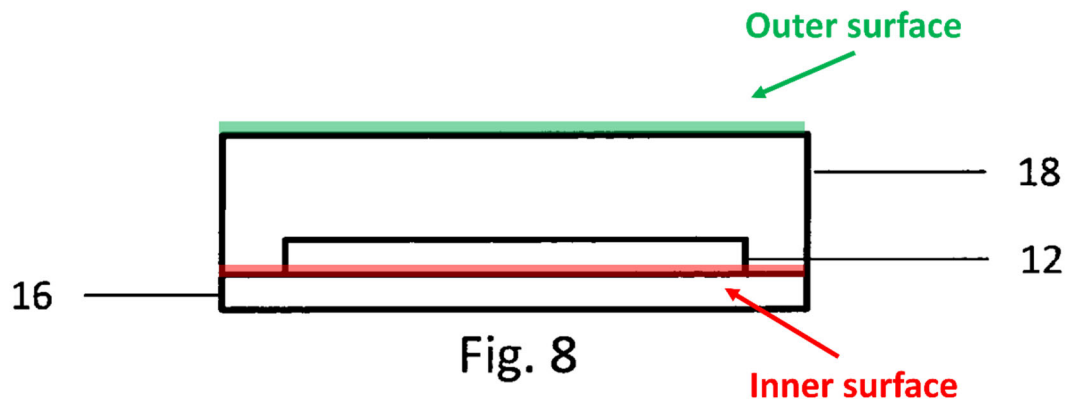
As shown in Figure 8, Schröder teaches a "finger-ring" made of two concentric shells 16 and 18. Ex-1007, 12:50-52, Fig. 8. A POSITA would have understood that Schröder teaches a "body part" under its plain and ordinary meaning, in two ways. Ex-1002 ¶291. First, a POSITA would have understood Schröder's entire "finger-ring" to be a "body part." *Id.* As shown in Figure 8, Schröder's two-component ring has an outer surface (part of component 18, shown in green below) and an inner surface (component 16, red). *Id.*; Ex-1007, Fig. 8.



Schröder teaches that the entire "finger-ring" may be made of one material, as the two ring components 16, 18 "can be manufactured from like or different

materials.” Ex-1007, 12:56-57. Schröder thus satisfies the claim requirement that the body part be made “of a material.” Ex-1002 ¶292.

A POSITA would also have understood that each of Schröder’s two ring components—or halves—which are concentric rings themselves, is also a “body part.” Ex-1002 ¶293. For example, component 18 in Figure 8 is a body part that has its own outer surface (shown in green below) and inner surface (red). Ex-1002 ¶¶293-294; Ex-1007, Fig. 8.

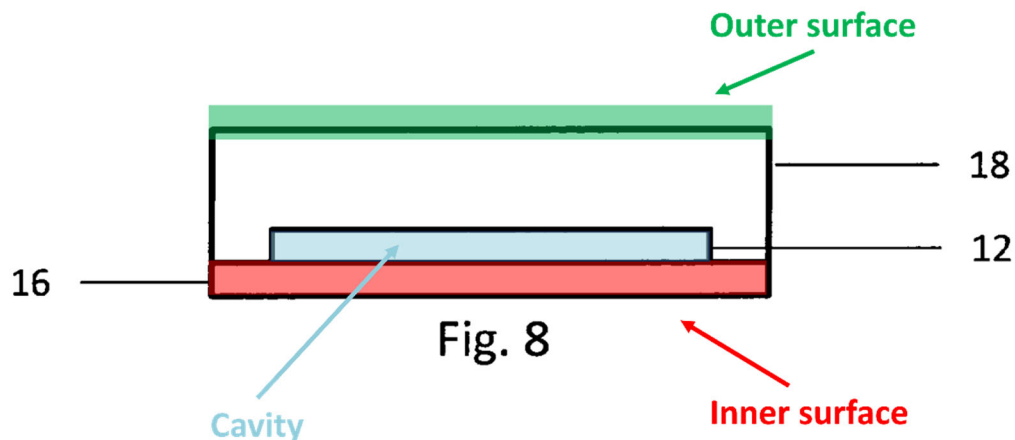


- c. **Elements 1[b]/10[b]: wherein a cavity is formed on the inner surface of the body part, the cavity extending from the inner surface of the body part towards the outer surface of the body part and having a depth arranged within the inner surface of the body part,**

Schröder teaches Elements 1[b]/10[b]. Ex-1002 ¶¶295-304.

Under a POSITA’s first understanding described above, with the entire “finger-ring” being the claimed body part, Schröder teaches that a cavity (shown in

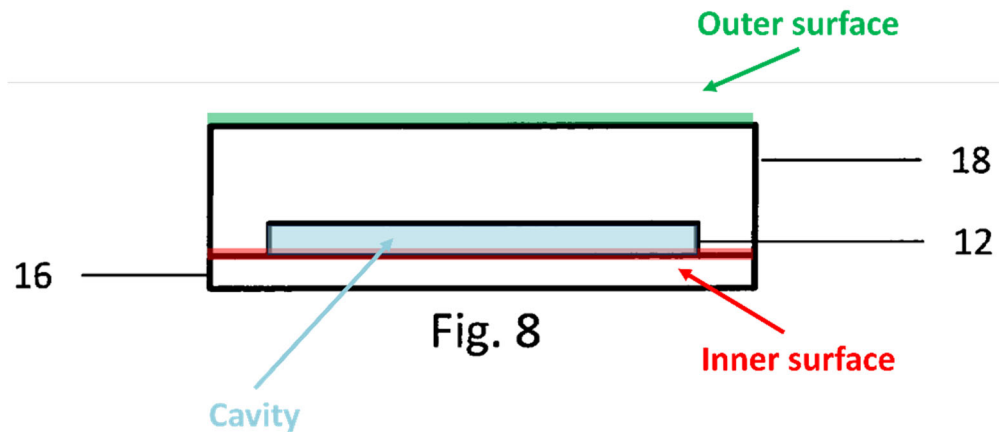
blue in Figure 8 below) is formed on the inner surface, i.e., component 16 (red) of the body part. Ex-1007, Fig. 8; Ex-1002 ¶296.



While the '147 specification does not define or even mention the word “cavity,” a POSITA would have understood that the area annotated blue is a cavity under the plain and ordinary meaning because Schröder refers to it as a “recess of the finger-ring 2,” in which a chip module and/or an inlay can be inserted. Ex-1007, 8:58-59 (“The chip module 10 is inserted into a recess of the finger-ring 2.”), 12:10-12 (“The finger-ring 2 consists...of at least one component 16, 18 into which at least one inlay 12 is inserted, whereby one component can be a ring half 16, 18.”); 12:26-28 (“The inlay 12 is...inserted into at least one recess provided therefor within at least one component.”). Schröder further teaches that the cavity (blue), housing the chip module and/or inlay, extends from the inner surface (component 16, red) towards the ring’s outer surface (component 18, green), as shown in Figure 8 above. Ex-1002 ¶297; Ex-1007, Fig. 8. A POSITA would have understood that the cavity

extending from the inner surface towards the outer surface of the body part has a depth arranged within the inner surface of the body part, as shown in Figure 8. Ex-1007, 12:10-12, Fig. 8; Ex-1002 ¶¶297-299.

Schröder also teaches a cavity formed on the inner surface if the “body part” is one of the ring component shells such as component 18. Ex-1002 ¶¶300. For example, as shown in Figure 8 below, the cavity (blue) is formed on the inner surface of component 18 (red), extends towards its outer surface (green), and has a depth (the vertical thickness (blue) in Figure 8) arranged within the inner surface. Ex-1002 ¶¶300-304.

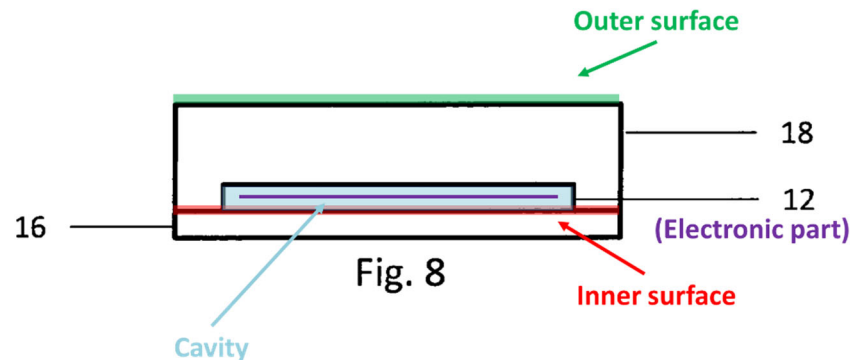


- d. **Elements 1[c]/10[c]: [disposing] an electronic part arranged in the cavity, wherein at least a portion of the electronic part has a thickness that is less than the depth of the cavity, and**

Schröder teaches Elements 1[c]/10[c]. Ex-1002 ¶¶305-313.

Schröder’s “finger-ring” includes a “recess” (annotated blue below) “within at least one component” such as component 18 where an inlay 12 (purple) is inserted.

Ex-1007, 12:10-12, 12:26-29, Fig. 8. Schröder teaches that at least an antenna coil 8 and a chip module are arranged on the inlay 12, which is preferably made of “a [] flexible carrier material.” *Id.*, 12:26-29. Schröder thus teaches an electronic part arranged within the cavity. Ex-1002 ¶¶306.



Schröder teaches that chip module 10 and/or inlay 12 are inserted *into* or *within* the recess of “finger-ring” 2. Ex-1007, 8:58-59 (“The chip module 10 is inserted *into* a recess of the finger-ring 2.”), 12:10-12 (“The finger-ring 2 consists...of at least one component 16, 18 *into* which at least one inlay 12 is inserted, whereby one component can be a ring half 16, 18.”), 12:26-28 (“The inlay 12 is...inserted *into* at least one recess provided therefor *within* at least one component.”). A POSITA would have understood that at least a portion of the electronic part, i.e., chip module 10 and/or inlay 12, has a thickness less than the cavity’s depth because the electronic part is inserted into or within the cavity. Ex-1002 ¶¶307-313.

- e. **Elements 1[d]/10[d]: [disposing] a coating made of a potting material on the inner surface of the body part, covering the electronic part and the cavity.**

Schröder teaches Elements 1[d]/10[d]. Ex-1002 ¶¶314-324.

As explained above, Schröder’s electronic part is arranged in the cavity, which has a depth arranged within the body part’s inner surface. Ex-1002 ¶¶305-313. Schröder teaches that the electronic part and the cavity are covered by a coating made of a potting material. Specifically, Schröder teaches that the “finger-ring” “can be manufactured by an injection-molding process.” Ex-1007, 14:35-37. Schröder explains the process as follows: the electronic part e.g., chip module 10 and antenna coil 8 “are arranged on a carrier foil”; “individual ring blanks” are “singled out of the carrier foil in different lengths...to roll up the ring blanks in a ring shape”; and “a rolled or non-rolled ring blank” are “inserted into an injection mold to overmold the ring blank with a suitable injection-molding material,” such as a resin or plastic. *Id.*, 14:38-46. The injection-molding process results in “a ring-shaped body in whose interior the chip module 10 and the antenna coil 8 and any further electronic devices are arranged.” *Id.*, 14:46-49. Schröder additionally teaches that chip module 10 and antenna coil 8 may be “inserted into an injection mold in order to be overmolded.” *Id.*, 14:50-53. A POSITA would have known that similar materials can be used for molding and for potting, and would have understood that Schröder’s

“molding material” is a “potting material” that fills in the cavity and encapsulates the electronic part within. Ex-1002 ¶¶316-324.

2. Dependent Claims 2-3, 5-9, 11, 13-14, 16-17

a. Claim 2: The wearable electronic device according to claim 1, wherein the material is a titanium material.

Schröder teaches Claim 2. Ex-1002 ¶¶325-326.

Schröder teaches that at least one of the “finger-ring” components can be made of, e.g., “silver, gold, *titanium*, steel.” Ex-1007, 15:9-11. Schröder also teaches that the ring components 16 and 18 “can be manufactured from like or different materials.” *Id.*, 12:56-57.

b. Claim 3: The wearable electronic device according to claim 1, wherein the material is selected from a group consisting of: steel, platinum, gold, silver, aluminum, polymer, plastic, tungsten carbide and a metal alloy.

Schröder teaches Claim 3. Ex-1002 ¶¶327-328.

Schröder teaches that one material a ring component can be made of is e.g., “*silver, gold*, titanium, *steel*.” Ex-1007, 15:9-11. Schröder also teaches that the ring components 16, 18 “can be manufactured from like or different materials.” *Id.*, 12:56-57.

- c. **Claims 5 and 13: The wearable electronic device according to claim 1/[The method according to claim 10], wherein the potting material is selected from a group consisting of: epoxy material, silicone, a resin, and a polymer.**

Schröder teaches Claims 5 and 13. Ex-1002 ¶¶329-333.

Schröder teaches that the moldable material (“potting material”) covering the electronic part and the cavity consists of at least a resin or a polymer. Ex-1002 ¶330. Specifically, Schröder teaches that the material used for the injection molding process described in §XII.D.1.e can be “*plastic* or a *resin*.” Ex-1007, 14:45-46. Schröder further teaches that the ring’s second component, which houses the electronic part, can be plastic, PET, or PVC. Ex-1007, 15:8-10, 15:14-15. Schröder additionally teaches that chip module 10 and antenna coil 8 (i.e., the electronic part in the cavity) may be “inserted into an injection mold in order to be overmolded.” Ex-1007, 14:50-53. A POSITA would have understood that PET and PVC are polymer resins and plastic is also a polymer. Ex-1002 ¶¶329-333.

- d. **Claim 6: The wearable electronic device according to claim 1/[The method according to claim 10], wherein the electronic part is selected from a group consisting of: a battery, an infrared transmitter, a microcontroller, a radio frequency transceiver, a temperature sensor, a haptic feedback device, a piezo actuator, and an infrared receiver.**

Schröder teaches Claims 6 and 14. Ex-1002 ¶¶334-340.

Schröder’s electronic part may include a radio frequency transmitter.

Schröder teaches “an antenna coil 8 for a first frequency, e.g. for an NFC application, as well as a chip module 10 which optionally also has an antenna coil for a second frequency.” Ex-1007, 5:14-16. A POSITA would have understood that these Schröder teachings correspond to and would require Schröder’s electronic part to include a radio frequency transceiver. Ex-1002 ¶335.

Schröder’s electronic part may also include a microcontroller. Schröder teaches that its ring may include “a plurality of processors.” Ex-1007, 2:53-56. Moreover, Schröder teaches that chip module 10 “has at least two physically mutually separate processors,” which a POSITA would have understood teaches a microcontroller. Ex-1007, 10:60-61; Ex-1002 ¶336.

Schröder’s electronic part may also include a battery. Schröder teaches that its ring “has an energy storage device, e.g. an accumulator or *a battery*,” which is “connected to the chip module 10 in order to supply the chip module 10 with energy outside an electromagnetic field of a reader.” Ex-1007, 11:46-50.

Schröder’s electronic part may also include an infrared transmitter and receiver. Schröder teaches that the energy storage device can “operate alternative communication channels, such as wireless LAN, infrared, etc...supported by the chip module 10.” Ex-1007, 11:55-58; *see also id.*, 6:42-48 (an infrared diode may be connected to chip module 10 via an electronic circuit, which switches the ring

protocol from NFC to “an infrared transfer”), 10:1-2 (infrared diode and infrared sensor are arranged “opposite each other”); Ex-1002 ¶¶338-340.

- e. **Claim 7: The wearable electronic device according to claim 1, wherein the electronic part comprises a circuit board selected from a group consisting of: a rigid-flexible printed circuit board, a flexible printed circuit board.**

Schröder teaches Claim 7. Ex-1002 ¶¶341-346.

A POSITA would have understood that Schröder’s inlay 12 made of a “flexible carrier material” such as “PET” or “Kapton” is a flexible printed circuit board (PCB). Ex-1002 ¶342; Ex-1007, 12:27-37, 13:23-37. Schröder teaches that at least antenna coil 8 and the chip module 10 are arranged on the “carrier,” and that “[t]he antenna coil 8 is applied to the carrier by a suitable technology, e.g. by a printing technique.” Ex-1007, 12:27-37; *see also id.*, 13:23-37 (disclosing that chip module 10 and antenna coil 8 “and optionally further electronic devices, e.g. a further antenna coil 8 or a display” are applied to the carrier foil, which “consists of a flexible plastic material, e.g. PET or Kapton.”). A POSITA would have recognized that PET and Kapton are typical materials for manufacturing flexible PCBs. Ex-1002 ¶343. Further, Schröder’s flexible PCB is shown extending inside the ring along its entire circumference. *Id.*; Ex-1007, Fig. 4, annotated purple below. A POSITA would have understood Schröder’s flexible inlay/carrier foil to be a flexible PCB. Ex-1002 ¶¶343-346. This recognition would stem from both the physical

description of the inlay's deployment within the device and its material composition, aligning with standard engineering practices for creating highly flexible electronic components.

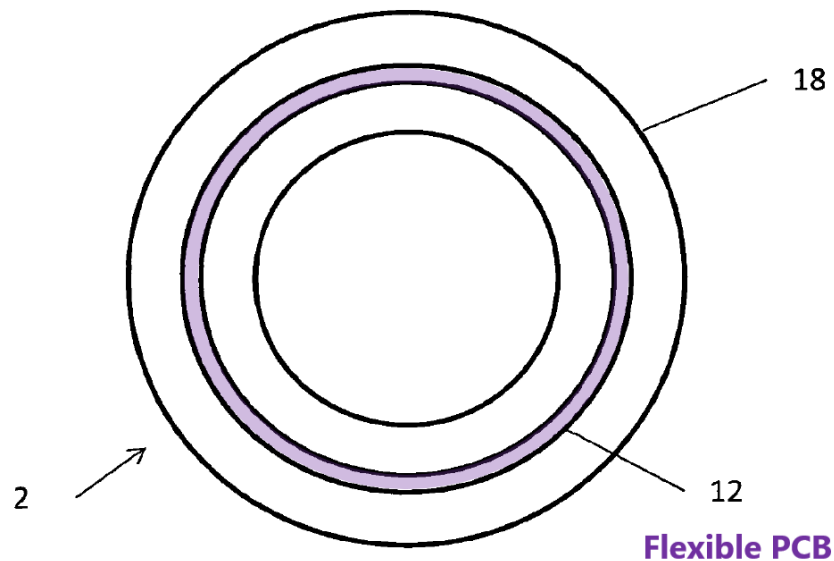


Fig. 4

- f. **Claims 8 and 16: The wearable electronic device according to claim 1/[The method according to claim 10], wherein the body part comprises a ring configured to be worn on a finger.**

Schröder teaches Claims 8 and 16. Ex-1002 ¶¶347-355.

Schröder teaches that its biometric sensing device is “a finger-ring,” which “is worn by a user e.g. permanently on the finger.” Ex-1007, 2:60-64, 3:61-62; *see also id.*, 9:54-10:9 (the ring’s biometric sensor captures “at least a partial vein image in the finger while the finger-ring 2 is being pushed over a finger”).

- g. Claims 9 and 17: The wearable electronic device according to claim 1/[The method according to claim 10], wherein the electronic part comprises an electromagnetic induction charging coil.**

Schröder teaches Claims 9 and 17. Ex-1002 ¶¶356-360.

Schröder teaches that the ring has an “energy storage device[s], e.g. an accumulator or a battery” and that “[t]he energy storage device is preferably *charged by means of the reader’s electromagnetic field*.” Ex-1007, 11:46-55. Schröder further describes that the battery “can, for charging, be *connected directly to the antenna coil 8* via a rectifier circuit, with the chip module 10 connecting the energy storage device to the antenna coil 8 accordingly by means of a suitable connection device.” Ex-1007 11:63-67. A POSITA would have understood that antenna coil 8 in Schröder’s battery charging process is an electromagnetic induction charging coil. Ex-1002 ¶¶357-360.

- h. Claim 11: The method according to claim 10, wherein the material is selected from a group consisting of: titanium, titanium alloy, steel, platinum, gold, silver, aluminum, polymer, plastic, tungsten carbide and a metal alloy.**

Schröder teaches Claim 11. Ex-1002 ¶361. *See* Claims 2, 3 (Ground 4, §XII.D.2.a-XII.D.2.b).

E. Ground 5: Claims 4, 7, 12, 15, and 18-22 are obvious over Schröder in view of Yuen.

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

A POSITA would have been motivated to combine Schröder's and Yuen's teachings and would have had a reasonable expectation of success because each relates to the same well-known technologies. Ex-1002 ¶¶362-372. Both are directed to wearable biometric sensing devices having similar structural components, e.g., inner and outer surfaces, a cavity, and an electronic component (such as batteries and microprocessors) within the cavity. *See, e.g.*, Ex-1007, 9:54-10:9, Figs. 6-10; Ex-1006, 2:26-28, Figs. 4, 7.

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, 12:10-12, 12:26-32, 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. Yuen's device also includes a cavity that houses an electronic part (e.g., optical sensors with LEDs and a photodetector) and explicitly teaches that the electronic part is "pressed or secured to the housing surface such that the optical components are flush to the housing surface." Ex-1006, 12:42-45. Moreover, Yuen teaches an optical transparent layer covering the electronic part and cavity of the device, which "may be formed through

in-mold labeling or ‘IML.’” Ex-1006, 2:44-45. Yuen further teaches that “the circuitry related to emitting and receiving light may be disposed in the interior of the device housing and underneath a plastic or glass layer.” *Id.*, 10:63-66.

A POSITA would have been motivated to dispose the electronic part in Schröder’s “finger-ring” proximate to the cavity’s bottom, as Yuen explicitly teaches, because it would provide, e.g., higher mechanical rigidity reducing the likelihood for relative motion between the body part and electronic part, less variable sensor reading, reduction of noise because of decreased pathways for “stray” light, vibration tolerance, and damage protection. Ex-1002 ¶364. Schröder teaches that the biometric sensor should capture “at least a partial vein image in the finger while the finger-ring 2 is being pushed over a finger.” Ex-1007, 9:62-66. Yuen teaches the desirability for “light source(s) and/or associated detector(s)” to be “close to the skin of the user (i.e., with little to no gap between the skin side of the device and the juxtaposed surface of the skin of the user)” because it “may increase the quality of the cardiac signal of interest.” Ex-1006, 12:24-35, 13:54-62; *see also id.*, 14:25-32; Ex-1002 ¶364. Additionally, a POSITA knew that electronic devices including wearable electronic devices are vulnerable to shock, damage, and vibrations, e.g., if dropped or hit against hard surfaces. Ex-1002 ¶364. Placing the electronic part at the cavity’s bottom would have been an obvious design choice to mitigate extreme vibrations and device damage. *Id.*

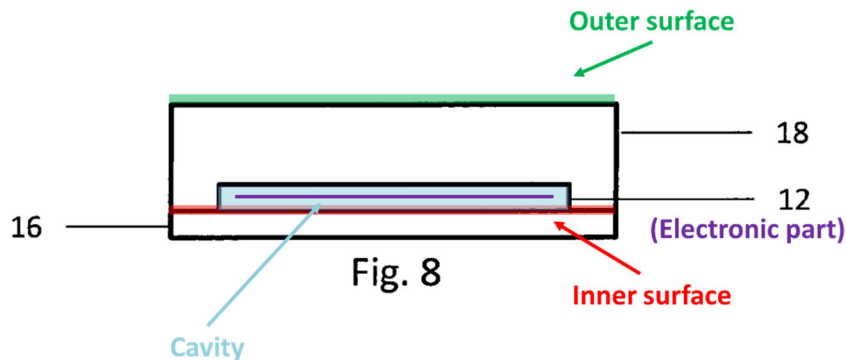
A POSITA would also have realized the advantages of using a rigid-flex PCB, as taught by Yuen, in Schröder's device. *Id.* ¶365. Yuen teaches that electronic components such as light sources or a photodetector can be placed on a rigid PCB, Ex-1006, 2:50-51, and a POSITA would have realized that such placement would ensure stable placement and alignment to mechanical structures and openings and better connect and protect sensitive or larger electronics. Ex-1002 ¶365.

A POSITA would have had a reasonable expectation of success in combining Schröder and Yuen, which are analogous prior art as they both involve biometric sensing devices having similar structural components such as inner and outer surfaces and a cavity housing an electronic part. Ex-1002 ¶372. A POSITA would have understood that the electronic components of Schröder and Yuen's biometric sensing devices are similar such that they are programmable using standard processors and are interchangeable regardless of whether the devices are in the form of, e.g., a toe band or a "finger-ring." *Id.* A POSITA would have understood, therefore, that these references disclose interrelated teachings based on routine technologies amenable to various well-understood and predictable combinations to provide more features and enhance user interest. Ex-1002 ¶372.

2. Dependent Claim 4: The wearable electronic device according to claim 1, wherein the electronic part is disposed proximate to a bottom of the cavity.

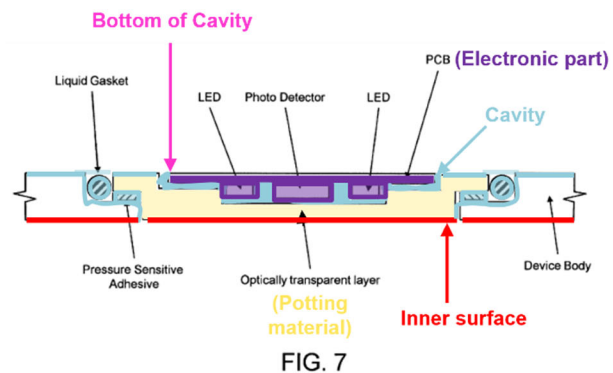
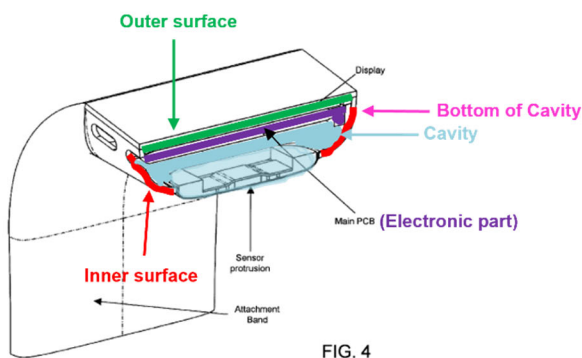
Schröder in view of Yuen (“Schröder-Yuen”) teaches Claim 4. Ex-1002 ¶¶373-381.

As discussed in Ground 4 (§XII.D.1.d), Schröder teaches that the electronic part (e.g., inlay 12 (purple)) is arranged in the cavity (blue). Ex-1007, 12:10-12, 12:26-32, Fig. 8.



Schröder teaches that “inlay 12 itself consists of a preferably flexible carrier material, e.g., PET, Kapton, etc.” Ex-1007, 12:28-29. A POSITA would have understood that inlay 12 would be disposed proximate to the cavity’s bottom to enable higher mechanical rigidity, reducing the likelihood for relative motion between the body part and electronic part, less variable sensor reading, reduction of noise because of decreased pathways for “stray” light, vibration tolerance, and damage protection. Placing inlay 12 near the cavity’s bottom would have been an obvious design choice to mitigate extreme vibrations and device damage.

To the extent that Schröder does not explicitly teach disposing the electronic part proximate to the cavity's bottom, this is taught by Yuen, as discussed at Ground 1. See §XII.A.2.c. A POSITA would have understood, as depicted in Yuen's Figures 4 and 7, that the electronic part (purple) is disposed in the cavity (blue) proximate to its bottom, i.e., away from the inner surface. Ex-1002 ¶376.



A POSITA would have been motivated to combine Schröder's and Yuen's teachings and would have had a reasonable expectation of success for the reasons discussed in §XII.E.1. Ex-1002 ¶381.

- 3. Dependent Claim 7: The wearable electronic device according to claim 1, wherein the electronic part comprises a circuit board selected from a group consisting of: a rigid-flexible printed circuit board, a flexible printed circuit board.**

Schröder-Yuen teaches Claim 7, because both Schröder and Yuen teach that the electronic part in the cavity comprises a flexible PCB. Ex-1002 ¶¶382-384.

As explained at Ground 4, a POSITA would have understood that Schröder's inlay 12 made of a "flexible carrier material" such as "PET" or "Kapton" is a flexible

PCB. Ex-1002 ¶¶342-343; Ex-1007, 12:27-37, 13:23-37; *supra* §XII.D.2.e. And as explained at Ground 1, Yuen also teaches a flexible or rigid-flex PCB (i.e., a flexible PCB connected to a regular (rigid) PCB). Ex-1002 ¶204; Ex-1006, 12:35-42, Fig. 5; *supra* §XII.A.2.f.

A POSITA would have been motivated to combine Schröder's and Yuen's teachings and would have had a reasonable expectation of success for the reasons discussed in §XII.E.1. Ex-1002 ¶384.

- 4. Dependent Claim 12: The method according to claim 10, wherein the electronic part is disposed proximate to a bottom of the cavity, and wherein the electronic part comprises a circuit board selected from a group consisting of: a rigid-flexible printed circuit board, a flexible printed circuit board.**

Schröder-Yuen teaches Claim 12. Ex-1002 ¶¶385-388.

As explained above at Claim 4 (Ground 1), Yuen teaches that the electronic part is disposed proximate to a bottom of the cavity. §XII.A.2.c.

Schröder teaches a flexible PCB disposed in the cavity. *See* Claim 7 (Ground 4, §XII.D.2.e). Yuen also teaches that the electronic part in the cavity can be a flexible or rigid-flex PCB, as discussed above at Claim 7 (Ground 1, §XII.A.2.f).

A POSITA would have been motivated to combine Schröder's and Yuen's teachings and would have had a reasonable expectation of success for the reasons discussed in §XII.E.1. Ex-1002 ¶388.

5. Dependent Claim 15: The method according to claim 14, wherein the potting material comprises a clear material and an opaque material.

Schröder-Yuen teaches Claim 15. Ex-1002 ¶¶389-392.

Schröder teaches that “[t]he second component consists e.g. of PET, PVC.” Ex-1007, 15:14-15. A POSITA would have understood that PET and PVC could be made clear or opaque. Ex. 1002, ¶390.

To the extent Schröder does not fully teach this claim, as discussed above at Ground 1, Yuen teaches that the optically transparent layer (i.e., the “potting material”) can have a clear portion and an opaque portion. Ex-1002 ¶¶208, 391; §XII.A.2.b.

A POSITA would have been motivated to combine Schröder’s and Yuen’s teachings and would have had a reasonable expectation of success for the reasons discussed in §XII.E.1. Ex-1002 ¶392.

6. Independent Claim 18

a. Element 18[pre]: A wearable electronic device configured to be worn on a finger comprising:

Schröder teaches the preamble, to the extent it is limiting. Ex-1002 ¶393. *See* Claims 1[pre], 8 (Ground 4, §§XII.D.1.a, XII.D.2.f).

b. Element 18[a]: a C-shaped body part made of a material, having an inner surface and an outer surface,

Schröder-Yuen teaches Element 18[a]. Ex-1002 ¶¶394-397.

As discussed at Element 1[a] (Ground 4), Schröder teaches a body part having an inner surface and an outer surface. §XII.D.1.b.

As discussed at Ground 2, a POSITA would have understood that Yuen teaches that the body-part is “C-shaped.” §XII.B.4.b; Ex-1002 ¶¶243-244;

A POSITA would have been motivated to combine Schröder’s and Yuen’s teachings and would have had a reasonable expectation of success for the reasons discussed in §XII.E.1. Ex-1002 ¶397.

- c. **Element 18[b]: wherein a cavity is formed on the inner surface of the C-shaped body part, the cavity extending from the inner surface of the C-shaped body part towards the outer surface of the C-shaped body part and having a depth arranged within the inner surface of the C-shaped body part;**

Schröder-Yuen teaches Element 18[b] for the reasons discussed at Element 1[b] (Ground 4). §XII.D.1.c; Ex-1002 ¶398.

- d. **Element 18[c]: an electronic part arranged in the cavity, wherein at least a portion of the electronic part has a thickness that is less than the depth of the cavity, wherein the electronic part comprises:**

Schröder teaches Element 18[c]. Ex-1002 ¶399. *See* Element 1[c] (Ground 4, §XII.D.1.d).

- e. **Element 18[d]: a flexible printed circuit board having an electronic component disposed thereon,**

Schröder teaches Element 18[d]. Ex-1002 ¶400. *See* Claim 7 (Ground 4, §XII.D.2.e).

- f. Element 18[e]: wherein the electronic component is selected from a group consisting of: an infrared transmitter, a microcontroller, a radio frequency transceiver, a temperature sensor and an infrared receiver, and a battery coupled to the flexible printed circuit board; and**

Schröder teaches Element 18[e]. Ex-1002 ¶401. *See* Claim 6 (Ground 4, §XII.D.2.d).

- g. Element 18[f]: a coating made of a potting material on the inner surface of the body part, covering the electronic part and the cavity.**

Schröder teaches Element 18[f]. Ex-1002 ¶402. *See* Element 1[d] (Ground 4, §XII.D.1.e).

7. Dependent Claims 19-20

- a. Claim 19: The wearable electronic device according to claim 18, wherein the material is selected from a group consisting of: titanium, titanium alloy, steel, platinum, gold, silver, aluminum, polymer, plastic, tungsten carbide and a metal alloy.**

Schröder teaches Claim 19. Ex-1002 ¶403. *See* Claims 2, 3 (Ground 4, §§XII.D.2.a-XII.D.2.b).

- b. Claim 20: The wearable electronic device according to claim 18, wherein the potting material is selected from a group consisting of: epoxy material, silicone, a resin, and a polymer.**

Schröder teaches Claim 20. Ex-1002 ¶404. *See* Claim 5 (Ground 4, §XII.D.2.c).

8. Independent Claim 21

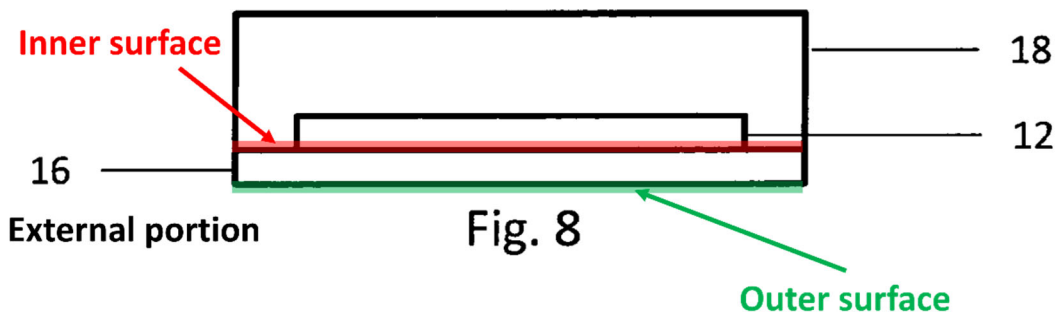
a. Element 21[pre]: A wearable electronic device configured to be worn on a finger comprising:

To the extent the preamble is limiting, Schröder-Yuen teaches the preamble for the reasons described for Element 1[pre] and Claim 8. Ex-1002 ¶405. See Claims 1[pre], 8 (Ground 4, §XII.D.1.a, XII.D.2.f).

b. Element 21[a]: an external portion made of a first material and having an inner surface and an outer surface, wherein the outer surface of the external portion defines an exterior surface of the electronic device;

Schröder-Yuen teaches Element 21[a]. Ex-1002 ¶¶406-408.

Schröder’s “finger-ring” has an external portion made of a first material with an inner surface and an outer surface. Ex-1002 ¶407; Ex-1007, Fig. 8.



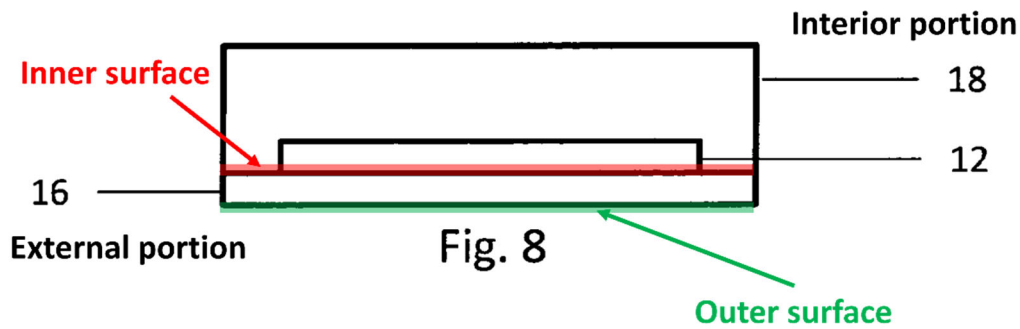
Schröder teaches that the ring’s exterior and internal portions can be made of different materials. Ex-1007, 12:56-57 (“The components 16, 18 of the finger-ring 2 can be manufactured from like or different materials.”); 15:9-10 (“A first component consists of metal and a second component consists of plastic.”). Schröder’s disclosure covers both options as to which of the components 18, 16 is

the ring's exterior and interior portion, respectively. Ex-1002 ¶408. A POSITA would have understood that component 16 in Figure 8 could be the exterior portion. *Id.* Design choice and system and manufacturing trade-offs would be considered by a POSITA when deciding how to arrange elements relative to interior/external portions. *Id.* Component 16 has an inner surface (annotated red above) and an outer surface (green). Ex-1007, Fig. 8. The outer surface defines the exterior surface of Schröder's ring, as required by the claim. Ex-1002 ¶408.

- c. **Element 21[b]: an interior portion coupled to the external portion, wherein the interior portion is disposed below the inner surface of the external portion, wherein the interior portion is made of a second material, and wherein the interior portion defines an interior surface of the electronic device;**

Schröder-Yuen teaches Element 21[b]. Ex-1002 ¶¶409-411.

Schröder's device has an interior portion, which a POSITA would have understood could be component 18 in Figure 8, and which can be made of a different material from the exterior portion 16. Ex-1007, 12:56-57, 15:9-10. As shown in Figure 8, the second component (18) is disposed below the external portion's inner surface. Ex-1007, Fig. 8.

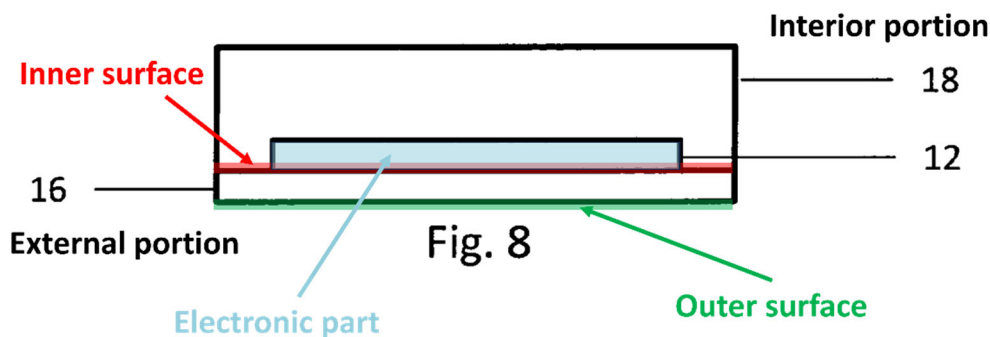


The second component defines the interior surface of Schröder's ring. Ex-1002 ¶411.

- d. **Element 21[c]: an electronic part disposed within the interior portion, wherein the electronic part comprises:**

Schröder-Yuen teaches Element 21[c]. Ex-1002 ¶¶412-415.

Schröder teaches an electronic part (blue) disposed within the interior portion (18), as shown in Figure 8. Ex-1002 ¶413; Ex-1007, Fig. 8.



Schröder discloses that the “chip module 10 and the antenna coil 8 and the possibly further electronic devices” are arranged on a flexible “carrier,” which is “preferably inserted into a recess in the second component.” Ex-1007, 15:19-22.

Schröder also teaches a biometric sensor that “can be integrated into the finger-ring 2” to capture vein images of the finger. Ex-1007, 9:62-66. A POSITA would have understood that the biometric sensor is disposed within the interior portion. Ex-1002 ¶415. Schröder further teaches that the biometric sensor can be on the chip module or a flexible PCB foil, Ex-1007, 9:60-62, which is “preferably inserted into a recess in the second component.” *Id.*, 15:21-22. A POSITA would have further understood that the sensor is disposed within the ring’s interior portion to capture vein images. Ex-1002 ¶415.

- e. **Element 21[d]: a rigid-flex printed circuit board comprising at least a first rigid circuit board and a second rigid circuit board coupled via a flexible material; and**

Schröder-Yuen teaches Element 21[d]. Ex-1002 ¶¶416-417.

Yuen teaches a rigid-flex circuit board made of flexible PCB connected to [regular] PCB. *Id.* ¶417; *see* Ground 2, §XII.B.6.e.

- f. **Element 21[e]: at least one electronic component disposed upon the first rigid printed circuit board, wherein the electronic component is selected from a group consisting of: a light emitting diode (LED), a microcontroller, a temperature sensor, a light sensor, an accelerometer, a wireless interface and a haptic feedback device.**

Schröder-Yuen teaches Element 21[e]. Ex-1002 ¶¶418-420.

Schröder teaches that the electronic part may include a microcontroller, i.e., chip module 10. *See* Claim 6 (Ground 4, §XII.D.2.d). Chip module 10 may be

disposed on the inlay 12, which as discussed above would be understood by a POSITA to be a flexible PCB. *See* Claim 7 (Ground 4, §XII.D.2.e). Schröder further teaches that the electronic part may include an LED. Ex-1002 ¶419. Schröder teaches that the biometric sensor can be attached on the chip module 10 or on a flexible PCB. Ex-1002 ¶419, Ex-1007, 9:60-62. The sensor may include “at least one infrared diode,” Ex-1007, 9:67, which a POSITA would understand is an LED. Ex-1002 ¶419.

Yuen teaches a rigid-flex PCB, *see* Element 21[d] (Ground 2, §XII.B.6.e), and a POSITA would have found it advantageous to dispose electronics such as the microcontroller or LED on the board’s rigid portion, for additional stability and resilience. Ex-1002 ¶420.

9. Dependent Claim 22

- a. Element 22[a]: The wearable electronic device according to claim 21, wherein the first material is selected from a group consisting of: titanium, titanium alloy, stainless steel, platinum, gold, silver, aluminum, polymer, plastic, tungsten carbide and a metal alloy;**

Schröder-Yuen teaches Element 22[a], because Schröder teaches its additional limitations. Ex-1002 ¶421. *See* Claims 2 and 3 (Ground 4, §§XII.D.2.a-XII.D.2.b).

- b. Element 22[b]: and wherein the second material is selected from a group consisting of: epoxy material, silicone, a resin, and a polymer.**

Schröder-Yuen teaches Element 22[b], because Schröder teaches its additional limitations. Ex-1002 ¶422. *See* Claim 5 (Ground 4, §XII.D.2.c).

F. Ground 6: Claims 21-22 are obvious over Schröder in view of Mestas.

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

A POSITA would have been motivated to combine Schröder’s and Mestas’s teachings and would have had a reasonable expectation of success because each relates to the same well-known technologies. Ex-1002 ¶¶423-427. Schröder and Mestas are both directed to wearable biometric sensing devices having similar structural components, e.g., inner and outer surfaces, a cavity, and an electronic component (such as batteries and microprocessors) within the cavity. *See, e.g.*, Ex-1007, 9:54-10:9, Figs. 6-10; Ex-1010 ¶¶151, 157, Figs. 4, 6.

Mestas contemplates different sizing of its generally circular wearable device, stating that its “wearable athletic device may be worn in a variety of locations...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 ¶424.

Mestas also discloses a rigid-flex PCB structure wrapped onto the spine of the device including rigid zones connected by flexible zones. Ex-1010, Figs. 14, 15, ¶¶164, 177. Mestas teaches that electronics such as display or LEDs are placed on the rigid zones “to prevent breakage.” *Id.* ¶172; *see also id.*, ¶170.

A POSITA would have been motivated to combine the functionality of Schröder’s biometric device with Mestas’s rigid-flex PCB, because a POSITA would have found it beneficial to implement Mestas’s rigid-flex PCB structure that would provide both the flexibility to follow the device contours and the ability to place sensitive or larger electronics on rigid PCB portions to prevent breakage. Ex-1002 ¶426.

A POSITA would have had a reasonable expectation of success in combining Schröder and Mestas, which are analogous prior art as they both involve biometric sensing devices having similar structural components. Ex-1002 ¶427. A POSITA would have understood that the electronic components of Schröder’s and Mestas’s biometric devices are similar such that they are programmable using standard processors and are interchangeable regardless of whether the devices are in the form of a “finger-ring” (Schröder) or a circular wrist- or arm-band (Mestas). *Id.* A POSITA would have understood, therefore, that these references disclose interrelated teachings based on routine technologies amenable to various well-

understood and predictable combinations to provide more features and enhance user interest. *Id.*

2. Independent Claim 21

a. Element 21[pre]

To the extent the preamble is limiting, Schröder-Mestas teaches the preamble for the reasons described for Element 1[pre] and Claim 8 (Ground 4). §§XII.D.1.a, XII.D.2.f, Ex-1002 ¶¶428.

b. Element 21[a]

Schröder-Mestas teaches Element 21[a] for the reasons discussed at Ground 5. §XII.E.8.b, Ex-1002 ¶¶429.

c. Element 21[b]

Schröder-Mestas teaches Element 21[b] for the reasons discussed at Ground 5. §XII.E.8.c, Ex-1002 ¶¶430.

d. Element 21[c]

Schröder-Mestas teaches Element 21[c] for the reasons discussed at Ground 5. §XII.E.8.d; Ex-1002 ¶431.

e. Element 21[d]: a rigid-flex printed circuit board comprising at least a first rigid circuit board and a second rigid circuit board coupled via a flexible material; and

Schröder-Mestas teaches Element 21[d]. Ex-1002 ¶432. As discussed at Ground 3, Mestas teaches a sequence of rigid and flexible PCBs, on which elements such as LEDs may be placed. *Id.*; §XII.C.2.e.

- f. Element 21[e]: at least one electronic component disposed upon the first rigid printed circuit board, wherein the electronic component is selected from a group consisting of: a light emitting diode (LED), a microcontroller, a temperature sensor, a light sensor, an accelerometer, a wireless interface and a haptic feedback device.**

Schröder-Mestas teaches Element 21[e]. Ex-1002 ¶¶433-436.

As discussed in Ground 5, Schröder teaches that the electronic part may include a microcontroller or LED. §XII.E.8.f; Ex-1002 ¶¶434.

As discussed in Ground 3, Mestas teaches a sequence of rigid and flexible PCBs, on which elements such as LEDs may be placed. §XII.C.2.f; Ex-1002 ¶435.

A POSITA would have understood the advantages of placing electronic components on the rigid PCB, as Mestas specifically teaches, including to prevent breakage. Ex-1002 ¶436; Ex-1010 ¶172. A POSITA would thus have been motivated to combine Schröder's and Mestas's teachings, and would have had a reasonable expectation of success. Ex-1002 ¶436.

3. Dependent Claim 22

a. Element 22[a]

Schröder-Mestas teaches Element 22[a], because Schröder discloses its additional limitations, as discussed at Ground 5. Ex-1002 ¶437. *See* §XII.E.9.a.

b. Element 22[b]

Schröder-Mestas teaches Element 22[b], because Schröder discloses its additional limitations, as discussed at Ground 5. Ex-1002 ¶438. *See* §XII.E.9.b.

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

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

XIV. CONCLUSION

Petitioner requests institution of IPR for Claims 1-22 of the '147 Patent based on each of the Petition grounds.

Respectfully Submitted,

/s/ William M. Fink

William M. Fink (Reg. No. 72,332)

CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. §42.24(d), Petitioner certifies that this petition includes 13,984 words, as measured by Microsoft Word, exclusive of the table of contents, mandatory notices under §42.8, certificates of service, word count, and exhibits.

Dated: May 31, 2024

Respectfully submitted,

/s/ William M. Fink

William M. Fink (Reg. No. 72,332)
O'Melveny & Myers LLP
1625 Eye Street, NW
Washington, DC 20006
Telephone: (202) 383-5300
Fax: (202) 383-5414
E-Mail: tfink@omm.com
Attorney for Petitioner

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

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

Holland & Hart LLP/Oura Health Oy
P.O. Box 11583
Salt Lake City, UT 84147

A courtesy copy was sent to the below counsel via electronic mail:

Janine Alison Carlan
Jasjit S Vidwan
Ross Quinn Panko
Arent Fox , LLP - DC
1717 K Street, NW
Washington, DC 20006-5344
Phone: 202-715-8506
Email: janine.carlan@afslaw.com
Email: jasjit.vidwan@afslaw.com
Email: ross.panko@afslaw.com

Matthew Thomas Wilkerson
Arent Fox Schiff LLP
233 S. Wacker Dr., Ste. 7100
Chicago, IL 60606
Phone: 312-258-5503
Email: matthew.wilkerson@afslaw.com

Michael E. Jones
Shaun William Hassett
Potter Minton
102 North College, Suite 900
Tyler, TX 75702
Phone: 903-525-2272
Email: mikejones@potterminton.com
Email: shaunhassett@potterminton.com

Dated: May 31, 2024

Respectfully submitted,

/s/ William M. Fink

William M. Fink (Reg. No. 72,332)

O'Melveny & Myers LLP

1625 Eye Street, NW

Washington, DC 20006

Telephone: (202) 383-5300

Fax: (202) 383-5414

E-Mail: tfink@omm.com

Attorney for Petitioner