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Paper 33
Entered: May 4, 2022

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

MASIMO CORPORATION,
Patent Owner.

IPR2020-01737
Patent 10,709,366 B1

Before JOSIAH C. COCKS, ROBERT L. KINDER, and
AMANDA F. WIEKER, *Administrative Patent Judges.*

KINDER, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

A. Background

Apple Inc. ("Petitioner") filed a Petition requesting an *inter partes* review of claims 1–27 ("challenged claims") of U.S. Patent No. 10,709,366 B1 (Ex. 1001, "the '366 patent"). Paper 2 ("Pet."). Masimo Corporation ("Patent Owner") waived filing a Preliminary Response. Paper 6. We instituted an *inter partes* review of all challenged claims 1–27 on all asserted grounds of unpatentability, pursuant to 35 U.S.C. § 314. Paper 7 ("Inst. Dec.").

After institution, Patent Owner filed a Response (Paper 15, "PO Resp.") to the Petition, Petitioner filed a Reply (Paper 19, "Pet. Reply"), and Patent Owner filed a Sur-reply (Paper 22, "Sur-reply"). An oral hearing was held on February 9, 2022, and a transcript of the hearing is included in the record. Paper 32 ("Tr.").

We issue this Final Written Decision pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons set forth below, Petitioner has met its burden of showing, by a preponderance of the evidence, that challenged claims 1–27 of the '366 patent are unpatentable.

B. Related Proceedings

Masimo Corporation v. Apple Inc., Civil Action No. 8:20-cv-00048 (C.D. Cal.) (filed Jan. 9, 2020);

Apple Inc. v. Masimo Corporation, IPR2020-01520 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,258,265 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01521 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,292,628 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01523 (PTAB Sept. 9, 2020) (challenging claims of U.S. Patent No. 8,457,703 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01524 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,433,776 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01526 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 6,771,994 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01536 (PTAB Aug. 31, 2020) (challenging claims 1–29 of U.S. Patent No. 10,588,553 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01537 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,588,553 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01538 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,588,554 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01539 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,588,554 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01713 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,624,564 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01714 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,631,765 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01715 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,631,765 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01716 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,702,194 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01722 (PTAB Oct. 2, 2020) (challenging claims of U.S. Patent No. 10,470,695 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01723 (PTAB Oct. 2, 2020) (challenging claims of U.S. Patent No. 10,470,695 B2); and

Apple Inc. v. Masimo Corporation, IPR2020-01733 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,702,195 B1).

Pet. 94–95; Paper 3, 1, 3–4.

Patent Owner further identifies certain pending patent applications, as well as other issued and abandoned applications, that claim priority to, or share a priority claim with, the ’366 patent. Paper 3, 1–2.

C. The ’366 Patent

The ’366 patent is titled “Multi-Stream Data Collection System for Noninvasive Measurement of Blood Constituents,” and issued on July 14, 2020, from U.S. Patent Application No. 16/829,510, filed March 25, 2020. Ex. 1001, codes (21), (22), (45), (54). The ’366 patent claims priority through a series of continuation and continuation-in-part applications to Provisional Application Nos. 61/086,060, 61/086,108, 61/086,063, 61/086,057, each filed August 4, 2008, as well as 61/091,732, filed August 25, 2008, and 61/078,228 and 61/078,207, both filed July 3, 2008. *Id.* at codes (60), (63).

The ’366 patent discloses a two-part data collection system including a noninvasive sensor that communicates with a patient monitor. *Id.* at 2:38–40. The sensor includes a sensor housing, an optical source, and several photodetectors, and is used to measure a blood constituent or analyte, e.g., oxygen or glucose. *Id.* at 2:29–37, 2:62–3:12. The patient monitor includes a display and a network interface for communicating with a handheld computing device. *Id.* at 2:42–48.

Figure 1 of the ’366 patent is reproduced below.

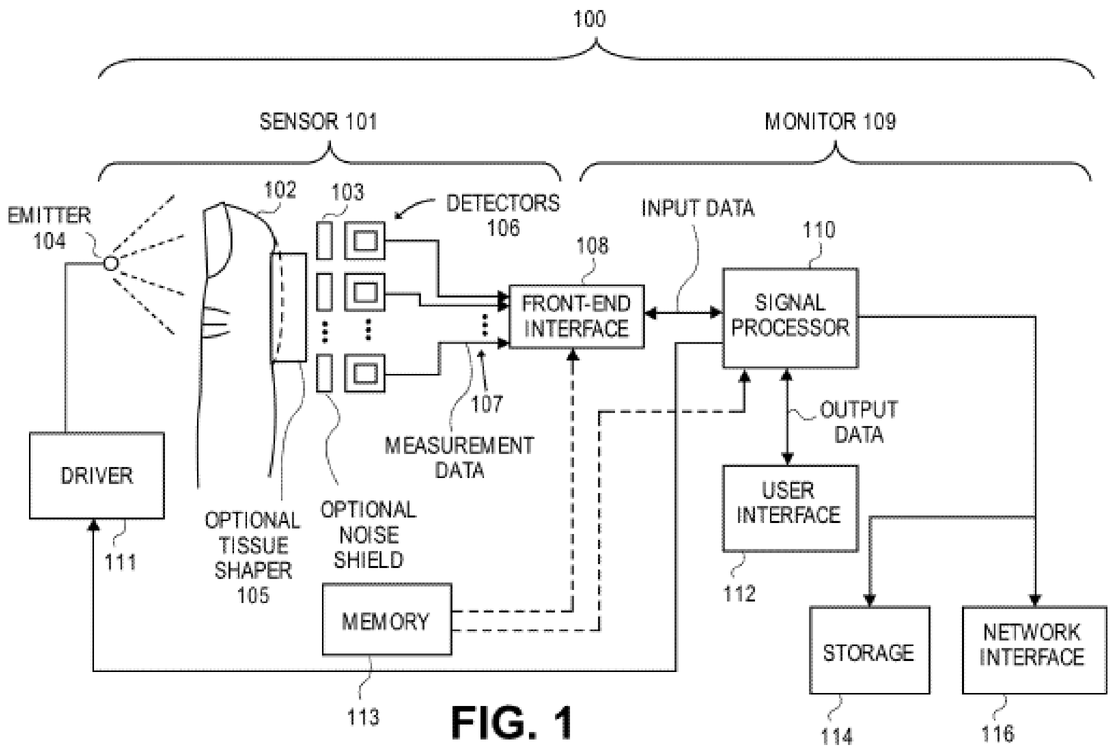

FIG. 1

Figure 1 illustrates a block diagram of data collection system 100 including sensor 101 and monitor 109. *Id.* at 11:51–61. Sensor 101 includes optical emitter 104 and detectors 106. *Id.* Emitters 104 emit light that is attenuated or reflected by the patient’s tissue at measurement site 102. *Id.* at 11:61–63; 14:4–7. Detectors 106 capture and measure the light attenuated or reflected from the tissue. *Id.* at 14:3–10. In response to the measured light, detectors 106 output detector signals 107 to monitor 109 through front-end interface 108. *Id.* at 14:7–10, 28–33. Sensor 101 also may include tissue shaper 105, which may be in the form of a convex surface that: (1) reduces the thickness of the patient’s measurement site; and (2) provides more surface area from which light can be detected. *Id.* at 10:61–11:13.

Monitor 109 includes signal processor 110 and user interface 112. *Id.* at 15:16–18. “[S]ignal processor 110 includes processing logic that determines measurements for desired analytes, . . . based on the signals received from the detectors 106." *Id.* at 15:20–24. User interface 112 presents the measurements to a user on a display, e.g., a touch-screen display. *Id.* at 15:46–50. The monitor may be connected to storage device 114 and network interface 116. *Id.* at 15:60–67.

The '366 patent describes various examples of sensor devices. Figures 14D and 14F, reproduced below, illustrate sensor devices.

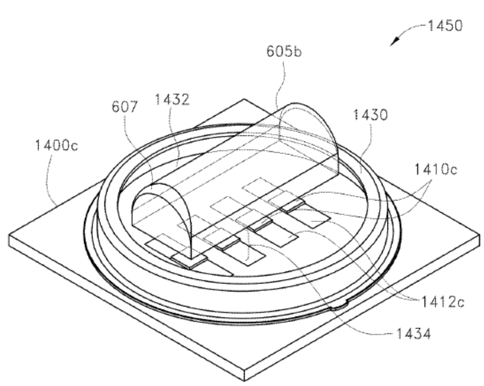

FIG. 14D

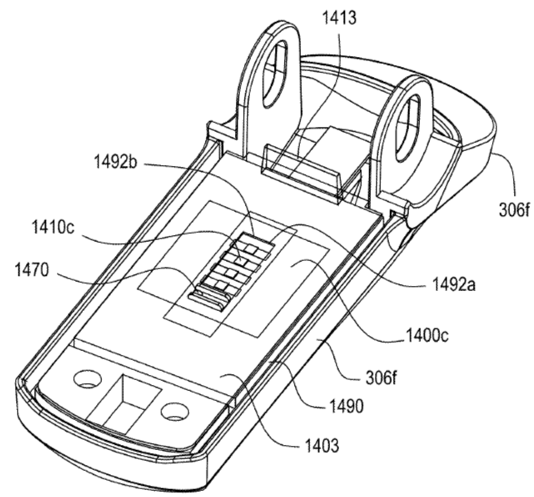

FIG. 14F

Figure 14D (left) illustrates portions of a detector submount and Figure 14F (right) illustrates portions of a detector shell. *Id.* at 6:44–47. As shown in Figure 14D, multiple detectors 1410c are located within housing 1430 and under transparent cover 1432, on which protrusion 605b (or partially cylindrical protrusion 605) is disposed. *Id.* at 35:39–43, 36:30–41. Figure 14F illustrates a detector shell 306f including detectors 1410c on substrate 1400c. *Id.* at 37:9–17. Substrate 1400c is enclosed by shielding enclosure 1490 and noise shield 1403, which include window 1492a and window 1492b, respectively, placed above detectors 1410c. *Id.* Alternatively, cylindrical housing 1430 may be disposed under noise shield 1403 and may enclose detectors 1410c. *Id.* at 37:47–49.

Figures 4A and 4B, reproduced below, illustrate an alternative example of a tissue contact area of a sensor device.

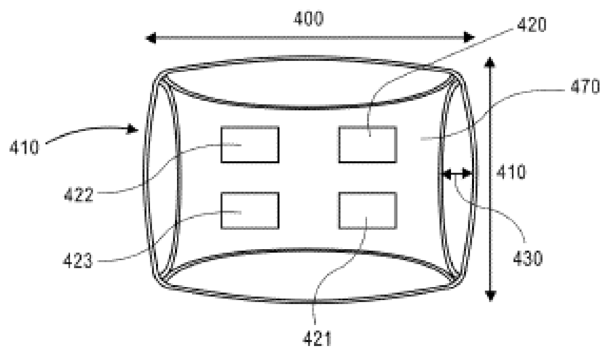

FIG. 4A

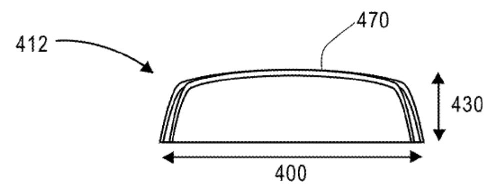

FIG. 4B

Figures 4A and 4B illustrate arrangements of protrusion 405 including measurement contact area 470. *Id.* at 23:18–24. "[M]easurement site contact area 470 can include a surface that molds body tissue of a measurement site." *Id.* "For example, . . . measurement site contact area 470 can be generally curved and/or convex with respect to the measurement site." *Id.* at 23:41–43. The measurement site contact area may include windows 420–423 that "mimic or approximately mimic a configuration of, or even house, a plurality of detectors." *Id.* at 23:49–63.

D. Illustrative Claim

Of the challenged claims, claim 1, 14, and 27 are independent. Claim 1 is illustrative and is reproduced below.

> 1. A noninvasive physiological parameter measurement device adapted to be worn by a wearer, the noninvasive physiological parameter measurement device comprising:
>
> [a] one or more light emitters;
>
> [b] a substrate having a surface;

> [c] a first set of photodiodes arranged on the surface and spaced apart from each other, wherein:
>
> > [d] the first set of photodiodes comprises at least four photodiodes, and
> >
> > [e] the photodiodes of the first set of photodiodes are connected to one another in parallel to provide a first signal stream responsive to light from at least one of the one or more light emitters attenuated by body tissue;
>
> [f] a second set of photodiodes arranged on the surface and spaced apart from each other, wherein:
>
> > [g] the second set of photodiodes comprises at least four photodiodes,
> >
> > [h] the photodiodes of the second set of photodiodes are connected to one another in parallel to provide a second signal stream responsive to light from at least one of the one or more light emitters attenuated by body tissue, and
> >
> > [i] at least one of the first signal stream or the second signal stream includes information usable to determine a physiological parameter of a wearer of the noninvasive physiological parameter measurement device;
>
> [j] a wall extending from the surface and configured to surround at least the first and second sets of photodiodes; and
>
> [k] a cover arranged to cover at least a portion of the surface of the substrate, wherein the cover comprises a protrusion that extends over all of the photodiodes of the first and second sets of photodiodes arranged on the surface, and wherein the cover is further configured to cover the wall.

Ex. 1001, 44:57–45:27 (bracketed identifiers [a]–[k] added). Independent claim 14 includes limitations substantially similar to limitations [a], [c]–[h], [j], and [k] and includes additional limitations drawn to "one or more processors configured to: receive information . . . ; [and], process the information to determine physiological parameter measurement information." *Id.* at 46:33–56. Independent Claim 27 contains numerous limitations, which are integrated from claim 1 (limitations [a]–[k]) as well as limitations from numerous dependent claims. *Id.* at 48:1–49:10; Pet. 81–84.

E. Applied References

Petitioner relies upon the following references:

Sherman et al., U.S. Patent No. 4,941,236, filed July 6, 1989, issued July 17, 1990 (Ex. 1047, "Sherman");

Ohsaki et al., U.S. Patent Application Publication No. 2001/0056243 A1, filed May 11, 2001, published December 27, 2001 (Ex. 1014, "Ohsaki");

Aizawa, U.S. Patent Application Publication No. 2002/0188210 A1, filed May 23, 2002, published December 12, 2002 (Ex. 1006, "Aizawa");

Goldsmith et al., U.S. Patent Application Publication No. 2007/0093786 A1, filed July 31, 2006, published April 26, 2007 (Ex. 1027, "Goldsmith); and

Y. Mendelson, et al., "*Measurement Site and Photodetector Size Considerations in Optimizing Power Consumption of a Wearable Reflectance Pulse Oximeter*," Proceedings of the 25th IEEE EMBS Annual International Conference, 3016-3019 (2003) (Ex. 1024, "Mendelson-2003").

Pet. 1–2.

Petitioner also submits, *inter alia*, a Declaration of Thomas W. Kenny, Ph.D. (Ex. 1003) and a Second Declaration of Dr. Kenny (Ex. 1060). Patent Owner submits, *inter alia*, a Declaration of Vijay K. Madisetti, Ph.D (Ex. 2004). The parties also provide deposition testimony from Dr. Kenny and Dr. Madisetti, including from this proceeding and others. Exs. 1053–1056, 2006–2009, 2026–2027.

F. Asserted Grounds of Unpatentability

We instituted an *inter partes* review based on the following grounds. Inst. Dec. 11, 33.

Claim(s) Challenged	35 U.S.C. §	References/Basis
1–12 and 14–27	103	Aizawa, Mendelson-2003, Ohsaki, Goldsmith
13	103	Aizawa, Mendelson-2003, Ohsaki, Goldsmith, Sherman

II. DISCUSSION

A. Claim Construction

For petitions filed on or after November 13, 2018, a claim shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b) (2020). Accordingly, we construe the claims according to the standard set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). Petitioner submits that no claim term requires express construction. Pet. 3. Patent Owner asserts that the claims should be given their ordinary and customary meaning, consistent with the specification. PO Resp. 9.

Based on our analysis of the issues in dispute, we conclude that no claim terms require express construction. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Matal*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

B. Principles of Law

A claim is unpatentable under 35 U.S.C. § 103(a) if "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406

(2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) objective evidence of nonobviousness.[1] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). When evaluating a combination of teachings, we must also "determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Whether a combination of elements would have produced a predictable result weighs in the ultimate determination of obviousness. *Id.* at 416–417.

In an *inter partes* review, the petitioner must show with particularity why each challenged claim is unpatentable. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016); 37 C.F.R. § 42.104(b). The burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). To prevail, Petitioner must support its challenge by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d).

We analyze the challenges presented in the Petition in accordance with the above-stated principles.

C. Level of Ordinary Skill in the Art

Petitioner identifies the appropriate level of skill in the art as that possessed by a person having "a Bachelor of Science degree in an academic discipline emphasizing the design of electrical, computer, or software

[1] The parties have not presented objective evidence of non-obviousness.

technologies, in combination with training or at least one to two years of related work experience with capture and processing of data or information." Pet. 3 (citing Ex. 1003 ¶¶ 21–22). "Alternatively, the person could have also had a Master of Science degree in a relevant academic discipline with less than a year of related work experience in the same discipline." *Id.*

Patent Owner makes several observations regarding Petitioner's identified level of skill in the art but, "[f]or this proceeding, [Patent Owner] nonetheless applies Petitioner's asserted level of skill." PO Resp. 9.

We adopt Petitioner's assessment as set forth above, which appears consistent with the level of skill reflected in the Specification and prior art.

D. Obviousness over the Combined Teachings of Aizawa, Mendelson-2003, Ohsaki, and Goldsmith

Petitioner contends that claims 1–12 and 14–27 of the '366 patent would have been obvious over the combined teachings of Aizawa, Mendelson-2003, Ohsaki, and Goldsmith. Pet. 10–91; *see also* Pet. Reply 8–37.[2] Patent Owner disagrees. PO Resp. 8–66; *see also* Sur-reply 1–29.

Based on our review of the parties' arguments and the cited evidence of record, we determine that Petitioner has met its burden of showing by a preponderance of the evidence that claims 1–12 and 14–27 are unpatentable.

1. Overview of Aizawa (Ex. 1006)

Aizawa is a U.S. patent application publication titled "Pulse Wave Sensor and Pulse Rate Detector," and discloses a pulse wave sensor that

[2] Petitioner's Reply includes a Table of Contents and an Exhibits list that spans pages ii–vii, and the substance of the Reply then begins on page 8.

detects light output from a light emitting diode and reflected from a patient's artery. Ex. 1006, codes (54), (57).

Figure 1(a) of Aizawa is reproduced below.

FIG. 1 (a)

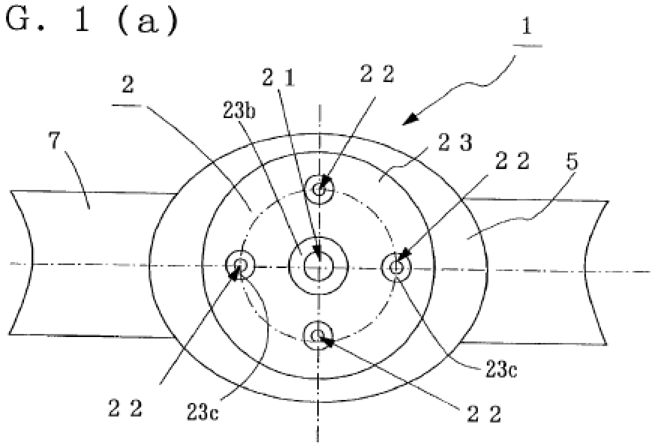

Figure 1(a) is a plan view of a pulse wave sensor. *Id.* ¶ 23. As shown in Figure 1(a), pulse wave sensor 2 includes light emitting diode ("LED") 21, four photodetectors 22 symmetrically disposed around LED 21, and holder 23 for storing LED 21 and photodetectors 22. *Id.* Aizawa discloses that, "to further improve detection efficiency, . . . the number of the photodetectors 22 may be increased." *Id.* ¶ 32, Fig. 4(a). "The same effect can be obtained when the number of photodetectors 22 is 1 and a plurality of light emitting diodes 21 are disposed around the photodetector 22." *Id.* ¶ 33.

Figure 1(b) of Aizawa is reproduced below.

FIG. 1 (b)

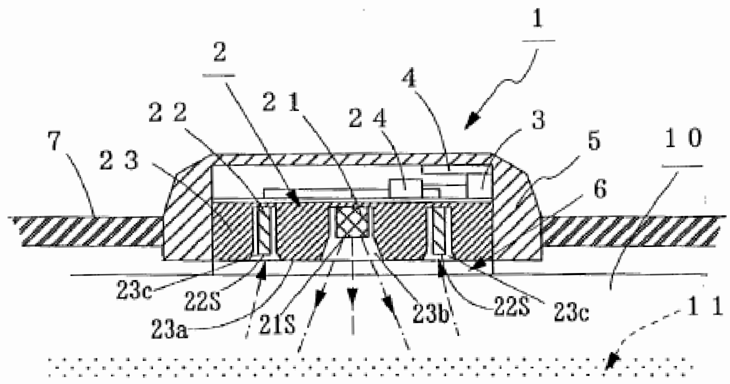

Figure 1(b) is a sectional view of the pulse wave sensor. *Id.* ¶ 23. As shown in Figure 1(b), pulse wave sensor 2 includes drive detection circuit 24 for detecting a pulse wave by amplifying the outputs of photodetectors 22. *Id.* Arithmetic circuit 3 computes a pulse rate from the detected pulse wave and transmitter 4 transmits the pulse rate data to an "unshown display." *Id.* The pulse rate detector further includes outer casing 5 for storing pulse wave sensor 2, acrylic transparent plate 6 mounted to detection face 23a of holder 23, and attachment belt 7. *Id.*

Aizawa discloses that LED 21 and photodetectors 22 "are stored in cavities 23b and 23c formed in the detection face 23a" of the pulse wave sensor. *Id.* ¶ 24. Detection face 23a "is a contact side between the holder 23 and a wrist 10, respectively, at positions where the light emitting face 21s of the light emitting diode 21 and the light receiving faces 22s of the photodetectors 22 are set back from the above detection face 23a." *Id.* Aizawa discloses that "a subject carries the above pulse rate detector 1 on the inner side of his/her wrist 10 . . . in such a manner that the light emitting face 21s of the light emitting diode 21 faces down (on the wrist 10 side)."

Id. ¶ 26. Furthermore, "the above belt 7 is fastened such that the acrylic transparent plate 6 becomes close to the artery 11 of the wrist 10. Thereby, adhesion between the wrist 10 and the pulse rate detector 1 is improved." *Id.* ¶¶ 26, 34.

2. Overview of Mendelson-2003 (Ex. 1024)

Mendelson-2003 is a journal article titled "Measurement Site and Photodetector Size Considerations in Optimizing Power Consumption of a Wearable Reflectance Pulse Oximeter," which discusses a pulse oximeter sensor in which "battery longevity could be extended considerably by employing a wide annularly shaped photodetector ring configuration and performing SpO_2 measurements from the forehead region." Ex. 1024, 3016.[3]

Mendelson-2003 explains that pulse oximetry uses sensors to monitor oxygen saturation (SpO_2), where the sensor typically includes light emitting diodes (LED) and a silicon photodetector (PD). *Id.* According to Mendelson-2003, when designing a pulse oximeter, it is important to offer "low power management without compromising signal quality." *Id.* at 3017. "However, high brightness LEDs commonly used in pulse oximeters require[] relatively high current pulses, typically in the range between 100–200mA. Thus, minimizing the drive currents supplied to the LEDs would contribute considerably toward the overall power saving in the design of a more efficient pulse oximeter." *Id.* To achieve this goal, Mendelson-2003 discusses previous studies in which

> the driving currents supplied to the LEDs . . . could be lowered significantly without compromising the quality of the

[3] We adopt Petitioner's citation format by referring to the original page numbering and not Petitioner's added page numbering at the bottom.

> [photoplethysmographic or PPG signals] by increasing the overall size of the PD . . . . Hence, by maximizing the light collected by the sensor, a very low power-consuming sensor could be developed, thereby extending the overall battery life of a pulse oximeter intended for telemedicine applications.

Id.

Mendelson-2003 discloses the prototype of such a sensor in Figure 1, which is reproduced below, and served as the basis for the studies evaluated in Mendelson-2003.

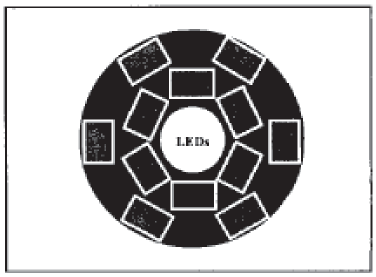

Figure 1 of Mendelson-2003 depicts a sensor configuration showing the relative positions of its PDs and LEDs. *Id.* As shown in Figure l, "six PDs were positioned in a close inner-ring configuration at a radial distance of 6.0mm from the LEDs. The second set of six PDs spaced equally along an outer-ring, separated from the LEDs by a radius of 10.0mm." *Id.* Mendelson-2003 also explains that "[e]ach cluster of six PDs were wired in parallel and connected through a central hub to the common summing input of a current-to-voltage converter." *Id.*

Mendelson-2003 reports the results of the studies as follows:

> Despite the noticeable differences between the PPG signals measured from the wrist and forehead, the data plotted in Fig. 3 also revealed that considerable stronger PPGs could be obtained by widening the active area of the PD which helps to collect a bigger proportion of backscattered light intensity. The additional increase, however, depends on the area and relative position of the PD with respect to the LEDs. For example,

> utilizing the outer-ring configuration, the overall increase in the average amplitudes of the R and IR PPGs measured from the forehead region was 23% and 40%, respectively. Similarly, the same increase in PD area produced an increase in the PPG signals measured from the wrist, but with a proportional higher increase of 42% and 73%.

Id. at 3019.

3. Overview of Ohsaki (Ex. 1014)

Ohsaki is a U.S. patent application publication titled "Wristwatch-type Human Pulse Wave Sensor Attached on Back Side of User's Wrist," and discloses an optical sensor for detecting a pulse wave of a human body. Ex. 1014, code (54), ¶ 3. Figure 1 of Ohsaki is reproduced below.

FIG. 1

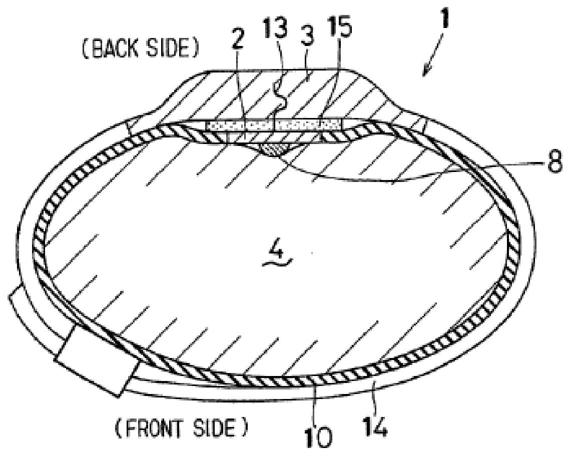

Figure 1 illustrates a cross-sectional view of pulse wave sensor 1 attached on the back side of user's wrist 4. *Id.* ¶¶ 12, 16. Pulse wave sensor 1 includes detecting element 2 and sensor body 3. *Id.* ¶ 16.

Figure 2 of Ohsaki, reproduced below, illustrates further detail of detecting element 2.

FIG. 2

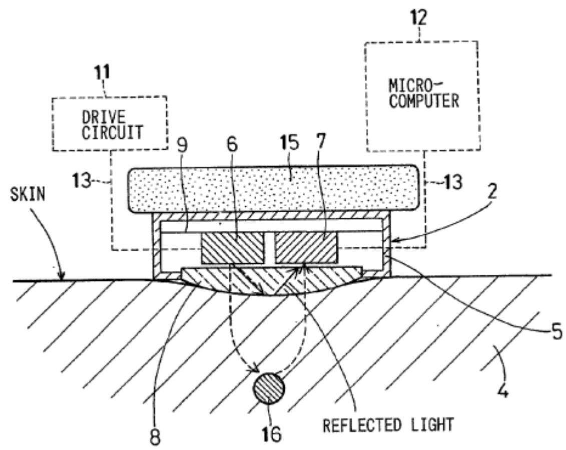

Figure 2 illustrates a mechanism for detecting a pulse wave. *Id.* ¶ 13. Detecting element 2 includes package 5, light emitting element 6, light receiving element 7, and translucent board 8. *Id.* ¶ 17. Light emitting element 6 and light receiving element 7 are arranged on circuit board 9 inside package 5. *Id.* ¶¶ 17, 19.

"Translucent board 8 is a glass board which is transparent to light, and attached to the opening of the package 5. A convex surface is formed on the top of the translucent board 8." *Id.* ¶ 17. "[T]he convex surface of the translucent board 8 is in intimate contact with the surface of the user's skin," preventing detecting element 2 from slipping off the detecting position of the user's wrist. *Id.* ¶ 25. By preventing the detecting element from moving, the convex surface suppresses "variation of the amount of the reflected light which is emitted from the light emitting element 6 and reaches the light receiving element 7 by being reflected by the surface of the user's skin." *Id.* Additionally, the convex surface prevents penetration by "noise such as disturbance light from the outside." *Id.*

Sensor body 3 is connected to detecting element 2 by signal line 13. *Id.* ¶ 20. Signal line 13 connects detecting element 2 to drive circuit 11, microcomputer 12, and a monitor display (not shown). *Id.* Drive circuit 11 drives light emitting element 6 to emit light toward wrist 4. *Id.* Detecting element 2 receives reflected light which is used by microcomputer 12 to calculate pulse rate. *Id.* "The monitor display shows the calculated pulse rate." *Id.*

4. Overview of Goldsmith (Ex. 1027)

Goldsmith is a U.S. patent application publication titled "Watch Controller for a Medical Device," and discloses a watch controller device that communicates with an infusion device to "provid[e] convenient monitoring and control of the infusion pump device." Ex. 1027, codes (54), (57).

Goldsmith's Figure 9A and 9B are reproduced below.

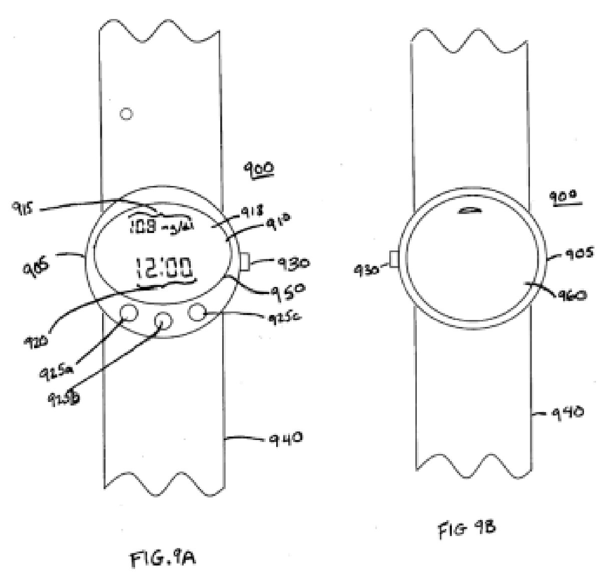

Figure 9A and Figure 9B are respective front and rear views of a combined watch and controller device. *Id.* ¶¶ 30–31. As shown in Figure 9A, watch controller 900 includes housing 905, transparent member 950, display 910, input devices 925a–c, scroll wheel 930, and wrist band 940. *Id.* ¶¶ 85–86. Figure 9B shows rear-side cover 960, and a rear view of housing 905, scroll wheel 930, and wrist band 940. *Id*.

Goldsmith discloses the watch controller may interact with one or more devices, such as infusion pumps or analyte monitors. *Id.* ¶ 85; *see also id.* ¶ 88 ("The analyte sensing device 1060 may be adapted to receive data from a sensor, such as a transcutaneous sensor."). Display 910 "may display at least a portion of whatever information and/or graph is being displayed on the infusion device display or on the analyte monitor display," such as, e.g., levels of glucose. *Id*. ¶ 86. The display is customizable in a variety of configurations including user-customizable backgrounds, languages, sounds, font (including font size), and wall papers. *Id*. ¶¶ 102, 104. Additionally, the watch controller may communicate with a remote station, e.g., a computer, to allow data downloading. *Id*. ¶ 89 (including wireless). The remote station may also include a cellular telephone to be "used as a conduit for remote monitoring and programming." *Id.*

5. *Independent Claim 1*

Petitioner contends that claim 1 would have been obvious over the combined teachings of Aizawa, Mendelson-2003, Ohsaki, and Goldsmith. Pet. 38–53. Below, we set forth how the combination of prior art references teaches or suggests the claim limitations that are not disputed by the parties. For those limitations and reasons for combining the references that are disputed, we examine each of the parties' contentions and then provide our analysis.

i. "A noninvasive physiological parameter measurement device adapted to be worn by a wearer, the noninvasive physiological parameter measurement device comprising"

The cited evidence supports Petitioner's undisputed contention that "Aizawa discloses a pulse sensor that is designed to 'detect[] the pulse wave of a subject from light reflected from a red corpuscle in the artery of a wrist of the subject by irradiating the artery of the wrist,'" and that Goldsmith teaches an analyte sensor that is part of a user-worn controller device that includes, e.g., a display.[4] Pet. 33, 39 (quoting Ex. 1006 ¶ 2); *see also* Ex. 1006 ¶ 27 (discussing optical path), Fig. 2 (depicting physiological parameter measurement device worn by a user); Ex. 1027 ¶¶ 85 ("a watch"), 88 ("analyte sensing device 1060"), Fig. 9A; Ex. 1003 ¶ 94.

Petitioner further contends that a person of ordinary skill in the art would have found it obvious to incorporate Aizawa's sensor "into Goldsmith's integrated wrist-worn watch controller device that includes, among other features, a touch screen, network interface, and storage device" in order to receive and display data sensed by Aizawa's sensor. Pet. 31–38; *see, e.g.*, Ex. 1003 ¶¶ 88–89 ("would have enhanced the sensor's utility and improved the user's experience"). According to Petitioner, this would have "enable[d] a user to view and interact with heart rate data during exercise via Goldsmith's touch-screen display, and to enable heart rate data to be monitored by the user and/or others through any of the devices with which Goldsmith's device can communicate." Pet. 34; *see, e.g.*, Ex. 1003 ¶ 89.

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[4] Whether the preamble is limiting need not be resolved because Petitioner shows sufficiently based on the final record that the recitation in the preamble is satisfied by the prior art.

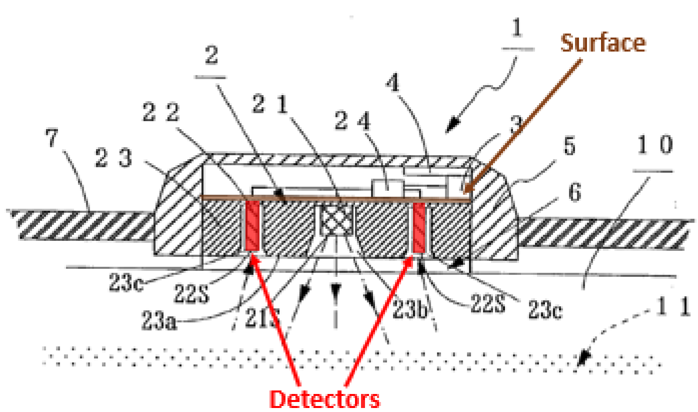
Petitioner asserts this would have been use of a known technique to improve similar devices in the same way. Pet. 35; *see, e.g.*, Ex. 1003 ¶ 90; *see also* Pet. 35–38 (also discussing physical incorporation); *see, e.g.*, Ex. 1003 ¶¶ 90–93 (same).

Petitioner's stated reasoning for the proposed modification is sufficiently supported, including by the unrebutted testimony of Dr. Kenny. *See, e.g.*, Ex. 1003 ¶¶ 88–94.

ii. "[a] one or more light emitters" and "[b] a substrate having a surface"

The cited evidence supports Petitioner's undisputed contention that Aizawa discloses an emitter, LED 21, that emits light that is picked up by photodetectors. Pet. 40; *see, e.g.*, Ex. 1006 ¶ 23 ("LED 21 . . . for emitting light having a wavelength of a near infrared range"), 27 (explaining that light is emitted toward the wrist), Fig. 1(b) (depicting emitter 21 facing user tissue 10), Fig. 2 (depicting sensor worn on user's wrist).

Petitioner persuasively demonstrates that a person of ordinary skill in the art would have understood that Aizawa's surface would include a substrate on which the emitter and detectors are arranged. Pet. 41. Petitioner relies on annotated Figure 1(b) of Aizawa, reproduced below.



Petitioner's annotated Figure 1(b) shows detectors highlighted in red and a substrate surface unnumbered but highlighted in brown. Pet. 41. Dr. Kenny likewise testifies that Aizawa teaches "a substrate having surface (shown in brown) on which the holder 23 is placed and on which the detectors/ photodiodes are arranged." Ex. 1003 ¶ 96.

iii. *"[c] a first set of photodiodes arranged on the surface and spaced apart from each other, wherein: [d] the first set of photodiodes comprises at least four photodiodes"*
and
"[f] a second set of photodiodes arranged on the surface and spaced apart from each other, wherein: [g] the second set of photodiodes comprises at least four photodiodes"

<u>Petitioner's Undisputed Contentions</u>

Petitioner contends that Aizawa discloses a first set of four photodiodes that are circularly arranged around a central emitter. Pet. 18 (citing, e.g., Ex. 1006 ¶ 23). Petitioner also contends that, in one embodiment, Aizawa discloses that eight or more detectors may be used to improve detection efficiency, but does not expressly teach a "second set of photodiodes," as claimed. *Id.* at 19–20 (citing, e.g., Ex. 1006, Fig. 4(a)); *see also* Ex. 1003 ¶¶ 67–68.

Patent Owner does not dispute these contentions, and we agree with Petitioner. Aizawa discloses a set of "four phototransistors 22" that are disposed in a single ring around central emitter 21. Ex. 1006 ¶ 23, Figs. 1(a)–1(b). Aizawa also discloses that "the number of the photodetectors 22 may be increased" to further improve detection efficiency, and depicts in Figure 4(a) an embodiment where eight photodetectors 22 are disposed in a single ring around central emitter 21. *Id.* ¶ 32.

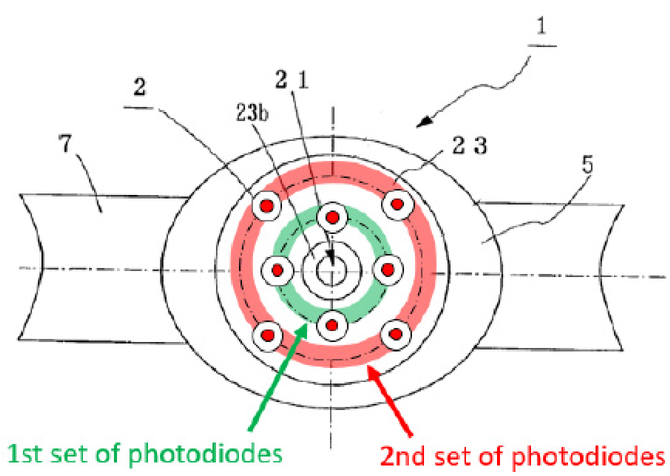
Also according to Petitioner, Mendelson-2003 teaches a sensor that uses two rings of photodiodes, which improve light collection efficiency, permit use of lower brightness LEDs, and reduce power consumption. Pet. 20–21; *see also* Ex. 1003 ¶¶ 69–70.

Patent Owner does not dispute these contentions regarding what Mendelson-2003 discloses, and we agree with Petitioner. Mendelson-2003 teaches an experimental sensor in which "six PDs [(photodetectors)] were positioned in a close inner-ring configuration . . . [and a] second set of six PDs [were] spaced equally along an outer-ring." Ex. 1024, 3017, Fig. 1 (depicting a prototype sensor with a near ring of photodetectors and a far ring of photodetectors). Based on experiments using the dual-ring sensor, as compared to sensors using only a near ring or only a far ring, Mendelson-2003 states that "considerabl[y] stronger PPGs [photoplethysmographic signals] could be obtained by widening the active area of the PD which helps to collect a bigger proportion of backscattered light intensity." *Id.* at 3019, Fig. 3. Mendelson-2003 also states that, "by combining both PD sets to simulate a single large PD area, it is possible to further reduce the driving currents of the LEDs without compromising the amplitude or quality of the detected PPGs." *Id.* at 3019, Fig. 4. Finally, Mendelson-2003 teaches that estimated battery life for the dual-ring sensor, as compared to sensors using only a near ring or only a far ring, "could be extended considerably." *Id.* at 3019, Table 1 (battery life of 52.5 days for the dual-ring sensor, compared to 45.8 and 20.3 days for the near ring or far ring sensors, respectively).

<u>Petitioner's Disputed Contentions</u>

In view of these teachings, Petitioner contends that a person of ordinary skill in the art would have found it obvious to modify Aizawa to include an additional ring of detectors, as taught by Mendelson-2003, (i.e., a "second set") to "advance[e] Aizawa's goal of improving detection efficiency through increased power savings." Pet. 20–21 (citing, e.g., Ex. 1003 ¶ 69), 41–43 (citing, e.g., Ex. 1003 ¶¶ 97–100), 48–50 (citing, e.g., Ex. 1003 ¶¶ 107–109). According to Petitioner, "by using Mendelson-2003's power-saving (and thus efficiency-enhancing) PD configuration, the power consumption of a wrist-based pulse sensing device as in Aizawa can be reduced through use of a less bright and, hence, lower power-consuming LED." *Id.* at 23 (citing, e.g., Ex. 1003 ¶ 72).

Petitioner provides "[a] n example implementation of adding an additional ring of detectors to Aizawa, as per Mendelson-2003," which is reproduced below.



Pet. 24 (citing, e.g., Ex. 1003 ¶ 73). Petitioner's modified and annotated figure depicts Aizawa's sensor with Aizawa's first set of photodiodes (depicted as connected by a green ring) and modified to include a second set of photodiodes as taught by Mendelson-2003 (depicted as connected by a red ring). Pet. 23–24, 42–43, 49–50. Petitioner contends this would have been the use of a known solution to improve similar systems in the same way, which "would have led to predictable [results] without significantly altering or hindering the functions performed by Aizawa's sensor," especially where Aizawa itself discloses adding extra detectors to improve light collection efficiency. *Id.* at 24–25 (citing, e.g., Ex. 1003 ¶ 74).

Patent Owner's Arguments

Patent Owner's arguments address limitations [c]–[e] and [g]–[i] together. *See* PO Resp. 19–21, 54–66. As such, Patent Owner's arguments, the parties' Reply and Sur-reply briefing, and our analyses, are presented below in connection with limitations [e] and [h]. *See infra* § II.D.5.iv.

iv. "[e] the photodiodes of the first set of photodiodes are connected to one another in parallel to provide a first signal stream responsive to light from at least one of the one or more light emitters attenuated by body tissue;"
and
"[h] the photodiodes of the second set of photodiodes are connected to one another in parallel to provide a second signal stream responsive to light from at least one of the one or more light emitters attenuated by body tissue"

Petitioner's Undisputed Contentions

Petitioner contends that a signal stream is sent from Aizawa's set of photodetectors 22 to drive detection circuit 24, which amplifies the outputs of the photodetectors. Pet. 18–19 (citing, e.g., Ex. 1006 ¶ 23; Ex. 1003 ¶ 67).

Patent Owner does not dispute this contention, and we agree with Petitioner. Aizawa discloses that "drive detection circuit 24 [is] for detecting a pulse wave by amplifying the outputs of the photodetectors 22." Ex. 1006 ¶ 23.

Petitioner additionally contends that Mendelson-2003 teaches that each set of photodiodes, i.e., its near ring and far ring, are wired in parallel, thereby providing a distinct signal stream for each ring. Pet. 21, 44–45 (citing, e.g., Ex. 1024, 3017).

Patent Owner does not dispute this contention regarding what Mendelson-2003 discloses, and we agree with Petitioner. Mendelson-2003 teaches that "[e]ach cluster of six PDs were wired in parallel and connected through a central hub to the common summing input of a current-to-voltage converter." Ex. 1024, 3017.

<u>Petitioner's Disputed Contentions</u>

In view of these teachings, Petitioner contends that a person of ordinary skill in the art "would have recognized and/or found it obvious that the first set of photodiodes [in the modified system of Aizawa and Mendelson-2003, *see supra* § II.D.5.iii] are connected to one another in parallel to provide a first signal stream in the manner claimed," and the photodiodes in the second/outer ring (i.e., second set of photodiodes) "are connected to one another in parallel to provide a second signal stream," as taught by Mendelson-2003. Pet. 44–45, 50 (citing, e.g., Ex. 1003 ¶¶ 103–110), 21–22 (citing, e.g., Ex. 1003 ¶ 71). Petitioner contends this "would have led to predictable results without significantly altering or hindering the functions performed by Aizawa's sensor." *Id.* at 24–25 (citing, e.g., Ex. 1003 ¶ 75).

According to Petitioner, this arrangement would have provided known benefits. Pet. 44–48. For example, Petitioner contends that a person of ordinary skill in the art "would have known that connecting multiple photodiodes together in parallel allows the current generated by the multiple photodiodes in [each] set/ring to be added to one another, thereby resulting in a larger total current akin to what would be generated from a single, large detector." *Id.* at 44. According to Petitioner, this was "a routine and conventional design choice." *Id.* at 45. Further, "monitoring each signal stream (from each ring of detectors) separately allows the system to determine when the sensor device is so severely located that its position should be adjusted," and can help detect motion artifacts. *Id.* at 45–46 (citing Ex. 1003 ¶ 104).

Petitioner also argues that a person of skill in the art would have known that "the photodiodes in the far ring (i.e., second set of photodiodes) would receive reflected light having a lower intensity than that received by the photodiodes in the near ring (i.e., first set of photodiodes) and would have been motivated and found it obvious to account for this discrepancy," e.g., by "keep[ing] each ring separately wired and connected to its own amplifier . . . to thereby keep the magnitude of the current signals provided by each ring approximately the same before being combined and transmitted to the arithmetic circuit 3." *Id.* at 46–48 (citing Ex. 1003 ¶¶ 105–106); *id.* at 50 (citing Ex. 1003 ¶ 110).

<u>Patent Owner's Arguments</u>

Patent Owner disputes Petitioner's contentions that it would have been obvious (1) to modify Aizawa to include a second set of at least four photodiodes, and (2) to wire the photodiodes of the first set in parallel to provide a first signal stream and to wire the photodiodes of the second set in parallel to provide a second signal stream. PO Resp. 54–66; Sur-reply 23–29.

First, Patent Owner argues this proposed modification changes Aizawa's principle of operation. Specifically, Patent Owner claims that "Aizawa's approach monitors different individual detector signals and calculates pulse rate based on each individual photodetector signal" and, in contrast to the proposed modification, "does not measure aggregated signals from detectors connected in parallel." PO Resp. 56 (citing Ex. 1006 ¶¶ 7, 19, 23, 27–29, 32, 36; Ex. 2004 ¶ 102; Ex. 2026, 76:13–22, 79:22–80:3). According to Patent Owner, the proposed modification "eliminates Aizawa's ***core feature***—the ability to monitor pulse using the output of each ***individual*** detector, which Aizawa indicates avoids displacement problems." *Id.* at 57–58 (citing, e.g., Ex. 2004 ¶¶ 104–105).

Second, Patent Owner argues this proposed modification would have resulted in increased power consumption. *Id.* at 58. According to Patent Owner, Mendelson-2003 states that its power savings is caused by "increasing the ***number of detectors*** and thus the detector area, not the two-ring structure." *Id.* at 58–59 (citing Ex. 1024, 3017; Ex. 2004 ¶ 106). Moreover, Patent Owner argues that Aizawa already discloses a way to improve detection efficiency—by including eight detectors in a single ring. *Id.* at 59 (citing Ex. 1006 ¶ 32, Fig. 4A; Ex. 2004 ¶ 107). In light of this teaching, Patent Owner argues that adding a second ring is unfounded and unnecessary, especially where the second ring of detectors "would receive substantially lower light intensity requiring greater power consumption to utilize than additional detectors added to the 'inner' ring." *Id.* at 59–61 (citing, e.g., Ex. 2004 ¶¶ 108–109; Ex. 2026, 55:7–17, 56:6–16, 59:14–60:7, 100:6–101,6, 102:5–17, 112:3–16). "Petitioner never explains why, given these straightforward options to increase signal strength, a [person of ordinary skill in the art] would instead add an entire new circle of detectors farther from the emitter." *Id.* at 61.

Third, Patent Owner argues that Mendelson-2003 provides only an experimental detector configuration, which would fail to provide the alleged benefits. Specifically, Patent Owner argues that Mendelson-2003 "uses its particular configuration for specific experiments comparing light intensity and LED drive currents for detectors arranged different distances from central emitters," and "teaches no benefits for this arrangement in practice." *Id.* at 62–63 (citing Ex. 1024, 3019; Ex. 2004 ¶¶ 111–112). To the contrary, Patent Owner alleges that Mendelson-2003 actually prefers a single detector ring that outputs a single signal stream: "Mendelson 2003 explains it 'combin[ed] both PD sets to simulate ***a single*** large PD area,' and notes 'battery longevity could be extended considerably by employing ***a*** wide annular PD,' which has a single signal stream—not two different signal streams from two different parallel-connected rings." *Id.* at 62 (citing, e.g., Ex. 2026, 87:8–88:1, 91:15–92:7).[5] Thus, according to Patent Owner, even if a skilled artisan would have added a second ring of detectors to Aizawa,

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[5] Patent Owner also criticizes the Petition's discussion of another reference, Mendelson '799 (Ex. 1025), which is not included in Petitioner's identification of the asserted ground of unpatentability. PO Resp. 62–64; Sur-reply 28–29. We discern no error in Petitioner's identification of Mendelson '799. The nature of Petitioner's reliance on Mendelson '799 in support of this ground is explained clearly in the Petition, even if Mendelson '799 is not listed as an additional reference in the identification of the ground. Thus, the Petition complies with 35 U.S.C. § 312(a)(3) (stating an IPR petition must "identif[y], in writing and with particularity . . . the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge").

they "would not have kept the first and second ring of detectors ***separate*** or separately amplified the aggregated signals"; instead, they would have "combin[ed] both PD sets to simulate ***a single*** large PD area," where "battery longevity could be extended considerably by employing ***a*** wide annular PD." *Id.* at 65 (quoting Ex. 1024, 3019; citing Ex. 2004 ¶ 116).

Finally, Patent Owner argues that the proposed combination "introduces signal processing problems requiring a ***further*** redesign for Aizawa's sensor" to include a second amplifier to account for signals of different strengths between the near and far rings. *Id.* at 64–65 (citing Ex. 2004 ¶ 115). Patent Owner alleges this demonstrates that a skilled artisan would not have added a second ring of detectors, as proposed, but instead would have increased the number of detectors in Aizawa's single ring. *Id.* at 65.

<u>Petitioner's Reply</u>

Petitioner replies that Patent Owner mischaracterizes Aizawa's principle of operation. Pet. Reply 31–33. Specifically, Petitioner contends that Aizawa's detector ring is connected in parallel, or at least that a person of ordinary skill in the art would have recognized that parallel connection would have been a known implementation detail, which allows a signal to be detected even if one of the multiple sensors is displaced on the user. *Id.* at 32 (citing Ex. 1003 ¶¶ 102–103; Ex. 1060 ¶ 62; Ex. 2026, 72:3–9). Moreover, Petitioner argues that Aizawa lacks any disclosure of individually monitoring signals from each photodetector. *Id.* at 33.

Petitioner reiterates its position that adding a second ring would collect a bigger portion of backscattered light, and would motivate the proposed combination. *Id.* at 33 (citing, e.g., Ex. 1060 ¶¶ 64–66). Petitioner also disputes that such a modification would increase power, noting that it is the emitters, not the detectors, that consume most power in the system. *Id.* at 34 (citing, e.g., Ex. 1060 ¶ 67). Moreover, Petitioner contends that by widening the detection area with a second ring, the system would capture additional light which would allow a lower brightness, and lower power, emitter to be used. *Id.* at 24–35.

Petitioner disputes Patent Owner's characterization of Mendelson-2003 as purely experimental, and alleges that Mendelson-2003 makes clear that employing two rings outputting two signal streams is equivalent to employing a wider single ring of detectors, and provides associated benefits. *Id.* at 35–37 (citing, e.g., Ex. 1060 ¶¶ 70–71).

Patent Owner's Sur-reply

Patent Owner reiterates its position that Aizawa concerns individual monitoring, which Patent Owner alleges is a "key feature of Aizawa's sensor," in order to avoid problems associated with sensor displacement. Sur-reply 23–25. Patent Owner also reiterates its positions that the proposed modified sensor would consume more power, and that Aizawa's disclosed embodiment with eight detectors in a single ring would have been preferred. *Id.* at 25–29.

Analysis

We have considered the parties' arguments and cited evidence, and we are persuaded by Petitioner's contentions. As discussed above, Aizawa discloses a sensor with a first set of four phototransistors 22 as claimed, which are disposed in a single ring around central emitter 21. Ex. 1006 ¶ 23, Figs. 1(a)–1(b). Mendelson-2003 teaches a sensor with a dual-ring configuration, where a first inner ring includes six photodetectors, and a second outer ring includes an additional six photodetectors. Ex. 1024, 3017, Fig. 1. Mendelson-2003 also states that by using this dual-ring configuration to simulate a wide photodetector area, stronger signals could be obtained, drive currents could be reduced, and battery life could be extended. *Id.* at 3019, Figs. 3, 4.

In light of these explicit teachings, we are persuaded by Petitioner's contention that a person of ordinary skill in the art would have found it obvious to include a second set of detectors in Aizawa's sensor, as taught by Mendelson-2003, to realize the benefits taught by Mendelson-2003, i.e., stronger signals with reduced power consumption. Pet. 21–23, 44–46. We credit Dr. Kenny's testimony that this would have been the use of a known solution—a sensor with dual detector rings as taught by Mendelson-2003—to improve similar systems—Aizawa's sensor with one detector ring—in the same way, which "would have led to predictable results without significantly altering or hindering the functions performed by Aizawa's sensor," especially where Aizawa itself discloses adding extra detectors to improve light collection efficiency. Ex. 1003 ¶ 75.

We also credit Dr. Kenny's testimony that, as taught by Mendelson-2003, it would have been obvious to connect the photodetectors of each set in parallel to provide first and second signal streams, respectively, and that this would have led to predictable results. Ex. 1003 ¶ 74 (predictable), 93–103 (first set), 110 (second set). Indeed, the two rings taught by Mendelson-2003 are disclosed as being "wired in parallel and connected through a central hub to the common summing input of a current-to-voltage converter." Ex. 1024, 3017. Dr. Kenny explains numerous advantages associated the parallel connections taught by Mendelson-2003, such as monitoring for displacement, accounting for motion artifacts, and compensating for the relative decrease in light that reaches the outer ring, which cannot be achieved with a single signal stream. Ex. 1003 ¶¶ 101–106.

We have considered Patent Owner's arguments but find them to be misplaced. First, we do not agree that Aizawa discloses the ability to individually monitor individual detectors as a "key feature" (PO Resp. 55; Sur-reply 24) of its sensor. We discern no persuasive support for this position in Aizawa. Aizawa does not discuss individual monitoring at all, at least not clearly, and does not discuss individual monitoring as a solution to sensor displacement. Rather, Aizawa explains that its sensor includes four photodetectors 22 and that "reflected light is detected by the plurality of photodetectors 22." Ex. 1006 ¶¶ 23, 27. Aizawa also explains that its sensor includes a "drive detection circuit 24 for detecting a pulse wave by amplifying the outputs of the photodetectors 22." *Id.* ¶ 23. These disclosures indicate that Aizawa does not monitor each photodetector 22 individually to ascertain the pulse wave but, rather, utilizes "the outputs" of *all* of the photodetectors together.

This understanding is consistent with Aizawa's disclosure of sensor displacement. As Patent Owner correctly notes, Aizawa recognizes a problem with sensor displacement, in which "no output signal can be obtained" if the sensor's detectors are placed away from an artery. *Id.* ¶ 7. Aizawa solves this problem by avoiding a "linear[]" detector arrangement, such that "[e]ven when the attachment position of the sensor is dislocated, a pulse wave can be detected accurately." *Id.* ¶ 9. Indeed, Aizawa is clear that, in its preferred embodiment, it is the disposition of photodetectors 22 in "a circle concentric to the light emitting diode 21" that enables accurate pulse detection even when the sensor is dislocated. *Id.* ¶ 27. Aizawa does not discuss individual monitoring in relation to sensor dislocation.

We have examined Patent Owner's alleged support for the importance of individual monitoring and find it lacking. *See, e.g.*, PO Resp. 56 (citing Ex. 1006 ¶¶ 7, 19, 23, 27–29, 32, 36; Ex. 2004 ¶ 102; Ex. 2026, 76:13–22, 79:22–80:3). Patent Owner identifies Figure 3, which depicts a "diagram of a pulse wave which is the output of *a photodetector*." Ex. 1006 ¶¶ 19 (emphasis added), 28 ("the above photodetector 22"). Patent Owner seems to place importance on the use of the article "a" or "the" photodetector, in the singular. PO Resp. 56; Sur-reply 24. However, we discern no significance in the singular use. In discussing this Figure, Aizawa does not discuss monitoring an individual photodetector, or describe that as a "key feature"; instead, Aizawa explains that drive detection circuit 24 amplifies the detected pulse wave and transmits it to arithmetic circuit 3, which compares it to a threshold value to calculate a pulse rate. Ex. 1006 ¶ 28. We discern that this discussion of how the circuits process a signal from "a" (or "the") photodetector is merely exemplary of the process; Patent Owner has not pointed to any persuasive support for its position that this somehow indicates a "key feature" of Aizawa is individual monitoring. As noted above, Aizawa plainly discloses that it is the signals from *the plurality* of photodetectors that is used to determine a pulse wave. *Id.* ¶¶ 23, 27. Nothing in Figure 3 or paragraph 28 clearly contradicts that disclosure.

We have considered the cited testimony of Dr. Madisetti, which Patent Owner relies upon as support for its position, but we find it lacking as well. Dr. Madisetti's testimony includes the same citations presented by

Patent Owner, none of which demonstrates individual monitoring. Ex. 2004 ¶ 102. Thus, we determine this testimony to be conclusory and entitled to little weight.

We do recognize, as did Dr. Kenny during his deposition, that Aizawa does not provide extensive discussion of the algorithms through which Aizawa determines a pulse wave. *See, e.g.*, Ex. 2026, 80:8–18 ("It doesn't describe the algorithm in detail. It just says amplifies the signals from the detectors and then performs whatever function takes place inside the arithmetic circuit. . . . It's left for one of ordinary skill in the art to process the waveforms."). Nonetheless, we decline Patent Owner's invitation to import into Aizawa's disclosure a "key feature" of individual monitoring that is not identified by Aizawa with any reasonable clarity. Again, as noted above, Dr. Madisetti provides no further support for the conclusory position advanced by Patent Owner.

By contrast, we credit Dr. Kenny's testimony, which is consistent with Aizawa's express disclosure of detecting a pulse wave from "the plurality of photodetectors" (Ex. 1006 ¶ 27), that:

> connecting multiple photodetectors together in parallel allows the current generated by the multiple photodetectors to be added to one another, which would subsequently ensure that even if one of multiple sensors connected in parallel were to be displaced so as to receive no signal, the fact that all the sensors are connected in parallel such that their signals are summed means that a signal will still be detected, in accordance with Aizawa's objective.

Ex. 1060 ¶ 62. Moreover, we agree with Dr. Kenny that "there is no disclosure anywhere in Aizawa to suggest that it is even capable of somehow monitoring the signals of each photodetector, and there is certainly no need to do so if its sensors are connected in parallel." *Id.* Thus, considering the express disclosure of Aizawa and the competing testimony of the parties' experts, we credit that of Dr. Kenny.

Patent Owner's second argument—that the proposed modification would have resulted in increased power consumption—is plainly contradicted by Mendelson-2003's disclosure. Table 1 of Mendelson-2003 is reproduced below.

Table 1. Comparison of estimated battery life for different PD configurations. Values based on forehead measurements for a typical 220mAhr coin size battery.

PD CONFIGURATION	BATTERY LIFE [Days]
Near	45.8
Far	20.3
Near+Far	52.5

Table 1 includes three rows, each associating a different photodetector configuration with an estimated battery life. Ex. 1024, 3019. The table indicates that a configuration consisting of only a near ring of photodetectors results in 45.8 days of battery life; a configuration consisting of only a far ring of photodetectors results in 20.3 days of battery life; and a configuration consisting of both a near ring and a far ring of photodetectors results in 52.5 days of battery life. *Id.* In describing this table, Mendelson-2003 states, "the considerable differences in the estimated power consumptions clearly points out the practical advantage gained by using a reflection sensor comprising a large ring-shaped PD area to perform SpO_2 measurements," which in this case, was realized by the combination of a near and far ring of detectors, akin to the modification proposed by Petitioner. *Id.* Thus, we do not agree with Patent Owner's argument that power consumption would increase if a second ring of detectors were added to Aizawa's sensor; Mendelson-2003 plainly suggests the opposite and supports Petitioner's contention that the proposed modification would result in a power savings over a single ring.

We also do not agree with the argument that a person of ordinary skill in the art would not make the proposed modification because Aizawa already discloses a way to improve detection efficiency, e.g., by including more detectors in a single ring. PO Resp. 59 (citing Ex. 1006 ¶ 32, Fig. 4A; Ex. 2004 ¶ 107). Aizawa explains that the photodetector arrangement of its single-ring preferred embodiment "is not limited" and suggests, "[f]or example," that "the number of photodetectors 22 may be increased." Ex. 1006 ¶ 32. Aizawa does not limit the increase in photodetectors to being included in only the existing single ring of detectors, i.e., the first set. Nothing in this disclosure teaches against adding a second set, as proposed by Petitioner for the well-supported reasons identified in Mendelson-2003 and further discussed by Dr. Kenny.

Patent Owner's third argument—that Mendelson-2003 is experimental and would not provide the alleged benefits—likewise fails. Patent Owner's suggestion that Mendelson-2003 teaches using a single large, wide detector ring that outputs a single signal stream is unfounded. The analysis provided in Mendelson-2003 explicitly compares a dual-ring arrangement to both a single near ring and a single far ring. *See, e.g.*, Ex. 1024, Figs. 3, 4, Table 1 (all comparing near, far, and near + far arrangements). Mendelson-2003 explains that the dual-ring arrangement "simulate[s] a single large PD area" and realizes benefits in LED power requirements. *Id.* at 3019. That Mendelson-2003 *simulates* a single ring by using two discrete rings demonstrates the fallacy of Patent Owner's argument.

Finally, we disagree with Patent Owner's argument that a person of ordinary skill in the art would not have made the proposed combination because it "introduces signal processing problems requiring a ***further*** redesign for Aizawa's sensor" to include a second amplifier to account for signals of different strengths between the near and far rings. PO Resp. 64–65. A person of ordinary skill in the art must be presumed to understand something about the art beyond what is disclosed in the references. *See In re Jacoby*, 309 F.2d 513, 516 (CCPA 1962). After all, "[a] person of ordinary skill is also a person of ordinary creativity, not an automaton." *KSR*, 550 U.S. at 421. Neither Patent Owner nor Dr. Madisetti assert that adding a second amplifier would be beyond the level of skill in the art or would introduce any specific problems, beyond its mere addition. We credit Dr. Kenny's testimony that a person of ordinary skill would have recognized that, in order to account for the disparate currents generated by the two rings, the rings would be separately wired with separate amplifiers (Ex. 1003 ¶ 106) and that this would have been a routine and conventional design choice, within the level of ordinary skill in the art (*id.* ¶ 103).

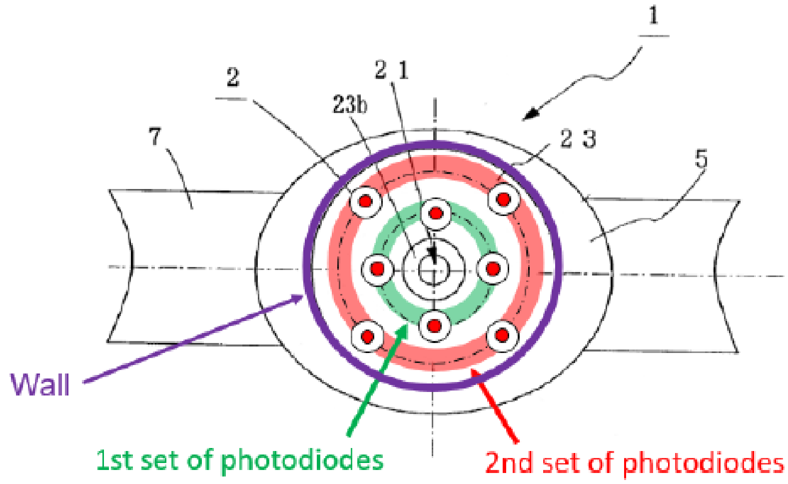
For the foregoing reasons, we are persuaded by Petitioner's contentions.

v. "[i] at least one of the first signal stream or the second signal stream includes information usable to determine a physiological parameter of a wearer of the noninvasive physiological parameter measurement device;"

The cited evidence supports Petitioner's undisputed contention that Aizawa discloses a signal stream usable to determine at least pulse rate. Pet. 43–48, 51. Petitioner contends that "Aizawa teaches that a 'drive detection circuit 24' is used for 'amplifying the outputs [*i.e.*, signal stream] of the photodetectors' and transmitting the amplified data to the arithmetic circuit 3, which computes the pulse rate, which is a physiological parameter." Pet. 51 (quoting Ex. 1006 ¶¶ 23, 28) (citing Ex. 1003 ¶ 111 ("Because the signal stream from Aizawa's detectors can be used to calculate pulse rate, it represents information usable to determine a physiological parameter of a wearer of the noninvasive physiological parameter measurement device.")).

vi. "[j] a wall extending from the surface and configured to surround at least the first and second sets of photodiodes; and"

The cited evidence also supports Petitioner's undisputed contention that Aizawa discloses a wall that surrounds the photodiodes, including the second set as suggested by the combined teachings of Aizawa and Mendelson-2003. Pet. 51–52; *see, e.g.*, Ex. 1006 ¶ 23 ("holder 23 for storing" LED 21 and detectors 22), Fig. 1(b) (depicting periphery of holder 23 surrounding the sensor components, including detectors 22, which are positioned on a surface); Ex. 1003 ¶¶ 100–102, 112. Petitioner contends that "[t]he outer periphery of Aizawa's holder 23 provides a circular wall (purple) that surrounds at least the first and second sets of photodiodes," and provides an annotated version of Aizawa's Figure 1(a), which is reproduced below.



Petitioner's modified and annotated Figure 1(a) of Aizawa depicts a wall (purple) surrounding both the first set of photodiodes and the second set of photodiodes. Pet. 52. Petitioner likewise contends that the identified wall extends from the surface of the substrate. *Id.* These undisputed contentions are sufficiently supported.

vii. "[k] a cover arranged to cover at least a portion of the surface of the substrate, wherein the cover comprises a protrusion that extends over all of the photodiodes of the first and second sets of photodiodes arranged on the surface, and wherein the cover is further configured to cover the wall."

Petitioner's Undisputed Contentions

Petitioner contends that Aizawa "teaches a light permeable cover in the form of an acrylic transparent plate 6 . . . that is mounted at the detection face 23a" of the sensor, i.e., above Aizawa's photodetectors, to provide "improved adhesion between the detector and the wrist to 'further improv[e] the detection efficiency of a pulse wave.'" Pet. 10–11 (citing Ex. 1006 ¶ 30, Fig. 1(b); Ex. 1003 ¶¶ 52–53). Patent Owner does not dispute this contention, and we agree with Petitioner. Aizawa discloses that "acrylic transparent plate 6 is provided on the detection face 23a of the holder 23 to improve adhesion to the wrist 10." Ex. 1006 ¶ 34, Fig. 1(b) (depicting transparent plate 6 between sensor 2 and wrist 10).

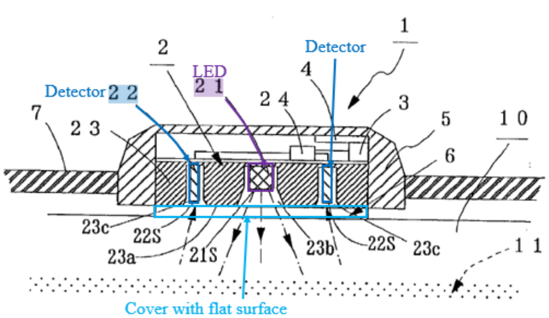
Petitioner also contends that Ohsaki teaches a wrist-worn sensor that includes a "translucent board" having a convex surface that contacts the user's skin to prevent slippage of the sensor. Pet. 14, 26–27 (citing Ex. 1014 ¶¶ 9–10). Patent Owner does not dispute this contention, and we agree with Petitioner. Ohsaki discloses that sensor 1 includes detecting element 2 and sensor body 3, and is "worn on the back side of the user's wrist 4." Ex. 1014 ¶ 16. Ohsaki discloses that detecting element 2 includes package 5 and "translucent board 8[,which] is a glass board which is transparent to light, and [is] attached to the opening of the package 5. A convex surface is formed on the top of the translucent board 8." *Id.* ¶ 17. As seen in Ohsaki's Figure 2, translucent board 8 has a single protruding convex surface, which is placed between a user's tissue and a light receiving element (e.g., photodetector) 7 when the sensor is worn. *Id.* at Fig. 2. As also seen in Figure 2, the board 8 is operably connected to the walls of sensor package 5. *Id.* ¶ 17 ("The translucent board 8 is . . . attached to the opening of the package 5."), Fig. 2.

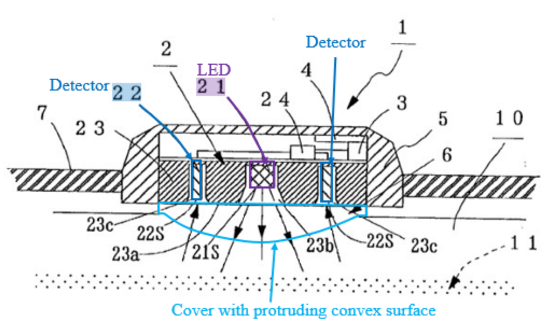
<u>Petitioner's Disputed Contentions</u>

Petitioner further contends that a person of ordinary skill in the art "would have found it obvious to modify Aizawa's sensor to include a cover having a protruding convex surface," so as to (1) improve adhesion between the user's wrist and the sensor's surface, (2) improve detection efficiency, and (3) protect the elements within sensor housing. Pet. 25–29 (citing, e.g., Ex. 1003 ¶¶ 76–80; Ex. 1014 ¶ 25). Petitioner contends that Ohsaki's convex surface is in "intimate contact" with the user's skin, which prevents slippage of the sensor and increases signal strength because "variation of the amount of the reflected light . . . that reaches the light receiving element 7 is suppressed" and because "the pulse wave can be detected without being affected by the movement of the user's wrist 4," as compared to a sensor with a flat surface. *Id.* at 26–28 (citing, e.g., Ex. 1003 ¶ 78; quoting Ex. 1014 ¶¶ 15, 17, 25, Figs. 1, 2, 4A, 4B). Accordingly, Petitioner contends that a person of ordinary skill in the art would have modified Aizawa's sensor to include a cover with a protruding convex surface, as taught by Ohsaki, that is "between a subject's wrist and a surface of the sensor." Pet. 25–29 (citing, e.g., Ex. 1003 ¶¶ 76–80).

Petitioner contends this modification would have been "nothing more than the use of a known technique to improve similar devices in the same way," i.e., when Ohsaki's sensor is worn "'the convex surface of the translucent board . . . is in intimate contact with the . . . user's skin'; this contact . . . prevents slippage, which increases the strength of the signals obtainable by Ohsaki's sensor." Pet. 26–29 (citing Ex. 1003 ¶¶ 77–80).

To illustrate its proposed modification, Petitioner includes two annotated versions of Aizawa's Figure 1(b), both of which are reproduced below. Pet. 25–29 (citing Ex. 1003 ¶¶ 76–80).





Petitioner's annotated figure on the left depicts Aizawa's sensor, modified to include a flat "acrylic transparent plate" (illustrated with blue outline); Petitioner's annotated figure on the right depicts Aizawa's sensor, modified to include a "cover with protruding convex surface" (illustrated with blue outline). Pet. 29.

Patent Owner's Arguments

Patent Owner argues that a person of ordinary skill in the art would not have been motivated to modify Aizawa's sensor to include Ohsaki's convex cover. PO Resp. 11–18, 22–54;[6] Sur-reply 3–23.

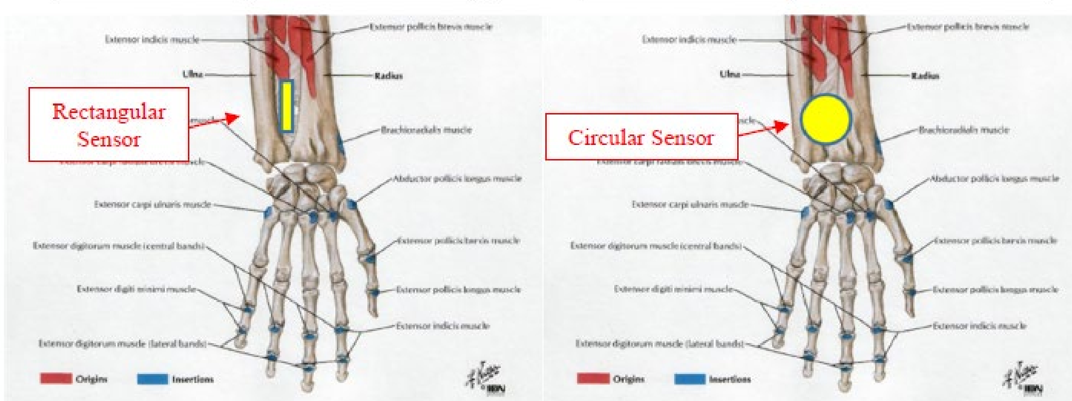
First, Patent Owner argues "Ohsaki's rectangular board would be incompatible with Aizawa's circular sensor arrangement" and that the proposed modification "eliminates the longitudinal shape that Ohsaki specifically identifies as important for the benefit of reducing slipping." PO Resp. 23–25 (emphases omitted). This argument is premised on Patent Owner's contention that Ohsaki's convex cover must be rectangular, with the cover's long direction aligned with the length of the user's forearm, to

[6] As an initial matter, Patent Owner observes that Petitioner "[r]eli[es] on a non-ground reference, Inokawa" (Ex. 1008), as providing the rationale for the proposed modification of Aizawa in view of Ohsaki, and as providing implementation details of the combination. PO Resp. 22–23 (citing Pet. 30–31); *id.* at 45–46, 51–52. We discern no error in Petitioner's identification of Inokawa. The nature of Petitioner's reliance on Inokawa in support of this ground is explained clearly in the Petition, even if Inokawa is not listed as an additional reference in the identification of the ground. Thus, the Petition complies with 35 U.S.C. § 312(a)(3) (stating an IPR petition must "identif[y], in writing and with particularity . . . the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge").

avoid interacting with bones in the wrist and forearm. *Id.* at 25–30 (citing, e.g., Ex. 2004 ¶¶ 55–62; Ex. 1014 ¶¶ 6, 19, 23–25); *see also* Sur-reply 3–11. According to Patent Owner, Ohsaki teaches that "aligning the sensor's longitudinal direction with the circumferential direction of the user's arm undesirably results in 'a tendency [for Ohsaki's sensor] to slip off.'" PO Resp. 26 (emphasis omitted) (alteration in original) (citing Ex. 1014 ¶ 19).

Thus, Patent Owner contends that Petitioner's proposed modification would "chang[e] Ohsaki's longitudinal detecting element and rectangular board into a circular shape," which "would eliminate the advantages discussed above" because it "cannot be placed in any longitudinal direction and thus cannot coincide with the longitudinal direction of the user's wrist." *Id.* at 27 (emphases omitted) (citing Ex. 2004 ¶¶ 57–58). Patent Owner presents annotated Figures depicting what it contends is Ohsaki's disclosed sensor placement as compared to that of the proposed modification, reproduced below.

Ohsaki's Longitudinal Teachings | Petitioner's Proposed Combination



Patent Owner's annotated Figure on the left depicts a rectangular sensor placed between a user's radius and ulna, while Patent Owner's annotated Figure on the right depicts a circular sensor placed across a user's radius and ulna. Based on these annotations, Patent Owner argues that the proposed "circular shape would press on the user's arm in all directions and thus cannot avoid undesirable interaction with the user's bone structure," such that a skilled artisan "would have understood that any such change would eliminate any benefit of Ohsaki's board for preventing slipping." PO Resp. 28–30 (citing, e.g., Ex. 2004 ¶¶ 55–62).[7]

Patent Owner additionally argues that changing Aizawa's circular sensor to accommodate Ohsaki's longitudinal structure "would redirect light away from some detectors and towards others" and would "disrupt Aizawa's sensor's circular symmetry." *Id.* at 30–32. This argument is premised on Patent Owner's contention that Ohsaki's convex cover must be rectangular. *Id.* at 30 (citing Ex. 2004 ¶¶ 63–64). According to Patent Owner, "placing Ohsaki's rectangular board onto Aizawa's circular sensor would result in undesirable asymmetrical pressure and inconsistent contact at the peripheral edge where Aizawa's detectors are located," which would "create air gaps over some of Aizawa's peripherally arrayed detectors, but not others, which could result in degraded optical signals." *Id.* at 31–32 (emphasis omitted) (citing Ex. 2004 ¶¶ 65–66). Thus, Patent Owner argues that a person of ordinary skill in the art "would not have been motivated to use Ohsaki's rectangular board with Aizawa's circular sensor." *Id.* at 32 (citing Ex. 2004 ¶¶ 65–66).

[7] Patent Owner further argues, "[t]o the extent Petitioner contends a [person of ordinary skill in the art] would use Ohsaki's rectangular board on Aizawa's circular sensor . . . that argument is unsupported and incorrect." PO Resp. 30. We do not read the Petition as making such a contention. We understand Petitioner to propose, in essence, changing Aizawa's circular *flat* cover into a circular *convex* cover. *See, e.g.*, Pet. 28–29.

Second, Patent Owner argues that Ohsaki requires its sensor be placed on the back of the user's wrist to achieve any benefits, but that such a location would have been unsuitable for Aizawa's sensor. PO Resp. 33. Specifically, Patent Owner argues that Aizawa's sensor must be worn on the palm side of the wrist, close to radial and ulnar arteries, which is the side opposite from where Ohsaki's sensor is worn. *Id.* at 33–42 (citing, e.g., Ex. 1006 ¶¶ 2, 7, 9, 26, 27, 36; Ex. 2004 ¶¶ 68–81). According to Patent Owner, Ohsaki teaches that the sensor's convex surface has a tendency to slip when placed on the palm side of the wrist, i.e., in the location taught by Aizawa. *Id.* at 39–42 (citing, e.g., Ex. 1014 ¶¶ 19, 23–24; Ex. 2004 ¶¶ 75–81). Thus, Patent Owner argues that a person of ordinary skill in the art "would not have been motivated to use Ohsaki's longitudinal board—designed to be worn on the back side of a user's wrist—with Aizawa's palm-side sensor." *Id.* at 42 (emphases omitted). Similarly, Patent Owner argues that Aizawa teaches away from the proposed modification because Aizawa teaches that its flat acrylic plate improves adhesion on the palm side of the wrist, while Ohsaki teaches that its convex board "has a tendency to slip" on the palm side of the wrist. *Id.* at 33–39 (citing, e.g., Ex. 2004 ¶¶ 67–74).

Third, Patent Owner argues that a person of ordinary skill in the art would not have placed Ohsaki's convex cover over Aizawa's peripheral detectors because the convex cover would condense light toward the center and away from Aizawa's detectors, which would decrease optical signal strength. PO Resp. 45–53 (citing, e.g., Ex. 2004 ¶¶ 86–97). Patent Owner also contends that Petitioner and Dr. Kenny admitted as much in a related proceeding. *Id.* at 46–47 (citing, e.g., Ex. 2019, 45; Ex. 2020, 69–70). Patent Owner also relies on Figure 14B of the '366 patent to support its position. *Id.* at 47–48 (citing Ex. 1001, 36:3–6, 36:13–15). In light of the foregoing, Patent Owner argues that a person of ordinary skill in the art would have understood that the proposed modification would have decreased signal strength by directing light away from Aizawa's peripheral detectors. *Id.* at 47.

Fourth and finally, Patent Owner argues that a person of ordinary skill in the art "would have understood that Aizawa's flat plate would provide better protection than a convex surface" because it "would be less prone to scratches." *Id.* at 53–54 (emphasis omitted) (citing Ex. 1008 ¶ 106; Ex. 2004 ¶¶ 98–99).

<u>Petitioner's Reply</u>

Concerning Patent Owner's first and second arguments, Petitioner responds that Ohsaki does not disclose the shape of its protrusion, other than its convexity as shown in Figures 1 and 2, nor does Ohsaki require a rectangular shape or placement on the back of the wrist in order to achieve the disclosed benefits. Pet. Reply 8–20 (citing, e.g., Ex. 1060 ¶¶ 7–30). Moreover, Petitioner asserts that "[e]ven if Ohsaki's translucent board 8 were understood to be rectangular, obviousness does not require 'bodily incorporation' of features from one reference into another"; rather, a person of ordinary skill in the art "would have been fully capable of modifying Aizawa to feature a light permeable protruding convex cover to obtain the benefits" taught by Ohsaki. *Id.* at 16 (citing, e.g., Ex. 1060 ¶ 23). Similarly, regarding the location of the sensor, Petitioner asserts,

> [E]ven assuming for the sake of argument that a [person of ordinary skill in the art] would have understood Aizawa's sensor as being limited to placement on the backside of the wrist, and would have understood Ohsaki's sensor's "tendency to slip"

> when arranged on the front side as informing consideration of Ohsaki's teachings with respect to Aizawa, that ***would have further motivated*** the [person of ordinary skill in the art] to implement a light permeable convex cover in Aizawa's sensor, to improve detection efficiency of that sensor when placed on the palm side.

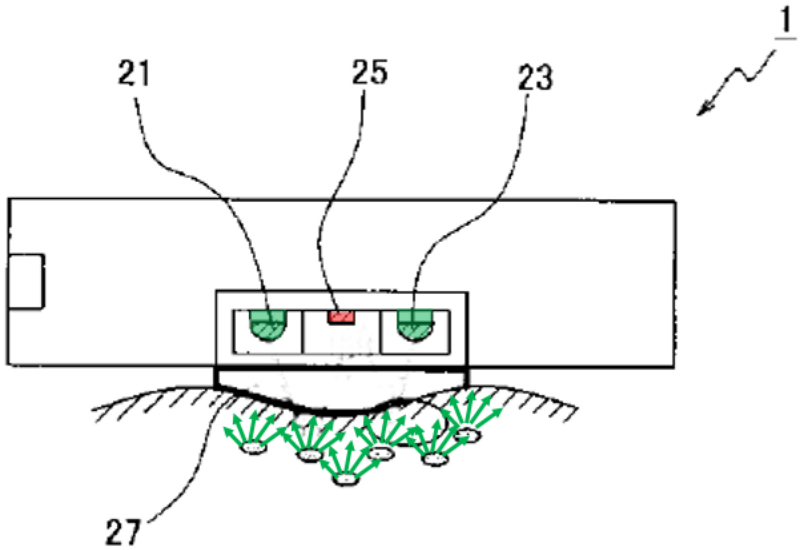
Id. at 18 (citing, e.g., Ex. 1060 ¶ 27). In other words, Ohsaki's disclosure that a convex surface suppresses variation in reflected light would have motivated an artisan to add such a surface to Aizawa to improve detection efficiency of that sensor when placed on the palm side. *Id.* at 18.

Concerning Patent Owner's third argument, Petitioner responds that adding a convex cover to Aizawa's sensor would not decrease signal strength but, instead, "would improve Aizawa's signal-to-noise ratio by causing more light backscattered from tissue to strike Aizawa's photodetectors than would have with a flat cover" because such a cover improves light concentration across the entire lens and does not direct it only towards the center. *Id.* at 20–21 (citing, e.g., Ex. 1060 ¶ 31).

Petitioner asserts that Patent Owner and Dr. Madisetti "ignore[] the well-known principle of reversibility," by which "a ray going from P to S will trace the same route as one from S to P." Pet. Reply 22 (emphasis omitted) (quoting Ex. 1061, 84, 92; Ex. 1062, 101, 110; Ex. 1053, 80:20–82:20). When applied to Aizawa's sensor, Petitioner contends that any condensing benefit achieved by a convex cover would thus direct emitted light toward Aizawa's peripheral detectors. *Id.* at 22–25 (citing, e.g., Ex. 1060 ¶¶ 35–45). Indeed, Petitioner contends this core concept of reversibility is applied in Aizawa. *Id.* at 25 (citing, e.g., Ex. 1006 ¶ 33; Ex. 1060 ¶¶ 41–44).

Petitioner also asserts that Patent Owner and Dr. Madisetti overlook the fact that light rays reflected by body tissue will be scattered and diffuse and will approach the detectors "from various random directions and angles." Pet. Reply 25–30 (citing, e.g., Ex. 1060 ¶¶ 46–59; Ex. 1061, 84 Ex. 1062, 101; Ex. 1063, 52, 86, 90; Ex. 1053, 80:20–82:20). This scattered and diffuse light, according to Petitioner, means that Ohsaki's convex cover cannot "focus[] light to the center" of the sensor device, as Patent Owner argues. *Id.* at 26. Instead, due to the random nature of this scattered light, Petitioner asserts that a person of ordinary skill in the art would have understood that "Ohsaki's convex cover provides a slight refracting effect, such that light rays that may have missed the detection area are instead directed toward that area." *Id.* at 26 (citing, e.g., Ex. 1060 ¶¶ 48–49). Petitioner applies this understanding to Aizawa, and asserts that using a cover with a convex protrusion in Aizawa would "enable backscattered light to be detected within a circular active detection area." *Id.* (citing, e.g., Ex. 1063, 86, 90).

Petitioner relies upon the following illustration of this alleged effect. Pet. Reply 29 (citing Ex. 1060 ¶ 54).



The above illustration depicts backscattered light with Aizawa's sensor reflecting off user tissue in various directions, such that it impinges upon the peripheral detectors from various random angles and directions. *Id.* According to Petitioner, this allows the detector to capture "light rays that otherwise would have missed the active detection area are instead directed toward that area." *Id.* (citing Ex. 1060 ¶ 55).

Petitioner also dismisses Patent Owner's reliance on Figure 14B of the '366 patent because it "is not a representation of light that has been reflected from a tissue measurement site." Pet. Reply 28 (citing, e.g., Ex. 1060 ¶¶ 51–52). According to Petitioner, for example, "[t]he light rays (1420) shown in FIG. 14B are collimated (i.e., parallel to one another), and each light ray's path is perpendicular to the detecting surface." *Id.*

Concerning Patent Owner's fourth argument, Petitioner responds that even if a flat surface might be less prone to scratching, that possible disadvantage would have been weighed against the "known advantages of applying Ohsaki's teachings," and would not negate a motivation to combine. *Id.* at 31 (citing, e.g., Ex. 1060 ¶ 60).

Patent Owner's Sur-reply

Concerning Patent Owner's first and second arguments, Patent Owner reiterates its position that Ohsaki's purported benefits attach only to a sensor with a rectangular convex surface that is located on the back of the wrist, and that "even small changes in sensor orientation or measurement location result in slippage." Sur-reply 1–14, 8.

Concerning Patent Owner's third argument (that the convex cover would condense light toward the center and away from Aizawa's detectors), Patent Owner asserts that Dr. Kenny and Petitioner have not overcome their admissions that a convex lens directs light toward the center. *Id.* at 14–16, 19–21. Patent Owner argues that Petitioner's Reply improperly presents several new arguments, relying on new evidence, as compared with the Petition. *Id.* at 16 (regarding reversibility), 16–19. Moreover, Patent Owner argues that Petitioner's discussion of the principle of reversibility is "irrelevant" because it "assumes conditions that are not present when tissue scatters and absorbs light." *Id.* at 16. The random nature of backscattered light, in Patent Owner's view, "hardly supports Petitioner's argument that light will necessarily travel the same paths regardless of whether the LEDs and detectors are reversed," and is irrelevant to the central issue presented here of "whether changing Aizawa's flat surface to a convex surface results in more light on Aizawa's peripherally located detectors." *Id.* at 17–18.

Patent Owner also asserts that Petitioner mischaracterizes Patent Owner's position, which is not that Ohsaki's cover with a convex protrusion "focuses ***all*** light to a single point" at the center of the sensor as Petitioner characterizes it. Sur-reply 19. Patent Owner's position, rather, is that Petitioner has not shown that a person of ordinary skill in the art "would have been motivated to change Aizawa's flat surface to a convex surface to improve signal strength." *Id.* In Patent Owner's view, by arguing that the convex cover provides only a "slight refracting effect," Petitioner undermines its contention that providing such a cover would have improved detection efficiency. *Id.* at 19–20 (emphasis omitted).

Patent Owner also argues that Petitioner's contention that a convex cover allows more light collection generally is a new theory not supported by Dr. Kenny's original declaration. *Id.* at 20. Moreover, Patent Owner argues that Petitioner's theory is "unavailing because it fails to consider the greater decrease in light at the detectors due to light redirection to a more central location." *Id.* (emphasis omitted). According to Patent Owner, any light redirected from the sensor's edge could not make up for the loss of signal strength from light redirected away from the detectors and toward the center. *Id.*

Concerning Patent Owner's fourth argument, Patent Owner argues that Petitioner does not dispute Patent Owner's position that a flat cover would be less prone to scratches and offers "***no*** plausible advantages for its asserted combination." *Id.* at 23. Moreover, Patent Owner argues that the risk of scratches undermines Petitioner's argument of adding a convex cover to protect the elements within the sensor housing. *Id.*

<u>Analysis</u>

As noted above, Petitioner provides three rationales to support its contention that a person of ordinary skill in the art would have provided "a light permeable cover with a protruding convex surface," such as that taught by Ohsaki, to Aizawa's sensor: (1) to improve adhesion between the sensor and the user's tissue, (2) to improve detection efficiency, and (3) to protect the elements within the sensor housing. Pet. 26–32 (citing, e.g., Ex. 1003 ¶¶ 76–84; Ex. 1014 ¶ 25). As further examined below, we determine all three rationales are supported by the evidence, and further that any single rationale standing alone would have been sufficient to establish a basis for the person of ordinary skill in the art to combine the references as proposed.

Rationales 1 and 2

The evidence of record persuades us that adding a convex cover, such as that taught by Ohsaki, would have improved adhesion between the sensor and the user's skin, which would have increased the signal strength of the sensor. Ohsaki teaches as much:

> [T]he convex surface of the translucent board 8 is in intimate contact with the surface of the user's skin. Thereby *it is prevented that the detecting element 2 slips off* the detecting position of the user's wrist 4. If the translucent board 8 has a flat surface, the detected pulse wave is adversely affected by the movement of the user's wrist 4 as shown in Fig. 4B. However, in the case that the translucent board 8 has a convex surface like the present embodiment, the *variation of the amount of the reflected light which is emitted from the light emitting element 6 and reaches the light receiving element 7 by being reflected by the surface of the user's skin is suppressed. It is also prevented that noise such as disturbance light from the outside penetrates the translucent board 8.* Therefore the pulse wave can be detected without being affected by the movement of the user's wrist 4 as shown in FIG. 4A.

Ex. 1014 ¶ 25 (emphasis added); *see also id.* ¶ 27 ("detecting element 2 is stably fixed").

We credit Dr. Kenny's testimony that a person of ordinary skill in the art would have been motivated by such teachings to apply a cover with a convex surface to Aizawa to improve that similar device in the same way and to yield predictable results, i.e., to resist movement of the sensor on the user's wrist and to suppress variation. *See, e.g.*, Ex. 1003 ¶¶ 77 ("[T]his contact between the convex surface and the user's skin is said to prevent slippage, which increases the strength of the signals obtainable by Ohsaki's sensor."), 79 (One of ordinary skill would have understood that this would "improve adhesion between the user's wrist and the sensor's surface, improve detection efficiency."). We find persuasive Dr. Kenny's explanation that the person of ordinary skill in the art "would have understood that a protruding convex cover would reduce the adverse effects of user movement on signals obtainable by photodetectors which are positioned to detect light reflected from user tissue." Ex. 1060 ¶ 13.

Indeed, Ohsaki expressly compares the performance of a wrist-worn pulse wave sensor depending on whether translucent board 8 is convex or flat, and concludes the convex surface results in improved performance over the flat surface, especially when the user is moving. Ex. 1014, Figs. 4A–4B, ¶¶ 15, 25 (stating that with "a flat surface, the detected pulse wave is adversely affected by the movement of the user's wrist 4," and with "a convex surface like the present embodiment, the variation of the amount of the reflected light" collected by the sensor "is suppressed"). Ohsaki also states that, with a convex surface, "[i]t is also prevented that noise such as disturbance light from the outside penetrates the translucent board 8." *Id.* ¶ 25.

We also credit Dr. Kenny's testimony that the proposed modification would have been within the skill level of an ordinary artisan. For example, Dr. Kenny testifies that one of ordinary skill would have combined the teachings of Aizawa and Ohsaki as "doing so would have amounted to nothing more than the use of a known technique to improve similar devices in the same way" and the combined elements "would each perform similar functions they had been known to perform prior to the combination." Ex. 1003 ¶ 80. In particular, one of ordinary skill would have recognized that by incorporating Ohsaki's convex surface, "'the convex surface of the translucent board . . . is in intimate contact with the surface of the user's skin'; this contact between the convex surface and the user's skin is said to prevent slippage, which increases the strength of the signals obtainable by Ohsaki's sensor." *Id.* ¶ 77 (citing Ex. 1014 ¶¶ 15, 17, 25, Figs. 1, 2, 4A, 4B).

In light of Ohsaki's express disclosure of the benefits of a convex cover, we credit Dr. Kenny's testimony that a person of ordinary skill in the art would have been motivated to modify Aizawa as proposed, and would have had a reasonable expectation of success in doing so.

We next address Patent Owner's first through third arguments, each of which implicates Petitioner's first and second asserted rationales of improved adhesion and detection efficiency.

Patent Owner's first argument is premised on the notion that Ohsaki's benefits only can be realized with a rectangular convex surface, because such a shape is required to avoid interacting with bones on the back of the user's forearm. PO Resp. 11–30. We disagree. Ohsaki does not disclose the shape of its convex cover, much less require it be rectangular. In fact, Ohsaki is silent as to the shape of the convex surface. Ohsaki discloses that sensor 1 includes detecting element 2, which includes package 5 within which the sensor components are located. Ex. 1014 ¶ 17. Ohsaki's convex surface is located on board 8, which is "attached to the opening of the package 5." *Id.* Ohsaki provides no further discussion regarding the shape of board 8 or its convex protrusion.

We disagree with Patent Owner's suggestion that the shape of the convex surface can be inferred to be rectangular from Ohsaki's Figures 1 and 2. PO Resp. 11–12. Ohsaki does not indicate that these figures are drawn to scale, or reflect precise dimensions or shapes of the convex surface. *See, e.g.*, Ex. 1014 ¶ 13 ("schematic diagram"); *see also* Pet. Reply 8–16; *Hockerson-Halberstadt, Inc. v. Avia Group Int'l, Inc.*, 222 F.3d 951, 956 (Fed. Cir. 2000) ("[I]t is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue.").

To be clear, Ohsaki describes the shape of *detecting element 2* as rectangular: "[T]he length of the detecting element 2 from the right side to the left side in FIG. 2 is longer than the length from the upper side to the lower side." Ex. 1014 ¶ 19. Ohsaki also describes that detecting element 2 is aligned longitudinally with the user's forearm: "[I]t is desirable that the detecting element 2 is arranged so that its longitudinal direction agrees with the longitudinal direction of the user's arm," to avoid slipping off. *Id.*; *see also id.* ¶ 9 ("The light emitting element and the light receiving element are arranged in the longitudinal direction of the user's arm.").

In light of this disclosed rectangular shape of detecting element 2, it is certainly possible that Ohsaki's convex surface may be similarly shaped. But, it may not be. Contrary to Patent Owner's argument, Ohsaki neither describes nor requires detecting element 2 to have the same shape as the convex surface of board 8. *Accord* Pet. Reply 13–14 (noting also that

"Ohsaki never describes the 'translucent board 8' as 'longitudinal,' and nowhere describes 'translucent board 8' and 'detecting element 2' as having the same shape."). We have considered the testimony of both Dr. Kenny and Dr. Madisetti on this point. Ex. 1060 ¶¶ 8–16; Ex. 2004 ¶¶ 36–39 (relying on Ohsaki's Figures 1–2 to support his opinion that the convex surface is rectangular). Dr. Madisetti's reliance on the dimensions of Ohsaki's figures is unpersuasive. *Hockerson-Halberstadt*, 222 F.3d at 956. We credit Dr. Kenny's testimony that Ohsaki does not describe its convex surface as rectangular, because this testimony is most consistent with Ohsaki's disclosure.

Further, Patent Owner suggests that the convex surface *must be* rectangular, in order to avoid interacting with bones in the user's forearm. PO Resp. 24–30; Sur-reply 4–8, 10 ("[A] POSITA would have understood Ohsaki's convex board must ***also*** have a longitudinal shape oriented up-and-down the watch-side of the user's wrist/forearm."). Although Ohsaki recognizes that interaction with these bones can cause problems, *see* Ex. 1014 ¶¶ 6, 19, we do not agree that the *only way* to avoid these bones is by aligning a rectangular cover with the longitudinal direction of the user's forearm. For example, in the annotated Figures provided by Patent Owner, *see* PO Resp. 28, we discern that the circular sensor that purports to depict the proposed modification would *also* avoid the bones in the forearm if it were slightly smaller. Patent Owner provides no persuasive explanation to justify the dimensions it provides in this annotated figure, or to demonstrate that such a large sensor would have been required. Indeed, we discern that it would have been within the level of skill of an ordinary artisan to appropriately size a modified sensor to avoid these well-known anatomical obstacles. "A person of ordinary skill is also a person of ordinary creativity, not an automaton." *KSR*, 550 U.S. at 421. After all, an artisan must be presumed to know something about the art apart from what the references disclose. *See Jacoby*, 309 F.2d at 516.

Finally, we do not agree with Patent Owner's position that Ohsaki's advantages apply only to rectangular convex surfaces. As discussed, Patent Owner has not shown that Ohsaki's convex surface is rectangular at all. Moreover, even if Ohsaki's convex surface is rectangular, when discussing the benefits associated with a convex cover, Ohsaki does not limit those benefits to a cover of any particular shape. Instead, Ohsaki explains that "detecting element 2 is arranged on the user's wrist 4 so that the convex surface of the translucent board 8 is in intimate contact with the surface of the user's skin," which prevents the detecting element from slipping off the detecting position of the user's wrist. Ex. 1014 ¶ 25; Ex. 1060 ¶ 21. Thus, we agree with Petitioner that Ohsaki's teaching of a convex surface would have motivated a person of ordinary skill in the art to add such a surface to Aizawa's circular-shaped sensor, to improve adhesion as taught by Ohsaki. *See, e.g.*, Pet. 20–23. Nothing in Ohsaki's disclosure limits such a benefit to a specific shape of the convex surface. Ex. 1060 ¶¶ 10–11, 14–23.

Moreover, Ohsaki contrasts the ability to properly receive reflected light with a convex surface as compared to a flat surface and notes that,

> in the case that the translucent board 8 has a convex surface . . . the variation of the amount of the reflected light which is emitted from the light emitting element 6 and reaches the light receiving element 7 by being reflected by the surface of the user's skin is suppressed. It is also prevented that noise such as disturbance light from the outside penetrates the translucent board 8.

> Therefore the pulse wave can be detected without being affected by the movement of the user's wrist 4 as shown in FIG. 4A.

Ex. 1014 ¶ 25; Ex. 1060 ¶¶ 12–13. Again, we agree with Petitioner that Ohsaki's teaching of a convex surface would have motivated a person of ordinary skill in the art to add such a surface to Aizawa's sensor, to improve signal strength, as taught by Ohsaki. *See, e.g.*, Pet. 26–29. Again, nothing in Ohsaki's disclosure limits such a benefit to the shape of the convex surface. Ex. 1060 ¶¶ 10–11, 18–23.

Accordingly, we do not agree that Ohsaki's disclosed advantages attach only to a rectangular convex surface, or would have been inapplicable to the proposed combination of Aizawa and Ohsaki.

We have also considered Patent Owner's arguments that Petitioner's proposed modification would disrupt Aizawa's "circular symmetry." *See* PO Resp. 30–32. We do not agree for the reasons set forth above. Further, Petitioner's proposed modification is not a bodily incorporation. That is, Petitioner does not propose a bodily incorporation of Ohsaki's rectangular board into Aizawa's circular cover, but only modifying Aizawa only to include a cover with a convex surface. Pet. Reply 15–16; Pet. 25. Further, we discern that it would have been within the capability of an ordinarily skilled artisan to eliminate any gap that would have decreased signal strength or quality. Ex. 1060 ¶ 23.

We have considered Patent Owner's second argument, that Ohsaki's benefits are realized only when the sensor and convex surface are placed on the back of the user's wrist, which is the opposite side of the wrist taught by Aizawa. PO Resp. 33–42. We do not agree. As an initial matter, Petitioner does not propose bodily incorporating the references; Petitioner simply proposes adding a convex cover to Aizawa's sensor, without discussing where Aizawa's sensor is used. *See, e.g.*, Pet. 25. In other words, Petitioner's proposed modification does not dictate any particular placement, whether on the palm side or back side of the wrist.

To be sure, Ohsaki's Figures 3A–3B compare the performance of detecting element 2, including its translucent board 8 having a convex protrusion, and show better performance when the element is attached to the back side of the wrist versus the front side of the wrist, when the user is in motion. *See* Ex. 1014 ¶¶ 23–24, Figs. 3A–3B. However, we do not agree that these figures support Dr. Madisetti's conclusion that "Ohsaki indicates a convex surface only prevents slipping on the back (i.e., watch) side of the wrist in a specific orientation, but tends to slip when used in different locations or orientations" such as the palm side of the wrist—particularly in comparison to a flat surface such as Aizawa's. Ex. 2004 ¶¶ 35, 67. Instead, Ohsaki acknowledges that, even when the detecting element is located "on the front [palm] side of the user's wrist 4, *the pulse wave can be detected well* if the user is at rest." Ex. 1014 ¶ 23 (emphasis added). Thus, Ohsaki discloses that, in at least some circumstances, a convex surface located on the front of the user's wrist achieves benefits. *Id.* Notably, Ohsaki's claims are not limited to detection during movement or exercise.

We credit, instead, Dr. Kenny's testimony that a person of ordinary skill in the art would have understood from Ohsaki that a convex protrusion will help prevent slippage, even in the context of Aizawa's sensor. *See* Ex. 1060 ¶¶ 10–11, 24–30. This is because the convex protrusion "promot[es] 'intimate contact with the surface of the user's skin,'" which "would have increased adhesion and reduced slippage of Aizawa's sensor when placed on either side of a user's wrist or forearm, and additionally would have provided associated improvements in signal quality." *Id.* ¶¶ 29–30 ("additional adhesive effect").

Dr. Madisetti testifies that

> [b]ased on Aizawa's teaching that a flat acrylic plate improves adhesion on the palm side of the wrist, and Ohsaki's teaching that a convex surface tends to slip on the palm side of the wrist, a [person of ordinary skill in the art] would have come to the opposite conclusion from Dr. Kenny: that modifying Aizawa's "flat cover . . . to include a lens/protrusion . . . similar to Ohsaki's translucent board" would <u>*not*</u> "improve adhesion."

Ex. 2004 ¶ 85; *see also id.* ¶ 67. We disagree with this reading of Aizawa. It is true that Aizawa's plate 6 is illustrated as having a flat surface (Ex. 1006, Fig. 1(b)), and that Aizawa states the plate "improve[s] adhesion" (*id.* ¶ 13). Aizawa further states: "the above belt 7 is fastened such that the acrylic transparent plate 6 becomes close to the artery 11 of the wrist 10," and "[t]hereby, adhesion between the wrist 10 and the pulse rate detector 1 is improved." *Id.* ¶ 26. These disclosures, however, indicate the improved adhesion is provided by the acrylic material of plate 6, not the shape of the surface of the plate, which is never specifically addressed. *See also id.* ¶¶ 30, 34 ("Since the acrylic transparent plate 6 is provided . . . adhesion between the pulse rate detector 1 and the wrist 10 can be improved."). Aizawa does not associate this benefit of improved adhesion with the surface shape of the plate, but rather, with the existence of an acrylic plate to begin with. Thus, there is no teaching away from using a convex surface to improve the adhesion of Aizawa's detector to the user's wrist.

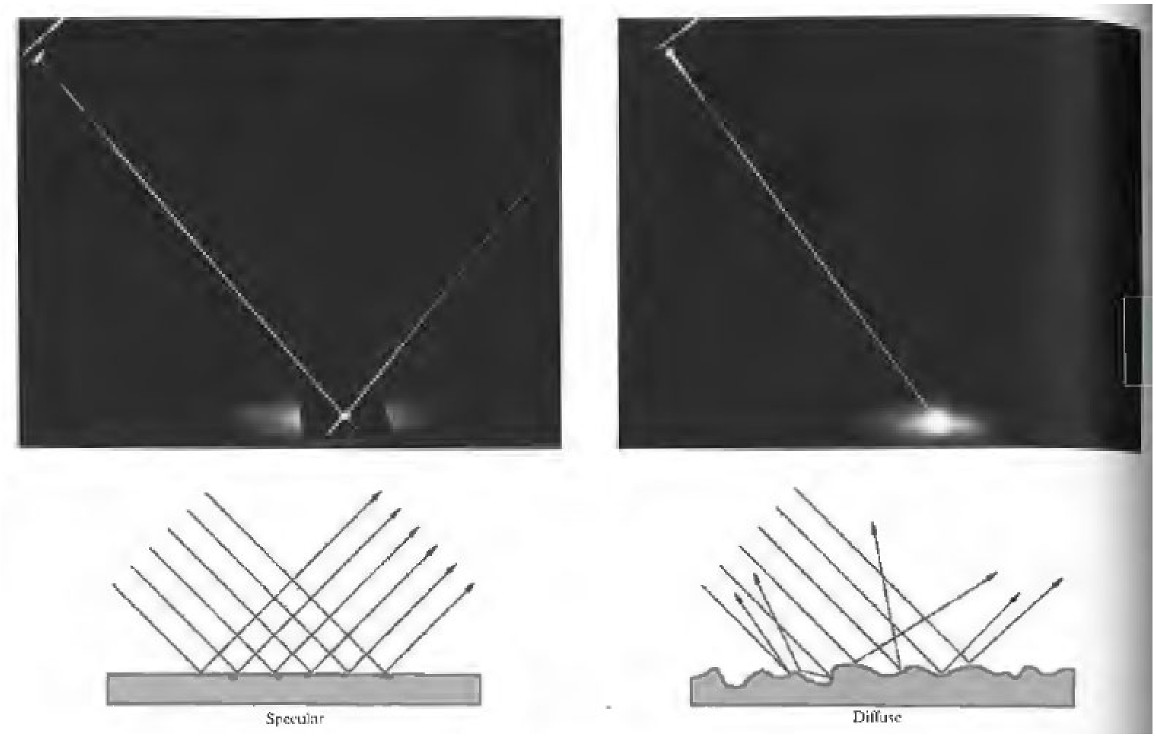
We have considered Patent Owner's third argument that a convex cover would condense light away from Aizawa's peripheral detectors, which

Patent Owner alleges would decrease signal strength. PO Resp. 45–53. We disagree.

There appears to be no dispute that when emitted light passes through user tissue, the light diffuses and scatters as it travels. *See, e.g.*, Pet. Reply 25 ("[R]eflectance-type sensors work by detecting light that has been 'partially reflected, transmitted, absorbed, and scattered by the skin and other tissues and the blood before it reaches the detector," thus, a person of ordinary skill in the art "would have understood that light that backscatters from the measurement site after diffusing through tissue reaches the active detection area from random directions and angles.") (quoting Ex. 1063, 86); Sur-reply 16 ("Even Petitioner admits that tissue randomly scatters and absorbs light rays.").

The light thus travels at random angles and directions, and no longer travels in a collimated and perpendicular manner. Exhibit 1061,[8] Figure 4.12, illustrates the difference between diffuse and collimated light, and is reproduced below:

[8] Eugene Hecht, *Optics* (2nd ed. 1990).



This figure provides at left a photograph and an illustration showing incoming collimated light reflecting from a smooth surface, and at right a photograph and an illustration of incoming collimated light reflecting from a rough surface. *See* Ex. 1061, 87–88 (original page numbers). The smooth surface provides specular reflection, in which the reflected light rays are collimated like the incoming light rays. *See id.* The rough surface provides diffuse reflection, in which the reflected light rays travel in random directions. *See id.*; *see also* Ex. 1060 ¶ 46 ("A [person of ordinary skill in the art] would have understood that light which backscatters from the measurement site after diffusing through tissue reaches the active detection area provided from various random directions and angles.").

Dr. Kenny testifies that Aizawa "detect[s] light that has been 'partially reflected, transmitted, absorbed, and scattered by the skin and other tissues and the blood before it reaches the detector.'" Ex. 1060 ¶ 46 (quoting

Ex. 1063, 86). Dr. Kenny further opines that a convex cover, when added to Aizawa's sensor with multiple detectors symmetrically arranged about a central light source, allows light rays that otherwise would have missed the detection area to instead be directed toward that area as they pass through the interface provided by the cover, thus increasing the light-gathering ability of Aizawa's sensor. *Id.* ¶¶ 47–49.

By contrast Dr. Madisetti testifies that "a convex cover condenses light passing through it towards the center of the sensor and away from the periphery." Ex. 2004 ¶ 87; *see also id.* ¶¶ 82, 86. We have considered this testimony, however, Dr. Madisetti's opinions largely are premised upon the behavior of collimated and perpendicular light as depicted in Figure 14B of the challenged patent. *See id.* ¶ 89. Dr. Madisetti does not explain how light would behave when approaching the sensor from various angles, as it would after being reflected by tissue. *Id.* ¶¶ 87–90. In other words, even if Patent Owner is correct that the '366 patent's Figure 14B depicts light condensing toward the center, this is not dispositive to the proposed modification, because light reflected by a user's tissue is scattered and random, and is not collimated and perpendicular as shown in Figure 14B. Ex. 1001, Fig. 14B.

Patent Owner and Dr. Madisetti argue that "Petitioner and Dr. Kenny both admit that a convex cover condenses light towards the center of the sensor and away from the periphery," in a different petition filed against a related patent, i.e., in IPR2020-01520. PO Resp. 46–47; Ex. 2004 ¶¶ 87–88. The cited portions of the Petition and Dr. Kenny's declaration from IPR2020-01520 discuss a decrease in the "mean path length" of a ray of light when it travels through a convex lens rather than through a flat surface. *See, e.g.*, Ex. 2020 ¶¶ 118–120. We do not agree that this discussion is inconsistent with Dr. Kenny's testimony here that, where light is reflected to the detectors at various random angles and directions, more light will reach Aizawa's symmetrically disposed detectors when travelling through the convex surface than would be reached without such a surface, because light that might have otherwise missed the detectors now will be captured. *See, e.g.*, Ex. 1060 ¶¶ 49, 55 ("Ohsaki's convex cover provides a slight refracting effect, such that light rays that may have otherwise missed the detection area are instead directed toward that area"). We do not discern that the convergence of a single ray of light toward the center, as discussed in IPR2020-01520, speaks to the aggregate effect on *all* light that travels through the convex surface.

We additionally do not agree with Patent Owner's argument that Petitioner's Reply presents new arguments and evidence that should have been first presented in the Petition, to afford Patent Owner an adequate opportunity to respond. *See* Sur-reply 16–19. The Petition proposed a specific modification of Aizawa to include a convex protrusion in the cover, for the purpose of increasing the light gathering ability of Aizawa's device. *See* Pet. 26–29. The Patent Owner Response then challenged that contention, with several arguments that Petitioner's proposed convex protrusion would not operate in the way the Petition alleges it would operate. *See* PO Resp. 45–53. This opened the door for Petitioner to provide, in the Reply, arguments and evidence attempting to rebut the contentions in the Patent Owner Response. *See* PTAB Consolidated Trial Practice Guide (Nov. 2019) ("Consolidated Guide"),[9] 73 ("A party also may submit rebuttal

[9] Available at https://www.uspto.gov/TrialPracticeGuideConsolidated.

evidence in support of its reply.”). This is what Petitioner did here. The Reply does not change Petitioner’s theory for obviousness; rather, the Reply presents more argument and evidence in support of the same theory for obviousness presented in the Petition. *Compare* Pet. 26–29, *with* Pet. Reply 20–30.

Rationale 3

Petitioner further contends that a person of ordinary skill in the art would have recognized that a cover with a protruding convex surface, such as that taught by Ohsaki, would “protect the elements within the sensor housing” of Aizawa. Pet. 28. We are persuaded that adding a convex cover, such as that taught by Ohsaki, would also protect the sensor’s internal components in a manner similar to Aizawa’s flat acrylic plate. Ex. 1003 ¶ 79; *see also* Ex. 1008 ¶ 15 (noting that a cover “protect[s] the LED or PD”).

We disagree with Patent Owner’s fourth argument that a person of ordinary skill in the art would not have modified Aizawa as proposed because a convex cover would be prone to scratches and because other alternatives existed. Patent Owner does not explain how the potential presence of scratches on a convex cover would preclude that cover’s ability to, nonetheless, protect the internal sensor components in Aizawa, as Petitioner proposes. That a convex cover may be more prone to scratches than Aizawa’s flat cover is one of numerous tradeoffs that a person of ordinary skill in the art would consider in determining whether the benefits of increased adhesion, signal strength, and protection outweigh the potential for a scratched cover. *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006). The totality of the final record does not support that the possibility of scratches alone would have dissuaded a person of ordinary skill in the art from the proposed modification, to achieve the benefits identified by Petitioner.

For the foregoing reasons, we are persuaded by Petitioner's contentions.

viii. Summary

For the foregoing reasons, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claim 1 would have been obvious over the cited combination of references.

6. Dependent Claims 2–12

Petitioner also contends that claims 2–12 would have been obvious based on the same combination of prior art addressed above. These challenged claims all depend directly or indirectly from independent claim 1. Petitioner identifies teachings in the prior art references that teach the limitations of these claims, and provides persuasive reasoning as to why the claimed subject matter would have been obvious to one of ordinary skill in the art. Pet. 54–75. Petitioner also supports its contentions for these claims with the testimony of Dr. Kenny. Ex. 1003 ¶¶ 116–148.

Patent Owner does not present any arguments for these claims other than those we have already considered with respect to independent claim 1. PO Resp. 66 ("[T]he Petition fails to establish that independent claims 1, 14, and 27 are obvious in view of the cited references of Ground 1 and therefore fails to establish obviousness of any of the challenged dependent claims.").

We have considered the evidence and arguments of record and determine that Petitioner has demonstrated by a preponderance of the evidence that claims 2–12 would have been obvious over the combined teachings of Aizawa, Mendelson-2003, Ohsaki, and Goldsmith for the reasons discussed in the Petition and as supported by the testimony of Dr. Kenny.

For the foregoing reasons, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claims 1–12 would have been obvious over the cited combination of references.

7. Claims 14–27

Independent claim 14 includes limitations substantially similar to limitations [a], [c]–[h], [j], and [k] and includes additional limitations drawn to "one or more processors configured to: receive information . . . ; [and], process the information to determine physiological parameter measurement information." *Compare* Ex. 1001, 44:57–45:27, *with id.* at 46:33–56. In asserting that claim 14 would have been obvious over the combined teachings of Aizawa, Mendelson-2003, Ohsaki, and Goldsmith, Petitioner refers to the contentions made regarding claim 1. *See* Pet. 75–76; Ex. 1003 ¶¶ 149–157.

Dependent claims 15–26 all depend directly or indirectly from independent claim 14. Petitioner identifies teachings in the prior art references that teach or suggest the limitations of these claims, and provides persuasive reasoning as to why the claimed subject matter would have been obvious to one of ordinary skill in the art. Pet. 76–81. Petitioner also supports its contentions for these claims with the testimony of Dr. Kenny. Ex. 1003 ¶¶ 158–181.

Independent Claim 27 contains numerous limitations, which are integrated from claim 1 (limitations [a]–[k]) as well as limitations from numerous dependent claims. *Id.* at 48:1–49:10 (reciting also a "touch-screen" and certain "preprocessing electronics"). In asserting that claim 27 would have been obvious over the combined teachings of Aizawa, Mendelson-2003, Ohsaki, and Goldsmith, Petitioner refers to the contentions made regarding claim 1, as well as claims depending therefrom. Pet. 81–84; Ex. 1003 ¶¶ 183–210.

Patent Owner does not present any arguments for these claims other than those we have already considered with respect to independent claim 1. PO Resp. 66 ("[T]he Petition fails to establish that independent claims 1, 14, and 27 are obvious in view of the cited references of Ground 1 and therefore fails to establish obviousness of any of the challenged dependent claims.").

For the same reasons discussed above, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claims 14–27 would have been obvious over the cited combination of references and as supported by the testimony of Dr. Kenny. *See supra* II.D.5; Ex. 1003 ¶¶ 149–210.

E. Obviousness over the Combined Teachings of Aizawa, Mendelson-2003, Ohsaki, Goldsmith, and Sherman

Petitioner contends that claim 13 of the '366 patent would have been obvious over the combined teachings of Aizawa, Mendelson-2003, Ohsaki, Goldsmith, and Sherman. Pet. 84–88; *see also* Pet. Reply 37–38. Patent Owner disagrees. PO Resp. 66–67; *see also* Sur-reply 29.

Based on our review of the parties' arguments and the cited evidence of record, we determine that Petitioner has met its burden of showing by a preponderance of the evidence that claim 13 is unpatentable.

1. Overview of Sherman (Ex. 1047)

Sherman is a patent titled "Magnetic Clasp for Wristwatch Strap," and it relates to use of magnetizable material embedded in thermoplastic material with rows of alternating magnetic poles. Ex. 1047, codes (54), (57). Sherman discloses a magnetic fastening mechanism for "wrist instruments," such as wristwatches. *Id.* at 1:4–10. Sherman's system provides "an improved clasp for a flexible strap which eliminates buckles or other types of protruding members" and is "secured, yet easy to engage when desired." *Id*. at 2:1–11. As shown below in Figure 2 of Sherman, the mechanism includes a pair of flexible strap ends having "permanently magnetizable material" of opposite polarities in addition to "mutually nesting uniformly spaced protuberances and indentations." *Id*. at 2:43–62, Fig. 2.

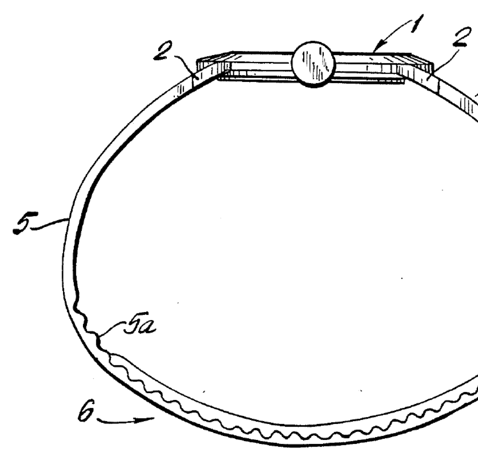


FIG.2

Figure 2 of Sherman depicts an end elevational view showing the wristwatch and strap with transverse ridges 4a and 5a incorporating magnetic securing materials. *Id.*

2. Dependent Claim 13

Claim 13 additionally requires "a magnet configured to be used as a connecting mechanism." Ex. 1001, 46:31–32. Petitioner contends that it would have been obvious for a person of ordinary skill in the art to have modified the sensor system of Aizawa-Ohsaki-Goldsmith to integrate a magnetic connection as taught by Sherman. Pet. 84–88.

Petitioner's Contentions

Petitioner contends that although Goldsmith generally discloses a fastener, Goldsmith "provides no details describing the fastener," but that a person of ordinary skill in the art "would have been motivated to look to other wearable, wrist worn devices such as Sherman's, for details regarding a mechanism for fastening a monitoring device." Pet. 86 (citing Ex. 1003 ¶¶ 211–214). Petitioner contends a person of ordinary skill in the art would have been motivated to add Sherman's magnetic connection in order to be more visually appealing, prevent corners from catching upon clothing, and to prevent broken connectors or accidental snagging. *Id.* (citing Ex. 1047, 1:11–24; Ex. 1003 ¶ 212).

Patent Owner's Contentions

Patent Owner disputes Petitioner's contentions. Patent Owner argues that Petitioner's proposed combination relies on Sherman solely for its alleged disclosure of a magnetic connector, but Ohsaki already includes a series of dedicated belts designed to exert a specific pressure on the user's wrist. PO Resp. 67 (citing Ex. 1014 ¶18). Patent Owner alleges that a person of ordinary skill in the art would have understood that any advantage from Ohsaki's convex board would also require Ohsaki's specific attachment arrangement, which includes belts and a cushion to prevent movement, yet, Petitioner does not explain how Sherman would have allowed consistent attachment pressure for its sensor as required by Ohsaki. *Id.* (citing Ex. 1014 ¶ 18); *see also* Sur-reply 29 ("Ohsaki teaches a specialized attachment mechanism having specific features to "stably fix[]" the detecting element to the wrist and improve signal-to-noise."). Thus, Patent Owner contends that the person of ordinary skill in the art would not have been motivated to incorporate Sherman's magnetic attachment mechanism into Petitioner's proposed combination. *Id.* (citing Ex. 2004 ¶ 122); *see also* Sur-reply 29.

<u>Analysis</u>

We are persuaded by Petitioner's evidence and argument that a person of ordinary skill in the art would have been motivated to combine Sherman's teaching of a magnetic connection in the existing combination of references. We find persuasive Dr. Kenny's testimony that a person of ordinary skill in the art would have understood from Ohsaki itself that a particular strap is not required to obtain the benefits of Ohsaki's convex cover. Ex. 1060 ¶ 72 (noting that "nothing in Ohsaki links the benefits of its convex cover to the use of any particular type of strap."). Further, we are persuaded by Dr. Kenny's testimony that "[t]he combination involves nothing more than applying a known technique to fasten two ends of a strap for attaching a wrist worn device to a user's arm." Ex. 1003 ¶ 214. In light of the totality of the record, including Dr. Kenny's testimony, we determine that a person of ordinary skill in the art would have been motivated to employ Sherman's magnetic connector because the pressure range required for Ohsaki's benefits could be achieved by any number of connection fastening mechanisms.

Further, Patent Owner's arguments do not persuasively address Petitioner's proposed combination. *See* Pet. 25–29, 86–88. Ohsaki was relied upon for its teaching that a convex surface protruding into a user's skin will, *inter alia*, prevent slippage. *See id.*; *see also* Ex. 1060 ¶ 11; Ex. 1014, 25, Figs. 4A, 4B. As discussed above, we found persuasive Dr. Kenny's testimony that a person of ordinary skill in the art would have had reason, in view of that teaching, to modify the Aizawa's sensor's flat cover to include a protrusion, so as to improve adhesion between the user's wrist and the sensor's surface, improve detection efficiency, and protect the elements within the sensor housing. *See* Ex. 1003 ¶¶ 76–80. The resulting sensor features Aizawa's cover modified in view of Ohsaki, not Ohsaki's translucent board. Ex. 1060 ¶ 7. Likewise, Patent Owner does not effectively rebut Dr. Kenny's testimony that a person of ordinary skill in the art would have integrated a magnetic connector in the combination of references in view of Sherman for reasons related to engagement and user comfort. *See* PO Resp. 66–67; Ex. 1003 ¶¶ 213–214 ("because it provided details of a wrist-worn device fastening mechanism that addresses the above-noted problems, is easy to engage, and improves user comfort"); Ex. 1060 ¶ 72.

3. Conclusion

We have considered the evidence and arguments of record, including those directed to claim 1 and addressed above, and we determine that Petitioner has demonstrated by a preponderance of the evidence that claim

13 would have been obvious over the combined teachings of Aizawa, Mendelson-2003, Ohsaki, Goldsmith, and Sherman for the reasons discussed in the Petition and as supported by the testimony of Dr. Kenny. *See, e.g.*, Pet. 84–88; Ex. 1047, 1:11–25, Fig. 2; Ex. 1003 ¶¶ 211–216.

III. CONCLUSION

In summary:[10]

Claims	**35 U.S.C. §**	**Reference(s)/ Basis**	**Claims Shown Unpatentable**	**Claims Not Shown Unpatentable**
1–12, 14–27	103	Aizawa, Mendelson-2003, Ohsaki, Goldsmith	1–12, 14–27	
13	103	Aizawa, Mendelson-2003, Ohsaki, Goldsmith, Sherman	13	
Overall Outcome			1–27	

[10] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

IV. ORDER

Upon consideration of the record before us, it is:

ORDERED that claims 1–27 of the ’366 patent have been shown to be unpatentable; and,

FURTHER ORDERED that, because this is a final written decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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