UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.
Petitioner,

v.

OMNI MEDSCI, INC.,
Patent Owner.

Case IPR2021-00453

Petitioner's Reply

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I. Introduction

The Board should again find that Lisogurski and Carlson make obvious a device configured to "*increase the signal-to-noise ratio… by increasing a pulse rate*" of a light emitting diode (LED) as it did in IPR2019-00916 and IPR2020-00175 (the "prior proceedings") involving parent patents. That is the principle limitation that Omni MedSci ("Omni") contends renders the claims nonobvious. In its Response, Omni largely rehashes its arguments from the prior proceedings, but nothing in this record warrants changing the Board's prior obviousness conclusions.

In its Response, Omni again embraces the central assertion of its prior arguments—that Lisogurski's cardiac cycle modulation ("CCM") does not increase an LED pulse rate to increase signal-to-noise ratio ("SNR"), and therefore, cannot meet the claim. Not only does the evidence show otherwise, but Omni previously admitted and the Board found that CCM increases the LED pulse rate and that by doing so CCM does increase SNR. *E.g.*, -916 FWD, 28-30; -175 FWD, 35-36.

Omni now argues that configuring Lisogurski to increase the LED pulse rate to avoid noise would change its principle of operation because doing so purportedly would break CCM which tracks the subject's heart rate (0.5-3 Hz). But Lisogurski *explicitly teaches* changing the LED pulse rate when using *other* modulation types, including drive cycle modulation ("DCM"), which would not

affect CCM's "principle of operation." Ex.1011, 35:10-30. Likewise, Lisogurski teaches *simultaneously* using both CCM and DCM, which will cause the LED firing rate to be raised to 1,000 Hz during CCM. Ex.1011, 25:58-65, 37:18-22, 6:31. Consequently, increasing the LED pulse rate (*e.g.*, by turning on DCM at 1,000 Hz) is consistent with Lisogurski, and does not change its principle of operation. Ex.1003, ¶166. And given that the claims do not require any minimum increase in LED pulse rate or SNR, Omni's arguments are, at bottom, irrelevant.

Disregarding the Board's findings in the prior proceedings, Omni also argues that Carlson does not suggest configuring Lisogurski's system to increase an LED pulse rate to increase SNR. -916 FWD, 32-34; -175 FWD, 41-42. But Carlson specifically teaches that SNR can be improved by increasing the LED pulse rate to dynamically offset noise from ambient light, which as Omni's expert Dr. MacFarlane admitted, generally increases SNR. Ex.1060, 37:17-22.

Next, Omni argues that there is no rationale to combine the references in Grounds 2 to 4. But even a cursory review of the Petition shows that Apple set forth robust rationales for combining them. *E.g.*, Pet., 10-14, 59-63.

Finally, Omni advances erroneous constructions for two terms in dependent claims that are ultimately irrelevant because the art meets Omni's constructions.

The record of evidence establishes that the challenged claims are obvious, and the Board should find the challenged '484 claims unpatentable.

II. Lisogurski Alone Discloses a Device Configured to Increase SNR by Increasing an LED Pulse Rate

Lisogurski alone discloses a device that is "*configured to increase the signal-to-noise ratio… by increasing a pulse rate of at least one [LED]*." Two features meet this limitation: (i) Lisogurski's description of changing parameters such as sampling rate, and (ii) Lisogurski's CCM. Pet., 48-51. The Board previously found that Lisogurski discloses this element (-916 FWD, 29-30; -175 FWD, 35-37), and Omni has presented no reason why the Board should reach a different conclusion here.

A. Lisogurski Can Increase LED Firing Rate which Increases SNR

It is undisputed that Lisogurksi discloses a device configured to increase its LED firing rate ("*pulse rate*") in some circumstances. *See* Ex.1011, 1:67-2:2, 25:52-55; Resp., 20. For example, Omni's expert, Dr. MacFarlane, previously agreed that "Lisogurski describes a device that is configured to increase the emitter firing rate in some circumstances." Ex.1060, 59:1-5. As Lisogurksi, explains:

> [T]he sampling rate may represent the amount of time between "on" periods [of the LEDs in Fig. 2A]. [D]ecreasing the duration of the "off" periods (i.e., ***increasing the emitter firing rate***) relates to an increased sampling rate.

Ex.1011, 35:24-31.

The above passage also shows that Lisogurski uses the term "sampling rate" to refer to the emitter (LED) firing rate, so an "increased sampling rate" means the

LED firing rate is increased. Ex.1003, ¶178; *see* Ex.1011, 34:12-13 ("the sampling rate may represent the amount of time between [LED] 'on' periods"). Lisogurski explains that the system may receive a signal "sampled at a first rate" and then a signal at "a second sampling rate," where "[f]or example, the period between the samples may be… reduced." Ex.1011, 33:65-34:16. A reduced "off" period between the samples has the effect of increasing the LED firing rate. *See* Ex.1011, 35:24-31.

Importantly, Lisogurski explains that "increasing the sampling rate for a portion of the cardiac cycle may ***result in more accurate and reliable physiological information***." Ex.1011, 33:56-58. Although Lisogurski does not use the term "SNR" in this passage, a skilled person would have understood that the physiological information is "more accurate and reliable" because its SNR is higher. Ex.1003, ¶183. Thus, that person would have understood that when Lisogurski's device increases the sampling rate, which necessarily increases the LED firing rate, it increases the signal relative to the noise (*e.g.*, ambient light), *i.e.*, it increases SNR. Ex.1003, ¶180; Ex.1011, 35:24-31. This is consistent with Omni's expert's testimony that "[g]enerally speaking… the faster the pulse rate, the lower the background noise." Ex.1060, 37:17-22, 39:12-17; *see id.*, 37:13-

38:3.[1] Thus, as the Board correctly found before, Lisogurski teaches the skilled person that SNR will generally increase when the LED pulse rate increases. *See* -916 FWD, 29-30; -175 FWD, 36.

Omni challenges this evidence by arguing that Lisogurski's disclosures of increasing the ***sampling rate*** "do not meet the claims' requirement of increasing the LED ***pulse*** *rate*. Resp., 16. That assertion simply misstates what Lisogurski describes. Specifically, Lisogurski expressly correlates sampling rate and LED firing (*pulse*) rate, stating that "decreasing the duration of the 'off' periods (i.e., ***increasing the emitter firing rate***) relates to an ***increased sampling rate***." Ex.1011, 35:24-31; *see* Ex.1011, Fig. 2A (showing off period 220 as the time between LED pulses).

Next, Omni incorrectly argues that Lisogurski discloses varying the LED pulse rate ***only*** during CCM. Resp., 16, 19. But Lisogurski discloses increasing LED firing rate of other types of modulation, including during DCM. Ex.1011, 34:10-13 ("sampling rate may represent the number of samples taken during… ***drive cycle modulation***"), 35:10-12; *see also* Ex.1011, 27:44-55, 33:47-49, 1:20-

[1] When asked if he could identify scenarios when increasing pulse rate did not increase SNR, he could only postulate there might be hypothetical scenarios he could imagine, but did not identify any actual ones that would. Ex.1060, 83:5-10.

22, 2:1. And Lisogurski discloses that CCM can be combined with DCM, which operates at around 1 kHz. Ex.1011, 25:58-65, 37:18-22, 6:31. Notably, this explicit disclosure fundamentally contradicts Omni's assertions that LED pulse rates at 1 kHz or higher are incompatible with CCM. Resp., 22-24.

B. Cardiac Cycle Modulation Increases SNR by Increasing the LED Pulse Rate

Lisogurski's CCM technique alone also discloses increasing the LED firing rate to increase SNR, as the Board found in both prior proceedings. -916 FWD, 29-30; -175 FWD, 35-36.

Lisogurski's CCM can vary the LED firing rate (increasing or decreasing) so as to be synchronous with the subject's heart rate. Ex.1011, 25:49-55; 31:11-24, 31:39-55. As Dr. Anthony explained, "the device will increase it[s] firing rate whenever a patient subject's heart rate increases. Thus, Lisogurski's device will increase its pulse rate to remain synchronous with a subject's heart rate resulting in an increased signal-to-noise ratio being detected." Ex.1003, ¶182. As the Board observed in both prior proceedings, Lisogurski explains that this increased firing rate can increase SNR in the presence of noise, and such noise can represent 1%-4% of the computed PPG signal. -916 FWD, 28-29; -175 FWD, 35; Ex.1011, 42:50-54; *see id.*, 25:66-26:14.

In the prior proceedings, Omni admitted that CCM increases SNR and that it can do so by increasing the LED firing rate. For example, Omni admitted that

"Lisogurski teaches [] different techniques for ***improving SNR***…, [including] by ***modulating the light signal*** to correlate with 'physiological pulses' such as… '***cardiac cycle modulation***.'" -175 Prelim Resp., 16;[2] -916 Resp., 15. It also admitted that "Lisogurski increases (or decreases) the LED firing rate… during CCM." -916 Resp., 26.

Omni now argues the precise opposite of what it previously conceded—that the "firing rate increases" during CCM "do not affect SNR." Resp., 19-20. But Omni even here acknowledges that "Lisogurski's claimed ***SNR benefits occur*** because the LED fires synchronously with the heartbeat." Resp. 20. The Board should ignore Omni's confused and internally inconsistent arguments. The claims do not require any minimum level of SNR increase, nor do they limit why the LED pulse rate can be increased. Omni has admitted that CCM can increase the LED pulse rate in response to increases in the subject's heart rate and that increasing the LED pulse rate will increase SNR. Resp., 26; -175 Resp., 36; Ex.1060, 37:8-39:17. Those concessions demonstrate that Lisogurski's devices meet this element.

Omni also argues that Lisogurski varies the LED firing rate to remain synchronous with cardiac cycle, and that any SNR improvement comes from

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[2] In this brief, all emphases are added unless otherwise noted.

maintaining synchronization, not increasing the firing rate. Resp., 20-21. The Board rejected this exact argument in the -175 proceeding, because ***why*** Lisogurski increases the LED firing rate is irrelevant. -175 FWD, 35-36. The challenged claims cover a device that increases SNR by increasing an LED pulse rate, even if the device does not intend to increase SNR by doing so or does not do so in all operation modes. *ParkerVision, Inc. v. Qualcomm Inc.*, 903 F.3d 1354, 1361 (Fed. Cir. 2018) (explaining that an "apparatus claims cover what a device is, not what a device does."); *see Application of Michlin*, 256 F.2d 317, 320 (C.C.P.A. 1958).

Omni also unconvincingly attempts to walk back its prior admissions about how CCM operates. Omni relies on Dr. MacFarlane's testimony that "a slight change in firing rate [during CCM] would have no measurable effect on SNR because… this frequency range is the same as the frequency range of the noise." Ex.2136, ¶ 83; *contra* Ex.1060, 83:5-10. But Lisogurski provides that CCM does increase SNR and that it does so in the presence of Gaussian noise of 0-5 Hz.[3] Ex.1011, 41:46-52. The Board has already addressed and rejected Omni's

[3] In the presence of Gaussian noise from 0-5 Hz, a shifting from 1 Hz to 2 or 3 Hz (*e.g.*, from 60 beats per minute to 120 or to 180) is non-trivial. Moreover, as Carlson shows, ambient light noise is not uniform; it has a peak close to 0 Hz, and then trails off. *See* Ex.1009, Fig. 7b.

arguments, including Dr. MacFarlane's erroneous figure showing a flat noise distribution from 0 to 10 Hz. -175 FWD, 34-36. The Board recognized that even small increases in LED firing rate during CCM can increase SNR in some noise environments, which is enough to satisfy the claims. *See* -916 FWD, 29-30; -175 FWD, 36; Ex.1060, 37:17-22; Ex.1003, ¶182. That finding is consistent with '484 patent as the challenged claims require no minimum increase in SNR or pulse rate, and the specification contains nothing that could require minimum SNR improvements.

Omni also incorrectly argues that Apple has never disputed Dr. MacFarlane's testimony that LED firing rate increases during CCM would have no measurable effect on SNR. Resp., 21-22. Apple has consistently maintained that LED firing rate increases during CCM increases SNR, relying on Lisogurski, Dr. Anthony, and Omni's and Dr. MacFarlane's previous admissions. Pet., 50-51; Ex.1003, ¶182. Apple need not depose Dr. MacFarlane or submit a reply declaration to dispute his conclusory and unsupported testimony.

III. Lisogurski and Carlson Teach a System "Configured to Increase the Signal-to-Noise Ratio by... Increasing a [LED] Pulse Rate"

Lisogurski and Carlson also make it obvious to configure Lisogurski's device to increase SNR by increasing its LED pulse rate. Omni advances two sets of arguments in opposition, arguing that: (i) neither Lisogurski nor Carlson ***alone***

teaches this element, and (ii) configuring Lisogurksi to increase the LED firing rate would change its principle of operation. Both sets of arguments are wrong.

A. Carlson Teaches Increasing LED Pulse Rate Can Increase SNR

Omni devotes a substantial portion of its brief to mischaracterizing Carlson. Resp., 24-28, 30-32. Omni asserts Carlson shows a pulsoximeter that cannot actively increase the LED's pulse rate during operation. Resp., 26-31. Omni's interpretation of Carlson is factually incorrect. Carlson teaches techniques for increasing a pulsoximeter's SNR to improve its performance in the presence of noise. Pet., 23-24; *see* Ex.1009, [0002] (goal is increasing the "quality and robustness of the measurement signal versus environmental disturbances"), [0067]-[0068]. Carlson also explains that the amount of ambient light "strongly varies as a function o[f] time and place where the pulsoximeter is used, e.g. day versus night, indoor versus outdoor." Ex.1009, [0007]; *see id.*, [0067]-[0068]. Thus, Carlson's device is designed to address ***changing*** environmental (*e.g.*, ambient light) conditions.

To handle interference from ambient light when present, Carlson explains that its device "***temporarily*** modulate[s] the amplitude of… the LED… in order ***to shift the power spectrum*** of the pulsoximeter signals ***into a higher frequency range*** where environmental optical radiation is unlikely." Ex.1009, [0020]; *see id.*, [0065]. This passage teaches several things. First, it teaches that higher pulse

frequencies can overcome noise. *Id.*, [0020]. Second, because it refers to a ***temporary*** shift in the frequency range, *id.*, [0020], it teaches ***changing*** the LED pulse rate based on current ambient light conditions, *id.*, [0068]-[0069]; Ex.1003, ¶84. Third, it teaches shifting the LED's pulses "to a higher frequency range," which indicates the LED previously pulsed at a lower frequency but was increased. Ex.1009, [0020]. These readings are consistent with Carlson's claims, which specify a device that includes "a light source amplitude modulating means to modulate the frequency of the emitted light" and that the means further can "***shift the frequency*** of the emitted light." Ex.1009, claims 10-13.

Omni incorrectly portrays Carlson as disclosing a device that only emits light continuously (*i.e.*, not pulsed) but in the presence of noise switches to pulsing an LED at a single, fixed pulse rate. Resp., 24-25, 27-28. That interpretation makes no sense in the context of Carlson's disclosure. Under Omni's reading, Carlson's device would consume excessive battery power, which undermines its purpose: balancing signal quality with energy consumption. Ex.1009, [0002], [0048]; *see* Ex.1011, 10:23-24, 36:38-47. Omni's contention also is irrelevant because a skilled person would have considered continuous light to have a pulse rate of 0 Hz, and thus, Carlson teaches increasing the pulse rate. Ex.1003, ¶189.

Reading Carlson as switching among pulse frequencies aligns with Carlson's broader context. Carlson teaches that ambient light interference "strongly varies as

a function o[f] time and place," *e.g.*, indoors versus outdoors. Ex.1009, [0007], [0067], [0068] ("sunlight can have a dramatic influence"). Because ambient light levels change over time, it would be natural to interpret Carlson as describing multiple pulse frequencies. *See* Ex.1060, 34:5-35:7 (Dr. MacFarlane agreeing that "Because sunlight variations and the weather are constantly changing…, it would be impractical, as a matter of common sense, to have the user manually reconfigure the LED pulse rate as conditions change").

B. Lisogurski and Carlson Together Teach a Device that Increases an LED Pulse Rate for the Purpose of Increasing SNR

Omni again challenges Apple's obviousness rationale by attacking the teachings of Lisogurski nor Carlson in isolation. Resp., 24-32. That, of course, violates the principal that "[n]on-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references." *In re Merck & Co.*, *Inc*., 800 F.2d 1091, 1097 (Fed. Cir. 1986); *see In re Keller 642 F.2d 413, 425* (Fed. Cir. 1981) (the test is "what the combined teachings of the references would have suggested").

Omni's arguments boil down to two assertions, neither of which are correct. First, it contends that Lisogurski does not teach increasing the LED firing rate ***for***

the purpose of increasing SNR.[4] Then, it claims that Carlson alone allegedly does not disclose increasing an LED's pulse rate during its operation.

Omni's assertions do not withstand scrutiny. First, it is undisputed that Lisogurski teaches a device that is configured to (i) detect changes in the noise level, (Ex.1011, 9:50-52, 5:56-61), (ii) vary LED modulation (*e.g.*, by changing the light drive parameters) in response to noise level changes, (Ex.1011, 1:67-2:3, 5:55-61, 9:46-60, 27:44-49, 33:53-57, 37:6-18), (iii) vary LED modulation for the purpose of increasing SNR, (-916 Resp., 16; -175 Prelim. Resp., 16), and (iv) increase LED firing rate (a light drive parameter) in some circumstances, (Resp., 17; Ex.1060, 59:1-5; Ex.1011, 25:53-55, 27:44-49, 35:24-31).

Second, as explained in §III.A, Carlson *does* disclose a device that changes an LED's pulse rate in operation. Moreover, Omni ignores what Carlson teaches—that SNR can be increased to overcome ambient light noise by switching an LED's pulse rate to a "a higher frequency range where environmental optical [noise] is unlikely," such as 1,000 Hz, 2,000 Hz, or higher. Ex.1009, [0020], [0069]; Ex.1003, ¶¶186-88. That teaching is consistent with the skilled person's background knowledge, as admitted by Dr. MacFarlane: "[g]enerally speaking, the

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[4] Though the device's intent is irrelevant, even if it were relevant, Lisogurski teaches it.

faster the modulation, ***the faster the pulse rate, the lower the background noise***." Ex.1060, 37:17-22. Thus, the references' combined teachings suggest configuring Lisogurski to increase LED pulse rate to increase SNR, as the Board previously found. *See* -916 FWD, 34 n.7 (finding that "Lisogurski teaches switching the LED pulse rate from a cardiac cycle mode (1 Hz pulse rate) to a second mode that reduces ambient light noise," and determining that "the combination teaches increasing signal-to-noise by increasing the LED pulse rate from 1 Hz to 1000 Hz").

C. Configuring Lisogurski to Change LED Firing Rate in Response to Noise Is Consistent with Lisogurski's Teachings

Omni asserts that a skilled person would not have configured Lisogurski to increase the LED firing rate to increase SNR because doing so allegedly would change Lisogurski's "principle of operation," and in particular the principle of how CCM operates. Resp., 26. Omni's argument is based on its assertions that (i) Lisogurski discloses changing LED firing rate during CCM but never during any other type of modulation, and (ii) CCM must always fire the LEDs at the same rate as the subject's heart rate (0.5-3 Hz). Resp., 28-32.

Omni is wrong that Lisogurski discloses changing LED firing rate only during CCM. Resp., 16-21. Lisogurski discloses that the system "may vary parameters related to the light drive signal including… light brightness… [and] firing rate." Ex.1011, 25:52-55, 1:20-22; *see* Ex.1003, ¶162. While Lisogurski

includes many examples of varying these parameters during CCM, Lisogurski also discloses that DCM and servo algorithms can vary the light drive parameters. Ex.1003, ¶¶166-68; Ex.1011, 1:12-15, 5:2-4, 5:57-61, 6:7-12, 10:23-34, 35:5-32. As explained in §II.A above, Lisogurski specifically discloses an example where the sampling rate during DCM may be increased which will also "increas[e] the emitter firing rate." Ex.1011, 35:10-12, 35:24-25, 35:29-31. Thus, Lisogurski teaches that DCM can increase the LED firing rate.

Omni also incorrectly argues that Apple relied solely on CCM. Resp., 15. But Apple relied on Lisogurski's general description of using modulation to change light drive parameters, including Lisogurski's discussion of varying sampling rate and LED firing rate during DCM. Pet., 45 (citing Ex.1011, 1:19-21), 53 (citing Ex.1011, 1:67-2:1, 5:55-61), 49 (citing Ex.1011, 33:47-49, 35:27-31); *see* Ex.1011, 35:10-12; *see also* Pet., 22. Dr. Anthony also explained that Lisogurski discloses varying the light drive parameters (including LED firing rate) for "all the modulation processes, including drive cycle modulation and the servo algorithms." Ex.1003, ¶166.

Next, Omni incorrectly argues that modifying Lisogurski to increase its LED pulse rate to avoid environmental noise based on Carlson would "change the principle of operation" of Lisogurski's CCM because the pulsing would not remain

synchronous with the cardiac cycle. Resp., 28-32. Omni's argument fails for multiple reasons.

First, Omni ignores the significance of Lisogurski's teaching that it can simultaneously use multiple modulation techniques. Ex.1011, 7:38-40, 7:4-12. Lisogurski provides, for example, that DCM has an envelope of approximately 1 kHz and CCM of approximately 1 Hz, yet it teaches using them together. Ex.1011, 6:26-31, 8:23-26, 25:58-65. Thus, firing the LED at 1,000 Hz or higher during CCM does not change its principle of operation.

Next, Omni's analysis is improperly rigid. The question is not whether Carlson's teaching of increasing an LED firing rate can be "bodily incorporated into the structure of" Lisogurski's CCM technique, but what the references considered together fairly suggest to a skilled person. *MCM Portfolio LLC v. Hewlett-Packard Co.*, 812 F.3d 1284, 1294 (Fed. Cir. 2015).

Omni also ignores that Lisogurski includes an example where ***CCM is turned off***. Pet., 53. Lisogurski describes two modulation modes where in response to "detect[ing] a change in background noise" the device will switch from a "first" to a "second" mode of operation. Ex.1011, 37:6-11, 36:48-53. "The first mode may be, for example, a first cardiac cycle modulation technique." Ex.1011, 36:52-53. For the second mode, Lisogurski provides several exemplary ways of changing modulation, including by "***stop[ping] cardiac cycle modulation***" or

changing CCM parameters. Ex.1011, 37:15-22; *see* -916 FWD, 32-33; -175 FWD, 39-41. A skilled person would have found it obvious to configure Lisogurski to respond to increased noise (*e.g.*, by switching to a second mode) by increasing the LED firing rate to 1,000 Hz or even higher based on Carlson. Pet., 49, 53. Increasing the LED pulse rate in this second mode cannot possibly change CCM's principle of operation.

Finally, Lisogurski teaches that while "cardiac cycle modulation techniques [are] generally related to the cardiac cycle, [they] may not necessarily be precisely correlated to the cardiac cycle and may be related to external triggers (e.g., respiration), user input, [or] other suitable techniques." Ex.1011, 5:41-47. When an external trigger, such as increased noise or ambient light, is present, CCM can deviate from the cardiac cycle. Ex.1011, 5:57-64, 9:46-60, 37:6-61. Again, this aligns with Lisogurski; it does not change Lisogurski's "principle of operation."

As the Board previously found, the evidence shows that Lisogurski and Carlson together teach a device that increases SNR by increasing an LED pulse rate. The Board should reach that conclusion again here.

IV. Ground 2: Claims 1-4, 7-12, and 15-22 Are Obvious from Lisogurski, Carlson, and Tran

Omni advances two arguments with respect to this ground. First, it incorrectly asserts Apple has not shown a skilled person would have combined these three references. Next, it argues Apple has not shown the combination meets

the "*identify*" and "*detect*" limitations of claims 3, 8, and 16. Omni's arguments should be rejected.

A. A Skilled Person Would Have Been Motivated to Combine Lisogurski, Carlson, and Tran

Omni incorrectly argues that Apple did not set forth a rationale to combine these references. Resp., 33. But Apple explained that a skilled person reading Lisogurski would have looked to other references that disclosed techniques for improving the operation of optical sensing devices because (i) that was part of the ordinary design process, and (ii) market trends were pushing artisans to design and develop miniaturized, wearable, mobile sensor devices for health tracking and fitness. Pet., 10-11, 26, 59. This would have caused the skilled person considering Lisogurski to look to analogous references such as Carlson and Tran.

Apple explained that a skilled person considering Lisogurski would have been motivated to find additional ways to analyze and use the data Lisogurski's device collected. Pet., 59; Ex.1003, ¶211. This would have caused that person to consider Tran's "in-depth, cost-effective" techniques for evaluating a patient's cardiac condition. Pet., 59-60. Tran teaches a wearable device that uses a neural network to evaluate the subject's cardiac condition, flag potentially dangerous conditions, and notify the patient. Ex.1064, 8:44-53; 74:45-46; 75:18-20, 94:57-65; Ex.1003, ¶211. Apple explained a skilled person would have been motivated

to incorporate that feature into Lisogurski to achieve the same benefits described in Tran. Pet., 60-62.

Omni argues this rationale is insufficient because Apple did not show a motivation to combine Carlson with Tran. Resp., 34. But Apple explained why a skilled person considering Lisogurski would been motivated to incorporate features from Carlson and features from Tran into Lisogurski's device.

Omni argues that Apple failed to identify with particularity which of the ten background references provide a motivation to combine, Resp., 33-34, but Omni ignores that Apple relied on specific teachings in Lisogurski and in Tran to provide the motivation. Pet., 59-60. Omni also ignores that the ten background references illustrate how market forces were pushing the industry in 2012 to create wearable mobile monitoring devices in sports and fitness, and to incorporate known features into such devices. Pet., 10-14. Moreover, Omni does not dispute that these market trends were present.

B. Construction of the "*Detect*" and "*Identify*" Terms in Claims 3, 8, and 16

In its Response, Omni presents new constructions of the terms "*identify an object*" (claims 3 and 8) and "*detect an object*" (claim 16). However, these terms are commonly understood, and need no construction.

To the extent a construction of the term "*detect an object*" is needed, a skilled person would understand it to mean "to discover or determine the existence,

presence, or fact of an object." Ex.1066. While generally consistent with Omni's proposed construction of "*detect*" (*i.e.*, "to discover or notice the existence or presence of something") (Resp., 36; *see* Ex. 2135), Apple's construction is more appropriate for system claims, given that a system can "discover" or "determine" but not "notice" something.

If it is necessary to construe the term "*identify an object*," a skilled person considering the '484 patent would understand it to mean the same thing "*detect an object*" does: "to discover or determine the existence, presence, or fact of an object." Ex.1066. Apple's construction is consistent with the claims, which uses the term "identify" simply to confirm that an object is present or not, rather than to take any action dependent on what the object is.[5] The specification uses "identify" in this same manner. Ex.1001, 17:12-13 ("identify objects that can change in the field of view"), 25:60-63 ("Moreover, many solids may be ***identified*** using stand-off ***detection*** or remote-sensing.").

Omni contends the term "*identify*" means "to recognize or establish an object as being a particular thing." Resp., 11-13. But Omni's construction is

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[5] For example, claims 3 and 8, after specifying that an object is identified, do not call for any action to be taken based on what the object is, but instead specify comparing "at least some of the ***output signal*** to a threshold."

inconsistent with the claim language and the specification. Most notably, the claims do not require the device to take any actions based on what an object is—they only require determining if something physical (an object) is present. For example, the claims do not require the device to "identify and distinguish between objects" or to "identify the type of object."

Most of the passages Omni quotes are irrelevant to the claims. For example, one passage refers to using "hyper-spectral imaging" with "two or three-dimensional images to provide … a chemical composition identification…" Ex.1001, 8:18-22. But that "identification" technique requires use of images of the object, which is not performed by claimed devices. Similarly, Omni cites a passage referring to the identification and quantification of "the concentrations of cholesterol…, glucose…, or other blood constituents." Ex.1001, 15:45-48. That "identification" technique again is irrelevant to the claims, which do not require any action (*e.g.*, quantification) to be taken based on the nature of the blood constituents present.

The incidental uses of the word "identify" in the '484 specification cited by Omni thus do not redefine this word to have the special meaning Omni proposes. In fact, certain of these passages contradict Omni's proposed special meaning for "*identify*." For example, Omni cites a passage that refers "…identify[ing] and distinguish[ing] between… materials." Ex.1001, 7:21-24. If anything, this

passage suggests that "identifying" an object is different than determining its characteristics sufficiently to know what the object is, which thus enables the device to "distinguish" it from other objects. Omni's attempt to import a special meaning into the term "identify" should be rejected. *Thorner v. Sony Comp. Ent. Am.*, 669 F.3d 1362 (Fed. Cir. 2012).

C. Lisogurski, Carlson, and Tran Teach the "*detect*" and "*identify*" Elements in Claims 3, 8, and 16

Claims 3 and 8 specify that the wearable device "*identify an object*," and claim 16 specifies that it "*detect an object*." Lisogurski teaches these elements under Apple's constructions and under Omni's "*detect*" construction.

Lisogurski teaches that its system "may detect a physiological condition," including cardiac irregularity and low blood oxygen saturation. Ex.1011, 36:54-57, 36:62-65. As part of this process, the system also "may detect a signal indicative of a system error such as a physiologically impossible value [or] a probe-off signal." Ex.1011, 36:66-37:2. In the Petition, Apple explained that Lisogurski's device reports a probe-off signal when the sensor is off of the subject (*e.g.*, it falls off during use) which is based on the determination that the subject's tissue (*e.g.*, wrist) is no longer in range of the sensor. Pet., 62. Because Lisogurski does not generate the probe-off signal when the sensor is affixed to the subject, Lisogurski must also be able to detect this fact by identifying the presence of the patient's tissue. Consequently, Lisogurski teaches that its sensor is able to both

"*identify*" and "*detect*" ("discover or determine the existence, presence, or fact of") the subject's tissue.

Omni asserts Lisogurski does not meet these claims based on a misreading of Lisogurski. Omni contends the probe-off signal only detects the "absence of a probe" when no sensor is connected to the system. Resp., 36. But Lisogurski reports the probe-off signal while the probe is in use, and thus, a probe is connected to the system. Lisogurski describes the probe-off feature as part of its system's process for modifying CCM based on its analysis of the signal representing the light reflected back from the subject's tissue. Ex.1011, 36:54-37:2. Thus, Lisogurski makes clear that its device has a connected probe, is analyzing light it is receiving, and will base its "probe-off" signal on its analysis of that light (which also could detect a different system error such as "a physiologically impossible value") to determine whether tissue is present.

Omni also asserts that Lisogurski's probe-off signal does not "*detect*" or "*identify*" the presence of an object because it instead detects the "absence" of something. Resp., 36. But for Lisogurski's device to detect that the probe is off, Lisogurski must be able to detect that it is on the patient by determining that the subject's tissue is present.

Omni further argues that the prior art does not teach "*identify[ing] an object*" based on Omni's construction, which is "to recognize or establish an object

as being a particular thing." Resp., 36-38. To support its construction, Omni cites two passages of the '484 patent that describe "identify[ing] the blood constituents of interest." Resp., 37-38 (quoting Ex.1001, 12:57-60, 15:45-48). Thus, under Omni's construction, this element is met if a device "identifies" "blood constituents."

Even if Omni's construction were accepted, the "*identify[ing]*" element is taught by both Lisogurski and Tran. Lisogurski and Tran each teach techniques for measuring blood oxygen saturation and other blood constituents. Pet., 58 (stating Tran's monitored information "includes pulse oximetry measurements"), 63 (discussing Lisogurski's "blood oxygen saturation"); Ex.1011, 4:36-41 (describing "calculat[ing]… an amount of a blood constituent (e.g., oxyhemoglobin)"); Ex.1064, 9:38-42, 37:2-12. Measuring blood oxygen saturation requires identifying and quantifying both the oxygenated and deoxygenated hemoglobin in the blood, which Lisogurski and Tran do by measuring reflected light at particular wavelengths known to be associated with each substance. Ex.1003, ¶¶38-39; Ex.1011, 4:42-51; Ex.1064, 37:2-12, 50:10-15. That is the same technique disclosed in the '484 patent. Ex.1001, 11:45-53, 11:59-12:3. Thus, Lisogurski and Tran both teach detecting and identifying blood constituents—oxygenated and deoxygenated hemoglobin—which satisfies Omni's construction.

V. Ground 3: Lisogurski, Carlson, Tran, and Isaacson Render Claims 5 and 13 Obvious

Omni argues that there was no motivation to combine these references because although Apple presented reasons a skilled person would have considered Lisogurski with each of Isaacson, Carlson, and Tran, Apple did not show why a skilled person would have considered every permutation of these references together. Resp., 38-39. Apple was not required to do so. Apple proposed incorporating Isaacson's sensor (an arrangement of LEDs and detectors) into Lisogurski's device, which taught that any known sensor layout could be used. Ex.1011, 17:39-45; Ex.1003, Ex.1003, ¶239-240. The skilled person would have looked to Isaacson because it was a known arrangement for that component of Lisogurski's device, and it also taught solutions to potential problems identified in Lisogurski (*e.g.*, with skin pigmentation). Pet., 68-69; Ex.1003, ¶243, Ex.1063, 7:59-62, Fig. 1. Thus, Apple provided specific reasons for including features from Isaacson into Lisogurski's devices.

VI. Ground 4: Lisogurski, Carlson, Tran, Isaacson, and Valencell-093 Render Claims 6, 14, and 23 Obvious

Omni again argues that there was no motivation to combine these references because though Apple presented reasons a skilled person would have considered Lisogurski with each of Valencell-093, Isaacson, Carlson, and Tran, Apple did not show why a skilled person would have considered every permutation of these

references. Resp., 40-41. Apple was not required to do so. Apple proposed incorporating Valencell-093's reflective surface into Lisogurski, which as Valencell-093 taught, could improve the optical coupling and relative motion between the wearable device and the user's skin, furthering Lisogurski's goal of improving SNR. Pet. 73-77; Ex.1005, [0153]; Ex.1003, ¶272. Thus, Apple provided specific reasons for including that feature of Valencell-093 into Lisogurski's devices.

VII. Conclusion

Apple respectfully request the Board to cancel the challenged claims.

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CERTIFICATE OF COMPLIANCE

I hereby certify that this brief complies with the type-volume limitations of 37 C.F.R. § 42.24, because it contains 5,586 words (as determined by the Microsoft Word word-processing system used to prepare the brief), excluding the parts of the brief exempted by 37 C.F.R. § 42.24.

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I hereby certify that on this 4th day of February, 2022, copies of this Petitioner's Reply, Attachments and Exhibits have been served in its entirety by email on the following counsel of record for Patent Owner:

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