NOTE: This disposition is nonprecedential.

United States Court of Appeals for the Federal Circuit

MASIMO CORPORATION,
Appellant

v.

APPLE INC.,
Appellee

2022-1631, 2022-1632, 2022-1633, 2022-1634, 2022-1635, 2022-1636, 2022-1637, 2022-1638

Appeals from the United States Patent and Trademark Office, Patent Trial and Appeal Board in Nos. IPR2020-01520, IPR2020-01521, IPR2020-01536, IPR2020-01537, IPR2020-01538, IPR2020-01539, IPR2020-01714, IPR2020-01715.

Decided: September 12, 2023

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Before LOURIE, PROST, and CUNNINGHAM, *Circuit Judges*.

LOURIE, *Circuit Judge*.

Masimo Corp. ("Masimo") appeals from eight final written decisions of the United States Patent and Trademark Office ("USPTO") Patent Trial and Appeal Board ("the Board") holding nearly all claims of U.S. Patents 10,258,265 ("the '265 patent"), 10,292,628 ("the '628 patent"), 10,577,553 ("the '553 patent"), 10,588,554 ("the '554 patent"), and 10,631,765 ("the '765 patent") (collectively, "the challenged patents") unpatentable as obvious. *Apple Inc. v. Masimo Corp.*, IPR2020-01520, 2022 WL 557896 (P.T.A.B. Feb. 23, 2022) ("*'1520 Decision*"), J.A. 1–106; *Apple Inc. v. Masimo Corp.*, IRPR2020-01521, 2022 WL 1093210 (P.T.A.B. Apr. 11, 2022) ("*'1521 Decision*"), J.A. 107–98; *Apple Inc. v. Masimo Corp.*, IPR2020-01536, 2022 WL 562452 (P.T.A.B. Feb. 23, 2022) ("*'1536 Decision*"), J.A. 199–276; *Apple Inc. v. Masimo Corp.*, IPR2020-01537, 2022 WL 557730 (P.T.A.B. Feb. 23, 2022) ("*'1537 Decision*"), J.A. 277–358; *Apple Inc. v. Masimo Corp.*, IPR2020-01538, 2022 WL 557732 (P.T.A.B. Feb. 23, 2022) ("*'1538 Decision*"), J.A. 359–428; *Apple Inc. v. Masimo Corp.*, IRPR2020-01539, 2022 WL 562219 (P.T.A.B. Feb. 23, 2022) ("*'1539 Decision*"), J.A. 429–514; *Apple Inc. v. Masimo Corp.*, IPR2020-01714, 2022 WL 1094551 (P.T.A.B. Apr. 6, 2022) ("*'1714 Decision*"), J.A. 515–91; *Apple Inc. v. Masimo Corp.*, IPR2020-01715, 2022 WL 1093219 (P.T.A.B. Apr. 6, 2022) ("*'1715 Decision*"), J.A. 592–675. For the reasons articulated below, we *reverse-in-part* and *affirm-in-part*.

BACKGROUND

The challenged patents, all assigned to Masimo, are directed to an optical sensor for noninvasively measuring blood constituents, including a protruding, convex cover

positioned over multiple light detectors and emitters. Representative claim 1 of the '628 patent is reproduced below.

> 1. A noninvasive optical physiological sensor comprising:
>
> a plurality of emitters configured to emit light into tissue of a user;
>
> a plurality of detectors configured to detect light that has been attenuated by tissue of the user, wherein the plurality of detectors comprise at least four detectors;
>
> a housing configured to house at least the plurality of detectors; and
>
> a light permeable cover configured to be located between tissue of the user and the plurality of detectors when the noninvasive optical physiological sensor is worn by the user, wherein the cover comprises an outwardly protruding convex surface configured to cause tissue of the user to conform to at least a portion of the outwardly protruding convex surface when the noninvasive optical physiological sensor is worn by the user and during operation of the noninvasive optical physiological sensor, and wherein the plurality of detectors are configured to receive light passed through the outwardly protruding convex surface after attenuation by tissue of the user.

'628 patent, col. 44 ll. 36–56.

Apple Inc. ("Apple") petitioned for review of the five challenged patents, asserting three primary references,

Aizawa,[1] Mendelson-1988,[2] and/or Mendelson-799,[3] in combination with at least one of three secondary references, Inokawa,[4] Ohsaki,[5] and/or Mendelson-2006.[6] Aizawa discloses a wrist, palm-side sensor for detecting a pulse with a single, central emitter and a "plate-like member" to "improve adhesion" (*e.g.*, contact between the sensor and a user's skin). Aizawa, Figs. 1(a), 1(b), 2, ¶ 13. Mendelson-1988 discloses a flat, forehead oxygen sensor with multiple detectors around a central emitter. Mendelson-1988, Fig. 2. Mendelson-799 discloses a similar arrangement but with three centrally clustered emitters. Mendelson-799, Fig. 7. Mendelson-2006 focuses on the transmission of data from an optical sensor. Mendelson-2006, Abstract. Inokawa discloses a wrist sensor with a convex cover, emitters on the periphery, and a single detector in the center. Inokawa, ¶¶ 58–59, Fig. 2. Ohsaki

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[1] U.S. Patent Application Publication 2002/0188210 A1 (filed May 23, 2002, published Dec. 12, 2002), J.A. 3242–48 ("Aizawa").

[2] Yitzhak Mendelson et al., *Design and Evaluation of a New Reflectance Pulse Oximeter Sensor*, 22 ASS'N FOR THE ADVANCEMENT OF MED. INSTRUMENTATION 167 (1988), J.A. 3358–64 ("Mendelson-1988").

[3] U.S. Patent 6,801,799 B2 (filed Feb. 6, 2003, issued Oct. 5, 2004), J.A. 155578–93 ("Mendelson-799").

[4] Japanese Patent Application Published 2006-296564 A (filed Apr. 18, 2005, published Nov. 2, 2006), J.A. 3249–95 ("Inokawa").

[5] U.S. Patent Application Publication 2001/0056243 A1 (filed May 11, 2001, published Dec. 27, 2001), J.A. 3352–57 ("Ohsaki").

[6] YITZHAK MENDELSON ET AL., A WEARABLE REFLECTANCE PULSE OXIMETER FOR REMOTE PHYSIOLOGICAL MONITORING (Proceedings of the 28th IEEE EMBS Annual International Conference, Aug. 30–Sep. 3, 2006), J.A. 23200–03 ("Mendelson-2006").

discloses a sensor with a convex cover worn on the "back side" (*i.e.*., watch side) of a user's wrist and that reduces slippage. Ohsaki, Abstract; *see also id.* at Fig. 1, ¶ 23.

In the eight *inter partes* review ("IPR") proceedings, Apple asserted a variety of motivations to combine the asserted references, including: (1) improved light collection, (2) improved adhesion, (3) improved detection efficiency, and (4) improved protection of the sensor elements. The improved light collection theory was based, in part, on what the Board and parties referred to as the "greatest curvature theory," meaning that light concentration would increase where the curvature of a lens's surface is the greatest—in Apple's proposed combinations, allegedly at the peripheral detectors, not directly at the center.

Masimo challenged each of the proffered motivations to combine, including arguing that (1) a convex lens would condense light toward the center, away from the peripheral detectors in Apple's combinations; (2) Apple's arguments contradicted admissions made by its expert witness; and (3) Ohsaki only teaches improved adhesion with a watch-side sensor, and the same benefits would not be achieved with Aizawa's palm-side sensor, which achieves adhesion through its flat plate. Masimo further argued that the greatest curvature theory was belatedly raised in Apple's Reply Brief. In addition, Masimo challenged Apple's asserted reasonable expectations of success and the references' alleged disclosure of every claim element, including the specific protrusion heights required by claims 11, 17, and 28 of the '554 patent and claims 12, 18, and 29 of the '765 patent.

The Board ultimately found that each challenged claim would have been obvious over the combination of references, except for independent claim 13 of the '554 patent.

Across the eight IPRs, the Board found the following motivations to combine[7]:

Combinations Appealed (Relevant Claims)	Board's Found Motivation(s) to Combine
Aizawa-Inokawa '1520 IPR: all challenged claims '1521 IPR: all challenged claims	Improve light collection
Aizawa-Inokawa-Ohsaki '1520 IPR: all challenged claims '1521 IPR: all challenged claims	Improve adhesion Improve detection efficiency
Aizawa-Inokawa-Ohsaki '1537 IPR: claims 1–6, 9–18, 20–24, 29	Improve adhesion Improve detection efficiency Protect sensor elements
Aizawa-Inokawa-Ohsaki-Mendelson-2006 '1537 IPR: claims 7, 10 '1539 IPR: all challenged claims '1715 IPR: all challenged claims	Improve adhesion Improve detection efficiency Protect sensor elements
Mendelson-1988-Inokawa '1520 IPR: claims 1, 2, 4, 14, 17–25, 26–30 '1521 IPR: all challenged claims	Improve light collection
Mendelson-799-Ohsaki '1536 IPR: all challenged claims '1538 IPR: all challenged claims	Improve adhesion Improve detection efficiency Protect sensor elements

[7] This chart is based on a chart included in Appellee Br. at 21. Masimo did not dispute that the chart was an accurate summary of the Board's motivation to combine findings.

Combinations Appealed (Relevant Claims)	Board's Found Motivation(s) to Combine
'1714 IPR: all challenged claims	

Masimo appealed to this court. We have jurisdiction under 28 U.S.C. § 1295(a)(4)(A).

DISCUSSION

Masimo raises a number of arguments on appeal, which fall into five main categories: (1) that the Board erred in relying on theories not raised by either party, (2) that the Board erred in failing to consider contrary evidence and admissions, (3) that the Board erred in relying on the allegedly belatedly raised "greatest curvature theory," (4) that the Board's factual findings underlying its obviousness determination were unsupported by substantial evidence, and (5) that the Board erred in finding that dependent claims 14–18 of the '554 patent would have been obvious when it found independent claim 13 nonobvious. We address each argument in turn.

I

Masimo argues that, in rendering its decisions, the Board relied on its own theories not asserted by either party, thereby depriving it of the opportunity to respond.

In the '1520 and '1521 IPRs, in response to Masimo's argument that Aizawa's plate's flatness provided its adhesion benefits, the Board found that Aizawa's "improved adhesion is provided by the acrylic material . . . not the flat surface." *'1520 Decision* at *28; *'1521 Decision* at *27. Masimo alleges that Apple never argued that. Appellant Br. at 50–51. Rather, it argues, Apple's expert testified that Aizawa's plate "doesn't explicitly require the use of acrylic" and that one "can obtain the benefits associated with Aizawa" by using materials including but not limited to acrylic. J.A. 5427, 133:5–9; J.A. 5428, 134:12–14.

In the ’1537, ’1539, and ’1715 IPRs, in response to Masimo’s argument that Ohsaki’s longitudinal protrusion successfully achieves improved adhesion by interacting with a user’s wrist bones, the Board found that a circular sensor like that in Aizawa “would *also* avoid the bones in the forearm if [the sensor] were slightly smaller.” *’1537 Decision* at *21; *’1539 Decision* at *22; *’1715 Decision* at *22. Masimo alleges that Apple never argued that, and that there is no evidence that a person of ordinary skill in the art would have reduced Aizawa’s sensor size, particularly when it was already “small.” Appellant’s Br. at 65–66 (citing Mendelson-2006).

Under the Administrative Procedure Act’s notice provisions, as relevant to Board proceedings, patent owners “shall be timely informed of . . . the matters of fact and law asserted” in IPRs, 5 U.S.C. § 554(b)(3), and the Board “shall give all interested parties opportunity for . . . the submission and consideration of facts [and] arguments,” *id.* § 554(c)(1). The Board, therefore, “must base its decision on arguments that were advanced by a party, and to which the opposing party was given a chance to respond.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1381 (Fed. Cir. 2016); *see also Apple Inc. v. Corephotonics, Ltd.*, No. 2022-1350, slip op. at 13 (Fed. Cir. Sep. 11, 2023) (finding the Board erred when its analysis focused on “an issue that no party meaningfully raised or asserted was relevant”); *Alacritech, Inc. v. Intel Corp.*, 966 F.3d 1367, 1372 (Fed. Cir. 2020) (finding that the Board erred where its “reasoning appear[ed] to be untethered to either party’s position”).

The Board may in certain circumstances rely on its own readings of references. *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1074 (Fed. Cir. 2005). These readings, however, must still “be supported by substantial evidence, and its decisions must be reached only after the parties have been provided fair notice and an opportunity to be heard.” *Apple*, No. 2022-1350 at 14–15.

The Board's conclusions on those two points were not supported by the petitions nor merely "simple point[s]" that the Board could have easily deduced from the face of the reference. *Belden*, 805 F.3d at 1074. Indeed, Apple does not argue that it presented those theories at any point in the IPRs. *See* Appellee Br. at 34–36. However, even if the Board may have erred in relying on its own theories, that is of no consequence here because they are not essential to its determinations.

The Board relied on those allegedly new arguments in rejecting Masimo's arguments against adhesion as a motivation to combine. But adhesion is not the only motivation to combine that the Board relied on. The Board also found that improved light collection, improved detection efficiency and, in all but the '1520 and '1521 IPRs, improved protection of the sensor elements provided motivations to combine the asserted references. *See infra*, Section IV.A; Oral Arg. at 11:42–51 ("And you see that whenever the Board relied on the motivation to increase adhesion, with Ohsaki, then the Board would also rely on a motivation to provide protection."). Therefore, even if the Board erred by relying on these theories as part of its finding of adhesion as a motivation to combine, it was, at most, harmless error.

II

Masimo argues that the Board failed to consider evidence and admissions by Apple and its expert witness that were contrary to the Board's findings. Masimo cites several nonprecedential opinions in support of its argument. *See* Appellant Br. at 32–33 (first citing *Cook Grp. Inc. v. Boston Sci. Scimed, Inc.*, 809 F. App'x 990, 999 (Fed. Cir. 2020) ("The Board erred in refusing to consider [petitioner's] admission[s] when it was weighing the evidence . . . ."); and then citing *PPC Broadband, Inc. v. Iancu*, 739 F. App'x 615, 623 (Fed. Cir. 2018) (vacating obviousness decision where Board failed to address expert's admissions)). Masimo is correct that the Board has an obligation

to look at evidence properly before it, even if it detracts from its determination. *See Parus Holdings, Inc. v. Google LLC*, 70 F.4th 1365, 1372 (Fed. Cir. 2023) (discussing *Aqua Prods. v. Matal*, 872 F.3d 1290, 1325 (Fed. Cir. 2017) (en banc)). However, the Board *did* consider the evidence and argument that Masimo claims were overlooked. The Board simply rejected those arguments or found the contrary evidence outweighed by other supporting evidence.

Masimo asserts that at least the following allegations were not properly considered: (1) Apple's and its expert's alleged admission that a convex cover would concentrate light toward the sensor's center, rather than toward the peripheral detectors, (2) Aizawa's alleged teaching of its flat plate providing benefits, *e.g.*, adhesion, (3) Inokawa's alleged failure to teach benefits of a convex lens, (4) the proposed combination's elimination of Ohsaki's convex cover aligning with a user's wrist bones, and (5) the proposed combination's potential creation of air gaps between the sensor and a user's skin. But the Board considered each of those allegations. For example, as discussed above, the Board considered and rejected Masimo's argument that Aizawa's adhesion benefits were attributable to its sensor cover being flat and the alignment of Ohsaki's protrusion with wrist bones. *See*, *supra*, Section I. The Board also thoroughly considered whether light would be condensed at the center, or elsewhere, citing testimony of Apple's expert stating that the light-focusing properties of a convex lens do not demonstrate "that a convex lens directs all light to the center." *See, e.g.*, *'1521 Decision* at *20, 22–24. The Board also found that Apple did "not propose including any air gaps" in its combination. *See, e.g.*, *'1536 Decision* at *18. And the Board found that "Inokawa demonstrates that it was known in the art prior to the '265 patent to use a lens to focus diffuse light reflected from body tissue on to the light detecting elements of a wrist-worn pulse sensor, to increase the light gathered by the sensor and thereby

improve the device's calculation of the user's pulse." *See, e.g.*, *'1520 Decision* at *20.

The Board therefore did not fail to consider evidence or argument. Rather, it considered all of Masimo's points; it just did not reach the conclusions that Masimo desired.

III

Masimo argues that the Board erred in relying on Apple's greatest curvature theory as a motivation to combine because it was allegedly included for the first time in Apple's Reply.[8] All arguments must be included in the petition. *VLSI Tech. LLC v. Intel Corp.*, 53 F.4th 646, 654 (Fed. Cir. 2022) ("[T]he petition defines the scope of the IPR proceeding and [] the Board must base its decision on arguments that were advanced by a party and to which the opposing party was given a chance to respond."). However, a party is "not barred from elaborating on [its] arguments on issues previously raised." *Chamberlain Grp., Inc. v. One World Techs., Inc.*, 944 F.3d 919, 925 (Fed. Cir. 2019). That type of elaboration is particularly permissible when it rebuts arguments raised by the other party. *See, e.g.*, *Provisur Techs., Inc. v. Weber, Inc.*, 50 F.4th 117, 122 (Fed. Cir. 2022) (finding the petitioner's reply proper when it was "directly responsive" to the patent owner's arguments).

We review the Board's decisions regarding the scope of proper reply material for an abuse of discretion. *Ericsson Inc. v. Intell. Ventures I LLC*, 901 F.3d 1374, 1379 (Fed.

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[8] Masimo additionally points to a number of other theories it alleges Apple pursued without including them in its petitions, Appellant Br. at 33–34, but only mentions these in passing. We do not consider arguments that are not fully developed. *See, e.g.*, *Monsanto Co. v. Scruggs*, 459 F.3d 1328, 1341 (Fed. Cir. 2006) ("In order for this court to reach the merits of an issue on appeal, it must be adequately developed.").

Cir. 2018). The Board abuses its discretion if its decision: "(1) is clearly unreasonable, arbitrary, or fanciful; (2) is based on an erroneous conclusion of law; (3) rests on clearly erroneous fact finding; or (4) involves a record that contains no evidence on which the Board could rationally base its decision." *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1367 (Fed. Cir. 2016).

The Board did not abuse its direction in considering the greatest curvature theory. Apple's petitions and its initial expert declarations stated and explained that the proposed combination would increase light-gathering. J.A. 1896–99; J.A. 3053–54, ¶¶ 95–97. Its expert's reply declarations merely further expanded on that theory and rebutted Masimo's arguments that light gathering would only increase at the center of the sensor. Pat. Owner Resp. at 15–40, J.A. 2212–37; J.A. 4531–42, ¶¶ 8–23. The Board therefore did not abuse its discretion in relying on that theory.

IV

Masimo argues that factual findings underlying the Board's ultimate conclusion of obviousness are not supported by substantial evidence. The ultimate conclusion of obviousness is a legal determination based on underlying factual findings, including whether or not a relevant artisan would have had a motivation to combine references in the manner required to achieve the claimed invention. *Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1331 (Fed. Cir. 2019) (citing *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1238–39 (Fed. Cir. 2010)). We review the Board's obviousness determination *de novo*, but its factual findings for substantial evidence. *E.g.*, *Game & Tech. Co. v. Wargaming Grp. Ltd.*, 942 F.3d 1343, 1348 (Fed. Cir. 2019). Substantial evidence exists when, reviewing the record as a whole, "a reasonable fact finder could have arrived at" the finding on review. *In re Gartside*, 203 F.3d 1305, 1312 (Fed. Cir. 2000).

Masimo makes a number of arguments against obviousness, but focuses on the Board's findings regarding (a) motivation to combine, (b) reasonable expectation of success, (c) the obviousness of '265 patent claims 12 and 14, which require a reduction in the "mean path length" of light, (d) whether or not the Aizawa-Inokawa combination discloses all the claim elements, and (e) the obviousness of '554 patent claims 11, 17, and 28 and '765 patent claims 12, 18, and 29 that recite specific protrusion height ranges. We address each of those arguments below.

A

First, Masimo challenges all of the motivations to combine found by the Board. *See, supra*, Background.

Many of Masimo's arguments regarding motivation to combine attack the Board's reliance on the greatest curvature theory, which provides support for improved light collection in certain of Apple's asserted combinations. However, that is not the sole basis for the Board's finding of a motivation to combine in any one IPR or for any one combination. Rather, the Board relies on multiple motivations to combine or a more generalized finding that the combination would improve light collection. As counsel for Apple stated at oral argument, even were we to find the greatest curvature theory problematic, we could still affirm the Board's finding. *See* Oral Arg. at 17:33–18:41.

Apple's asserted motivation of improved light collection rested on the premise that the nature of light itself would cause a convex lens to increase light gathering. The greatest curvature theory was simply a rebuttal to Masimo's argument that light would not be directed to the peripherally positioned detectors. *See, e.g.*, *id*. The Board's analysis in its decisions confirm that understanding. For example, in the '1520 IPR, the Board pointed to an annotated version of Inokawa Figure 2 created by Apple's expert that showed "the various directions that light rays may be directed," creating "backscattered light that is diffuse, rather than

collimated, in nature." *'1520 Decision* at *20. The Board found that that "suggests that a lens might be useful to increase the amount of collected light and thereby increase the reliability of the pulse data generated using the collected light." *Id*. The Board further found that Inokawa further supported that theory:

> [I]n a general sense, Inokawa demonstrates that it was known in the art prior to the '265 patent to use a lens to focus diffuse light reflected from body tissue on to the light detecting elements of a wrist-worn pulse sensor, to increase the light gathered by the sensor and thereby improve the device's calculation of the user's pulse. Inokawa also discloses, in its Figure 2, that a convexly protruding lens may advantageously be used for this purpose.

Id. Those findings, and Inokawa's teachings, are distinct from the greatest curvature theory. Indeed, neither party asserts that Inokawa discusses the greatest curvature theory. *See, e.g.*, Appellant Br. at 40. That the Board found that the greatest curvature theory provided *additional* support for improved light capture as a motivation does not impact whether the Board had evidentiary support for its conclusion that "a lens might be useful to increase the amount of collected light and thereby increase the reliability of the pulse data generated using the collected light." *'1520 Decision* at *20. And, given Apple's expert testimony and Inokawa, we conclude that finding was supported by substantial evidence. We therefore do not need to reach the more specific issue whether the greatest curvature theory is supported by substantial evidence.

We further conclude that, in certain IPRs, protection of the sensor elements provides an alternative or additional motivation to combine. Masimo argues that a convex cover provides no more protection than a flat cover, and that a convex cover would be more prone to scratches, making it undesirable. But the Board already found that a convex

cover would protect sensor elements, which was not disputed by Masimo, and that the potential for scratches was but one tradeoff that a person of ordinary skill in the art would consider. *'1537 Decision* at *24–25 (citing Oral Hearing Tr. at 64:6–65:5). Masimo's arguments that that motivation is not supported by substantial evidence therefore largely amount to asking us to reweigh the evidence already considered by the Board, which we decline to do. "A finding is supported by substantial evidence if a reasonable mind might accept the evidence as adequate to support the finding." *Henny Penny Corp. v. Frymaster, LLC*, 938 F.3d 1324, 1330 (Fed. Cir. 2019). The Board's determinations that protection provided a motivation to combine was thus supported by substantial evidence.

Because we conclude that the Board's findings regarding improved light collection and protection of sensor elements were supported by substantial evidence, we do not need to consider the issues of adhesion and the related benefit of improved detection efficiency.

B

In addition to challenging the Board's findings on motivation to combine, Masimo asserts that the Board's findings that there would have been a reasonable expectation of success were not supported by substantial evidence. Its main argument is that the Board ignored Apple's expert testimony regarding the complexity of designing a physiological sensor. *See, e.g.*, Appellant Br. at 53–56, 68, 78–79. However, much of the complexity that Masimo points to is tied to specific goals, such as improving light collection, and perfecting the sensor structure. The claims themselves require no specific benefits. Rather, they simply require a noninvasive optical physiological sensor comprising certain elements. Apple only needed to show that a person of ordinary skill in the art would have had a reasonable expectation of success in arriving at the claimed invention, not an ideal optical sensor. *E.g.*, *Intelligent Bio-Sys, Inc.*,

821 F.3d at 1367 ("The reasonable expectation of success requirement refers to the likelihood of success in combining references to meet the limitations of the claimed invention."). Masimo's arguments regarding reasonable expectations of success are therefore without merit.

C

Masimo separately argues that the Board's findings regarding the obviousness of '265 patent claims 12 and 14, which require a reduction in the "mean path length" of light are not supported by substantial evidence. Apple's support for the alleged disclosure of a reduction of mean path length rests on the theory that, with a convex lens, "refraction of the incoming reflected light can shorten the path of the light before it reaches the detector . . . because the incoming light is 'condensed' toward the center." J.A. 3068–70, ¶¶ 119–20. According to Masimo, that theory contradicts the greatest curvature theory, which assumes that light is concentrated at the detectors. Masimo argues that the Board's findings for the mean path length claims, relying on Apple's expert testimony that light condenses toward the center, therefore contradict its findings on the greatest curvature theory. *See '1536 Decision* at *18. Masimo also criticizes the Board for relying on Apple's expert's analysis of a single ray of light, rather than requiring an analysis of the aggregate effect on all light that travels through the convex surface or calculation of an average.

Apple responds that Masimo forfeited any argument that dependent claims 12 and 14 of the '265 patent were separately patentable by not arguing them before the Board. Apple also points to testimony and illustrations from its expert showing that the lens would concentrate light and reduce the mean path length, demonstrating that the Board's finding was supported by substantial evidence.

To the extent Masimo is making new criticisms of Apple's expert testimony (*e.g.*, that he analyzed a single ray of light rather than the aggregate), we agree with Apple that

those arguments should have been raised before the Board. However, Masimo could not have earlier argued that the Board's findings were contradictory. We therefore do not determine that argument to be forfeited, despite Masimo's previous decision to not separately argue for the independent claims' patentability.

Nonetheless, we do not agree with Masimo on the merits. Although there may be tension between certain portions of testimony of Apple's expert that the Board relied on, we do not observe a clear contradiction negating a finding of substantial evidence. That the greatest curvature theory may support increased light collection at the detectors is not incongruent with light being condensed toward the center. Those two theories are not mutually exclusive. *See*, *e.g.*, *'1521 Decision* at *20 ("[T]he light-focusing properties of a convex lens . . . does not demonstrate 'that a convex lens directs all light to the center.'"); Oral Arg. at 15:10–20 ("Now, that motivation to combine does not focus on any sort of theory that all light must go to the dead center in a convex lens."). The Board's finding that light being condensed toward the center does not mean all light is concentrated at a single point to the exclusion of light elsewhere is supported by substantial evidence. *'1521 Decision* at *24 ("[I]t is reasonable to conclude, as Dr. Kenny does, that the central light lost by adding a protrusion will be outweighed by the peripheral light gained by adding a protrusion."). The Board's findings regarding claims 12 and 14 of the '265 patent were therefore supported by substantial evidence.

D

Masimo argues that the Aizawa-Inokawa combination in the '1520 and '1521 IPRs does not disclose all the required claim elements. Namely, the challenged claims all require a plurality of emitters and at least four detectors. *See, e.g.*, '265 patent, col. 45 ll. 4, 7. But Masimo contends that Inokawa discloses a sensor with two emitters and only

one detector, while Aizawa discloses separate embodiments with either (1) multiple emitters and one detector, or (2) one emitter and multiple detectors. Masimo argues that the Board erred in relying on a person of ordinary skill in the art's "ordinary creativity" to supply the allegedly missing limitation.

Apple responds that the Board did *not* rely on a person of ordinary skill in the art's "ordinary creativity" to supply any missing limitation. Rather, it asserts that the Board found the combination of Aizawa's and Inokawa's teachings would have rendered obvious a device meeting the claim limitations. Apple points out that nonobviousness is not established by attacking references individually when unpatentability is predicated upon a combination of prior art disclosures. *See In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986). Rather, obviousness concerns the combined teachings of the references. *See id.* ("[T]he test is whether the references, taken as a whole, would have suggested appellant's invention to one of ordinary skill in the [art].").

We agree with Apple that the Board properly considered the combined teachings of the asserted references. As the Board found, "the combination of Aizawa and Inokawa teaches that having multiple emitters is beneficial, and having multiple detectors is beneficial." *'1520 Decision* at *14. And Aizawa describes its disclosed embodiments as nonlimiting examples. Aizawa at ¶ 32 ("The arrangement of the light emitting diode 21 and the photodetectors 22 is not limited to this."); *see also id.* at ¶ 33 (explaining that "the same effect can be obtained" with a different arrangement). Crediting Apple's expert testimony, the Board found that a person of ordinary skill in the art would have known and been motivated to use the four detectors disclosed in Aizawa with the multiple emitters disclosed in both references. *'1520 Decision* at *14. The Board's finding on that issue was therefore supported by substantial evidence.

E

Masimo argues that the Board's findings regarding dependent claims 11, 17, and 28 of the '554 patent and dependent claims 12, 18, and 29 of the '765 patent that recite specific protrusion height ranges were not supported by substantial evidence. Those claims specify a protrusion height of either "between 1 millimeter and 3 millimeters" or "greater than 2 millimeters and less than 3 millimeters." *See, e.g.*, '554 patent, col. 45 l. 67, col. 46 l. 25. The specification explains that that height range "was found to help signal strength by about an order of magnitude versus other shapes." *Id.* col. 20 ll. 18–22. Masimo points to the Board's acknowledgement that "none of Aizawa, Inokawa, Ohsaki, or Mendelson-2006 teach the claimed range." *'1539 Decision* at *31; *see also '1715 Decision* at *30. It goes on to criticize the Board for relying on the allegedly conclusory testimony of Apple's expert, which largely cited diameter dimensions, rather than heights, and stated that there were a "a finite range of possible protruding heights" without specifically naming the heights. J.A. 37119, ¶¶ 275–76.

Apple responds that, as the Board acknowledged, an express teaching is unnecessary when there are "a finite number of identified, predictable solutions" to a problem. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007); *see also Uber Techs., Inc. v. X One, Inc.*, 957 F.3d 1334, 1340 (Fed. Cir. 2020). It argues that, as explained by its expert and found by the Board, there were limitations on the protrusion height due to user comfort and maximizing contact with the skin. Apple argues that it therefore did not matter that no particular reference identified its protrusion height, and that a person of ordinary skill in the art would have understood there to be only finite possibilities.

The Board found that Apple "ha[d] shown sufficiently that only a finite number of solutions existed with respect to the height of a convex protrusion on a tissue-facing sensor, which would have met the art-recognized goals of both

(1) intimate contact between the sensor's surface and the user and (2) user comfort." *'1539 Decision* at *30. The Board credited Apple's expert's testimony that a person of ordinary skill in the art "would have found it obvious that a device designed to fit on a user's wrist would be on the order of millimeters" given the practical limits on dimensions. *Id*. (quoting J.A. 37119, ¶ 275). It would have been preferable for Apple to identify the height options that meet these two goals with more specificity. However, in this case, which involves the mechanical arts, the identified *limitations* on the range, which are supported by expert testimony, provide sufficient guidance as to what a person of ordinary skill in the art would have understood the range of protrusion heights to be. And, as the Board found, Masimo never disputed Apple's position that there was a finite number of options available for the height of a convex surface. *See id.* at *31. The Board's findings regarding claims 11, 17, and 28 of the '554 patent and claims 12, 18, and 29 of the '765 patent were therefore supported by substantial evidence.

V

Lastly, Masimo argues that the Board erred in holding that dependent claims 14–18 of the '554 patent would have been obvious when it found that Apple had not shown that claim 13 (from which claims 14–18 depend) would have been. *See '1539 Decision* at *1, 31. Generally, "dependent claims are nonobvious if the . . . claims from which they depend are nonobvious." *In re Fritch*, 972 F.2d 1260, 1266 (Fed. Cir. 1992). Apple has not cross-appealed the Board's finding regarding claim 13 and agrees that "[u]nder these circumstances, . . . the Board's obviousness holding for claims 14–18 of the '554 patent should be set aside." Appellee Br. at 72. We agree, and therefore reverse the Board's finding that claims 14–18 of the '554 patent would have been obvious.

CONCLUSION

We have considered Masimo's remaining arguments but find them unpersuasive. For the foregoing reasons, the decision of the Board is *affirmed-in-part* and *reversed-in-part*.

AFFIRMED-IN-PART AND REVERSED-IN-PART.

COSTS

Costs to Apple.