

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

KARL STORZ ENDOSCOPY-AMERICA, INC.,
Petitioner,

v.

NOVADAQ TECHNOLOGIES, INC.,
Patent Owner.

Case IPR2015-01847
Patent 7,420,151 B2

Before MICHAEL W. KIM, JENNIFER S. BISK, and
DANIEL N. FISHMAN, *Administrative Patent Judges*.

FISHMAN, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

A. Background

Karl Storz Endoscopy-America, Inc. (“Petitioner”) filed a Petition (Paper 1, “Pet.”) for *inter partes* review of claims 1–17 of U.S. Patent No. 7,420,151 B2 (Ex. 1001) (“the ’151 patent”) pursuant to 35 U.S.C. §§ 311–319. Novadaq Technologies, Inc. (“Patent Owner”) filed a Patent Owner’s Preliminary Response (Paper 6, “Prelim. Resp.”). On March 10, 2016, based on the record before us at the time, we instituted an *inter partes* review of all claims (1–17) (Paper 7, “Dec.”). We instituted the review on the following challenges to the claims:

References	Basis	Claims challenged
Yabe ¹	§ 103(a)	1–17
Krauter ²	§ 102(b)	1, 7, 10, 12, 14

Dec. 22.

After we instituted this review, Patent Owner filed a Patent Owner Response (Paper 11, “PO Resp.”)³ and Petitioner filed a Reply (Paper 15, “Pet. Reply”). Petitioner relies on the Declaration (Ex. 1011) and Rebuttal

¹ U.S. Patent No. 4,885,634; Dec. 5, 1989. Ex. 1007 (“Yabe”).

² U.S. Patent No. 6,147,705; Nov. 14, 2000. Ex. 1004 (“Krauter”).

³ We observe that Patent Owner’s Response does not comply with 37 C.F.R. § 42.24(d) by failing to “include a certification stating the number of words in the paper.” Petitioner did not object to this error by Patent Owner. Pursuant to our authority under 37 C.F.R. § 42.5(b), we hereby waive this violation of our rule requiring certification of the word count in Patent Owner’s Response. We advise Patent Owner, however, to adhere to our rules in any further filings in this, or other matters before the Board.

Declaration of Erhan Gunday (Ex. 1018). Patent Owner relies on the Declaration of Bruno Jaggi (Ex. 2001).

Patent Owner filed Observations on the Cross Examination of Reply Witness (Paper 25) to which Petitioner responded (Paper 27). We have considered the remarks of both parties in these papers in our analysis to follow.

Oral hearing was conducted on December 6, 2016. The record contains a transcript of the hearing (Paper 34, “Tr.”)

We have jurisdiction under 35 U.S.C. § 6. The evidentiary standard is a preponderance of the evidence. *See* 35 U.S.C. § 316(e); *see also* 37 C.F.R. § 42.1(d). This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73.

For the reasons expressed below, we conclude that Petitioner has demonstrated by a preponderance of the evidence that claims 1–17 are unpatentable.

B. The '151 patent

According to the '151 patent, medical imaging devices for viewing internal body tissue typically illuminate subject tissue with broadband (i.e., white) light and present an image of the illuminated tissue on a display monitor device. Ex. 1001, 1:20–28. Later medical developments recognized a benefit of viewing internal body tissue using short wavelength (e.g., blue and green) illumination of the tissue to, *inter alia*, better highlight blood and blood vessel structures. *Id.* at 1:29–43. The '151 patent indicates prior known medical imaging devices recognized the benefit of utilizing both broadband (e.g., white) illumination and short wavelength (e.g., blue

and green) illumination for a physician, and suggests prior medical imaging devices provide such a capability as a broadband spectrum illumination source with associated movable filters. *Id.* at 1:44–59.

The '151 patent discloses and claims a medical imaging device that uses a single light source for a full spectrum white light imaging mode as well as for short wavelength imaging mode, “but does not to [sic] require the incorporation and movement of filters in the light source to produce the light for the two different imaging modes.” *Id.* at 1:66–2:2. Light reflected from a single light source is sensed by a color image sensor, which may be, for example, “an RGB [(red, blue, and green)] type image sensor having a number of pixels that are covered with a mosaic filter that passes light in the red, green, or blue spectral bands,” (*Id.* at 3:41–44) or, for example, “a complimentary color filter mosaic such as a CMYG (cyan, magenta, yellow, and green)” (*Id.* at 4:45–47). An image processor of the '151 patent reduces a contribution of red illumination, thereby generating a short wavelength false image, by calculating values for display pixels stored in a memory based on sensed values of the color image sensor. *See id.* at 4:8–12, 6:60–7:3, 7:63–66.

Figure 1 of the '151 patent is reproduced below.

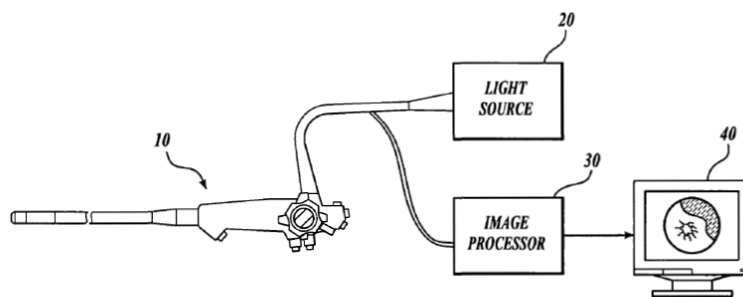


Fig.1.

Figure 1 of the '151 patent, reproduced above, discloses an exemplary imaging system in which the subject matter of the '151 patent may be employed. Light source 20 illuminates body tissue through scope 10 and reflected light from the illuminated tissue is returned to image processor 30 for presentation on display 40. See Ex. 1001, 3:14–29.

Figure 2C of the '151 patent shows an exemplary embodiment of processing performed within the image processor of Figure 1.

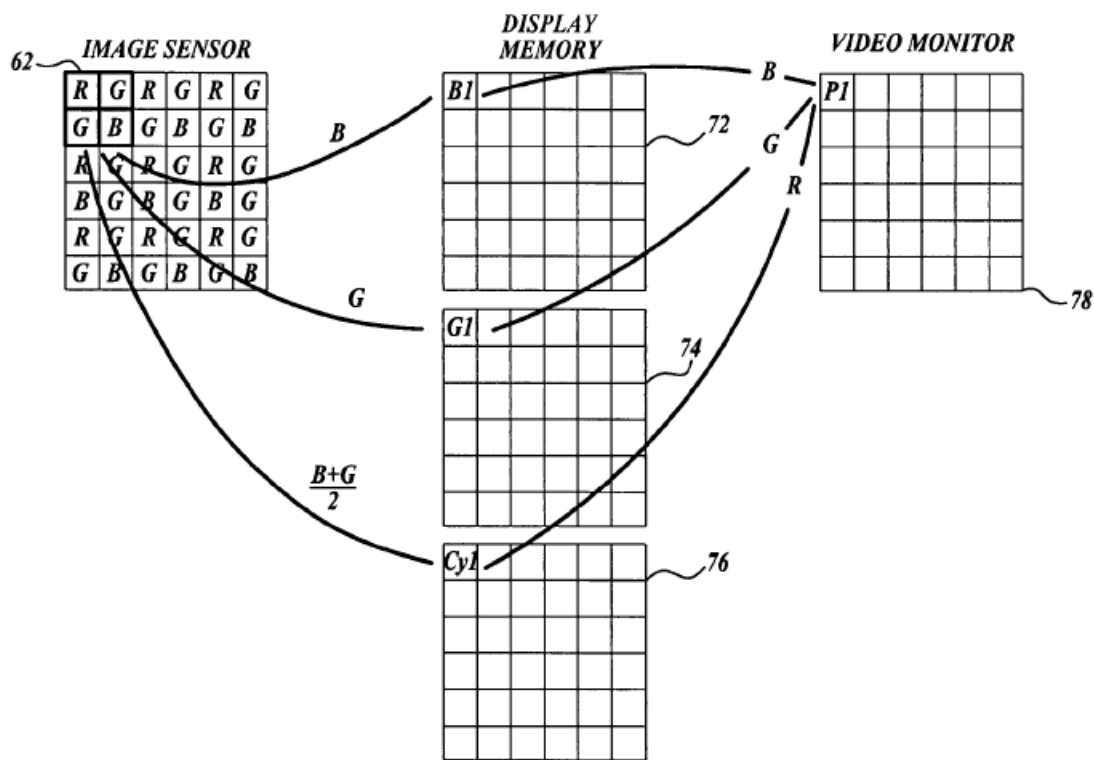


Fig.2C.

Figure 2C of the '151 patent, reproduced above, shows RGB color image sensor 62 producing RGB signal values used by the image processor to determine (e.g., “calculate”) display pixel values (*B1*, *G1*, *Cy1*) in memory 72, 74, 76 for presentation on display 78 as a pixel with reduced red

contribution (*P1*) to generate a short wavelength false image. See Ex. 1001, 4:12–42.

B. Related Matters

Both parties indicate there are no related matters. Pet. 1; Paper 5, 2.

C. Illustrative Claim

Independent claim 1, reproduced below, is exemplary of the invention:

1. A system for producing images of tissue with a medical device that delivers an illumination light to a body cavity and a color image sensor that produces images of the tissue from a number of pixels that are sensitive to different wavelengths of light, comprising:

an image processor coupled to receive signals produced by the color image sensor in response to illumination light reflected from the tissue having red, green, and blue color components, wherein, the image processor calculates image signals that are stored in a memory by minimizing the contribution from signals produced by the image sensor in response to red illumination light.

Ex. 1001, 9:2–14.

II. ANALYSIS

A. Claim Construction

In an *inter partes* review, a claim in an unexpired patent shall be given its broadest reasonable construction in light of the specification of the patent in which it appears. 37 C.F.R. § 42.100(b); see also *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2142 (2016) (affirming that USPTO has

statutory authority to construe claims according to 37 C.F.R. § 42.100(b)). Under the broadest reasonable construction standard, claim terms are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). “[A] claim construction analysis must begin and remain centered on the claim language itself.” *Innova/Pure Water, Inc. v. Safari Water Filtration Systems, Inc.*, 381 F.3d 1111, 1116 (Fed. Cir. 2004). “Though understanding the claim language may be aided by the explanations contained in the written description, it is important not to import into a claim limitations that are not a part of the claim.” *SuperGuide Corp. v. DirecTV Enters., Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004). Furthermore, only those terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *See Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

1. “Image Sensor,” “RGB Sensor,” “CMYG Sensor”

Independent claim 1 recites, “a color image sensor that produces images of the tissue from a number of pixels that are sensitive to different wavelengths of light.” Independent claim 10 similarly recites, “an image sensor that receives reflected light from the tissue sample, the image sensor having a number of pixels sensitive to different wavelengths of light and which generate image signals in response to the light received from the tissue sample.” Dependent claims 2–6 and 13 narrow the scope of the image sensor to an “RGB sensor.” Dependent claims 7–9 and 14 narrow the scope of the image sensor to a “CMYG sensor.”

Petitioner proposes the broadest reasonable interpretation of “color image sensor” or “image sensor” as: “an arrangement comprising an image sensor and at least one color filter, where the image sensor’s pixels receive light that passes through the color filter.” Pet. 12 (emphasis omitted). Petitioner contends this construction is consistent with the claims and encompasses several types of sensors known in the art at the time of the ’151 patent. Pet. 13. In particular, Petitioner’s proposed construction encompasses “RGB (rotary filter) sensors.” *Id.* Petitioner next argues the specification does not narrow the construction of the term but, instead, merely provides examples of known color image sensors including a CMYG color image sensor and an RGB color image sensor. *Id.*

In the Preliminary Response, Patent Owner argues Petitioner’s proposed construction is unreasonably broad and, in particular, is inconsistent with the specification, which specifically distinguishes previously known apparatus that use movable filters which cause the same color light to fall on every pixel of the image sensor. Prelim. Resp. 8–10 (citing Ex. 1001, 1:44–59, 1:63–2:1). Furthermore, Patent Owner argues Petitioner’s proposed construction is inconsistent with the claim, per se, requiring that the sensor “produce images from, or have, a number of pixels that are sensitive to different wavelengths of light.” Prelim. Resp. 10. Patent Owner contends this is only possible if the image sensor has at least two different color filters on its surface. *Id.*

In our Decision on Institution, we determined an *image sensor*, as recited in the claims, is *a device that senses incident light on a plurality of pixels, at least two of which are sensitive to different wavelengths of incident light*. Dec. 12. Further, consistent with the Specification of the ’151 patent,

we determined an *RGB sensor*, as recited in the claims, is *an image sensor having one or more pixels that are sensitive to red light, one or more pixels that are sensitive to green light, and one or more pixels that are sensitive to blue light*. *Id.* Similarly, we determined a *CMYG sensor*, as recited in the claims, is *an image sensor having one or more pixels that are sensitive to cyan light, one or more pixels that are sensitive to magenta light, one or more pixels that are sensitive to yellow light, and one or more pixels that are sensitive to green light*. *Id.* The analytical basis for our constructions was as follows:

The express language of independent claims 1 and 10 makes clear that an image sensor must have or use a plurality of pixels that respond to different wavelengths of light. The exemplary embodiments of the '151 patent are consistent with that claim language, in that the specification discusses the use of an “RGB color image sensor having pixels that are sensitive to red, green, and blue light” (Ex. 1001, 2:9–10) and “a CMYG color image sensor . . . [having] pixels that are sensitive to complementary colors (cyan, magenta, yellow, and green)” (*id.* at 2:20–23). Both these exemplary sensor embodiments utilize mosaic filters coupled with the sensors such that each pixel has an associated filter determining the wavelengths of light incident upon the corresponding pixel, and at least two of those filters have different spectral bands/colors that are passed. *Id.* at 3:40–44, 4:43–47. Thus, for a construction of “image sensor” to be consistent with the claims and the specification, we are persuaded that the construction must be limited to sensors having a plurality of pixels, at least some of which are sensitive to different wavelengths of light (i.e., different colors) than at least some of the other pixels, such as by use of a mosaic filter in front of a CCD sensor array.

By implication, we are persuaded that a proper construction consistent with the claims and the specification would exclude a sensor structure in which all pixels of the sensor respond to the same wavelengths of light. For example, the

admitted prior art techniques identified in the specification (Ex. 1001, 1:44-59) provide that moving filters that pass a single color at a time are placed in front of the light source such that the color of reflected light is incident upon each pixel of the sensor (i.e., a CCD sensor). Thus, in such admitted prior art techniques, each pixel of such a sensor is sensitive to the same wavelength, which is typically any photon or “white” light, but is in any case a monochromatic reflected light that is based on the spectral band of the movable filter presently positioned in the path between the tissue sample and the illumination source.

Dec. 11–12.

In its Patent Owner Response, Patent Owner argues that our use of the word “having” renders unclear whether the above construction is intended to be “open-ended, allowing the image sensor to include pixels that are sensitive to colors other than the three specified in the constructions.” PO Resp. 4. Patent Owner contends the terms *RGB sensor* and *CMYG sensor* had well-understood meanings to ordinarily skilled artisans at the time of filing of the ’151 patent. *Id.* (citing Ex. 2001 ¶ 79). Specifically, Patent Owner asserts that an *RGB sensor* was understood to include *only* pixels sensitive to red, blue, and green and no other colors, and that a *CMYG sensor* was understood to include *only* pixels sensitive to cyan, magenta, yellow, and green and no other colors, and, thus, urges us to modify our above constructions to reflect the same. *Id.* at 4–5 (citing Ex. 2007, 18:19–20:3). We decline to do so. Other than Mr. Jaggi’s unsupported assertion (Ex. 2001 ¶ 79), Patent Owner offers no evidence in support of its assertion that the ordinarily skilled artisan would understand “RGB sensor” and “CMYG sensor” as limited only to the primary colors of the corresponding filters. Patent Owner does not identify any teaching of the ’151 patent that requires such a narrow reading of the terms. To the contrary, as noted by

Mr. Gunday, RGB and CMYG sensors that were sensitive to additional colors were known at the time of the '151 patent filing. Ex. 1018 ¶ 23 (citing Ex. 1007, Fig. 11 (disclosing a sensor that combines *both* RGB and CMYG pixels)); *see also* Pet. Reply 1–2 (agreeing with the Board’s preliminary constructions). Thus, we perceive no lack of clarity in our constructions and emphasize that our constructions of “RGB sensor” and “CMYG sensor” do not limit such sensors to *only* the three (RGB) or four (CMYG) types of pixels.

For the above reasons, we perceive no reason to modify our constructions of the terms “RGB sensor” and “CMYG sensor” in light of the record developed at trial.

2. *“Calculates” Image Signals by Minimizing Red Light Contribution*

Independent claim 1 recites “calculates image signals that are stored in a memory by minimizing the contribution from signals produced by the image sensor in response to red illumination light.” Petitioner does not propose a construction of this phrase in its Petition. Patent Owner argues we should construe the word “calculates” as “performing a mathematical manipulation.” PO Resp. 5 (citing Mr. Jaggi’s Declaration, Ex. 2001 ¶ 81 (which, in turn, relies on Ex. 2005, an online dictionary definition⁴)).

⁴ We observe Exhibit 2005, the online dictionary Mr. Jaggi relies upon in opining on a definition of “calculates,” includes other definitions, such as, “to determine by reasoning, common sense, or practical experience” and “to make suitable or fit for a purpose; adapt.” Ex. 2005. Mr. Jaggi does not explain his basis for selecting one of the multiple definitions as evidence of the understanding of the ordinarily skilled artisan and, thus, we accord little weight to this aspect of Mr. Jaggi’s Declaration. *See* Ex. 2001 ¶ 81.

Furthermore, Patent Owner contends the calculated signals must include green, blue, and cyan, and further contends, “[e]very embodiment in the ’151 patent also calculates blue, green, and cyan image signals in order to minimize the contribution from signals in response to red light.” PO Resp. 5–6. Based on this interpretation of “calculates,” Patent Owner contends the phrase, “‘calculates image signals . . . by minimizing the contribution from signals produced by the image sensor in response to red illumination light’ means ‘computing green, blue, and cyan image signals, resulting in minimizing the contribution from components of light with wavelengths over 600 nm.’” PO Resp. 8 (citing Ex. 2001 ¶ 91). Petitioner replies that, for a variety of reasons, Patent Owner’s proposed construction is unduly narrow and concurs with our interpretation in our Decision on Institution. Pet. Reply 2–4.

We are disinclined to adopt Patent Owner’s proposed construction of this phrase, as recited in claim 1, to require mathematical manipulation. Claim 1 recites “calculates” in a self-defining manner, specifically reciting calculating the image signals “**by** minimizing the contribution from signals produced by the image sensor in response to red illumination light.” Thus, claim 1 is clear on its face that the calculation to be performed is **by** minimizing the contribution from red light. Therefore, our analysis shifts to determining the meaning of “minimizing” as recited in claim 1.

The ’151 patent discloses a variety of embodiments for “minimizing” the contribution of red light.⁵ For example, in support of the Patent Owner’s

⁵ Additionally we observe that “minimizing” appears only once in the ’151 patent—in claim 1 (and, thereby, also in its dependent claims 2–9).

construction, the '151 patent does disclose exemplary embodiments that minimize red light contribution utilizing mathematical manipulations including, for example, CMYG filter computations that are “considered to be well known to those of ordinary skill in the art” (Ex. 1001, 4:66–7:59) and averaging blue and green signals to “compute” a cyan signal (*id.* at 4:21–24). The '151 patent, however, also specifically recites,

Because the passbands of the red mosaic filters do not significantly overlap with the pass bands of the other filters for a short wavelength imaging mode, the contribution of the image signals due to red illumination light can be *reduced or largely eliminated by not assigning the image signals produced by image sensor pixels that are sensitive to red light* to their corresponding display pixels.

Id. at 4:5–12 (emphasis added). The '151 patent further states “a short wave-length image (or the color components of such an image) can be computed from a subset of image sensor signals (i.e. *excluding the signal data from red light*).” *Id.* at 8:29–32 (emphasis added). Thus, the '151 patent also encompasses the contribution of red light in the image being

Claim 10 includes a related recitation using the phrase “substantially eliminating” in reference to contribution from red light. The '151 patent uses other phrases in reference to the contribution of red light, including, “reduces” (Ex. 1001, Abstract), “substantially eliminate” (*id.* at 2:24), “remove or reduce” (*id.* at 3:9), “reduced or largely eliminated” (*id.* at 4:9), “substantially reduced or eliminated” (*id.* at 6:63), “substantially reduced” (*id.* at 7:65), “eliminate” (*id.* at 8:9), and “substantially eliminating” (*id.* at 8:42). At oral hearing, Patent Owner’s counsel acknowledged Patent Owner does not propose a different interpretation of these various phrases. Tr. 40:16–17. Thus, we determine that “minimize,” “reduce,” “eliminate,” various root extensions of these words, and combinations of these words with and without the adverb “substantially,” are considered synonymous in the '151 patent.

“reduced or largely eliminated” in an image (i.e., “minimized”), by simply disregarding the red signal value in determining the pixels of the displayed image (i.e., “not assigning” the pixels sensing red to the corresponding display pixels or “excluding” the red pixels).

Therefore, we construe “calculates image signals that are stored in a memory by minimizing the contribution from signals produced by the image sensor in response to red illumination light” as encompassing mathematical manipulations, as well as non-mathematical techniques, that “minimize the contribution from signals produced by the image sensor in response to red illumination light.”⁶

3. “Memory”

Claim 1 recites, *inter alia*, that the “calculated” signal values “are stored in a memory.” In our Decision on Institution, we determined, in our analysis of the prior art grounds, that “[n]othing in claim 1 requires a particular type of memory for storing the calculated image signals nor a particular location for such a memory.” Dec. 15–16. Patent Owner argues that although the arguments pre-institution focused on where the memory was located in the claimed structures, “[a] separate issue, however, is the fact that the term ‘memory’ as used in the claims, must be ‘display memory.’” PO Resp. 8–9. Patent Owner contends “memory,” as recited in

⁶ This construction is consistent with that alluded to in the analysis of the prior art grounds in the Decision on Institution, where we determined that the aforementioned claim limitations requires minimizing red light contribution, but does not require any particular method for minimizing the contribution of red light in the generated image. See Dec. 16, 19; see also Pet. Reply 2 (asserting the same).

claim 1, means “display memory,” because the only memory referred to in the Specification of the ’151 patent is “display memory.” *Id.* at 9. Patent Owner further contends the recited memory must be a display memory including a “frame buffer that stores the processed image data for scanning to a monitor for real time display,” because a physician would need to view real-time images in endoscopic applications, and a display memory frame buffer “was the only type of memory capable of achieving such real-time display.” *Id.* at 10 (citing Ex. 2001 ¶ 95). Thus, Patent Owner concludes “memory” as recited in claim 1 is a “display memory.” *Id.*

We do not adopt Patent Owner’s interpretation. Although the claims are interpreted consistent with the specification, we decline to import exemplary embodiments from the specification as limitations in the claims. *See SuperGuide*, 358 F.3d at 875. Nothing in the ’151 patent discusses real-time display of a frame as argued by Patent Owner. All that is required of the “memory” recited in claim 1 is a memory capable of storing the calculated signals (i.e., the signals determined mathematically or otherwise to minimize the contribution of red light). Because claim 1 only requires storing the calculated values, it is presumed that a wide variety of memory would meet that claim limitation.

Another aspect of “memory” at issue here is whether the term should be interpreted to broadly encompass an analog “memory” device (such as analog buffers as discussed *infra*). This issue is relevant because Krauter (Ex. 1004), as discussed below, performs certain calculations to process pixels of an image and, after processing the pixel values digitally, converts the digital values to analog signals. The analog signals are applied to an

analog “buffer,” which, in turn, applies the analog signal value to a display monitor.

In applying Krauter, Petitioner argues such an analog buffer may be considered “memory” because it stores data—even if only temporarily. See Pet. 44 (“The image signals that are calculated by the DSP [a]re stored in memory ‘buffers’ for display on a monitor.”); *see also* Ex. 1011 ¶ 264 (“It is common knowledge that buffers are a type of memory.”). In his deposition, Mr. Gunday testified,

Q[:] But what’s described as an analog buffer is not a memory, right?

A[:] Could be considered as a memory. There’s analog memories that will hold a value for -- you know.

Q[:] Well, what do you understand this Buffer 33 to be doing?

A[:] It’s holding the analog value to go out to a monitor.

Q[:] And you describe that as memory?

A[:] I can, sure. Buffer is a memory.”

Ex. 2007, 57:10–19

Patent Owner responds by arguing Krauter’s buffers are not memory because they store analog data and, by contrast, the ordinarily skilled artisan would understand “memory” as digital memory (i.e., storing digital data rather than analog data). PO Resp. 46–48 (citing Mr. Gunday’s deposition testimony Ex. 2007, 57:20–58:1 (“Q[:] Well, isn’t it true that as -- using -- one skilled in the art, if you hear the term “memory,” you think about a digital memory? A[:] Sure. I agree with that.”). At oral hearing Patent Owner emphasized this point stating,

JUDGE BISK: I think that's true because I think most memory is digital, but I'm not sure that it leads to your conclusion that analog buffer is not.

MR. KREEGER: Well, it's not just what Mr. Jaggi's bare testimony. He explains that what the analog buffer does is it does not actually store the value. It passes through it transiently for a very brief moment of time, as it's true for anywhere within the circuit as a whole. If the analog buffer counts as a memory, then every portion of this circuit is a memory.

Because as the signal passes through the circuit, it will transiently pass through that in a moment in time, but one of skill in the art would not consider that a memory and it's not a memory and it's quite different from the other sorts of components.

JUDGE BISK: So how long does it have to stay to be a memory?

MR. KREEGER: Well, it has to be stored for some period of time and we submit that as used in this patent and as used in the art, it would have to be a digital memory to be stored for a nontrivial portion of time. This is not that. This buffer is not for that purpose. It's not a memory.

Paper 34, 35:22–36:15.

Although the '151 patent does not address “analog” or “digital” in reference to “memory,” we agree with Patent Owner, based primarily on the cross-examination testimony of Petitioner's expert, Mr. Gunday, that the ordinarily skilled artisan at the time of the '151 patent filing would have understood “memory,” in the context of the '151 patent, to be referring to digital memory rather than analog buffers. The signals stored in Krauter's analog buffers are transitory, analog signals propagating from circuits that calculate a value, through the analog buffer, to an analog input of a display monitor. We are persuaded that an ordinarily skilled artisan would not have considered such analog buffers to be a memory in the context of the '151 patent.

Thus, we determine “memory,” as recited in claim 1, means *any digital memory capable of storing image signals that minimize the contribution of red light*.

4. “Sensitive” and “Primarily Sensitive”

Patent Owner observes claim 3 recites pixels “sensitive” to certain colors and claim 7 recites pixels “primarily sensitive” to certain colors. PO Resp. 11. Patent Owner then argues “a person of ordinary skill in the art would have understood the term ‘sensitive to’ light of a particular color to mean ‘primarily sensitive to’ the light of that color.” *Id.* (citing Ex. 2001 ¶¶ 96–99). Petitioner responds that Patent Owner’s proposed interpretation should be rejected because “sensitive” is a broader term than “primarily sensitive.” Pet. Reply 5. Petitioner further asserts “while a pixel in a color image sensor may be sensitive to more than one color of light, it is *primarily* (i.e. mostly) responsive to one color of light.” *Id.* at 6.

The doctrine of claim differentiation would normally give rise to a presumption that “primarily sensitive,” as recited in dependent claim 7, is narrower than “sensitive” as recited in its base claim 1. We observe, however, claim 2 recites “primarily sensitive” and depends from claim 1, which recites “sensitive.” Thus, claim differentiation would again support a presumption that “primarily sensitive” (in claim 2) is narrower than “sensitive” (in claim 1). But claim 3 recites “sensitive” and depends from claim 2, which recites the presumably narrower “primarily sensitive,” giving rise to the opposite presumption under the claim differentiation doctrine. Therefore, the claim differentiation doctrine does not aid us in determining a difference between these two terms.

We further observe that “primarily sensitive” does not appear in the Specification of the ’151 patent. Still further, we observe that claim 2, dependent from claim 1 and from which claim 3 depends, uses both “primarily sensitive” and “sensitive” in reference to the same blue and green pixels.

Thus, it appears the ’151 patent intended no distinction between “sensitive” and “primarily sensitive.” Therefore, we are unable to identify any basis for interpreting “primarily sensitive” as meaning anything different than “sensitive” in the context of the ’151 patent claims. Furthermore, we agree with Mr. Jaggi that a pixel being “sensitive” to a color should be understood to mean the pixel is mostly sensitive to a particular color (a range of the spectrum) but not to the exclusion of some degree of sensitivity to other colors. *See* Ex. 2001 ¶¶ 97–98.

We, therefore, interpret “sensitive” and “primarily sensitive” to be synonymous in the context of the ’151 patent.

5. *Producing a “Short Wavelength Image . . . by Substantially Eliminating a Contribution of Red Light”*

Independent claim 10 recites, in part, “wherein the short wavelength image of the tissue is produced by substantially eliminating a contribution of red light in the set of image signals.” Based on exemplary embodiments in the ’151 patent (PO Resp. 11–13), Patent Owner argues this phrase should be interpreted as “forming an image from calculated green, blue, and cyan signals, thereby substantially eliminating the contribution from components of light with wavelengths over 600 nm” (PO Resp. 13 (citing Ex. 2001 ¶ 103)).

Petitioner argues, and we agree, Patent Owner’s argument unduly narrows the aforementioned phrase to require calculation of green, blue and cyan signals to effect the substantial elimination of red light. Pet. Reply 6–7. In particular, analogous to our discussion *supra* (section II.A.2 regarding “calculates . . . by minimizing,” as recited in claim 1), claim 10 recites producing a short wavelength image in a self-defining manner—“by substantially eliminating a contribution of red light in the set of image signals.” Thus, the calculation to be performed is any approach that substantially eliminates a contribution of red light in the set of image signals. Further, as discussed *supra*, the ’151 patent recites a number of exemplary embodiments and techniques for “substantially eliminating” (i.e., “minimizing”), including both mathematical manipulation and non-mathematical techniques (Ex. 1001, 4:10–12 (“not assigning the image signals produced by image sensor pixels that are sensitive to red light to their corresponding display pixels”))).

We decline to narrow the interpretation of claim 10, as proposed by Patent Owner, by importing exemplary embodiments of the Specification into claim 10 to require calculation of a particular set of color signals by mathematical manipulation. Instead, we construe “wherein the short wavelength image of the tissue is produced by substantially eliminating a contribution of red light in the set of image signals” as encompassing mathematical manipulations, as well as non-mathematical techniques, that “substantially eliminat[e] a contribution of red light in the set of image signals.”

6. *Other Claim Terms*

On the record before us as developed at trial, we determine that it is unnecessary to explicitly construe any other claim terms.

B. Obviousness over Yabe (Ex. 1007)

Petitioner contends that claims 1–17 are obvious over Yabe.

A patent claim is unpatentable under 35 U.S.C. § 103(a) “if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007) (citing 35 U.S.C. § 103(a)). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) where in evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). Furthermore, the *KSR* Court guides us that,

“there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness” [H]owever, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ. 550 U.S. at 418 (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

With these standards in mind, we address the obviousness challenge below.

1. *Level of Ordinary Skill*

Mr. Gunday testified,

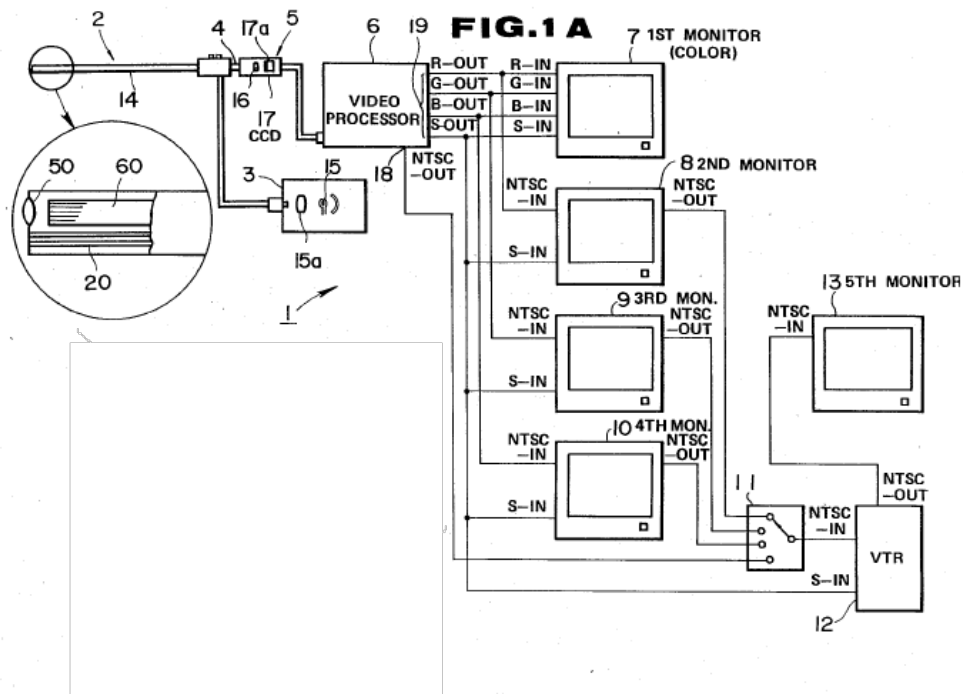
In my opinion, a person having ordinary skill in the relevant art at the time of the alleged invention is a person with a Bachelor of Science degree in Physics, Computer Engineering, Computer Science, or other similar degree, and two ([2]) to three (3) years of work experience relating to medical endoscopic imaging. Such a person would have had an understanding of, or experience in, designing, implementing, and using endoscopic imaging systems, including light sources and endoscopic video and image processing.

Ex. 1011 ¶ 76. Mr. Jaggi agrees with Mr. Gunday's opinion in this regard, adding only that degrees in "Electrical engineering or Engineering Physics" would each qualify as Mr. Gunday's "other similar degree." Ex. 2001 ¶¶ 53–54.

We agree with and adopt the view of the parties regarding the level of ordinary skill in the art.

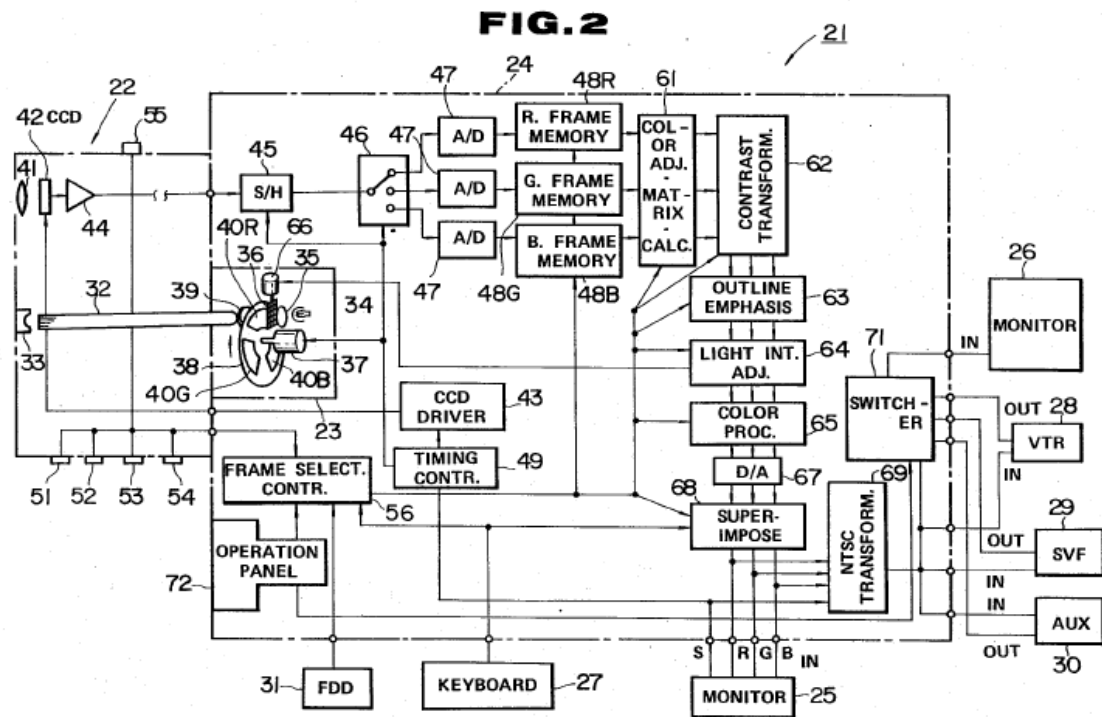
2. *Summary of Yabe*

Yabe discloses three embodiments of an endoscope imaging device. Yabe's first embodiment (Ex. 1007, Fig. 1A) is depicted as follows:



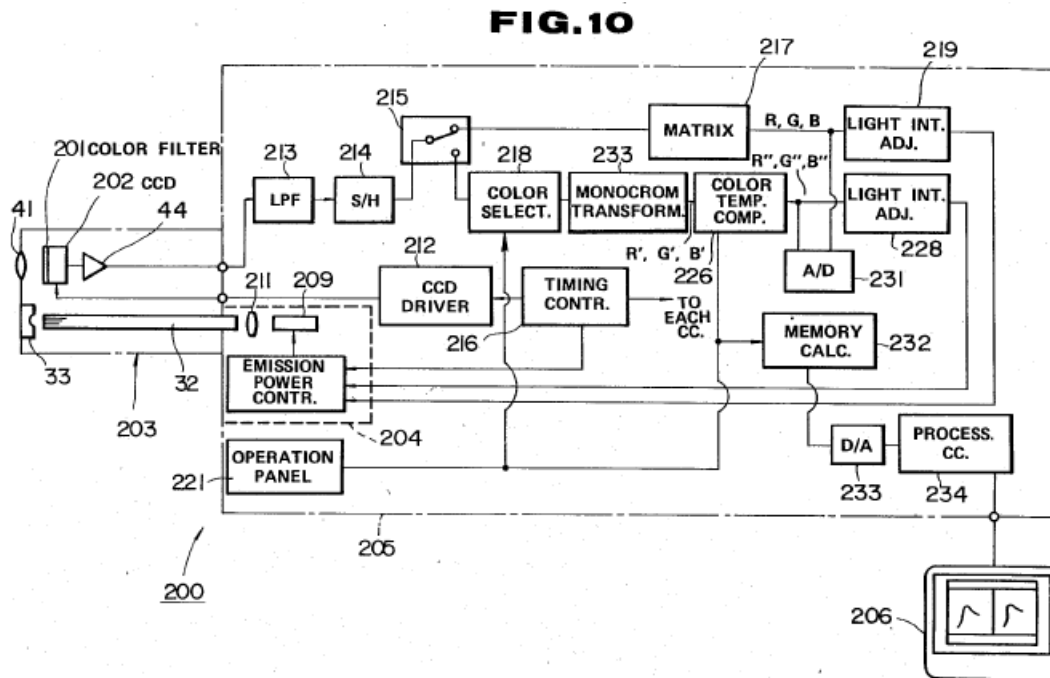
Yabe Figure 1A, reproduced above, shows medical imaging device 1 having white light source apparatus 3 illuminating tissue, the illuminations reflected back to camera head 5 having CCD image sensor 17 with mosaic filter 17a attached thereto. Ex. 1007, 3:12–34. Mosaic filter 17a may be, for example, an RGB filter. *Id.* at 3:30–31.

The second embodiment of Yabe (Ex. 1007, Fig. 2) discloses a medical imaging device as follows:



Yabe Figure 2 reproduced above is a block diagram of medical imaging device 32 using light source section 23 that includes rotary filter 38 to selectively generate colors from the light that reflects back to CCD sensor 42. Ex. 1007, 5:40-53.

The third embodiment of Yabe (Ex. 1007, Fig. 10) discloses a medical imaging device as follows:



Yabe Figure 10, reproduced above, is a block diagram of endoscope 200 using light source section 204 and mosaic filter 201 mounted in front of CCD 202 to effectuate color separation for pixels of CCD 202 receiving reflected light. Ex. 1004, 18:59–19:6. Filter 201 may be a mosaic filter including RGB and CMYG color filter elements. *Id.* at 19:6–10, Fig. 11.

3. Independent Claims 1 and 10

a. Motivation to Modify Yabe

Petitioner does not rely on any one of Yabe's three embodiments, alone, to meet every limitation of claim 1 but, instead, proposes a combination of elements relying primarily on the structure of Yabe's second embodiment (Ex. 1007, Fig. 2) with modifications based on features of embodiment one (*id.* at Fig. 1a) and embodiment three (*id.* at Fig. 10).

Pet. 15–16. The first and third embodiments of Yabe include CCD sensors, and utilize mosaic filter structures in which each pixel of the CCD sensor responds to the color of the mosaic filter element positioned between the pixel and the reflected light. In the structure of the second embodiment, however, CCD sensor 42 does not fall within the scope of our above construction of the recited *image sensor*, i.e., it is not a device that senses incident light on a plurality of pixels, *at least two of which are sensitive to different wavelengths of incident light*. Instead, all pixels of CCD sensor 42 respond to the same wavelength of light generated by the light source through rotating filter 38, as all the light falling on all the pixels passes through only one filter passing only one color at a time. *See, e.g.*, Ex. 1007, 6:53–59

Petitioner proposes combining image sensor features of the first or third embodiments (CCD with a mosaic filter) with the image processing structure of the second embodiment. Pet. 16–20. Petitioner argues that the ordinarily skilled artisan would have combined the mosaic filter CCD structure of Yabe’s first embodiment (17/17a) with the endoscope of Yabe’s second embodiment, contending CCD image sensor with attached mosaic filters “were well known in the art.” *Id.* at 20. Petitioner further argues Yabe “states that the second embodiment can be applied to electronic scopes with ‘built-in color filters [(i.e., mosaic filters)] for image pickup’ and Yabe’s first embodiment includes such a scope.” *Id.* (citing Ex. 1007, 6:44–49, 18:17–23). In particular, Petitioner argues Yabe expressly provides the motivation to combine the second embodiment with a mosaic filter CCD image sensor, stating, “[t]he present invention can be applied not only to the surface-sequential-type endoscope (endoscopic system [(with a rotating

filter))) but also to a system composed of an electronic scope with a built-in color filter [(mosaic filter attached to the CCD image sensor)] used under a white light illumination.” Ex. 1007, 18:17–22. Thus, Petitioner contends it would have been “obvious to try the ‘image pickup means’ of Yabe’s first embodiment in the Yabe’s second embodiment because it would serve the same purpose as the existing rotary filter/CCD arrangement and lead to predictable results (i.e. the generation of red, blue, and green image signals).” Pet. 20.

Patent Owner argues Petitioner’s reasons to combine—“to enhance the diagnostic effectiveness of the endoscopic images” or “obtain effective endoscopic examinations”—are merely stated without explanation. PO Resp. 13–14 (quoting Pet. 22–25). Patent Owner’s arguments are misplaced. The portions of the Petition quoted by Patent Owner relate to motivations to combine embodiments to provide features of dependent claims—not the reasons quoted above that Petitioner provided with respect to claim 1.

Patent Owner further argues it would not have been obvious to combine the aforementioned embodiments of Yabe, because the proposed combination would be difficult and produce unpredictable results. PO Resp. 14–16 (citing Ex. 2001 ¶¶ 123–128). Specifically, Patent Owner asserts the proposed combination to replace the rotating filter of Yabe’s second embodiment with a CCD mosaic image sensor in Yabe’s first or third embodiments “would have involved numerous design changes and hardware modifications, not to mention testing on biological tissue to ensure that the redesigned system worked for its intended purpose,” and that such modifications would have been beyond the ability of the ordinarily skilled

artisan. *Id.* at 15 (citing Ex. 2001 ¶¶ 124–128). Mr. Jaggi’s Declaration, on which Patent Owner relies, enumerates a variety of issues alleged to require complex re-design by extraordinarily skilled artisans to combine the embodiments of Yabe. Ex. 2001 ¶¶ 124–128. Petitioner responds by refuting the alleged complexities of the proposed combination of embodiments maintaining the required modifications are simple and within the skill of the ordinarily skilled artisan. Pet. Reply 7–8 (citing Ex. 1018 ¶¶ 48–58). We agree with Petitioner.

Initially, we note bodily incorporation of the features of the embodiments is not the test of obviousness; rather, the test lies in what is taught or suggested to the ordinarily skilled artisan by the proposed combination of embodiments of Yabe. *See In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986). Furthermore, “the [obviousness] analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” *KSR*, 550 U.S. at 418. “If a person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability.” *Id.* at 417.

Yabe discloses multiple embodiments and expressly discloses interchangeability of rotary (“surface-sequential-type”) filters as disclosed in Yabe’s second embodiment (Figure 2) and mosaic (“built-in”) filters as disclosed in Yabe’s first and third embodiments (Figures 1a and 10). Ex. 1007, 18:17–21. Yabe’s express disclosures outweigh the unsupported assertions of Patent Owner’s expert regarding the complexity of constructing the proposed combination of embodiments. “Combining two embodiments disclosed adjacent to each other in a prior art patent does not require a leap

of inventiveness.” *Boston Sci. Scimed, Inc. v. Cordis Corp.*, 554 F.3d 982, 991 (Fed. Cir. 2009). Therefore, we are persuaded, by a preponderance of the evidence, that the ordinarily skilled artisan would have had reason to combine the embodiments of Yabe, as proposed by Petitioner, “because it would serve the same purpose as the existing rotary filter/CCD arrangement and lead to predictable results.” *See* Pet. 20; *see also* *KSR*, 550 U.S. at 417.

b. Comparing Claims 1 and 10 to Yabe

Petitioner identifies all limitations of claim 1 in features of Yabe’s device, as modified to combine the second embodiment with either the first or third embodiment. Pet. 16–20. In particular, Petitioner argues Yabe teaches calculating image signals that are stored in a memory as values that are stored in “a still video floppy apparatus (SVF) for picking up images, and other recording devices (AUX) 30 for recording/reproducing the composite video signals input to said monitor 26; and a floppy disk drive apparatus (FDD) 31.” Pet. 19 (citing Ex. 1007, Fig. 2, 17:37–42; Ex. 1011 ¶ 127).

Patent Owner argues Petitioner’s proposed modifications of Yabe (combining embodiments) fails to disclose “calculates image signals . . . by minimizing the contribution” of red light, as recited in claim 1. PO Resp. 16–23. Specifically, this argument hinges on Patent Owner’s proposed interpretation of the phrase as requiring mathematical manipulation (calculation) of each of a green signal, a blue signal, and a cyan signal. *Id.* at 16. As discussed *supra* (section II.A.2), we reject Patent Owner’s proposed construction that requires mathematical calculations (within the scope of claim 1) or even that requires any determination of green, blue, and

cyan signals. Rather, claim 1, properly construing the “calculates . . . by minimizing” phrase, merely requires any technique that reduces/minimizes the contribution of red light to the generated image. Contrary to Patent Owner’s assertions, the ’151 patent specifically discloses an embodiment in which “the contribution of the image signals due to red illumination light can be reduced or largely eliminated by not assigning the image signals produced by image sensor pixels that are sensitive to red light to their corresponding display pixels.” Ex. 1001, 4:8–12. Thus, at least one disclosed embodiment within the scope of claim 1 reduces or largely eliminates the contribution from red light without any mathematical manipulations, and Petitioner’s proposed modifications of Yabe (combining embodiments) meets that scope.

Patent Owner also contends “Yabe does not disclose a display memory that stores calculated image signals.” PO Resp. 27 (citing Ex. 2001 ¶ 146). Patent Owner’s contention is based on its assertion that “memory,” as recited in claim 1, would be understood as “display memory,” which, in turn, “was known in the art to refer to a frame buffer” storing image data to be “scanned out to a monitor for real-time display.” *Id.* As discussed *supra* (section II.A.3), we rejected Patent Owner’s proposed interpretation of “memory” as narrowly reading only on “display memory” (i.e., a frame buffer) to the exclusion of other types of memory. Even under Patent Owner’s narrower interpretation, however, Petitioner contends Yabe’s second embodiment discloses frame buffers in the circuits that perform image processing, as follows:

Yabe’s video processor 24 stores the image signals received from the CCD 42 “in R, G, and B frame memories 48R, 48G, and 48B” and those signals are then “input into a color

adjustment/matrix/calculation circuit 61,” after which they undergo various other transformation and processing steps including before ultimately being output to monitors 25 and 26. (Ex. 1007 at 6:65-7:31, 8:36-12:60; Fig. 2; Gunday at ¶¶121-28.)

Pet. 18. Yabe further discloses, “the color adjustment/matrix/calculation circuit 61, the contrast transformation circuit 62, the outline emphasis circuit 63 and the color processing circuit 65 are digital image processing circuits each having a frame memory.” Ex. 1007, 18:1–5; *see also* Pet. Reply 11. Still further, Yabe discloses a still video floppy 29 (“SVF”) and “AUX” 30 both used to store image data that has been processed to minimize the contribution from red light. *See, e.g.*, Ex. 1007, 7:17–30. Accordingly, we agree with Petitioner that Yabe teaches the disputed limitation even under Patent Owner’s narrower interpretation of the term “memory.”

Considering the parties’ arguments and the evidence of record, we are persuaded, by a preponderance of the evidence, that Yabe’s embodiments, combined as proposed by Petitioner, teaches or suggests all features of independent claim 1.

Independent claim 10 includes recitations substantially similar to claim 1. Petitioner identifies features of claim 10 in Yabe (modified to combine embodiments) similar to those identified in claim 1 discussed *supra*. *See* Pet. 30–33. Patent Owner argues claim 10 is not obvious over Yabe for essentially the same reasons as claim 1 (PO Resp. 42–44) and Petitioner responds that claim 10 is obvious over Yabe for essentially the same reasons as claim 1 (Pet. Reply 18). Considering the parties’ arguments and the evidence of record regarding claim 10, we are persuaded by a preponderance of the evidence, for reasons explained above with respect to

claim 1, that Yabe's embodiments, combined as proposed by Petitioner, teaches or suggests all features of independent claim 10.

4. *Dependent Claims 2–9 and 11–17*

a. *Claim 2*

Claim 2 depends from claim 1, and further recites “the image sensor is an RGB sensor having pixels that are sensitive to red, green, and blue light,” and recites the image processor “computes the image signals for storage in the memory from the signals produced by the pixels that are sensitive to green and blue light only.” As discussed *supra*, we find no distinction in the recitation of pixels that are “primarily sensitive” to blue and green and pixels that are “sensitive” to blue and green. Despite differences within the recitations of claim 2, the claim is referring to the same blue and green pixels.

Petitioner identifies this feature in Yabe's Table 1.2, in which the “G+B” mode of operation uses only the values “Gii” (green) and “Bii” (blue) to generate output signals “Roi,” “Goi,” and “Boi.” Pet. 21.

Yabe's Table 1.2 is reproduced below.

TABLE 1.2			
Set mode	Set mode		
	NORMAL	B/W	COLORING
G + B mode	Roi = 0	$\text{Roi} = 0.3 C_6 (\text{Gii} + C_7 \text{Bii})$	$\text{Roi} = 0.3 C_6 (\text{Gii} + C_7 \text{Bii})$
	Goi = Gii	$\text{Goi} = 0.59 C_6 (\text{Gii} + C_7 \text{Bii})$	$\text{Goi} = 0.59 C_6 (\text{Gii} + C_7 \text{Bii})$
	Boi = Bii	$\text{Boi} = 0.11 C_6 (\text{Gii} + C_7 \text{Bii})$	$\text{Boi} = 0.11 C_6 (\text{Gii} + C_7 \text{Bii})$
R + B mode	Roi = Rii	$\text{Roi} = 0.3 C_8 (\text{Gii} + C_9 \text{Bii})$	$\text{Roi} = 0.3 C_8 (\text{Gii} + C_9 \text{Bii})$
	Goi = 0	$\text{Goi} = 0.59 C_8 (\text{Gii} + C_9 \text{Bii})$	$\text{Goi} = 0.59 C_8 (\text{Gii} + C_9 \text{Bii})$
	Boi = Bii	$\text{Boi} = 0.11 C_8 (\text{Gii} + C_9 \text{Bii})$	$\text{Boi} = 0.11 C_8 (\text{Gii} + C_9 \text{Bii})$
R mode	Roi = Rii	$\text{Roi} = 0.3 C_{10} \text{Rii}$	$\text{Roi} = 0.3 C_{10} \text{Rii}$
	Goi = 0	$\text{Goi} = 0.59 C_{10} \text{Rii}$	$\text{Goi} = 0.59 C_{10} \text{Rii}$
	Boi = 0	$\text{Boi} = 0.11 C_{10} \text{Rii}$	$\text{Boi} = 0.11 C_{10} \text{Rii}$
G mode	Roi = 0	$\text{Roi} = 0.3 C_{11} \text{Gii}$	$\text{Roi} = 0.3 C_{11} \text{Gii}$
	Goi = Gii	$\text{Goi} = 0.59 C_{11} \text{Gii}$	$\text{Goi} = 0.59 C_{11} \text{Gii}$
	Boi = 0	$\text{Boi} = 0.11 C_{11} \text{Gii}$	$\text{Boi} = 0.11 C_{11} \text{Gii}$
B mode	Roi = 0	$\text{Roi} = 0.3 C_{12} \text{Bii}$	$\text{Roi} = 0.3 C_{12} \text{Bii}$
	Goi = 0	$\text{Goi} = 0.59 C_{12} \text{Bii}$	$\text{Goi} = 0.59 C_{12} \text{Bii}$
	Boi = Bii	$\text{Boi} = 0.11 C_{12} \text{Bii}$	$\text{Boi} = 0.11 C_{12} \text{Bii}$
Normal mode	Roi = Rii	$\text{Roi} = 0.3(0.3 \text{Rii} + 0.59 \text{Gii} + 0.11 \text{Bii})$	$\text{Roi} = \text{Rii}$
	Goi = Gii	$\text{Goi} = 0.59(0.3 \text{Rii} + 0.59 \text{Gii} + 0.11 \text{Bii})$	$\text{Goi} = \text{Gii}$
	Boi = Bii	$\text{Boi} = 0.11(0.3 \text{Rii} + 0.59 \text{Gii} + 0.11 \text{Bii})$	$\text{Boi} = \text{Bii}$

Yabe's Table 1.2 (Ex. 1007, 14:5–57), reproduced above, depicts computations involving pixel values from an image sensor (Rii, Gii, and Bii) to generate output pixel values for display or storage (Roi, Goi, and Boi) based on a user's selected "Set Mode." Patent Owner argues claim 2 is non-obvious over Yabe for the same reasons as claim 1 from which it depends. PO Resp. 30.

We agree with Petitioner (Pet. 21) that, in at least the "G+B" "Normal" mode of operation as disclosed in Table 1.2, only the green and blue pixel signals input from the CCD image sensor are used to generate output pixel values. Thus, we are persuaded by a preponderance of the evidence that Yabe's embodiments, combined as proposed by Petitioner, teaches or suggests all features of dependent claim 2.

b. Claim 3

Claim 3 depends from claim 2, and further recites the stored image signals stored in memory are computed by,

calculating a blue signal value from the signals produced by sensor pixels that are sensitive to blue light, a green signal value from the signals produced by sensor pixels that are sensitive to green light and the cyan signal value from a combination of the signals produced by sensor pixels that are sensitive to blue light and the signals produced by sensor pixels that are sensitive to green light.

Ex. 1001, 9:23–30.

Petitioner argues it would have been obvious to the ordinarily skilled artisan to use the “B” mode of Yabe’s Table 1.2 to calculate a blue value as recited in claim 3, to use the “G” mode to compute a green value, and to use the “G+B” mode to calculate a cyan value. Pet. 22; *see also* Pet. Reply 12 (asserting the same). Petitioner further argues it was well known in the art that cyan is a combination of green and blue wavelengths of light and, referring to Yabe’s Table 1.2, argues “in the ‘G+B mode,’ the B/W and COLORING calculations use combinations of green and blue light, and a POSITA would interpret these calculations as generating a cyan signal from the blue and green light.” Pet. 23.

Patent Owner responds that claim 3 expressly requires the calculation of three values—a green value, a blue value, and a cyan value—and argues “the ‘G+B’ ‘B/W’ and ‘Coloring’ modes calculate *different shades of the same color*, which Yabe refers to as blue.” PO Resp. 30–31. Patent Owner further argues Yabe is focused on display of monochrome images and, by contrast, claim 3⁷ “requires the calculation of three signal values (blue,

⁷ In arguing claim 3, Patent Owner argues “[t]his results in different images than claim 1.” PO Resp. 32. The argument refers to claim 1 though purporting to argue regarding claim 3. It is clear that Patent Owner’s reference to claim 1, rather than claim 3, was a typographical error. We consider the arguments as they relate to claim 3.

green, and cyan), which a person of ordinary skill in the art understood would result in a *tricolor* image when displayed on a monitor.” *Id.* at 32.

Initially, we observe nothing in claim 3 requires the calculated value be “displayed on a monitor,” let alone displayed as a “tricolor image” on a monitor. Rather, claim 3 merely recites that three values are to be calculated—values that are stored in a memory based on claim 1, from which claim 3 indirectly depends.

Further, we agree with Petitioner that claim 3 does not require the blue, green, and cyan colors be calculated at the same time. More specifically, the claim does not require that the cyan signal value is calculated from the *values calculated* for blue and green but, instead, recites calculating the cyan signal from the *pixel values* for blue and green (not the calculated values for blue and green), a requirement which Yabe meets in at least the “G+B” mode of operation in Table 1.2. Ex. 1007, 14:5–57.

Thus, we are persuaded by a preponderance of the evidence that Yabe’s embodiments, combined as proposed by Petitioner, teaches or suggests all features of dependent claim 3.

c. Claim 4

Claim 4 depends from claim 3, and further recites the cyan value is calculated by “averaging the signals produced by the pixels that are sensitive to blue light and green light.” Petitioner argues it would have been obvious to the ordinarily skilled artisan to try averaging the signal values of blue pixels and green pixels to calculate a cyan signal value, because “it would involve manipulation of simple known mathematical equations and user-specified constants C_6 and C_7 to reach predicable results,” and the

motivation for trying averaging would have been “simplifying the output signal calculations or to tailor the endoscopic images to better view and compare structures for the diseases or regions of human tissue concerned.” Pet. 23–24 (citing Ex. 1007, Table 1.2, 14:17–20 (“Here, the set values of C_1 to C_{13} are input through the keyboard 27 according to the kind of the principal disease concerned and the region of interest to be examined.”)).

Patent Owner responds, “[t]here is no indication, and Karl-Storz [Petitioner] provides none, that a signal calculated from the average of the green and blue signals would have been expected to provide a better image.” PO Resp. 33 (citing Ex. 2001 ¶ 160). Patent Owner further argues averaging the green and blue signals would not have been a simple mathematical manipulation, but “would have been an enormous amount of work to try thousands of permutations of these constants and simulate their effect on the image, not to mention determining their clinical significance, in order to settle on the particular combination of claim 4.” *Id.* (citing Ex. 2001 ¶ 159).

We agree with Petitioner. It was well known that cyan is a combination of blue and green wavelengths. Ex. 1011 ¶ 138. Thus, it logically follows that various combinations of blue and green would, therefore, generate various shades of cyan. In reference to the “Roi” equation in the “G+B” “COLORING” mode of Yabe’s Table 1.2 (“ $Roi = 0.3 C_6 (G_{ii} + C_7 B_{ii})$ ”), Mr. Gunday testifies, “one of ordinary skill in the art would therefore be motivated to select set values for C_6 and C_7 to generate a cyan (blue + green) signal for use in endoscopic examinations of a disease or region of human tissue.” *Id.* ¶¶ 139–140. We agree with Mr. Gunday that “routine experimentation and use of basic mathematical principles to obtain predictable results” would have led the ordinarily skilled artisan, at the time

of the '151 patent filing, to try averaging the Gii (green pixel signal value) and Bii (blue pixel signal value) to generate a cyan signal value that would have been useful for a particular diagnosis of region of interest in tissue being illuminated. *See id.* ¶ 144. Patent Owner's expert, Mr. Jaggi, agrees that averaging green and blue signals to generate cyan was known in the art prior to the '151 patent filing. Ex. 1017, 76:7–11.

Thus, we are persuaded by a preponderance of the evidence that Yabe's embodiments, combined as proposed by Petitioner, teaches or suggests all features of dependent claim 4.

d. Claim 5

Claim 5 depends from claim 3, and further recites "the calculated blue signal value, green signal value and cyan signal value stored in the memory are supplied to separate color inputs of a color video monitor." Petitioner argues Yabe discloses an RGB monitor for display of video signals output to the monitor through red, blue, and green output terminals. Pet. 24 (citing Ex. 1007, 7:22–25, Fig. 2). Patent Owner responds that claim 5 is non-obvious over Yabe for the same reasons as claim 1 (from which it indirectly depends). PO Resp. 34.

We agree with Petitioner. Yabe discloses use of an RGB monitor for display of signals output from superimpose element 68, following the image processing performed by elements 61–65, and each signal is applied to a corresponding "R," "G," and "B" color input of monitor 25. *See* Ex. 1007, Fig. 2. As discussed *supra*, according to Yabe Table 1.2, a red signal value ("Roi") in the "G+B" "Colored" mode of operation is calculated to provide a cyan signal from the combination of green and blue pixel signal values.

Thus, the output of the image processing of Yabe's Figure 2, applied to the RGB inputs of monitor 25, include cyan, blue, and green.

Thus, we are persuaded by a preponderance of the evidence that Yabe's embodiments, combined as proposed by Petitioner, teaches or suggests all features of dependent claim 5.

e. Claim 6

Claim 6 depends from claim 5, and further recites "the calculated blue signal value, green signal value and cyan signal value stored in the memory are respectively supplied to blue, red, and green color inputs of the color video monitor." Petitioner argues "[t]his variation would have been obvious to try because it would involve basic known techniques of re-routing of video signals to RGB monitor inputs using the video processor's existing functionality, with predictable results." Pet. 25. Petitioner further argues the ordinarily skilled artisan would have been motivated to try such connections "to obtain additional endoscopic image enhancements depending on the disease concerned or the region of interest being examined with the endoscope when in the 'G+B', 'G' or 'B' mode.'" *Id.*

Patent Owner responds, because "Yabe is silent as to how its red, green, and blue output signals . . . are input to a monitor," the ordinarily skilled artisan would have routed the signals in the standard manner. PO Resp. 34. Patent Owner further argues, in the absence of any guidance in Yabe for routing the signals, "a person of ordinary in the art would not have been motivated to map the output signals in the claimed manner." *Id.* at 35 (citing Ex. 2001 ¶¶ 167–169).

Petitioner replies “since there are only three color inputs to the monitor, that presents a relatively small number of possibilities for routing the calculated image signals, so reaching the configuration in claim 6 would not entail undue experimentation.” Pet. Reply 15. We agree with Petitioner.

Initially, we observe Yabe is not silent, as asserted by Patent Owner, regarding connections of output signals to monitor inputs. To the contrary, Yabe’s Table 1.2 provides details for computation of three output signals (Roi, Goi, and Boi) for each operational configuration of his device and, following the image processing of elements 61–65, outputs the generated Roi, Goi, and Boi to the R, G, and B inputs of monitor 25. See Ex. 1007, Fig. 2, 7:22–24.

Additionally, the *KSR* court held,

When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In that instance the fact that a combination was obvious to try might show that it was obvious under § 103.

550 U.S. at 421. Here, in Yabe, as in the ’151 patent, we agree with Petitioner (Pet. Reply 15) there is a small, finite number of solutions to the problem of connecting three output signals to three input terminals of a monitor (e.g., monitor 25 of Yabe’s Figure 2). Specifically, there are six possible configurations of connecting three output signals to three inputs of a monitor (i.e., 123, 132, 213, 231, 312, 321), plus three more configurations if one of the output signals (e.g., red signal input) is not connected to the monitor (i.e., x12, 1x2, 12x). Mr. Gunday testifies that it was common in the art at the time of the ’151 patent filing to disconnect the red signal input

of a monitor to view green, blue, and the resulting combination – cyan. See Ex. 1018 ¶¶ 19; *see also* Pet. Reply 15 (citing the same). Thus, we agree with Petitioner it would have been obvious to try any/all of the limited number of solutions to determine a view that is most useful for a particular diagnostic procedure.

For the reasons above, we are persuaded by a preponderance of the evidence that Yabe’s embodiments, combined as proposed by Petitioner, teaches or suggests all features of dependent claim 6.

f. Claim 7

Claim 7 depends from claim 1, and further recites that the image sensor is a CMYG sensor (having cyan, magenta, yellow, and green pixels) “wherein the image processor computes luminance, red chroma difference and blue chroma difference values from CMYG pixel signals and converts the luminance, red chroma difference and blue chroma difference into blue, green, and cyan signal values and stores these signal values in the memory.”

Petitioner argues CMYG sensors were well known and, as discussed *supra* (section II.B.4.a), it would have been obvious to combine the CMYG mosaic filter of Yabe’s third embodiment with Yabe’s second embodiment (replacing the rotary filter of the second embodiment with a CMYG mosaic filter of the third embodiment). Pet. 24–27. Petitioner further argues the ordinarily skilled artisan would be motivated to make the substitution because “it is more common sense, simpler arrangement than the existing rotary filter/CCD arrangement in Yabe’s second embodiment.” Pet. 26.

Petitioner contends it would have been obvious to the ordinarily skilled artisan to compute luminance and red and blue chroma differences,

because the '151 patent admits such a computation is well known in the art. Pet. 26 (citing Ex. 1001, 4:57–62, 4:66–6:59; Ex. 1011 ¶¶ 159–160).

Petitioner further contends it would have been obvious to calculate blue, green, and cyan signal values, from the calculated luminance and red and blue chroma difference values, because Yabe discloses converting CMYG sensor signals (used to calculate luminance and red and blue chroma values), into red, green, and blue signal values and, in turn, Yabe uses red, green, and blue signal values to calculate blue, green, and cyan colors, as shown in Yabe's Table 1.2 (as discussed *supra*). Pet. 26–27; *see also id.* at 21–23.

Patent Owner argues, for the same reasons discussed *supra* regarding claim 1, it would not have been obvious to substitute a CMYG mosaic filter for the rotary filter of Yabe's second embodiment, because the substitution would have required a complete, complex system redesign. PO Resp. 35–37. For the same reasons as discussed *supra*, we are persuaded that Petitioner is correct that the proposed modification to Yabe would have been obvious and suggested to the ordinarily skilled artisan.

Patent Owner further argues Yabe, as modified, “never mentions computing luminance, red chroma difference, and blue chroma difference values from pixel signals, nor does Yabe describe converting those values into blue, green, and cyan signal values.” PO Resp. 37. Patent Owner further argues calculating blue, green, and cyan signal values from luminance and chroma difference signals is not disclosed by Yabe, and is not routine. *Id.* at 37–38.

We are persuaded it would have been obvious to perform the calculations recited in claim 7. Although Yabe does not expressly disclose determining green, blue, and cyan signal values directly from a CMYG

sensor, we are persuaded Yabe's disclosures combined well known concepts, as admitted by Patent Owner, and, thus, teach or suggest the recited calculations of claim 7.

First, Petitioner asserts it was well known to calculate luminance, red chroma difference, and blue chroma difference from signals produced by a CMYG sensor. Pet. 25; Ex. 1011 ¶ 164. Patent Owner's expert testifies that such calculations are within the capabilities of the ordinarily skilled artisan. Ex. 1017, 164:20–25 (“Q. Do you agree that one of ordinary skill in the art could use the CMYG pixel values from the sensor in Yabe's third embodiment to calculate illuminance [sic] and red chroma difference and blue chroma difference values? A. Yes.”). Petitioner also argues, and we agree, Yabe discloses calculating red, blue, and green signal values from CMYG sensor values. Pet. 27 (citing Ex. 1007, 19:34–37 (“The above matrix circuit 217 exclusively uses those outputs of the CCD which have [passed] through the filters Mg, G₁, Cy₁, and Ye and performs **normal color calculation** so as to convert them into R, G, B signals” (emphasis added))). Patent Owner's expert agrees it was standard (well known) to convert luminance and chroma difference values (such as generated by a CMYG sensor) into red, green, and blue (RGB) signal values.

Q. So would you also then agree that Yabe's third embodiment can be used to convert those luminance, red chroma difference, and blue chroma difference values into blue, green, and cyan signal values?

A. No. I -- you know, I -- I mean, you're talking about standard. You're talking about what's known -- what's known in the industry. If you look at the various conversion matrices, it is CMYG to YCBCR. **It is to RGB.** But -- but it's not to cyan.

Ex. 1017, 165:1–11 (emphasis added). In other words, from the above-summarized evidence, we determine it was known to the ordinarily skilled artisan that: (1) luminance, red chroma difference, and blue chroma difference values are generated from output of a CMYG sensor; (2) red, green, and blue signals values are determined directly from luminance, red chroma difference, and blue chroma difference values; and (3) red, green, and blue signals are determined directly from output signals of a CMYG sensor. Thus, we are persuaded by a preponderance of the evidence that it was well known to convert luminance and chroma difference signals from a CMYG sensor into red, blue, and green signal values. Lastly, Yabe’s Table 1.2 in the “G+B” “COLORING” mode of operation, as discussed *supra*, discloses how to calculate a cyan signal value by combining a blue signal value and a green signal value. Pet. 27; *see also id.* at 21–23. Thus, based on calculations well known to an ordinarily skilled artisan at the time of the ’151 patent filing and Yabe’s Table 1.2, we are persuaded the ordinarily skilled artisan would have found it obvious to calculate blue, green, and cyan signal values based on the calculated luminance and chroma difference values calculated from a CMYG sensor (e.g., at least indirectly by first computing red, green, and blue signal values, which are then used to determine green, blue, and cyan signal values).

For the reasons above, we are persuaded by a preponderance of the evidence that Yabe’s embodiments, combined as proposed by Petitioner, teaches or suggests all features of dependent claim 7.

g. Claims 8 and 9

Claim 8 depends from claim 7, and further recites “wherein the conversion of the luminance, red chroma difference, and blue chroma difference values to blue, green, and cyan signal values incorporates a subtraction of approximately 1.5 times the red chroma difference value from the luminance value.” Claim 9 depends from claim 8, and further recites “wherein the conversion of the luminance, red chroma difference, and blue chroma difference values to blue, green, and cyan signal values incorporates a contribution from the blue chroma difference value to the green, cyan and blue signals in a ratio of approximately 1:4:6, respectively.”

Regarding claim 8, Petitioner argues the recited subtraction “would have been a routine matter of experimentation with matrix coefficients” and that “[s]uch mathematical experimentation with matrices was known and common in the art.” Pet. 28 (citing Ex. 1011 ¶¶ 53–56, 167–169). Petitioner further argues the ordinarily skilled artisan would have been motivated “to try using the claimed subtraction to ensure the elimination [of] the red input component” in Yabe’s “G+B,” “G,” and “B” modes. *Id.*

In like manner, regarding claim 9, Petitioner argues the ordinarily skilled artisan would be motivated to select matrix coefficients to achieve the recited ratio of 1:4:6 to improve the display of desirable green, blue, and cyan colors in Yabe’s “G+B” mode of operation. Pet. 29.

Regarding claim 8, Patent Owner argues Petitioner “provides no more than generic statements in support of its argument, and provides no explanation of how “routine experimentation using basic mathematical principles” would result in the claimed subtraction value.” PO Resp. 39. Patent Owner further argues “there are an infinite number of ways to modify

manufacturer-provided matrix coefficients, and Yabe provides no suggestion or direction that would have led a person of ordinary skill in the art to the claimed value.” *Id.* at 40. Similarly regarding claim 9, Patent Owner contends determining the recited ration “would have required more than routine experimentation to convert luminance and red and blue chroma difference values using the claimed ratio.” *Id.* at 42 (citing Ex. 2001 ¶¶ 210–217).

We agree with Petitioner. Yabe, like the ’151 patent, uses common mathematical matrix manipulation to enhance or reduce the contribution of sensed pixel values in a generated image. Manipulation of coefficients in such matrix math were well known basic mathematical principles. Ex. 1011 ¶ 169. Adding support to our view, Patent Owner’s expert generated some figures purported to represent exemplary displays generated by Yabe’s approach, and generated by the approach of the ’151 patent. *See* Ex. 2001 ¶ 143. In his deposition, Mr. Jaggi was queried about his approach to generate these figures and testified as follows.

Q. But how could that be possible when you didn't select any coefficients -- any values for the coefficients or any values for the input signals?

A. You know, I think in concepts. I think in what -- what do I need to achieve here. What’s important here. And when Krauter says, I’m reducing R, then I’m reducing R.

And I look at this algorithm, and I say to myself, these particular coefficients are not important to that particular question as long as R is being reduced.

And, you know, I don’t want to overstate that figure, as I said. That figure is a nice way, but a correct way to illustrate what I think Krauter is -- is saying.

Ex. 1017, 99:21–100:10. Thus, Mr. Jaggi engaged in “routine experimentation” to generate coefficients—coefficients for which precision is not particularly important—that presented a desired effect of reducing the contribution from red light—the “routine experimentation” Patent Owner contends was not feasible.

Thus, we are persuaded that determining specific reductions of red light contribution based on a subtracted value (1.5) or a particular ratio (1:4:6) would have involved only routine experimentation with the coefficients of the well-known matrix equations, where the range of acceptable coefficients was relatively large. Furthermore, “[t]he normal desire of artisans to improve upon what is already generally known can provide the motivation to optimize variables . . . for use in a known device.” *In re Ethicon, Inc.*, 844 F.3d 1344, 1351 (Fed. Cir. 2017) (citations omitted).

For the reasons above, we are persuaded by a preponderance of the evidence that Yabe’s embodiments, combined as proposed by Petitioner, teaches or suggests all features of dependent claims 8 and 9.

h. Claims 11–14

Claims 11 and 12 each depend from claim 10, and recite that the image sensor is positioned at the distal and proximal end, respectively, of an endoscope. Claims 13 and 14 each depend from claim 10, and recite that the image sensor is an RGB sensor and a CMYG sensor, respectively. Patent Owner does not respond to any arguments of Petitioner regarding these claims, other than to refer to the arguments for claim 10 from which these claims depend. PO Resp. 44.

Regarding claims 11 and 12, Petitioner argues each positioning option of claims 11 and 12 would have been an obvious design choice in Yabe. Pet. 33–34 (citing Ex. 1011 ¶¶ 199–203). More specifically, regarding claim 11, Petitioner identifies Yabe’s third embodiment as disclosing the image sensor at the distal end of the device. Pet. 34 (citing Ex. 1001, Fig. 10). Relying on Mr. Gunday’s opinion (Ex. 1011 ¶ 199), Petitioner argues the ordinarily skilled person “would be motivated to make that design choice to permit more reflected light from the tissue surface to be captured by the CCD’s surface.” *Id.* Petitioner’s un rebutted arguments are persuasive and have identified a reason the ordinarily skilled artisan would make the proffered modification for the reason stated, i.e., “to permit more reflected light from the tissue surface to be captured by the CCD’s surface.”⁸

Regarding claim 12, Petitioner identifies Yabe’s first embodiment as disclosing the image sensor at the proximal end of the device. Pet. 34 (citing Ex. 1001, Fig. 1; Ex. 1011 ¶¶ 202–203). Petitioner argues the ordinarily skilled artisan would have been motivated to pursue this option because Yabe discloses, in Figure 1a, CCD sensor 17a is within head 5—suggestive of the proximal end of the device. Pet. 34. Petitioner’s un rebutted arguments are persuasive and have identified a reason the ordinarily skilled artisan would pursue this design choice.⁹

Regarding claims 13 and 14, Petitioner argues, for the same reasons as claims 1 and 10 discussed *supra*, Yabe, as modified to combine the second

⁸ Although Mr. Jaggi suggests there may be space constraints attempting to position an image sensor at the distal end of a device, he acknowledges that such devices existed in 2005. Ex. 1017, 50:11–22.

⁹ Mr. Jaggi acknowledges that Yabe’s first embodiment depicts a sensor at the proximal end of its device. Ex. 1017, 130:10–13, 158:18–23.

embodiment with the first and third embodiments, teaches or suggests that the image sensor is an RGB sensor and a CMYG sensor, respectively. For the reasons discussed above with respect to claims 1 and 10, Petitioner's un rebutted arguments are persuasive.

For the reasons above, we are persuaded by a preponderance of the evidence that Yabe's embodiments, combined as proposed by Petitioner, teaches or suggests all features of dependent claims 11–14.

i. Claim 15

Claim 15 depends from claim 10, and further recites “the image processor has sufficient processing speed and a display memory to process and provide for display both a white light image and a short wavelength image within a video frame.” Petitioner asserts that Yabe's third embodiment, combined with the second embodiment, “teaches that ‘a normal color image and a specific wavelength region image are simultaneously displayed, side by side’ on the same monitor, and so ‘the physician is enabled to perform a sophisticated diagnosis by comparing the two images with each other.’” Pet. 36 (citing Ex. 1007, 20:55–64, Fig. 14). Petitioner contends it would have been a “matter of routine experimentation to find the right processor and display memory.” *Id.*

Patent Owner responds arguing Yabe's second embodiment, with which Petitioner proposes to combine the third embodiment, refers only to switching between two images, and does not disclose displaying two images simultaneously. PO Resp. 44–45. Patent Owner further argues it would not have been obvious to combine Yabe's second and third embodiments. *Id.* at 45.

We agree with Petitioner that Yabe's third embodiment explicitly discloses simultaneous display of two images. As addressed *supra*, we disagree with Patent Owner's arguments regarding the non-obviousness of combining Yabe's second and third embodiment. In discussing claim 10, from which claim 15 depends, Petitioner provided adequate reasoning based on sufficient rational underpinnings for the proposed combination of Yabe's second embodiment with the CMYG sensor of the third embodiment. Pet. 31–33. Yabe's explicit disclosure of simultaneous display of two images inherently discloses its image processor has sufficient power and memory to achieve that purpose.

For the reasons above, we are persuaded by a preponderance of the evidence that Yabe's embodiments, combined as proposed by Petitioner, teaches or suggests all features of dependent claim 15.

j. Claims 16–17

Claims 16 and 17 each depend from claim 15, and recite the two images of claim 15 are simultaneously display on the same monitor or on two separate monitors, respectively. Petitioner argues Yabe's third embodiment expressly discloses displaying two images on a single monitor (Pet. 37 (citing Ex. 1007, 20:55–59, Fig. 14)) and Yabe's second embodiment expressly discloses two images simultaneously on two separate monitors (Pet. 37–38 (citing Ex. 1007, Fig. 2 (monitors 25 and 26)); *see also* Pet. 36 (citing Ex. 1007, 14:57–64)). Patent Owner does not respond to any arguments of Petitioner regarding these claims, other than to refer to the arguments for claim 10 from which these claimed depend. PO Resp. 45.

Petitioner's arguments are un rebutted and persuasive. For the reasons above, we are persuaded by a preponderance of the evidence that Yabe's embodiments, combined as proposed by Petitioner, teaches or suggests all features of dependent claims 16–17.

5. *Conclusion Regarding Obviousness over Yabe*

We have reviewed all of Petitioner's above-referenced mappings of Yabe and are persuaded that they are correct and we are persuaded that an ordinarily skilled artisan would have been motivated to modify Yabe as proposed by Petitioner. Accordingly, we adopt them as our own. We are persuaded that Yabe, as modified to combine embodiments, teaches or suggests every limitation of claims 1–17.

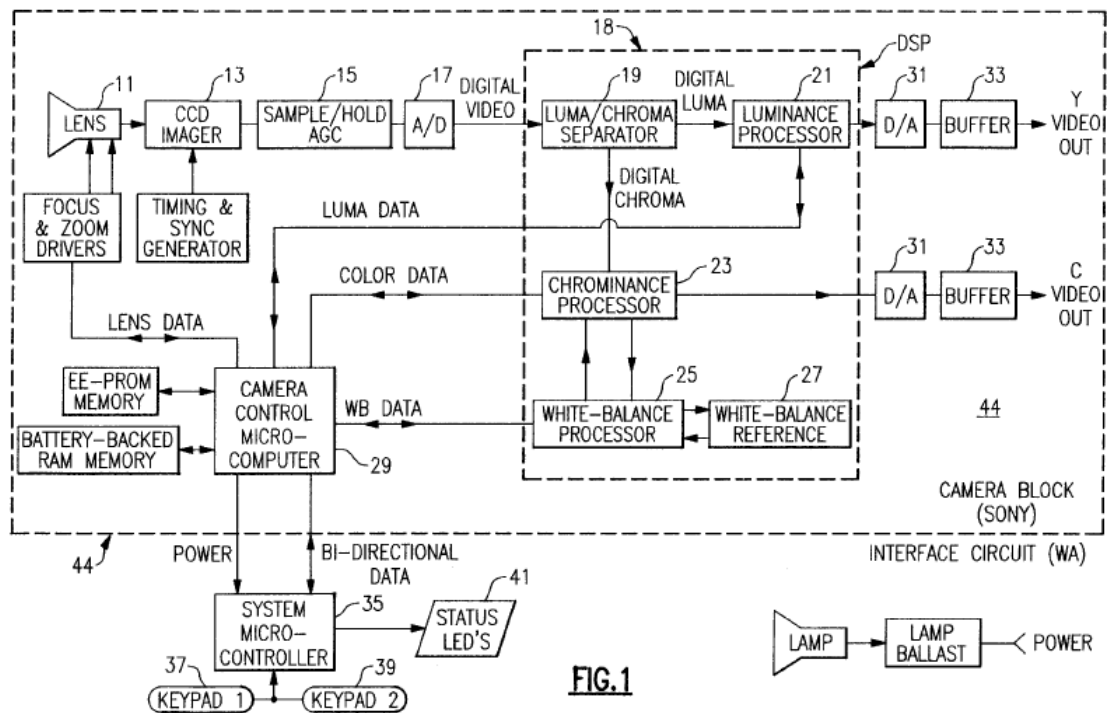
C. *Anticipation by Krauter (Ex. 1004)*

To establish anticipation, each and every element in a claim, arranged as recited in the claim, must be found in a single prior art reference. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008); *Karsten Mfg. Corp. v. Cleveland Golf Co.*, 242 F.3d 1376, 1383 (Fed. Cir. 2001). While the elements must be arranged or combined in the same way as in the claim, “the reference need not satisfy an *ipsissimis verbis* test,” i.e., identity of terminology is not required. *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009); *In re Bond*, 910 F.2d 831, 832 (Fed. Cir. 1990). “A reference anticipates a claim if it discloses the claimed invention such that a skilled artisan could take its teachings in combination with his own knowledge of the particular art and be in possession of the invention.” *In re Graves*, 69 F.3d 1147, 1152 (Fed. Cir. 1995) (quoting *In re LeGrice*, 301

F.2d 929, 936 (CCPA 1962)) (internal quotation marks and emphasis omitted). In the context of anticipation, “it is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom.” *In re Preda*, 401 F.2d 825, 826 (CCPA 1968).

1. Summary of Krauter

Krauter discloses a medical imaging device (colposcope) exemplified in Figure 1 reproduced below.



Krauter’s Figure 1 reproduced above, discloses an exemplary colposcope operable in two modes: “normal” and “green filter.” Ex. 1004, 4:9–10. Zoom lens 11 focuses an image onto CCD imager sensor 13, which converts the image to an analog electrical signal. *Id.* at 4:11–13. The analog signal is amplified and sampled in sample-and-hold element 15, then digitized by

analog-to-digital converter 17. *Id.* at 4:13–15. The digital signal is applied to digital signal processor (“DSP”) 18, which separates the image data into luminance and chrominance components in separator 19. *Id.* at 4:15–19. Luminance processor 21 processes the image and the processed chrominance signal is applied to chrominance processor 23, which generates signals for the three color primaries (red, green, blue). *Id.* at 4:19–25.

2. *Independent Claim 1*

Petitioner argues Krauter teaches the recited image sensor as CMYG image sensor 13, which ultimately generates luminance and chrominance pixel values. Pet. 43 (citing Ex. 1004, Fig. 1, Fig. 7, 4:7–12, 6:19–28, 5:53–55; Ex. 1011 ¶¶ 256–257). Petitioner further argues chrominance processor 23 of Krauter receive signals from CMYG sensor 13, and determines red, green, and blue pixel values therefrom. Pet. 44 (citing Ex. 1004, 4:22–25; Ex. 1011 ¶¶ 258–259). Petitioner asserts that when Krauter is operated in its “green” mode, a DSP, in receipt of the red, green, and blue signals from the chrominance processor, “calculates image signals where the red portion of light is decreased or suppressed.” *Id.* (citing Ex. 1004), or suppressed (Ex. 1004, Abstract, 1:11–19, 4:66–67, 2:61–67, 2:67–3:6, 4:66–5:52, Fig. 1; Ex. 1011 ¶¶ 260–263, 265). Lastly, Petitioner asserts the signals, so generated with decreased/suppressed red by the DSP, are stored in a memory (analog buffers 33 of Krauter’s Figure 1). *Id.* (citing Ex. 1004, 4:49–52; Ex. 1011 ¶ 264).

Patent Owner responds arguing Krauter’s analog buffers 33 would not be considered “memory” as the term would have been understood by persons of ordinary skill in the art. PO Resp. 47 (citing Ex. 2001 ¶¶ 234–

235). In accordance with our construction of the term “memory” in the context of the ’151 patent (*see* section II.A.3), we agree with Patent Owner that Krauter’s analog buffers 33 would not have been understood to encompass the recited “memory.”

Thus, we are not persuaded that Petitioner has met their burden of showing, by a preponderance of the evidence, that claim 1 is anticipated by Krauter.

3. Dependent Claim 7

Claim 7 depends from claim 1, and further recites that the image sensor is a CMYG sensor (having cyan, magenta, yellow, and green pixels) “wherein the image processor computes luminance, red chroma difference and blue chroma difference values from CMYG pixel signals and converts the luminance, red chroma difference and blue chroma difference into blue, green, and cyan signal values and stores these signal values in the memory.”

For at least the same reasons as claim 1, from which claim 7 depends, we are not persuaded Krauter stores values in a “memory” as we construe the term in the context of the ’151 patent. Krauter’s analog buffers 33 are not digital memory. Thus, we are not persuaded that Petitioner has met their burden of showing, by a preponderance of the evidence, that claim 7 is anticipated by Krauter.

4. Claims 10, 12, and 14

Independent claim 10 is broadly similar to claim 1, but has no requirement of memory to store calculated signal values. Claims 12 and 14 each depend from claim 10, further reciting the image sensor is at the

proximal end of an endoscope and the image sensor is a CMYG sensor, respectively.

Regarding all three claims, Petitioner argues Krauter teaches a system that generates the recited white light images in Krauter's "normal" mode of operation, and generates the recited short wavelength images in its "green" mode of operation and displays the generated images on a color monitor. Pet. 46. Petitioner further argues Krauter teaches the recited image sensor as CCD 13 (as discussed *supra* with respect to claim 1). *Id.* at 46–47. Lastly, Petitioner argues Krauter generates the short wavelength images by "substantially eliminating" the contribution of red light, as recited, by use of its "green" mode of operation in which "red response is suppressed, while the green response is enhanced." *Id.* at 47 (citing Ex. 1004, 2:61–3:11, 4:7–17, 4:66–5:44; Ex. 1011 ¶¶ 280, 258–259).

Patent Owner responds arguing "the 'green filter' mode in Krauter produces red, green, and blue output signal responses, not blue, green, and cyan output signal responses." PO Resp. 62–63 (citing Ex. 2001 ¶¶ 281–282). Patent Owner further argues "Krauter does not teach minimizing the contribution from components of light with wavelengths over 600 nanometers, and actually teaches away from the "substantially eliminating" limitation." *Id.* at 63 (citing Ex. 2001 ¶283). Still further, Patent Owner argues Krauter does not generate the short wavelength signals "from a subset of the image signals," as recited in claim 10, but is instead produced from the entire set of image signals. *Id.* (citing Ex. 1004, 4:15–31, 4:66–5:25, Fig. 7; Ex. 2001 ¶ 286). We agree with Petitioner.

Initially, we observe nothing in claim 10 that requires any particular wavelength threshold over which the contribution of light is minimized to

generate the desired image. Thus, Patent Owner's argument regarding 600 nanometers as such a required threshold is inapposite. See Pet. Reply 22. Additionally, Patent Owner's argument that Krauter does not use a subset of the image signals is incorrect. The manipulations performed by Krauter's digital signal processor apply computations to the raw signals received from a CCD sensor and, in the "green" operating mode, mathematically reduce the contribution of red signals in the sensed light. See Ex. 1004, 2:61–67. Therefore, by reducing the contribution from red light in the generated image, Krauter teaches use of "a subset of the image signals" in generated toe short wavelength image. Furthermore, we agree with Petitioner that claim 10 does not require removal of all contribution from red light but, instead, merely requires "substantially eliminating" the contribution of red light in the generated image. See Pet. Reply 22.

Petitioner has identified the elements of claims 12 and 14 in the teachings of Krauter (Pet. 47–48) and Patent Owner does not rebut these assertions (PO Resp. 22). We agree with Petitioner's assertions regarding claims 10, 12, and 14 and, therefore, we are persuaded by a preponderance of the evidence that Krauter teaches all features of 10, 12, and 14.

5. *Conclusion Regarding Anticipation by Krauter*

We have reviewed all of Petitioner's above-referenced mappings of Krauter and are persuaded that, with respect to claims 10, 12, and 14, they are correct and, accordingly, we adopt them as our own. Accordingly, we are persuaded that Krauter teaches every limitation of claims 10, 12, and 14. We are not persuaded by Petitioner's arguments regarding claims 1 and 7 and, accordingly, do not adopt those arguments and are not persuaded that claims 1 and 7 are anticipated by Krauter.

E. Conclusion

Petitioner has demonstrated, by a preponderance of the evidence, that claims 1–17 of the '151 patent are unpatentable.

III. ORDERS

After due consideration of the record before us, and for the foregoing reasons, it is:

ORDERED that claims 1–17 of the '151 patent are held *unpatentable*; and

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

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Patent 7,420,151 B2

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