Lisogurski increases sampling rate to optimize power consumption

Regardless, Lisogurski discloses varying the *sampling rate* of the *detector* to "optimize power consumption"—***not*** to increase SNR by increasing the *pulse rate* of the *light source* as claimed. (*Id.*, ¶68; Ex. 1011, Lisogurski at 10:23-26.)

Response at 15-16

Finally, regarding Apple's "sampling rate" argument, the Board determined "Lisogurski is teaching varying the sampling rate to be synchronous with the cardiac cycle, not to improve signal-to-noise." *Id.* at 31.

Ex. 2122, ¶ 73

Lisogurski teaches setting sampling rate based on firing rate, not the other way around

Petitioner asserts that Lisogurski "describes embodiments where the firing rate of an LED is correlated to the sampling rate of an analog-to-digital converter in the detector," and that Lisogurski "teaches that as the sample rate increases, the firing rate of the LED also increases." (Pet. at 36 citing Lisogurski at 11:43-46; 11:52-55; 33:47-49; 33:56-58; 35:7-9; 35:27-31.) Petitioner has it backwards. The cited passages of Lisogurski disclose setting the sampling rate based on the modulation of the light drive signal—not vice-versa as Petitioner asserts. (Ex. 2122, MacFarlane Decl., ¶¶67-68.)

Response at 15

APPLE ON LISOGURSKI

The Board: Lisogurski alone does not disclose the "pulse rate" limitation

[2] The Board preliminarily found that Lisogurski alone does not disclose increasing pulse rate for the purpose of increasing SNR. Inst. Dec., 30.

Reply at 7

Apple's supposed "undisputed facts" about Lisogurski

Initially, the distinction Omni is trying to draw between Lisogurski and Carlson and the challenged claims is very narrow. This is shown by several undisputed facts about what Lisogurski teaches:

- As explained in §III.A above, Lisogurski teaches a device that increases the pulse rate of its LED in some scenarios.[5] Omni admits this, stating "Lisogurski discloses a pulse oximeter having an adjustable 'firing rate.'" Resp., 22; Ex.1060, 59:1-5; Ex. 2122, ¶87 (same).

Not for SNR

Reply at 16-19

Apple's supposed "undisputed facts" about Lisogurski

- Lisogurski teaches a device that attempts to increase SNR by altering characteristics of how the LEDs fire.[6] Omni admits this, stating that "Lisogurski teaches [] different techniques for improving SNR, [including] by increasing the 'brightness' of the light source… and [] by modulating the light signal to correlate with 'physiological pulses' such as a 'cardiac pulse.'" Resp., 15.

Not firing rate

- Lisogurski teaches a device that detects increases in background noise and in response attempts to increase SNR.[7] Omni admits this, stating that "Lisogurski discloses… increasing signal brightness to address interference caused by ambient light." Resp., 22; Ex.2122, ¶87.

Not by changing firing rate

Reply at 16-19

Anthony mixes "sampling rate" and "firing rate"

116. Lisogurski explains that the sampling rate (and therefore the LED firing rate) can be varied for the same reasons that light brightness is varied.

> It will also be understood that sampling rate is one of the components that may be modulated in cardiac cycle modulation as described above. It will also be understood that the earlier described embodiments relating to varying light output may also apply to sampling rate.

Ex.1011 (Lisogurski), 35:5-9. With respect to the light output, Lisogurski states that "[t]he system may ***increase the brightness of the light sources*** in response to the noise ***to improve the signal-to-noise ratio***." Ex.1011 (Lisogurski), 9:46-52 (emphases added). Lisogurski states that increasing the sampling rate "may result in more accurate and reliable physiological information." Ex.1011 (Lisogurski), 33:56-58. Therefore, Lisogurski explains that the LED firing rate can be increased to increase signal-to-noise ratio.

Ex. 1003

Sampling rate ≠ firing/pulse rate

BY MR. BROUGHAN:

Q. And this passage also describes sampling rates.

What do you understand "sampling rate" to mean?

A. "Sampling rate" is typically used for a detector -- for the analog-to-digital sampling rate -- for that detector. And I believe that's how Lisogurski uses that for the most part as well.

Q. So a higher sampling rate means that the analog-to-digital converter is making more measurements?

A. Per unit time, yes.

Ex. 1060 at 59

CARLSON

Carlson's "basic idea" does not have a modulated light source

Carlson teaches a pulsoximeter sensor whose "basic idea" is to "use a beam-shaping element . . . to direct the emitted optical radiation" of a "light source" to "increase the optical signal power . . . and thus increasing the Signal/Noise-and signal/Background ratio." (Ex. 1009 at [0014].) This "basic idea" does not have a modulated light source, which Carlson introduces later in the specification. (*Id.* at [0018].)

Sur-reply at 11-12

Carlson's solution to SNR issues is to temporarily modulate unmodulated light

In later embodiments, Carlson proposes "temporarily" modulating the otherwise unmodulated light source:

- "temporarily modulate the amplitude of the optical radiation";
- "it is further proposed to temporarily modulate the amplitude of the optical radiation of the light source";
- "[t]he basic idea of using AC-Coupling or Lock-In Amplification detection means is to temporarily modulate the optical radiation";
- "it is furthermore possible to use a light source modulation to temporarily modulate the optical radiation of the LED";
- "temporarily modulate the optical radiation of the LED at the carrier frequency f_c in order to shift the power spectrum."

(Ex. 1009 at [0020], [0027], [0064], [0065].)

Sur-reply at 12

Apple agrees Carlson temporarily modulates

An ordinary artisan would understand that Carlson's solution to an SNR problem is to temporarily modulate the otherwise unmodulated light source at a predetermined frequency. Apple agrees this is Carlson's teaching:

> To handle interference from ambient light when present, Carlson explains that its device "***temporarily*** modulate[s] the amplitude of the optical radiation of, e.g., the LED at a carrier frequency fc in order ***to shift the power spectrum*** of the pulsoximeter signals ***into a higher frequency range*** where environmental optical radiation is unlikely."

(Reply at 14.)[6]

Sur-reply at 12-13

Apple has no evidence that Carlson increases pulse rate

Apple's attorneys assert, without evidence, this disclosure in Carlson "indicat[es] that the LED previously emitted pulses at a lower frequency—i.e., that Carlson is switching between at least two different frequencies." (Reply at 14, citing Carlson at [0020].) But Carlson only discloses ***temporary*** modulation, not, as Apple's attorneys assert, modulation at different (or increasing) rates as claimed. Carlson's "temporarily modulate" disclosures confirm that the change described in Carlson is from an ***unmodulated*** light source to a temporarily modulated light source at a chosen, unvarying pulse rate—***not*** a pulsing light source configured to increase SNR by increasing its pulse rate as claimed.[7]

Sur-reply at 13

Apple has no evidence that Carlson consumes excessive battery power

[7] Apple's attorneys also assert Omni's reading of Carlson "would consume excessive battery power." (Reply at 15.) They never explain their new assertion and it is incorrect. Carlson's first two embodiments disclose "at least one light source which can emit light at least at two wavelengths." (Ex. 1009 at [0012] and [0016].) And Fig. 7c is "a diagram showing power spectrum of physiological signals and ambient light ***without . . . modulation of the light source*** of a sensor." (*Id.* at [0044].) Carlson follows these two embodiments with several "alternative" configurations in which the light source is "temporarily modulate[d]." (Ex. 1009 at [0018-20] and [0027].) Carlson thus discloses unmodulated light (*i.e.*, not the "temporarily modulated" light) in the first two embodiments. This refutes Apple's new—and unsupported—"battery power" argument.

Sur-reply at 13-14

Carlson does not disclose "increasing a pulse rate"

Petitioner asserts that Carlson "teaches that increasing the modulation frequency of the pulsed LEDs improves the signal-to-noise ratio" and that "a skilled person would have found it obvious to configure Lisogurski to increase the firing rate (frequency) of LEDs as taught by Carlson." (Pet. at 39.) But contrary to Petitioner's assertion, Carlson does ***not*** disclose increasing a pulse rate of a light source to increase SNR as claimed. (Ex. 2122, MacFarlane Decl., ¶84.) Carlson discloses, instead, designing the system to modulate the LED at a fixed, ***specific*** carrier frequency, f_c/f_0 (as distinct from "current or continuous light") "in order to shift the power spectrum of the pulsoximeter signals into a higher frequency range where environmental radiation is unlikely." (Ex. 1009, Carlson at [65] and [69]; Ex. 2122, MacFarlane Decl., ¶¶77-79.) Carlson thus teaches modulating the light source at a chosen single, fixed pulse rate, not ***increasing*** the pulse rate to increase SNR as claimed. (Ex. 2122, MacFarlane Decl., ¶79.)

Response at 17

Carlson chooses the (single) frequency

Carlson makes clear that the (single) carrier frequency f_c/f_0 is "chosen"—not "increased"—as claimed.

- "The frequency is ***chosen*** in such a way that it is outside the frequency spectrum of sunlight and of ambient light . . .." (Ex. 1009, Carlson at [69].)
- "f_0 is the ***chosen*** frequency of the emitted light" (*Id.*)
- "f_0 of course can be ***chosen*** at any other frequency, as e.g. 2000 Hz or even higher" (*Id.*)

Response at 17-18

Anthony misreads Carlson Fig. 7c

74. Dr. Anthony cites Carlson Figures 7c and 8, and their associated description, to teach what Dr. Anthony calls the "Carlson technique." (Ex. 1003, ¶¶119-121.)

75. For reference, I have inserted Fig. 7c below. The annotations are original (I did not add them).

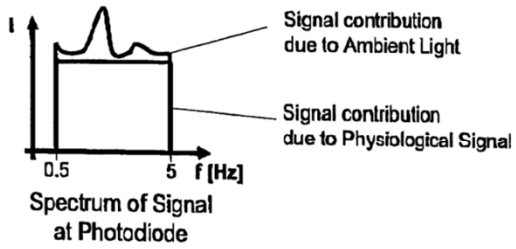

Figure 7c

76. Carlson explains that Figure 7c is "a diagram showing power spectrum of physiological signals and ambient light ***without*** phase shifting or ***modulation*** of the light source." Ex. 1009, Carlson at [0044].) In other words, Figure 7c discloses the power spectrum for ***continuous*** light, not pulsed light. Carlson explains, as

Carlson Fig. 8

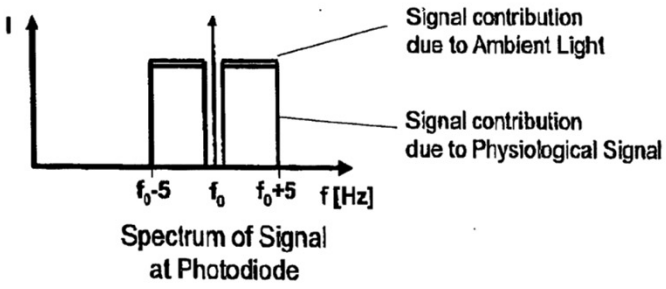

Figure 8

77. Then, in paragraph [0069], Carlson then explains:

As a consequence, it is therefore proposed to emit light by the LEDs ***not as current or continuous light but as pulsed light***. The frequency is chosen in such a way that it is outside the frequency spectrum of sunlight and of ambient light which, according to FIG. 7b, is in the range of above approximately 1000 Hz.

79. Carlson states:

"FIG. 8 shows the shift spectrum of signal to a region where there is little influence, e.g. of ambient light. F_0 is the chosen frequency of the emitted light to operate the pulsoximeter sensor and the range between f_0-5 Hz and f_{0+5} Hz is the consequence of the influence of the frequency due to physiological signal. Therefore, as shown in FIG. 8, the frequency spectrum of signal at the photo diode does have a basic signal contribution due to physiological signal."

(Ex. 1009, Carlson at [0069].) Carlson thus teaches modulating the light source at a chosen single, fixed pulse rate, not ***increasing*** the pulse rate to increase SNR. The "chosen" carrier frequency does not change. It does not increase over time for any purpose, let alone to increase SNR. Ex. 2122

Deconstructing Anthony's analysis of Carlson

80. Dr. Anthony incorrectly describes Carlson when he states:

> "Figure 8 of Carlson shows increasing the operating frequency F_0 of the LEDs as compared to Fig. 7c. Ex.1009 (Carlson), [0069]. This frequency shift, which corresponds to increasing the 'pulse rate' of the emitter, increases 'significantly the Signal-to-Noise and Signal-to-Background ratio.' Ex.1009 (Carlson), [0069]."

(Ex. 1003, ¶119.)

81. Both of Dr. Anthony's statements are incorrect. First, Figure 7c discloses only continuous light from the light source, not modulated or pulsed light. Figure 7c thus lacks what Dr. Anthony describes as an "operating frequency F_0 of the LEDs." As a result, there is no "frequency shift" between Figures 7c and 8 as Dr. Anthony states – Figure 7c lacks a frequency F_0 in the first place.

Ex. 2122

Deconstructing Anthony's analysis of Carlson – part 2

82. Second, Dr. Anthony incorrectly states that the (non-existent) "frequency shift" between Figures 7c and 8 "corresponds to increasing the 'pulse rate' of the emitter." Figure 7c discloses continuous light lacking any pulse rate or modulation. Thus, it is incorrect to state that Figure 8 discloses "increasing the 'pulse rate' of the emitter" as compared to Figure 7c. Figure 8 does not increase modulation frequency—because there is no initial modulation frequency—it ***introduces*** modulation at f_0 that simply does not exist in Figure 7c. There is thus no "frequency shift" or "increasing the pulse rate" between Figures 7c and 8 as Dr. Anthony states.

Ex. 2122

Carlson: Shifting the power spectrum does not increate a pulse rate

83. In its Institution Decision the Board determined "Carlson more generally teaches 'shift[ing] the ***power spectrum*** of the pulsoximeter signals into a higher frequency range where environmental optical radiation is unlikely.'" (Paper 16 at 35.) Fig. 7c discloses a power spectrum around zero hertz because the light source is continuous and is not modulated. In Fig. 8c, in contrast, modulation is introduced with a carrier frequency. As explained in Carlson, this leads to a shift in power spectrum from around zero Hertz to around the carrier frequency. This does not disclose increasing a pulse rate as claimed because, without a starting pulse rate, there cannot be a pulse rate increase. For these reasons, shifting the power spectrum does not increate a pulse rate.

Ex. 2122

Carlson does not increase the modulation frequency of the pulsed light

84. In ¶120, Dr. Anthony states, "Carlson describes that increasing the modulation frequency of the pulsed LEDs improves the signal-to-noise ratio. Ex.1009 (Carlson), [0069]." But as explained above, Carlson never discloses "increasing the modulation frequency of the pulsed LEDs," let alone to "improve the signal-to-noise ratio." Carlson discloses, as an alternative to a continuous light source (e.g., Fig. 7c), a modulated light source at a particular modulation frequency that is "chosen" to avoid ambient light (e.g., Fig. 8):

> ***The frequency is chosen*** in such a way that it is outside the frequency spectrum of sunlight and of ambient light which, according to FIG. 7b, is in the range of above approximately 1000 Hz.

(Ex. 1009, Carlson at [0069].)

APPLE ON CARLSON

Carlson "temporarily" modulates

To handle interference from ambient light when it is present, Carlson explains that its device "***temporarily*** modulate[s] the amplitude of the optical radiation of, e.g., the LED at a carrier frequency fc 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]. In this passage, Carlson describes shifting the frequency of an LED's emission "to a higher frequency range," thus indicating that the LED previously emitted pulses at a lower frequency—*i.e.*, that Carlson is switching between at least two different frequencies. Ex.1009, [0020]. Carlson also states that its device ***temporarily*** makes this adjustment, *id.*, [0020], which means the device will change how its LEDs pulse based on the presence and characteristics of ambient light at any particular moment in time, *id.*, [0068]. Based on his reading of Carlson, Dr. Anthony explains that "Carlson teaches that increasing the modulation frequency of the pulsed LEDs improves the signal-to-noise ratio." Ex.1003, ¶121; *see* Ex.1009, [0069].

← Yes

← No

← No

← Yes

Reply at 14

CARLSON'S DOES NOT FILL LISOGURSKI'S GAP

The references do not suggest increasing the pulse rate for any reason

Thus, as relevant here, Carlson teaches nothing that Lisogurski does not already know, namely ambient/background signals can be a problem and 1000 Hz is a useful frequency. Lisogurski solved his noise problem using off/on subtraction at 1000 Hz. Carlson solved his noise problem by temporarily modulating the LED above 1000 Hz. But the references do not teach or even suggest ***increasing*** the exemplary the 1000 Hz rate for any reason, let alone ***for the purpose of increasing SNR*** as the claims require. The record is devoid of any evidence that would render the claimed "pulse rate" limitation obvious.

Sur-reply at 17

Carlson adds "less than nothing" to Lisogurski

Apple adds Carlson purportedly to provide what is missing from Lisogurski. But Carlson adds nothing relevant to Lisogurski because the two references contain identically the same teaching—right down to the same exemplary 1000 Hz modulation rate. (*Compare* Ex. 1011, Lisogurski, at 6:30 *with* Ex. 1009, Carlson, at [0069].) In fact, Carlson adds less than nothing because it merely modulates an unmodulated light source temporarily without varying the predetermined modulation frequency. An ordinary artisan reading Carlson would learn nothing new beyond what Lisogurski already discloses, which the Board correctly determined is *not* the claimed configuration. (Paper No. 16, ID at 30.)

Sur-reply at 2-3

Anthony's reason to combine is incorrect because he misunderstands Carlson

86. I disagree with Dr. Anthony's conclusion that "a person of ordinary skill in the art would have found it obvious to configure Lisogurski to increase the firing rate (frequency) of LEDs as taught by Carlson, given that Carlson teaches that increasing the modulation frequency of the pulsed LEDs improves the signal-to-noise ratio. Ex.1009 (Carlson), [0069]." (Ex. 1003 at ¶121.) As I explained above, Carlson does not teach that "increasing the modulation frequency of the pulsed LEDs improves the signal-to-noise ratio." Carlson teaches only that, as an alternative to continuous light (Fig. 7c), modulated light at a "chosen" frequency F_0 (Fig. 8) may help avoid interreference caused by sunlight, other ambient light and/or intermittent shade. Carlson never discloses a ***device*** that ***increases*** the modulation frequency or the pulse rate, let alone to increase SNR as claimed.

Ex. 2122

"Anthony has no other basis for asserting obviousness"

88. I note that Dr. Anthony does not advance an obviousness analysis other than modifying Lisogurski using the "Carlson technique" which, as explained above, is not a device that increases pulse rate to increase SNR. Dr. Anthony's analysis is based entirely on his incorrect conclusion that Lisogurski and/or Carlson independently disclose increasing SNR by increasing a pulse rate as claimed. In other words, Dr. Anthony's opinions regarding Lisogurski and Carlson are wrong (they are as explained above) and Dr. Anthony has no other basis for asserting obviousness.

Ex. 2122

No *prima facie* case when Carlson does not teach an increasing pulse rate for SNR

Dr. Anthony never asserted obviousness "accepting as true Patent Owner's argument that Carlson teaches selecting a single (e.g., 1000 Hz) LED pulse rate when designing the pulsoximeter." (Ex. 2122, MacFarlane Decl., ¶¶89-90.) On the contrary he asserted, incorrectly, that both Lisogurski and Carlson disclosed that limitation. (*Id.*) His obviousness conclusion is based on this (incorrect) statement that "Carlson teaches that increasing the modulation frequency of the pulsed LEDs improves the signal-to-noise ratio." (Ex. 1003, ¶121; Ex. 2122, MacFarlane Decl., ¶89.)

Response at 25

No argument or evidence that "increasing a pulse rate" is obvious if that limitation is not disclosed in Lisogurski or Carlson

1. Petitioner presents no argument or evidence that "*increasing a pulse rate*" is obvious if that limitation is not disclosed in Lisogurski or Carlson

Apple asserts, incorrectly, that both Lisogurski and Carlson disclose increasing SNR by "increasing a pulse rate." (Pet. at 35-39; Ex. 1003, ¶¶110-121.) Apple, and its expert, make no argument and present no evidence that the limitation is obvious *independent of* Lisogurski or Carlson. (*Id.*) In other words, if Patent Owner (and the Board) is correct that neither Lisogurski nor Carlson disclose the "increasing a pulse rate" limitation (and they do not), the Petition lacks any other basis for asserting obviousness.

Response at 23

Lisogurski+Carlson ≠ obviousness

Dr. Anthony neither advanced nor supported an obviousness argument based on the reality the Board accepted "as true" – that neither Carlson nor Lisogurski disclosed the claimed configuration. (Ex. 2122, MacFarlane Decl., ¶90.) Given that ***neither reference*** teaches nor suggests a device configured to increase a pulse rate to increase SNR, as claimed, the combined teachings of Lisogurski and Carlson could not have rendered obvious the claimed configuration in which a device increases the pulse rate to increase SNR. (*Id.*)

Response at 25-26

REPLY: REASON TO COMBINE

Apple claims: Lisogurski+Carlson = obviousness

Even if not explicitly taught by Lisogurski alone, the combination of Lisogurski and Carlson makes obvious a device that "*increase[es] a signal-to-noise ratio by increasing the pulse rate*" of its LED. As the Board found, Lisogurski discloses a device that increases the pulse rate of its LED, but does not explicitly describe doing that for the purpose of increasing SNR. Inst. Dec., 30-31. Apple explained, however, that Lisogurski teaches the skilled person that the firing of its LED can be varied (*e.g.*, by altering its intensity) for the purpose of improving SNR, and this would have motivated the skilled person to look for additional way to achieve that goal. Pet., 24-26. Carlson specifically identifies increasing an LED's pulse rate as a way to increase SNR and provides a reason for doing that—to dynamically offset noise from ambient light when performing physiological measurements.

1

2

3

Reply at 1-2

APPLE'S UNTIMELY/IMPROPER ARGUMENTS

Improper to use new evidence/argument in Reply

In addition, Petitioner cannot "fix" this flaw in its Reply. 35 U.S.C. § 312(a)(3) requires that the ***petition*** must identify, "***with particularity***, . . . the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge to each claim." A *prima facie* case of obviousness is absent from the Petition; thus, there is no *prima facie* case of obviousness to fix. And § 312(a)(3) bars any Reply argument or evidence to add a missing *prima facie* case of obviousness where none previously existed. *See also* Consolidated Trial Practice Guide (Nov. 2019) at 73 ("Petitioner may not submit new evidence or argument in reply that it could have presented earlier, *e.g.* to make out a *prima facie* case of unpatentability."); *Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-00582, Paper No. 34 at 30-31 (PTAB Aug. 5, 2019) (Informative) (rejecting Petitioner's new argument and evidence asserting obviousness in its reply that was not presented in the petition).

Response at 27

Apple's untimely and erroneous argument based on dependent Carlson claims

Apple points to dependent claims 10-13 of Carlson reciting a "means" that can "shift the frequency of the emitted light." (Reply at 15.) Apple never made this argument in its Petition,[8] and it is incorrect. The claimed "means" must be construed to cover the specific structures and materials disclosed in the specification for performing the claimed function and equivalents. *See* 35 U.S.C. § 112(f). The only frequency shifting Carlson teaches is the introduction of a carrier frequency to shift the frequency of the "power spectrum" of the unmodulated light—not increasing the "pulse rate" as claimed. (Ex. 1009 at [0020] and [0027].) As explained by Dr. MacFarlane, the claimed pulse rate and Carlson's power spectrum are different concepts. (Ex. 2122, MacFarlane Decl., ¶ 83.)

Sur-reply at 14-15

Apple's untimely and erroneous "common sense" argument

Finally, Apple argues that switching among different frequencies is "common sense." (Reply at 15-16.) Because Apple presented no "common sense" argument in its Petition, and because Apple's expert does not support the new "common sense" theory, the Board should not give any weight to Apple's new "common sense" argument. *Hulu*, IPR2018-00582, Paper No. 34 at 30-31. In addition, Carlson proceeds contrary to Apple's purported "common sense." Carlson uses an approach in which a modulation frequency "is chosen in such a way that it is outside the frequency spectrum of sunlight and of ambient light which, according to FIG. 7b, is in the range of above approximately 1000 Hz." (Ex. 1009, Carlson at [0069].) Carlson thus solves the varying interference problem by choosing a ***single*** frequency above ***all*** expected interference, *i.e.*, above approximately 1000 Hz. (*Id.*) Relying on mere attorney argument, Apple supplies no ***evidence*** an ordinary skilled artisan would have rejected these teachings of Carlson. Apple's lack of evidence means that Apple has not met its burden of proof. 35 U.S.C. § 316(e).

Sur-reply at 15

APPLE'S NEW "GENERAL KNOWLEDGE" ARGUMENT

Apple claims "general knowledge" that increased pulse rate "will" "necessarily" increase SNR

That is because the Lisogurski device will, in certain physiological situations, increase the pulse rate of an LED and that increase will necessarily increase SNR as well.

* * *

A. Scientifically, Increasing LED Pulse Rate Will Increase SNR

* * *

Thus, as even Omni's expert acknowledged, a skilled person reading Lisogurski would have understood that when its device increases its LED firing rate, it will increase SNR as well. Therefore, Lisogurski meets this claim

Reply at 1, 3, 12

Apple claims "general knowledge" that increased the pulse rate "will generally increase" SNR

Modulating or pulsing a signal is a standard technique to enhance the signal's detectability in the presence of noise, such as ambient light. Ex.1003, ¶45. In an optical sensor, an LED is pulsed, and each time it is, a detector measures the amount of light reflected back from the sample and determines how the sample is changing (*e.g.*, how the volume of blood in tissue is changing over time). Ex.1003, ¶¶39, 41-42. It was well-known that, in the presence of noise, increasing the rate at which an LED pulses (and the sampling rate, which is the rate at which the signal is measured) will generally increase the SNR. At his deposition, Omni's expert Dr. MacFarlane admitted this was a well-known scientific fact:

Reply at 3

Apple claims Lisogurski "is consistent with the general knowledge"

Lisogurski's description of what happens when its device increases the LED firing rate is consistent with the general knowledge that it would increase SNR. 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, 33:46-52.

Lisogurski says "may" (and "sampling rate")

Reply at 11

CASELAW

Caselaw: Improper hindsight

- "The mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification."
  - *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984)

- "This form of hindsight reasoning, using the invention as a roadmap to find its prior art components, would discount the value of combining various existing features or principles in a new way to achieve a new result—often the very definition of invention."
  - *Ruiz v. A.B. Chance Co.*, 357 F.3d 1270, 1275 (Fed. Cir. 2004)

Caselaw: Apple relies on Merck, Keller, and MCM Portfolio

that actively increases the pulse rate of an LED for the purpose of increasing SNR while the device is in operation. Omni ignores 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 also In re Keller 642 F.2d 413, 425* (Fed. Cir. 1981) (the test for obviousness is "what the combined teachings of the references would have suggested to those of ordinary skill in the art"); *MCM Portfolio LLC v. Hewlett-Packard Co.*, 812 F.3d 1284, 1294 (Fed. Cir. 2015) ("Moreover, [t]he test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference…."). As explained in the Petition, the combined teachings of Lisogurski and Carlson suggest a device that meets the claims.

Reply at 17

Flaws in Apple's Reply

Apple's Reply rewrites the challenged claims, mischaracterizes the testimony of Omni MedSci's expert, misconstrues the teachings of Lisogurski and Carlson, and improperly relies on obviousness arguments Apple did not make in its Petition. Separately and combined, Lisogurski and Carlson fail to disclose or render obvious "a light source ***configured to increase signal-to-noise ratio*** ["SNR"] . . . by increasing a pulse rate of at least one of the plurality of semiconductor sources." (Ex. 1001 29:51-11.)[1, 2]

Sur-reply at 1

Conclusion

91. Because challenged independent claims 5 and 13 each recite that the light source increases a pulse rate to increase SNR, Dr. Anthony has not established obviousness of those claims for the reasons stated above. And, because each challenged dependent claim (claims 7-10 and 15-17) includes the limitations of the independent claim from which it depends, Dr. Anthony has not established obviousness of the challenged dependent claims for the same reasons.