

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD., and
SAMSUNG ELECTRONICS AMERICA, INC.
Petitioner,

v.

CELLECT, LLC,
Patent Owner.

IPR2020-00476
Patent 9,198,565 B2

Before JAMESON LEE, TERRENCE W. McMILLIN, and
GARTH D. BAER, *Administrative Patent Judges*.

LEE, *Administrative Patent Judge*.

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

I. INTRODUCTION

We have authority to hear this *inter partes* review under 35 U.S.C. § 6. This Final Written Decision issues pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. We determine that Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (“Petitioner”) has proved by a preponderance of the evidence that claims 1, 6, 31, 32, and 36 U.S. Patent 9,198,565 B2 (Ex. 1001, “the ’565 patent”) are unpatentable.

A. *Background*

Petitioner filed a Petition for *inter partes* review of claims 1, 6, 31, 32, and 36 of the ’565 patent. Paper 2 (“Pet.”). Collect, LLC (“Patent Owner”) filed a Preliminary Response. Paper 6. We instituted review on July 31, 2020. Paper 14 (“Decision on Institution”). Patent Owner filed a Patent Owner Response. Paper 17 (“PO Resp.”). Petitioner filed a Reply. Paper 20 (“Reply”). Patent Owner filed a Sur-Reply. Paper 24 (“Sur-Reply”). Oral hearing was consolidated with the oral hearing in IPR2020-00477 (Paper 28), and was held on April 30, 2021. A copy of the hearing transcript has been entered into the record as Paper 32 (“Tr.”).

B. *Real Parties-in-Interest*

Each party identifies itself as the only real party in interest. Pet. 5; Paper 4, 1.

C. *Related Matters*

The parties indicate that the ’565 patent is the subject of the following district court case: *Collect, LLC v. Samsung Electronics Co., Ltd. et al.*, 1-19-cv-00438 (D. Colo.) Pet. 6; Paper 4, 1.¹ Petitioner has filed petitions for

¹ That action has been stayed by order of the district court. Paper 10 (Appx. A).

inter partes review of these patents, which it regards as related to the '565 patent: U.S. Patent 6,043,839 (IPR2020-00472); U.S. Patent 6,275,255 (IPR2020-00473); U.S. Patent 6,982,740 (IPR2020-00474); U.S. Patent 9,186,052 (IPR2020-00475, IPR2020-00512); U.S. Patent 9,667,896 (IPR2020-00477); U.S. Patent 6,982,742 (IPR2020-00559, IPR2020-00560, IPR2020-00561); U.S. Patent 6,424,369 (IPR2020-00562, IPR2020-00563, IPR2020-00564); U.S. Patent 6,452,626 (IPR2020-00565, IPR2020-00566, IPR2020-00567); U.S. Patent 6,862,036 (IPR2020-00568, IPR2020-00569); and U.S. Patent 7,002,621 (IPR2020-00571, IPR2020-00572). Pet. 6.

D. The '565 Patent

The '565 patent relates to a reduced area imaging device. Ex. 1001, Abstr. It states the following:

It is one general object of this invention to provide a wireless endoscope incorporating reduced area imaging devices which take advantage of “camera on a chip” technology, but rearrange the circuitry in a stacked relationship so that there is a minimum profile presented when used within a surgical instrument or other investigating device.

Id. at 3:31–36. The '565 patent further states:

In accordance with the present invention, reduced area imaging devices are provided. The term “imaging device” as used herein describes the imaging elements and processing circuitry which is used to produce a video signal which may be accepted by a standard video device such as a television or video monitor accompanying a personal computer. The term “image sensor” as used herein describes the components of a solid state imaging device which captures images and stores them within the structure of each of the pixels in the array of pixels found in the imaging device. As further discussed below, the timing and control circuits can be placed either on the same planar structure as the pixel array, in which case the image sensor can also be defined as an integrated circuit, or the timing and control circuitry can be placed remote from the pixel array.

Id. at 4:6–20. The term “timing and control circuits” refers to “electronic components which control the release of the image signal from the pixel array.” *Id.* at 4:28–31.

Figures 1a and 1b show a first arrangement of the imaging device:

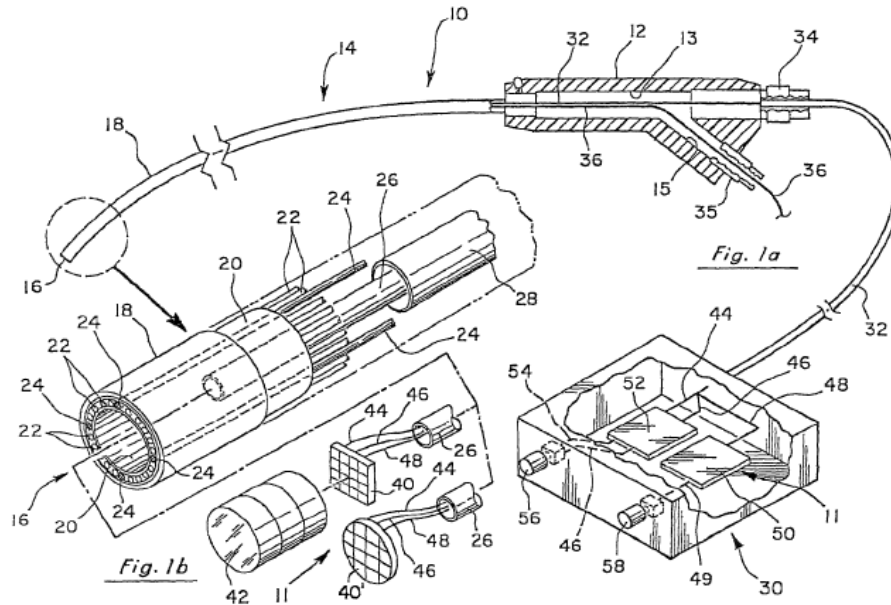


Figure 1a shows a fragmentary cross-sectional view of a generic endoscope and a fragmentary perspective view of a control box each incorporating elements of a reduced area imaging device. *Id.* at 6:44–49. Figure 1b is a fragmentary partially exploded view of the distal end of the endoscope and it specifically illustrates the arrangement of an image sensor. *Id.* at 6:50–54.

As shown in Figure 1a, endoscope 10 incorporates imaging device 11 shown in Figure 1b. *Id.* at 7:65–8:1. As shown in Figure 1b, image sensor 40 is placed within the central channel defined by inner tube 20, and cable 26 is used to house the conductors which communicate with image sensor 40. *Id.* at 8:40–43. Intermediate support tube 28 may be placed concentrically outside of cable 26 and concentrically within inner tube 20 to provide support for the cable as it traverses through the inner channel defined by inner tube 20. *Id.* at 8:43–47. Image sensor 40 is illustrated as

being planar and square. *Id.* at 9:3–4. Alternatively, the image sensor can be planar and round, as shown and designated by 40'. *Id.* at 9:3–8.

The image signal transmitted from the image sensor on conductor 48 is referred to as a pre-video signal and is received by video processing board 50. *Id.* at 9:26–31. Video processing board 50 carries out all the conditioning of the pre-video signal and places it in a form so that it may be viewed directly on a standard video device, television or standard computer video monitor. *Id.* at 9:31–35. The signal produced by video processing board 50 is referred to as a post-video signal. *Id.* at 9:35–37.

Figures 2a and 2b show a second arrangement of the imaging device:

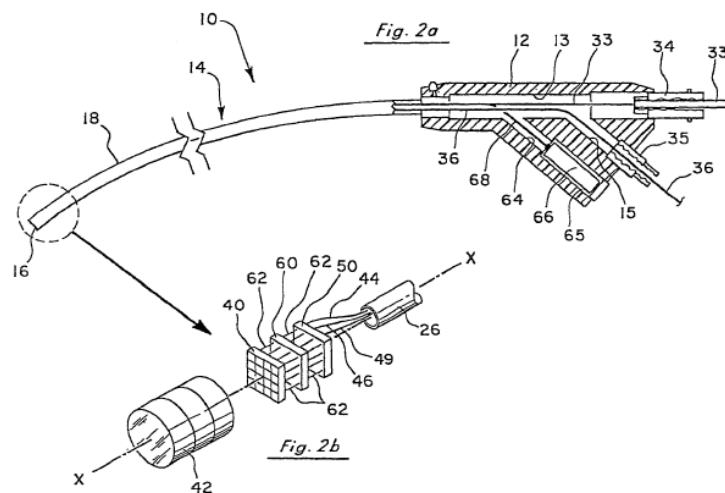


Figure 2a shows a fragmentary cross-sectional view of the same endoscope shown in Figure 1a but with a different arrangement of the imaging device at the distal end of the endoscope. *Id.* at 6:55–58. Figure 2b is a fragmentary partially exploded view of the distal end of the endoscope shown in Figure 2a and it illustrates the different arrangement of the image sensor. *Id.* at 6:50–54.

In the arrangement shown in Figure 2b, video processing board 50 is placed directly behind image sensor 40. *Id.* at 9:58–59. If necessary, one or

more supplementary boards 60 may be provided which further contain processing circuitry to process the image signal and present it in a form which may be directly received by a desired video device. *Id.* at 9:65–10:2. Imaging elements on boards 50 and 60 must be able to be placed on one or more circuit boards which are longitudinally aligned with image sensor 40 along longitudinal axis XX. *Id.* at 10:4–8.

Figure 4a is a schematic diagram of a circuit board embodiment that includes both array of pixels 90 and the timing and control circuits 92 (*id.* at 7:6–8, 12:26–28) and it is reproduced below:

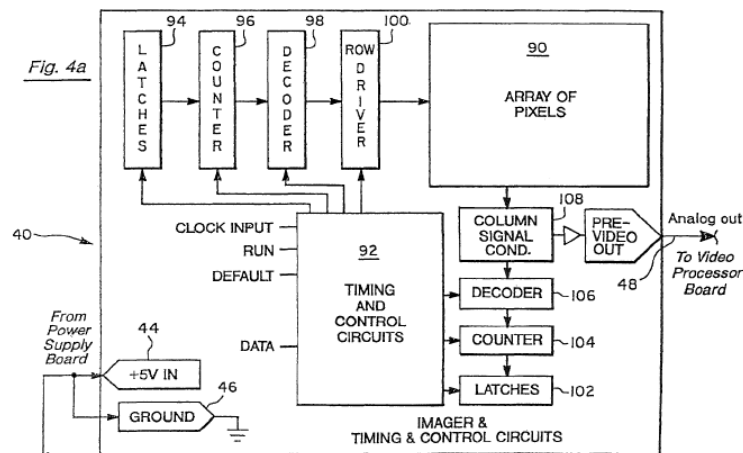


Figure 4a illustrates the image sensor and the timing and control circuits being placed on the same planar structure. *Id.* at 12:3–4. The '565 patent describes that, alternatively, the timing and control circuits may be separated from the pixel array and placed on video processing board 50. *Id.* at 12:3–7.

E. Illustrative Claims

Claims 1 and 31 are independent. They are each directed to an imaging device but neither requires the imaging device to be a part of an endoscope. Ex. 1001, 21:25–61; 25:37–26:28. Claims 1 and 31 are reproduced below:

1. An imaging device comprising:
 - a housing;
 - an image sensor mounted in said housing, said image sensor including a first circuit board having a length and a width thereto, wherein said length and width of said first circuit board define a first plane, said first circuit board including an array of CMOS pixels thereon, wherein a plurality of CMOS pixels within said array of CMOS pixels each include an amplifier, said first circuit board further including timing and control circuitry thereon, said timing and control circuitry being coupled to said array of CMOS pixels, said image sensor producing a pre-video signal;
 - a second circuit board mounted in said housing, said second circuit board being electrically coupled to said first circuit board, said second circuit board having a length and a width thereto, wherein said length and width of the second circuit board define a second plane, said second circuit board including circuitry thereon to convert said pre-video signal to a post-video signal, said second circuit board being offset from said first circuit board, said second plane of said second circuit board being substantially parallel to said first plane of said first circuit board;
 - a lens mounted in said housing, said lens being integral with said imaging device, said lens focusing images on said array of CMOS pixels of said image sensor;
 - a video screen, said video screen being electrically coupled to said second circuit board, said video screen receiving said post-video signal and displaying images from said post-video signal; and
 - a power supply mounted in said housing, said power supply being electrically coupled to said first circuit board to provide power to said array of CMOS pixels and said timing and control circuitry, said power supply also being electrically coupled to said second circuit board to provide power thereto.

Id. at 21:25–61.

31. An imaging device comprising:
- a housing;
 - an image sensor mounted in said housing, said image sensor including a planar substrate having a length and a width thereto, wherein said length and width of said planar substrate define a first plane, said planar substrate including an array of CMOS pixels thereon, wherein a plurality of CMOS pixels within said array of CMOS pixels each include an amplifier, said planar substrate further including timing and control circuitry thereon, said timing and control circuitry being coupled to said array of CMOS pixels, said image sensor producing a pre-video signal;
 - a circuit board mounted in said housing, said circuit board being electrically coupled to said planar substrate, said circuit board having a length and a width thereto, wherein said length and width of said circuit board define a second plane, said circuit board including circuitry thereon to convert said pre-video signal to a post-video signal, said circuit board being positioned in a stacked arrangement with respect to said planar substrate, said second plane of said circuit board being substantially parallel to said first plane of said planar substrate;
 - a lens mounted in said housing, said lens being integral with said imaging device, said lens focusing images on said array of CMOS pixels of said image sensor;
 - a video screen, said video screen being electrically coupled to said circuit board, said video screen receiving said post-video signal and displaying images from said post-video signal; and
 - a power supply mounted in said housing, said power supply being electrically coupled to said planar substrate to provide power to said array of CMOS pixels and said timing and control circuitry, said

power supply also being electrically coupled to said circuit board to provide power thereto.

Id. at 25:37–26:28.

F. Applied Prior Art References and Declarations

Petitioner relies on the following prior art references:

References		Date	Exhibit
Wakabayashi	U.S. Patent 5,903,706	issued May 11, 1999; filed Aug. 22, 1995	Ex. 1027
Ackland	U.S. Patent 5,835,141	issued Nov. 10, 1998; filed July 3, 1996	Ex. 1006

Petitioner states that it takes no position on the priority claim of the '565 patent, because all applied prior art predates the earliest possible effective filing date of the '565 patent.² Pet. 8 n.2.

Petitioner also relies on the Declaration and Rebuttal Declaration of Dean P. Neikirk, Ph.D. Exs. 1004, 1086.

Patent Owner relies on the Declaration of Michael Lebby, Ph.D. Ex. 2088.

² The '565 patent issued from Application 14/333,260, filed July 16, 2014, which is a continuation of Application 12/889,287, filed Sept. 23, 2010, which is a continuation-in-part of Application 11/245,960, filed Oct. 6, 2005, which is a continuation of Application 09/929,531, filed Aug. 13, 2001, now Patent 7,030,904, which is a continuation-in-part of Application 09/496,312, filed on Feb. 1, 2000, now Patent 6,275,255, which is a continuation of Application 09/175,685, filed on Oct. 20, 1998, now Patent 6,043,839, which is a continuation-in-part of Application 08/944,322, filed Oct. 6, 1997, now Patent 5,929,901. Ex. 1001, code (63).

G. Asserted Grounds of Unpatentability

Petitioner asserts that the challenged claims are unpatentable on the following ground:

Claims Challenged	35 U.S.C. §³	Basis
1, 6, 31, 32, 36	103	Wakabayashi, Ackland

II. ANALYSIS

A. Principles of Law

To prevail in its challenge to Patent Owner’s claims, Petitioner must demonstrate by a preponderance of the evidence that the claims are unpatentable.⁴ 35 U.S.C. § 316(e) (2018); 37 C.F.R. § 42.1(d). That burden never shifts to the patentee. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

A patent claim is unpatentable under 35 U.S.C. § 103 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). The question of obviousness is resolved on the basis of underlying

³ The Leahy-Smith America Invents Act, Pub. L. No. 112–29, 125 Stat. 284, 287–88 (2011) (“AIA”), revised 35 U.S.C. §§ 102 and 103 effective March 16, 2013. Because the effective filing date of the ’565 patent is prior to March 16, 2013 (Ex. 1001, codes (22), (63)), we apply the pre-AIA version of § 103.

⁴ The burden of showing something by a preponderance of the evidence requires the trier of fact to believe that the existence of a fact is more probable than its nonexistence before the trier of fact may find in favor of the party who carries the burden. *Concrete Pipe & Prods. of Cal., Inc. v. Constr. Laborers Pension Tr. for S. Cal.*, 508 U.S. 602, 622 (1993).

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 ordinary skill in the art; and (4) when in evidence, objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

Petitioner asserts that on or before 10/6/1997, a person of ordinary skill in the art (“POSITA”), would have had a minimum of “a Bachelor’s degree in Electrical Engineering, Physics, or a related field,” and “approximately two years of professional experience in the field of imaging devices.” Pet. 15 (citing Ex. 1004 ¶¶ 34–37).

Patent Owner asserts: “a person of ordinary skill in the art in October 6, 1997 (the earliest effective date of the ’565 patent) would have had a Bachelor’s degree in Electrical Engineering, Physics, or a related field, and approximately three years of professional experience in the field of visible optical imaging devices.” PO Resp. 18–19 (citing Ex. 2088 ¶ 40).

Neither party identifies any material differences between a skill level corresponding to approximately two years of professional experience in the field of imaging devices and approximately three years of professional experience in the field of visible optical imaging devices, or any difference in the field of imaging devices and the field of visible optical imaging devices. On this record, there is none.

We determine that the level of ordinary skill in the art is at the level of that of one who would have had a Bachelor’s degree in Electrical Engineering, Physics, or a related field, and approximately two to three years of professional experience in the field of visible optical imaging

devices. We do not adopt Petitioner's inclusion of the qualifier "minimum," to keep the specified level of skill from being vague and over-inclusive, extending to a range that corresponds to the skill level of an expert.

C. Claim Construction

In an *inter partes* review, we use the same claim construction standard that would be used in a civil action under 35 U.S.C. § 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. 37 C.F.R. § 42.100(b) (2019). We apply the claim construction standard from *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). Only those claim terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

Claim terms are generally given their ordinary and customary meaning as would be understood by one with ordinary skill in the art in the context of the specification, the prosecution history, other claims, and even extrinsic evidence including expert and inventor testimony, dictionaries, and learned treatises, although extrinsic evidence is less significant than the intrinsic record. *Phillips*, 415 F.3d at 1312–17. Usually, the specification is dispositive, and it is the single best guide to the meaning of a disputed term. *Id.* at 1315.

The specification may reveal a special definition given to a claim term by the patentee, or the specification or prosecution history may reveal an intentional disclaimer or disavowal of claim scope by the inventor. *Id.* at 1316. If an inventor acts as his or her own lexicographer, the definition

must be set forth in the specification with reasonable clarity, deliberateness, and precision. *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998). The disavowal of claim scope, if any, can be effectuated by language in the specification or the prosecution history. *Poly-America, L.P. v. API Indus., Inc.*, 839 F.3d 1131, 1136 (Fed. Cir. 2016). “In either case, the standard for disavowal is exacting, requiring clear and unequivocal evidence that the claimed invention includes or does not include a particular feature.” *Id.*

Neither party has proposed an express construction for any claim term. Pet. 16. We do not have a need to expressly construe any claim term.

D. Obviousness of Claims 1, 6, 31, 32, and 36 over Wakabayashi and Ackland

We make our determination of patentability based on the entirety of the evidence before us, both for and against obviousness. First, we review the evidence of nonobviousness submitted by Patent Owner. Then, with the evidence of nonobviousness in mind, we consider Petitioner’s contentions based on the prior art references and the level of ordinary skill in the art.

1. Patent Owner’s Evidence of Nonobviousness

Patent Owner asserts that there are these secondary considerations, which support nonobviousness: (1) commercial success; (2) satisfaction of a longfelt but unresolved need; (3) industry praise; (4) unexpected results; and (5) industry skepticism/proceeding contrary to accepted wisdom. PO Resp. 56–62.

It is well established that in order to be accorded substantial weight to secondary considerations in an obviousness analysis, the evidence of secondary considerations must have a nexus to the claims, i.e., there must be a legally and factually sufficient connection between the evidence and the

patented invention. *Fox Factory, Inc. v. SRAM, LLC*, 944 F.3d 1366, 1373 (Fed. Cir. 2019). A patentee is entitled to a presumption of nexus when the patentee shows that the asserted objective evidence is tied to a specific product and that product embodies the claimed features, and is coextensive with them. *Id.* Even where nexus cannot be presumed, “the patent owner is still afforded an opportunity to prove nexus by showing that the evidence of secondary considerations is the ‘direct result of the unique characteristics of the claimed invention.’” *Id.*

(a) *Alleged Commercial Success*

As evidence of commercial success, Patent Owner asserts that “companies have taken a license to the ’565 Patent.” PO Resp. 56. Patent Owner asserts:

Patent Owner and its parent, Micro-Imaging Solutions has licensed its patented reduced [area] imaging devices to several companies including: Gyrus Group PLC, Cook Inc., Cook Medical Technologies LLC, Coopersurgical, Inc., Ethicon Endo-Surgery, Inc., Fujikura Ltd., Microtek Medical, Inc., Endosee Corp., Karl Storz Imaging, Inc., and Voyage Medical Inc. *See* Ex. 2074.

Id. at 56–57. Patent Owner does not indicate which of the above-identified entities, or how many, have taken a license to the ’565 patent. Exhibit 2074, cited by Patent Owner, is unexplained by Patent Owner with regard to its nature, source, origin, and authorship, and does not identify or refer to any specific licensed patent or licensee (except Fujikara Ltd.). Exhibit 2074 does not support that any entity has taken a license to any claim of the ’565 patent, much less for what specific reason. There is only Patent Owner’s bare assertion that companies have taken a license to the ’565 patent. There is no presumption of nexus between any license and the merits of the ’565

patent and the Patent Owner has not separately proved a nexus between any license and the '565 patent.

In that regard, the Court of Appeals for the Federal Circuit has stated:

Antor, beyond alleging the existence of a number of licenses, has not asserted any nexus between the merits of the invention and the licenses themselves. *See In re GPAC Inc.*, 57 F.3d 1573, 1580 (Fed. Cir. 1995). Antor merely lists the licensees and their respective sales revenue. The licenses themselves are not even part of the record. Antor provides no evidence showing that the licensing program was successful either because of the merits of the claimed invention or because they were entered into as business decisions to avoid litigation, because of prior business relationships, or for other economic reasons.

In re Antor Media Corp., 689 F.3d 1282, 1293–94 (Fed. Cir. 2012). Here, Patent Owner's assertions are even less than that of the patentee in *Antor*, in that Patent Owner has not identified any specific licensee of the '565 patent. Also, as in *Antor*, patent Owner has not submitted any actual license, redacted or non-redacted, for any patent, into the record.

Accordingly, there is no presumption of nexus and Patent Owner has not separately proved the required nexus for the alleged licensing and commercial success. There is not a legally and factually sufficient connection between the evidence and the patented invention.

(b) Alleged Satisfaction of Longfelt but Unresolved Need

Patent Owner also asserts that the '565 patent satisfied a longfelt but unresolved pressing "need for smaller, more cost effective and reliable endoscope." PO Resp. 57. Patent Owner cites Orthopaedic Product News which states as follows:

A Denver-based company has developed and patented high resolution, sturdy and inexpensive CMOS sensors (Complimentary Metal Oxide Semiconductors) that are actually

built into the distal tip of arthroscopes, as well as other commonly used endoscopes.

It is evident that we have needed an appropriate and thoughtful improvement to the scope and video system as we currently know it. The development of the CMOS sensor has addressed the needs of the surgeon, surgical facility and the patient while addressing the important issues of video image, thoughtful design and cost-effectiveness. This disposable scope system represents a significant advancement for arthroscopists, cost-conscious hospitals and surgeon centers and I believe it will be embraced by the endoscopy companies. The justification that my peers and I always recall is that if we can't see . . . we can't do the procedure.

Ex. 2089, 2–3 (cited at PO Resp. 57–58). For numerous reasons, Patent Owner's assertion that the claimed invention of the '565 patent satisfied a longfelt but unresolved need is not supported by the evidence of record.

Establishing a long-felt need requires objective evidence that the invention has provided a long-awaited, widely accepted, and promptly adopted solution to a problem extant in the art, or that others had tried but failed to solve that problem. *In re Mixon*, 470 F.2d 1374, 1377 (CCPA 1973); *In re Allen*, 324 F.2d 993, 997 (CCPA 1963).

First, Patent Owner does not explain why the referenced Denver-based company in the news article is the Patent Owner. Second, Patent Owner does not explain whether the referenced tips of arthroscopes and endoscopes with a built-in CMOS sensor make use of the claimed invention of the '565 patent, and if so, which claims. Third, Patent Owner does not indicate whether any significant features are included in the referenced tips of arthroscopes and endoscopes, which are not recited in any claim of the '565 patent. Fourth, Patent Owner does not explain how long a pressing need existed for a smaller, more cost effective and reliable endoscope. Fifth,

Patent Owner has not identified any prompt adoption of the claimed invention by anyone. Sixth, Patent Owner has not identified any specific prior failed attempts to resolve the alleged need. Seventh, a single article is not demonstration of widespread recognition by those with ordinary skill in the art that there was a problem without a solution in the industry.

Finally, even assuming that there was a longfelt but unresolved need for a smaller and more cost-effective arthroscope or endoscope, Patent Owner has not shown a nexus to the claimed invention and none can be presumed. None of the challenged claims requires either an arthroscope or endoscope. Assuming that the article is referring to a product of Patent Owner, Patent Owner has not shown that the product is “coextensive” with any challenged claim from the perspective of satisfaction of a longfelt but unresolved need. *See Fox Factory*, 944 F.3d at 1373.

For the foregoing reasons, there is not a legally and factually sufficient connection between the alleged longfelt but unresolved need and the claimed invention.

(c) Alleged Industry Praise

Patent Owner asserts that it has received industry praise. PO Resp. 60. Specifically, Patent Owner states:

Micro-Imaging Systems won the Orthopedics This Week’s 2016 Sports Medicine Technology Award for its “Distally mounted CMOS Sensor for disposable/reusable and rigid/flexible scopes” which features the claimed reduced area imaging device, Orthopedics This Week noted the benefits of Patent Owner’s CMOS sensors that could be placed in the tip of an endoscope.

Id. at 60–61 (citing Ex. 2090, 14–15). The cited portion of Exhibit 2090 reads as follows:

Current cameras and endoscopes (all types) have remained unchanged for decades and degrade from “Day 1” of utilization

thus causing undesirably compromise of visual clarity at an extremely inconvenient time! This technology allows for flexible or rigid applications as a reusable or a disposable with significant value. Utilization of this technology can eliminate the five things that degrade current and problematic technology. It has the real benefit of reducing repair costs as well as OR “down time” and the need to acquire costly surplus inventory to avoid catastrophes.

Ex. 2090, 14–15.

Patent Owner has not identified sufficient nexus between the above-quoted text in Exhibit 2090 and the features of the invention claimed in the ’565 patent, and between the “award” and the features of the invention claimed in the ’565 patent. There is insufficient detail in the above-quoted text to associate that which is praised to the features claimed in the ’565 patent. The references to “This technology” and “this technology” do not reveal specific features of what is being praised. Even assuming that “this technology” includes the features of the claimed invention, the praise also is directed to additional features not recited in the challenged claims, i.e., an imaging device mounted on an *endoscope*. None of the challenged claims requires the image sensor to be mounted on or affixed to an endoscope. Thus, Patent Owner has not shown that the alleged industry praise is “coextensive” with any challenged claim. *See Fox Factory*, 944 F.3d at 1373. There is not a legally and factually sufficient connection between the alleged industry praise and the claimed invention.

(d) *Alleged Unexpected Results*

According to Patent Owner, its inventor discovered an unknown but very important advantage that the claimed invention has over CCD type imagers, i.e., the capability to reject *radio frequency interference* (RFI) *emitted by electrosurgical generators used during surgery*. PO Resp. 60.

Patent Owner notes that an inventor declaration was submitted during prosecution of a related application in which it was stated that CCD devices cannot be used near an electrical surgical generator without requiring significant shielding, and that even with shielding, RFI levels are only brought to a reasonable level, which may still result in an obstructed view of the surgical area. *Id.* (citing Ex. 1003, 85 (¶ 11)). Patent Owner further notes that in that declaration, the inventor further states that “[a]fter testing several types of CMOS configurations, we concluded that remoting the processing circuitry from the CMOS imager and timing and control circuits eliminated the need for shielding.” *Id.* (citing Ex. 1003, 85 (¶ 12)).

We first find that Patent Owner has not shown sufficient nexus between the alleged unexpected result and any of claims 1, 6, 31, 32, and 36. The alleged unexpected result is based on radio frequency interference caused by electrosurgical generators used during surgery. However, none of the imaging devices claimed is incorporated in a medical surgical device such as an endoscope. Thus, the unexpected result, even if true, is not commensurate in scope with what has been claimed. “In order to establish unexpected results for a claimed invention, objective evidence of non-obviousness must be commensurate in scope with the claims which the evidence is offered to support.” *In re Clemens*, 622 F.2d 1029, 1035 (CCPA 1980) (citations omitted).

Further, to establish a showing of unexpected results, Patent Owner has to compare the claimed invention with the closest prior art. *In re Fracalossi*, 681 F.2d 792, 794 (CCPA 1982); *In re Fenn*, 639 F.2d 762, 763 (CCPA 1981). Patent Owner has not shown that the closest prior art is a CCD imager. According to Patent Owner, CMOS technology and CCD technology are very different from each other. PO Resp. 10–18. On that

basis, it would appear that a closer prior art than a CCD device would be a CMOS imager such as that disclosed in Ackland, or WO 95/34988, Published December 21, 1995 (“Swift” (Ex. 1005)), or US. Pat. 5,919,130, filed March 17, 1997 (“Monroe” (Ex. 1007)).⁵

Additionally, Dr. Neikirk provides contrary testimony. Dr. Neikirk states that the alleged discovery is not unexpected but, rather, predictable. Ex. 1004 ¶ 187. Dr. Neikirk explains as follows:

[A]s the declaration notes, they were using endoscopic cameras around an “electrosurgical generator” that was used to “cut or cauterize” tissue. ’839 File History, 85. It would have been understood by a person of ordinary skill in the art that such an electrosurgical generator would create a large amount of electromagnetic (“EM”) radiation. Moreover, while the declaration does not clearly state how many wires were in the CCD system at issue, a person of ordinary skill in the art would have understood that such EM radiation would cause radio frequency interference (“RFI”) in a system, and would have a more significant adverse effect on a system with more wires than a system with fewer wires. It was also known that a CCD sensor could have many more wires than a CMOS sensor. For example, according to the declaration, the prior art CCD sensor identified in the declaration (“Pelchy”) includes “a large number of transmission wires 33 which interconnect the circuit boards placed perpendicular to the pixel array with an external processor 13.” ’839 File History, 92. Thus, in a CCD sensor with many wires, the radio frequency interference would have a relatively large effect on the quality of images produced by the image sensor. On the other hand, CMOS sensors require only a few wires to connect to the pixel array, and thus interference created in a CMOS image sensor would be much smaller than in such CCD arrangement.

⁵ Swift and Monroe are cited in the Petition to show CMOS sensor configurations already known in the art. Pet. 26.

Ex. 1004 ¶ 187. This testimony is not rebutted by Patent Owner's expert, Dr. Lebby. Patent Owner does not identify any testimony of Dr. Lebby conveying that it would have been unexpected to one of ordinary skill in the art that a CMOS sensor with remotely located processing circuitry would have no need for RFI shielding.

Dr. Neikirk's testimony is rational and we credit his testimony over the testimony of Patent Owner's inventor who provides no explanation as to why it was unexpected that, as compared to CCD devices, a CMOS imager with remotely located processing circuitry requires no RFI shielding.

For the foregoing reasons, Patent Owner has not established that the alleged unexpected result truly would have been unexpected to one with ordinary skill in the art. Even assuming the alleged unexpected result truly would have been unexpected to one of ordinary skill in the art, Patent Owner has not shown sufficient nexus between the unexpected result and the claimed invention.

(e) Allegedly Proceeding Contrary to Accepted Wisdom

Patent Owner asserts:

Prior to the '565 Patent, the accepted wisdom in the art was that CMOS imagers should be implemented in an on-chip integration manner. Dr. Eric Fossum spearheaded the development of the CMOS camera on a chip design efforts. Fossum's design would enable full realization of the benefits of a CMOS imager boasting numerous benefits over the dominant CCD image sensor. For example, the CMOS camera on a chip would enable designers to "make a camera small and cheap enough to open vast new markets for everything from dolls that "see" to rear-bumpers cameras that would help drivers back up" Ex. 1060. However, Patent Owner recognized that a need still existed for a reduced area imaging device which could be used in even smaller devices, such as endoscopic instruments, in order to view areas that are particularly difficult to access, and to

further minimize patient trauma by an even smaller diameter invasive instrument. As a result, the '565 Patent describes and claims a reduced area imaging device which took advantage of Fossum's revolutionary "camera on a chip" technology, but rearranged the circuitry to separate out circuitry so that a further minimum profile could be achieved.

PO Resp. 61–62.

Patent Owner's argument is excessively vague. The meaning of "accepted wisdom in the art" is unclear and not sufficiently defined. We do not know whether Patent Owner means (1) one with ordinary skill in the art would have recognized a CMOS imager in a multi-chip implementation to be inoperative or unworkable and thus would not have considered it, or (2) that substantial focus and effort existed at the time to develop a "camera-on-a-chip" design for CMOS imagers which was perceived to be better than a multi-chip configuration for CMOS imagers.

Between the two, only the first possibly can serve as an objective indicia of nonobviousness, and only if the "accepted wisdom in the art" turns out to be incorrect. The second simply is not an objective indicia of nonobviousness. Because the argument appears in Patent Owner's discussion of objective indicia of nonobviousness, we discuss Patent Owner's argument from the perspective of the first noted meaning.

Patent Owner does not cite to any expert testimony that supports the position that a CMOS imager in a multi-chip configuration was inoperative or unworkable. In fact, the record evidence is to the contrary. As discussed below in Section II.D.4, Swift and Monroe are examples of prior-art disclosures of CMOS imagers with multi-chip configuration. Petitioner's expert, Dr. Neikirk, specifically identifies such examples. Ex. 1004 ¶ 40.

The record evidence does not support Patent Owner's assertion that the accepted wisdom in the art was that CMOS imagers should be implemented in an on-chip integration manner. We do not find that to be so. Also, Patent Owner appears to have ignored basic skills or fundamental engineering principles that would have been possessed by one with ordinary skill in the art, e.g., off loading some components to another chip or another circuit board would decrease the required size for the containing chip or circuit board. Dr. Neikirk testifies that "a person of ordinary skill would have known that components could be placed on a number of circuit boards and arranged in any number of different 'planes' based on the design needs and intended applications of a given device." Ex. 1004 ¶ 40. Patent Owner does not identify any contrary testimony from its expert, Dr. Lebby. We credit this testimony from Dr. Neikirk.

For the foregoing reasons, Patent Owner's argument that it proceeded against accepted wisdom adds very little to the strength of its evidence on objective indicia of nonobviousness.

(f) Alleged Industry Skepticism

Patent Owner further asserts that, at the time of the invention of the '565 patent, the industry was skeptical regarding the use of CMOS imagers for medical imaging because CMOS imager quality was "meaningfully lower than [the image quality] available with CCD imager devices." PO Resp. 58. Patent Owner cites a declaration of the same inventor submitted in a related patent application. *Id.* at 59. In that declaration, the inventor states:

There has been great skepticism in the industry as to the capability to use CMOS technology in medical imaging applications. CMOS imagers have been characterized as not being able of producing high quality images. Despite this

skepticism, we were able to locate companies developing CMOS technology that might be useable within an imaging device . . . [that] utilize[] a CMOS pixel array with timing and control placed together on one plane or circuit board, and remaining processing circuitry either placed in a remote control box, or on other circuit boards placed closely adjacent the CMOS pixel array.

Ex. 1003 at 85.

First and foremost, Patent Owner has not shown sufficient nexus between the alleged industry skepticism and any claimed invention. As Petitioner correctly observes (Reply 28), the alleged industry skepticism pertains to the image quality of CMOS image sensors incorporated in medical devices. Yet, none of the challenged claims requires incorporation of the CMOS image sensor in a medical device, such as an endoscope, and none of the challenged claims requires a minimum or threshold level of image quality. The claimed features are not coextensive or commensurate in scope with the purported industry skepticism. *See Fox Factory*, 944 F.3d at 1373.

Additionally, Patent Owner's reliance on the purported industry skepticism as objective indicia of nonobviousness is misplaced where, as here, the evidence does not show and Patent Owner does not assert that the skepticism actually was wrong. The significance of industry skepticism as an objective indicia of nonobviousness stems from the thought that one with ordinary skill in the art would have shared that same skepticism and not pursued something to the contrary. Implicit in that frame of thought is that the industry skepticism must have been shown as wrong by the inventor who believes otherwise. Here, the evidence does not show and Patent Owner does not assert that the inventor doubted the industry skepticism and actually obtained higher image quality with a CMOS image sensor than what the

industry expected. In this circumstance, the purported industry skepticism does not have much meaning as an objective indicia of nonobviousness.

(g) *Summary of Objective Evidence of Nonobviousness*

For the foregoing reasons, the objective evidence of nonobviousness submitted by and relied on by Patent Owner is weak. We will consider this evidence together with the evidence of obviousness presented by Petitioner and discussed below, to arrive at a conclusion of whether each challenged claim would have been obvious over Wakabayashi and Ackland.

2. Overview of Wakabayashi

Wakabayashi relates to a portable imager apparatus including a video camera, a flat display, and a semiconductor memory, all integrated with each other. Ex. 1027, 1:5–11. A user can monitor an image on the flat display, to adjust the angle of the video camera while imaging a subject. *Id.* at 1:11–14. The video camera is small and rotatable about an axis, to allow a user to manipulate the video camera with a thumb or index finger for setting an imaging angle of the video camera. *Id.* at 3:39–45. An embodiment of Wakabayashi's imager apparatus is shown in Figures 1 and 2:

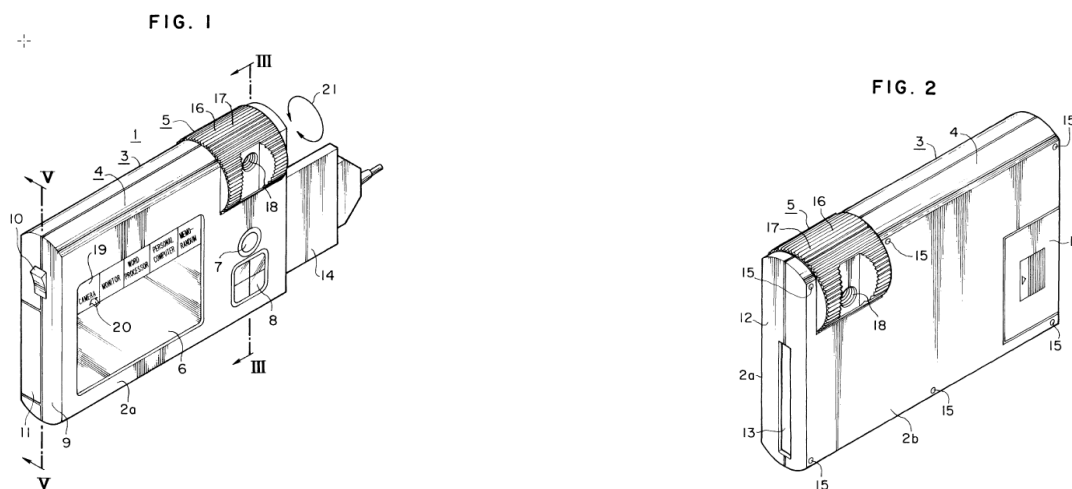


Figure 1 is a perspective external frontal view of an embodiment of Wakabayashi's imager. *Id.* at 3:49–51. Figure 2 is a perspective external

rear view of the same embodiment as shown in Figure 1. *Id.* at 3:52–54. The imager includes front panel 2a and rear panel 2b. *Id.* at 4:40–43. The imager apparatus has video camera unit 5 rotatably mounted on an end portion of upper edge 4, liquid crystal display 6 in housing 3, selection button 7 and cursor key 8 on front panel 2a. *Id.* at 4:44–48. It also has power supply switch 10 and battery-cover 11 arranged on left side surface 9 of housing 3, and card slot 13 formed on right surface 12 of housing 3 for inserting PCMCIA card 14. *Id.* at 4:48–51. Video camera unit 5 has camera case 16 formed with anti-slip kurl 17 on its surface. *Id.* at 4:54–55.

Wakabayashi describes that, for each of its disclosed embodiments, camera head 100 in the video camera unit includes a light receiving lens, a solid state imager device, and a circuit for driving the solid state imager device. *Id.* at 9:9–14, 12:47–51. Wakabayashi also describes that the camera head generates an opto-electrically converted signal that is inputted to camera circuit 102. *Id.* Camera circuit 102 generates a video signal from the opto-electrically converted signal. *Id.* at 9:14–18, 12:51–55. Wakabayashi further describes that camera head 100 and camera circuit 102 together constitute the video camera unit. *Id.* at 9:18–21, 12:55–57.

Figure 7 of Wakabayashi is reproduced below:

FIG. 7

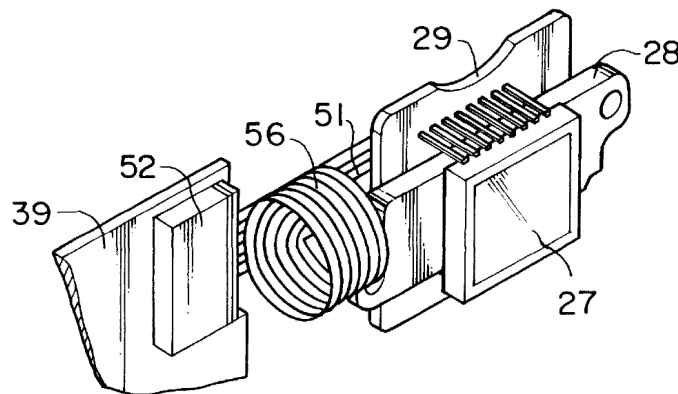


Figure 7 is a partial perspective sectional view of the imager apparatus of Figure 1. Ex. 1027, 6:20–21, 44–45. Flexible board 51 is electrically connected to camera circuit board 29 by soldering, and imager device 27 is electrically connected to camera circuit board 29 by soldering with mounting plate 28 interposed therebetween. *Id.* at 6:45–49. Flexible board 51 connects camera circuit board 29 to connector 52 on circuit board 39.

Figure 22 of Wakabayashi, illustrating a circuit block diagram, is reproduced below:

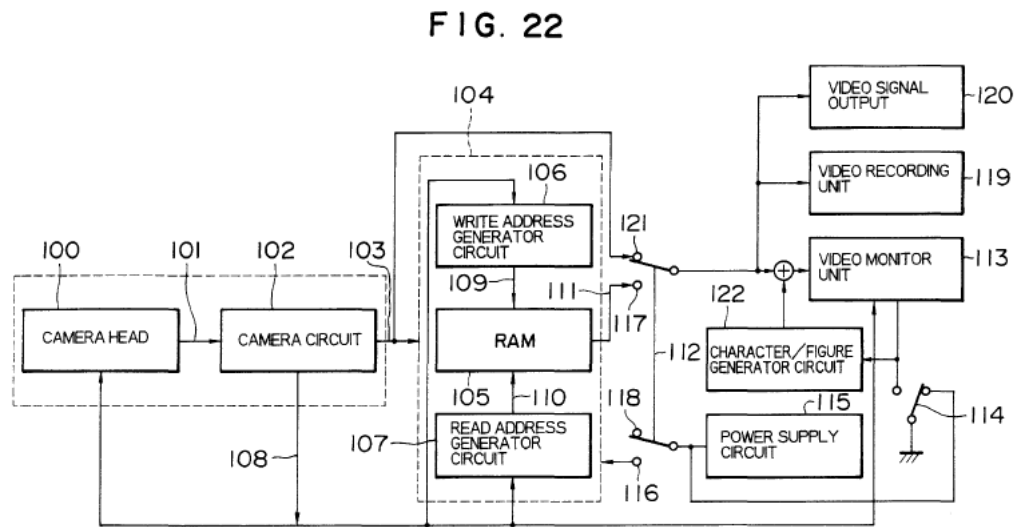


Figure 22 shows a block diagram of a circuit used in Wakabayashi's imager apparatus. Ex. 1006, 9:9–10. Camera head 100 includes a light receiving lens, a solid-state imager device, a circuit for driving the solid-state imager device, and generates opto-electrically converted signal 101 that is provided to camera circuit 102. *Id.* at 9:10–14. Camera circuit 102 includes camera signal processing circuit and synchronization signal generator circuit, and generates video signal 103 in television signal format from opto-electrically converted signal 101. *Id.* at 9: 14–18.

3. Overview of Ackland

Ackland relates to CMOS active pixels and discloses a method for operating a CMOS active pixel array. Ex. 1006, 1:10–11, 2:20–22. Ackland expressly states that a class of solid state image sensors is a CMOS active pixel array. *Id.* at 1:33–34. Figure 6 of Ackland depicts an array of CMOS active pixels and is reproduced below:

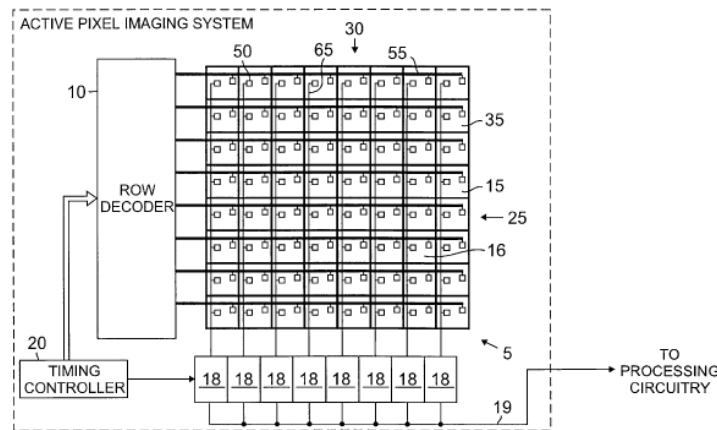


FIG. 6

Figure 6 of Ackland depicts an array of CMOS active pixels forming an imaging system which may be used as a solid state camera. *Id.* at 7:59–64.

The pixels in each row 25 are connected to a common conductor 55 serving as a control line. *Id.* at 8:10–11. The pixel output 50 is connected to the column output line 65. *Id.* at 8:16–17. Each active pixel output 50 in a corresponding column 30 is connected by a common conductor 65 serving as a column output line to a particular amplifier 18. *Id.* at 8:18–20. Ackland explains:

In operation, a timing controller 20 provides timing signals to the row decoder 10. In response, the decoder 10 sequentially activates each row 25 of active pixels 35 via the control lines 55 to detect light intensity and to generate corresponding output voltage signals during each frame interval.

Id. at 8:24–29. Acland further explains:

The output voltage signals generated by the activated row 35 are simultaneously provided to the corresponding amplifiers 18 via the column output line 65. Output signals from the amplifiers 18 are provided to the common output line 19 in serial fashion based on timing control signals from the timing control 20. The output signals are routed to suitable processing circuitry, not shown.

Id. at 6:44–51.

4. *Independent Claim 1*

a) *preamble*

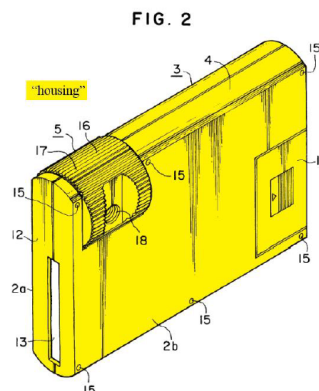
Claim 1’s preamble recites “[a]n imaging device.” Ex. 1001, 25.

Wakabayashi, as applied by Petitioner, discloses a portable imager apparatus including a video camera, a flat display, and a semiconductor memory.

Ex. 1027, 1:5–11, Figs. 1 and 2. Patent Owner does not dispute that Wakabayashi’s portable imager apparatus is an imaging device. We need not determine whether the preamble is limiting.

b) *housing*

Claim 1 further recites a “housing.” Ex. 1001, 21:26. Petitioner identifies Wakabayashi’s housing 3, camera case 16, and battery-plate 11 as collectively constituting the claimed housing. Pet. 35. A color-annotated Figure 2 of Wakabayashi, with what Petitioner regards as the housing colored in yellow, appears on page 37 of the Petition and is reproduced below:



The figure shows what Petitioner identifies as the claimed housing.
Pet. 37. Patent Owner in the Patent Owner Response does not dispute Petitioner's assertion. We are persuaded that housing 3 including two halves 2a and 2b, camera case 16, and battery cover-plate 11 together form a housing as claimed.

c) image sensor

Claim 1 further recites:

an image sensor mounted in said housing, said image sensor including a first circuit board having a length and a width thereto, wherein said length and width of said first circuit board define a first plane, said first circuit board including an array of CMOS pixels thereon, wherein a plurality of CMOS pixels within said array of CMOS pixels each include an amplifier, said first circuit board further including timing and control circuitry thereon, said timing and control circuitry being coupled to said array of CMOS pixels, said image sensor producing a pre-video signal;

Ex. 1001, 21:27–37. For the above-quoted image sensor limitation, Petitioner asserts that Wakabayashi discloses all recited elements *except* (1) that the first circuit board in Wakabayashi's image sensor is not described as including an array of CMOS pixels wherein a plurality of CMOS pixels within the array each include an amplifier, and (2) that the first circuit board in Wakabayashi does not include timing and control circuitry. Pet. 21, 38–47.

Specifically, Petitioner identifies imager device 27 and circuit board 29 together as the claimed image sensor, circuit board 29 as the claimed first circuit board having a length and a width defining a first plane, and explains that imager device 27 is soldered onto circuit board 29, which is fixed to camera case 16. Pet. 38–39 (citing Ex. 1027, 5:56–65, 6:46–48, 9:10–14, Figs. 3, 7; Ex. 1004 ¶¶ 102–105). The identification is supported by the

cited evidence. Wakabayashi describes imager device 27 as “solid state imager device” and does not specify the particular type of solid state imager device, e.g., CCD, CMOS, etc. Ex. 1027, 9:10–14. Petitioner asserts that Wakabayashi’s camera head, which includes the solid-state imager device, generates a pre-video signal in the form of “an opto-electrically converted signal.” Pet. 21 (citing Ex. 1027, 9:10–14, Fig. 22; Neikirk ¶ 67). Indeed, Wakabayashi describes that camera circuit 102 receives the opto-electrically converted signal and generates a video signal. *Id.* at 9:14–18.

For the image sensor limitation, Patent Owner does not dispute Petitioner’s identification of what features are missing from Wakabayashi. We are persuaded that Wakabayashi discloses the claimed image sensor except for the two exceptions identified by Petitioner as noted above.

Petitioner asserts that Ackland discloses a specific type of solid state imager device, one comprising (1) an array of CMOS pixels a plurality of which each include an amplifier, and (2) timing and control circuitry coupled to the array of CMOS pixels. Pet. 29, 41–47. Patent Owner does not dispute this assertion. Petitioner’s expert, Dr. Neikirk, testifies that a CMOS based imager is a solid state imager. Ex. 1004 ¶¶ 43–44. Patent Owner’s expert, Dr. Lebby, does not provide contrary testimony. The ’565 patent also describes that CMOS imagers use solid state imaging technology. Ex. 1001, 1:62–64. Ackland specifically states: “Another class of solid state image sensors is a CMOS active pixel array.” Ex. 1006, 1:33–34. We find that a CMOS imager, an imager including an array of CMOS pixels, is a solid state imager.

Specifically, Petitioner identifies array 5 in Ackland’s Figure 6 as an array of CMOS pixels, a plurality of which each include an amplifier, and timing controller 20 in Ackland’s Figure 6 as the claimed timing and control

circuitry coupled to the array of CMOS pixels. Pet. 41–47 (citing Ex. 1006, 1:35–38, 2:19–23, 2:66–67, 3:6–7, 3:20–25, 3:39–54, 4:45–49, 5:7–10, 7:44–47, 7:59–8:9, 8:16–17, 8:24–34, 8:48–51, Figs. 3, 6; Ex. 1004 ¶¶ 106–117). The identification is supported by the cited evidence. Ackland’s Figure 6 shows CMOS pixel array 5 and timing and control circuitry 20 coupled to the CMOS pixel array. Ex. 1006, Fig. 6.

Petitioner further asserts that Ackland’s imager device produces a pre-video signal. Pet. 47–48 (citing Ex. 1006, 8:44–51, Fig. 6; Ex. 1004 ¶¶ 118–120). The ’565 patent refers to the image signal transmitted from the image sensor to video processing circuitry as a pre-video signal. Ex. 1001, 9:26–35. Patent Owner does not dispute Petitioner’s assertion. Petitioner identifies the pre-video signal in Ackland by annotating Ackland’s Figure 6, which shows a CMOS imager device, on page 48 of the Petition, as reproduced below:

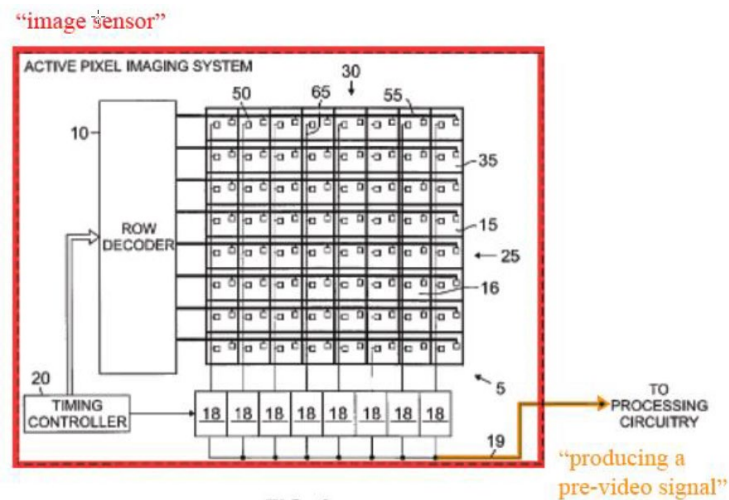


Figure 6 shows Ackland’s CMOS imager device, color annotated by Petitioner to indicate production of a pre-video signal that is to be provided to downstream processing circuitry. Pet. 47–48. Petitioner’s identification

is supported by the cited evidence. We are persuaded that Ackland’s CMOS solid state imager device produces a pre-video signal.

Petitioner notes that although Wakabayashi describes its image sensor as a “solid-state imager device,” and describes a “circuit for driving the solid-state imager device,” Wakabayashi does not specifically describe a particular type of solid-state imager device, e.g., one that includes an array of CMOS pixels. Pet. 30. Petitioner explains that, on the other hand, Ackland describes a specific type of imaging system, one that includes a CMOS pixel array, which is “used as a solid-state camera.” *Id.* Petitioner further notes that each pixel output in Ackland’s CMOS pixel array is coupled to an amplifier to provide a more advantageous output. *Id.* Petitioner additionally notes that in Ackland, timing controller 20 provides timing signals that control the imaging system to achieve a desired frame rate. *Id.* at 30–31.

Petitioner asserts that “[a] POSITA would have been motivated to apply **Ackland’s** known teachings described above in implementing **Wakabayashi’s** ‘imaging apparatus.’” *Id.* at 32, 41–42. These teachings from Ackland include the array of CMOS pixels, the amplifiers coupled to each pixel, and associated timing controller 20.⁶ *Id.* at 41–42. Dr. Neikirk testifies that:

[A] person of ordinary skill in the art would have been motivated and found it obvious and straight forward to apply Ackland’s

⁶ Petitioner asserts that “[a]s the ’565 [patent] acknowledges, CMOS image sensors and readout circuitry for operating such sensors, as disclosed in **Ackland**, were well known in the art. ’565, 2:8–15, 2:25–34. Neikirk, ¶90.” Pet. 32. The ’565 patent, in its Background of the Invention section, describes that the CMOS imager in U.S. Patent 5,471,515 can incorporate timing circuits on the same circuit board as the CMOS pixel array. Ex. 1001, 2:8–14.

known teachings of an array of CMOS active pixels in an image sensor in implementing Wakabayashi's imager apparatus and would have recognized this combination (yielding the claimed invention) would work as expected.

Ex. 1004 ¶ 109.

Notwithstanding Patent Owner's arguments to the contrary, discussed below, we are persuaded by Petitioner that one with ordinary skill in the art would have had reason to implement Wakabayashi's solid state imager device 27 with Ackland's array of CMOS pixels, associated amplifiers, and corresponding timing and control circuitry as shown in Ackland's Figure 6, and would have had a reasonable expectation of success in doing so. We make this conclusion while in full consideration of the objective evidence of nonobviousness submitted by Patent Owner, discussed above.

The motivation to combine the teachings of Wakabayashi and Ackland is that Wakabayashi discloses using a solid-state imager without indicating a specific type of solid-state imager (Ex. 1027, 9:9–14, 12:47–51), and Ackland teaches using a CMOS imager for use in a solid-state camera (Ex. 1006, 7:59–63). Also in support of the stated motivation to combine is the fact, as we have determined above, that a CMOS imager, an imager that includes an array of CMOS pixels, is a solid state imager. The associated amplifiers and timing controller from Ackland would also be used, along with Ackland's CMOS pixel array, and because the amplifiers provide a more advantageous output and the timing and the timing controller provide an appropriate and desirable frame rate for reading the pixel array, as Petitioner has explained.

Figure 7 of Wakabayashi is reproduced below, to show how imager device 27 is mounted on camera circuit board 29:

FIG. 7

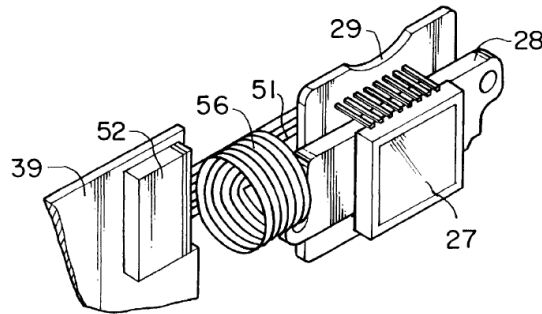


Figure 7 shows the internal structure of Wakabayashi's solid state video camera. Ex. 1027, 3:64–65. In the Wakabayashi and Ackland combination proposed by Petitioner, Ackland's imaging device including an array of CMOS pixels and associated parts which are used to provide an output from the pixel array, i.e., associated amplifiers and timing controller 20, would take the place of Wakabayashi's imager device 27.

Patent Owner presents several reasons that a person of ordinary skill in the art would not have been motivated to combine Wakabayashi and Ackland. First, Patent Owner asserts:

Wakabayashi and Ackland fail to teach or suggest a “first circuit board including an array of CMOS pixels thereon, wherein a plurality of CMOS pixels within said array of CMOS pixels each include an amplifier, said first circuit board further including timing and control circuitry thereon, said timing and control circuitry being coupled to said array of CMOS pixels,” as recited in independent claims 1 and 31 of the '565 Patent.

PO Resp. 24. The argument is unpersuasive. When Ackland's CMOS pixel array, amplifiers associated with each pixel, and timing controller 20 collectively implement Wakabayashi's imager device 27, Wakabayashi's circuit board 29 satisfies the requirements of the claimed first circuit board. Also, a plurality of CMOS pixels within the array would each include corresponding amplifier 18, and timing controller 20 (timing and control

circuitry) would be coupled to the array of CMOS pixels, as shown in Ackland's Figure 6.

Second, Patent Owner asserts that Petitioner never articulated that in its proposed combination, Ackland's CMOS pixel array, associated amplifiers, and corresponding timing and control circuitry would take the place of Wakabayashi's imager device 27. PO Resp. 36. We disagree. As noted above, Petitioner asserts that "[a] POSITA would have been motivated to apply **Ackland's** known teachings described above in implementing **Wakabayashi's** 'imaging apparatus.'" Pet. 32, 41–42. The teachings "described above" are the array of CMOS pixels, the amplifiers coupled to each pixel, and associated timing controller 20, i.e., the pixel array and circuitry for obtaining a readout from the array to output a pre-video signal. *Id.* at 30–31.

It is implicit and understood that Wakabayashi's component implemented by the referenced parts from Ackland is Wakabayashi's solid state imager device 27, which likewise generates a pre-video signal. It is Petitioner's position that Wakabayashi's solid-state imager device 27 generates a pre-video signal. Pet. 21. Furthermore, unless expressly stated otherwise, we understand the proposed substitution to be between parts that are similar in kind. In Wakabayashi, that which corresponds in kind to Ackland's image pixel array is imager device 27. Circuitry that generates a pre-video signal as output does not logically substitute for or implement circuitry that receives a pre-video signal as input. We understand Petitioner as proposing to implement Wakabayashi's imager device 27 by or substitute it with Ackland's CMOS pixel array 5, associated amplifiers 18, and timing controller 20. It is unreasonable not to read Petitioner's proposed combination that way.

Third, Patent Owner asserts that Petitioner's assertion that a POSITA would have been motivated to apply Ackland's known teachings described above in implementing Wakabayashi's imager apparatus is conclusory. PO Resp. 35. We disagree. Petitioner's expert, Dr. Neikirk, testifies that a CMOS based imager is a solid state imager. Ex. 1004 ¶¶ 43–44. Petitioner notes that although Wakabayashi describes its image sensor as a "solid-state imager device," Wakabayashi does not specifically describe a particular type of solid-state imager device. Pet. 30. Petitioner explains that Ackland describes a specific type of imaging system, one that includes a CMOS pixel array, which is "used as a solid-state camera." *Id.* Petitioner's stated reasoning is not conclusory but has rational underpinnings, based on the fact that Wakabayashi describes using a solid-state imager, that Ackland's CMOS imager is a type of solid-state imager, and that Ackland describes its CMOS imager is used as a solid-state camera.

Petitioner asserts additional reasons why one with ordinary skill in the art would have been motivated to combine teachings from Wakabayashi and Ackland: (1) both Wakabayashi and Ackland are in the same field of art and both constitute analogous art to the '565 patent; (2) both Wakabayashi and Ackland are reasonably pertinent to the alleged problems identified in the '565 patent, i.e., arranging the circuitry of image sensor, including minimizing the size of the device and for the develop to be low cost; (3) the stated goals of the '565 patent of producing a very small or low cost imaging device were objectives well known to one with ordinary skill in the art; (4) it was well known that fitting of components into available space while maintaining orientation of the components relative to one another, including placement of circuitry on various layers arranged stackwise is a common design consideration for portable devices; (5) a POSITA would have found it

routine, straightforward and advantageous to rearrange components as needed to create a smaller overall device; and (6) relative to other CMOS image sensor options, Ackland's array of single-polysilicon active pixels requires no active drive signal for charge transfer, which advantageously allows the image sensor to operate with less power and which makes possible the application of a simpler fabrication process that lowers cost and reduces image lag. Pet. 33–34.

These additional reasons are inadequately explained by Petitioner and, on this record, do not have much, if anything, to do with using Ackland's CMOS image sensor 5, associated amplifiers 18, and timing controller 20 in Wakabayashi's imaging apparatus, so as to implement Wakabayashi's imager device 27. That both Wakabayashi and Ackland are in the same field, are reasonably pertinent to the problems identified in the '565 patent, and are analogous art to the '565 patent is too general to constitute a sufficient motivation to combine specific teachings. That the goals of the '565 patent were well known in the art is not a sufficient reason to combine specific teachings. That fitting of components into available space while maintaining orientation of the components relative to one another, including placement of circuitry on various layers arranged stackwise, is a common design consideration for portable devices, is not sufficiently related to using Ackland's CMOS imager as Wakabayashi's solid-state imager device. That a POSITA would have found it routine, straightforward and advantageous to rearrange components as needed to create a smaller overall device is also not sufficiently related to using Ackland's CMOS imager as Wakabayashi's solid-state imager device. Finally, that Ackland's array of single-polysilicon active pixels is better than other CMOS image sensor options is not a sufficient reason to use Ackland's CMOS imager as Wakabayashi's solid-

state imager device, because Wakabayashi does not describe its imager device as a CMOS imager. In other words, being the best CMOS imager does not explain why use a CMOS imager at all.

Nevertheless, Petitioner need not rely on any of these additional reasons to establish an adequate motivation for one with ordinary skill in the art to use Ackland's CMOS image sensor 5, associated amplifiers 18, and timing controller 20 in Wakabayashi's imaging apparatus to implement Wakabayashi's imager device 27. Petitioner has provided adequate reasoning with rational underpinnings, as discussed above.

Fourth, Patent Owner argues that Petitioner's proposed combination of Wakabayashi and Ackland "would render Wakabayashi inoperable for its intended purpose." PO Resp. 25. Specifically, Patent Owner asserts: "Petitioner's proposed modification to incorporate Ackland's CMOS camera-on-a-chip sensor would fundamentally change Wakabayashi's principle of operation as a CCD imaging device, thereby requiring substantial reconstruction and redesign." *Id.* at 26. The assertion is premised on Patent Owner's underlying contention that Wakabayashi's disclosure is limited only to a CCD imaging device. Patent Owner states:

As discussed above, a POSITA would understand that the portable digital camera disclosed in Wakabayashi to be a CCD sensor device. *See supra* § VI(A). For example, the fact that Wakabayashi's [imaging apparatus] includes an off-chip signal processing circuit separate from the imager pixel array tells a POSITA that Wakabayashi describes a CCD imaging sensor. *Id.*

Id. The contention is not sufficiently supported by evidence of record. We are persuaded by Petitioner that Wakabayashi describes the use of a solid-state imager and is not limited to CCD type imaging sensors.

We have reviewed Patent Owner's contentions in Section VI(A) of the Patent Owner Response, as alluded to in the above-quoted argument. In that section, Patent Owner asserts:

As explained in the accompanying declaration of Dr. Michael Lebby, a POSITA would understand Wakabayashi to be a CCD device, as Wakabayashi refers to a solid-state imager and describes a conventional CCD device design used in 1995 (when Wakabayashi was filed), for several reasons. *Lebby Decl.*, ¶¶ 100-103, 107, 108, 119. Therefore, Wakabayashi refers to a solid-state imager and describes a conventional CCD device design used in 1995 (when Wakabayashi was filed).

PO Resp. 21.

The argument is misplaced, as it is misdirected to a different subject, i.e., whether Wakabayashi's disclosed circuit configuration reflects what is conventional for a CCD device. Even if the circuit design reflects what was conventional at the time for CCD devices, that does not preclude Wakabayashi from reasonably also suggesting the use of a CMOS imager in that configuration. The question is not a binary choice between CCD and CMOS. Wakabayashi reasonably could have suggested both. Indeed, that Wakabayashi reasonably would have suggested use of CCD imager in that disclosed configuration does not mean it reasonably would not have suggested the use of a CMOS imager in that configuration. There is no inconsistency between Wakabayashi's disclosed circuit design being conventional for CCD devices and Wakabayashi's reasonably suggesting the use of a CMOS imager by referencing not a CCD device but a "solid-state imager."

Fifth, Patent Owner asserts in its Sur-Reply that the presence of a mounting plate 28 between the imager device and circuit board in Wakabayashi and Wakabayashi's usage of its image arrangement convertor

circuit 104 suggest that Wakabayashi's camera architecture is *only* for a CCD sensor, and *not* for a CMOS sensor. Sur-Reply 13–14. We do not find this argument persuasive, even assuming that the specific embodiment described must be a CCD sensor. Similar to what is discussed immediately above, specific disclosure of a CCD embodiment does not take away or undermine Wakabayashi's broader express disclosure that a solid state imager may be used. Wakabayashi does not have to specifically describe a CMOS imager embodiment for its reference to "solid state imager" to have reasonably suggested a CMOS imager to one with ordinary skill in the art. There is no inconsistency between specifically disclosing a CCD embodiment and also reasonably suggesting using a CMOS imager by having broader disclosure.

The term "CCD" or "charge-couple device" nowhere appears in the disclosure of Wakabayashi, and Wakabayashi expressly teaches the use of a solid-state imager. Ex. 1027, 9:9–14, 12:47–51. We have determined above that a CMOS imager is a solid-state imager. Patent Owner does not assert and Dr. Lebby does not testify that an off-chip design for locating processing circuitry is usable *exclusively* by CCD devices. Even Dr. Lebby, Patent Owner's expert, testifies that Wakabayashi's disclosed circuit architecture "would have been understood to use CCD, MOS, or CID image sensors." Ex. 2088 ¶ 100. Thus, Patent Owner's argument that Wakabayashi's off-chip design for processing circuitry is conventional for CCD devices misses the mark in countering Petitioner's stated rationale for using Ackland's CMOS imager 5, amplifiers 18, and timing controller 20 to implement Wakabayashi's imager device 27.

Furthermore, Petitioner in its Reply asserts that CMOS image sensors with off-chip processing circuitry were well known, citing as examples the

disclosures of WO 95/34988, published December 21, 1995 (Ex. 1005) (“Swift”) and U.S. Patent 5,919,130, filed March 17, 1997 (Ex. 1007) (“Monroe”). Reply 3. Patent Owner in its Sur-Reply does not argue that Swift and Monroe do not disclose what Petitioner asserts they disclose, i.e., CMOS imager in which the processing circuitry is located off-chip and separate from the CMOS pixel array was well known. Instead, Patent Owner argues that Petitioner engaged in “an attempt to apply general knowledge of one skilled in the art to supply the missing motivation [to] combine.” Sur-Reply, 6–7. On this record, Petitioner’s assertion regarding the disclosure of Swift and Monroe stands unrebutted.⁷ It was also not inappropriate for Petitioner to identify Swift and Monroe as general knowledge in the art, in response to Patent Owner’s assertion that Wakabayashi would have been understood as disclosing a CCD device.

Even according to Patent Owner, a CMOS sensor provides the “*ability* to integrate much of the camera timing, control and signal processing circuitry onto the same silicon die.” PO Resp. 16 (emphasis added). Patent Owner does not assert and Dr. Lebby does not testify that a CMOS sensor requires all such components to be integrated onto the same die or chip. Providing an ability does not and cannot be equated to imposing a requirement.

⁷ During oral argument, counsel for Patent Owner argued for the first time that Swift and Monroe do not disclose what Petitioner asserted they disclose. Tr. 82:15–19. Such an argument is belated and cannot be raised for the first time at oral argument. PTAB Consolidated Trial Practice Guide (November 2019) 85–86 (available at <https://www.uspto.gov/TrialPracticeGuideConsolidated>). We decline to consider it.

For the foregoing reasons, Petitioner's stated rationale for using Ackland's CMOS imager as Wakabayashi's solid-state imager is not undermined by Patent Owner's argument that Wakabayashi's circuit design is conventional for CCD devices and thus one with ordinary skill in the art would have understood that Wakabayashi describes a CCD device. The scope of "solid-state imager" as referenced in Wakabayashi is broader and would have reasonably suggested a CMOS imager, particularly in light of Ackland's CMOS imager that described being for a "solid state camera." We make this conclusion while in full consideration of the objective evidence of nonobviousness submitted by Patent Owner, discussed above.

Sixth, Patent Owner additionally argues that "Petitioner's proposed modification to incorporate Ackland's CMOS sensor would nevertheless make Wakabayashi's imaging apparatus unsuitable for its intended purpose as a portable digital camera for taking videos and photographs." PO Resp. 29–30. Patent Owner asserts that "[a] POSITA would understand that known CMOS image sensors at the time the invention was made were not suitable for [capturing digital videos and photographs] purposes." *Id.* at 30.

Specifically, according to Patent Owner, CMOS image sensors at the time of the invention "produced images having high noise levels corresponding to poor image quality," citing Exhibits 1060, 2060, 2063. But relatively poorer quality as compared to other technologies at the time does not mean or equate to inability to produce an image. Patent Owner does not assert that CMOS image sensors are incapable of producing an image, i.e., a picture or photograph. Exhibits 1060 and 2063 indicate that CMOS image sensors do produce images, just not as good, at the time, as CCD devices. Ex. 1060, 55; Ex. 2063, 1–2. Exhibit 2060 indicates that CMOS image sensors do produce images but include "annoying little dots or scratches on

photos.” Ex. 2060, 3–4. Even the testimony of Patent Owner’s expert, Dr. Lebby, confirms that CMOS image sensors at the time of the invention were usable for taking pictures. Ex. 2088 ¶ 106 (“[A]doption of CMOS sensors in 1997 were limited to applications where the quality of the image was less important . . .”).

Seventh, Patent Owner further asserts:

The unsuitability of CMOS image sensors for digital cameras is confirmed by a review of all major digital cameras released in 1997, which showed all digital cameras having CCD sensors and not CMOS sensors. *See* Ex. 2052 (showing a timeline of digital cameras released in 1997). This review even identified a digital camera, Casio QV-700, which has a swiveling lens similar to that of Wakabayashi, that has a CCD sensor.

PO Resp. 31. However, the argument is weak and unpersuasive. That all major digital cameras released in 1997 used CCD sensors and not CMOS sensors, even if true, does not mean CMOS sensors are incapable of being used for taking a picture or photograph. As noted above, Exhibits 1060, 2060, and 2063, as well as the testimony of Patent Owner’s expert Dr. Lebby, all indicate that CMOS sensors were capable of producing an image, i.e., a picture or photograph. For commercial products, it is understandable that sensors producing higher quality image would be used. But that does not mean sensors outputting a lower quality image are incapable of producing a picture or photograph.

In any event, Patent Owner does not point to any description in Wakabayashi that specifies a minimum level of image quality that must be obtained by Wakabayashi’s imaging apparatus. Even if it did, a prior art reference must be considered for everything it teaches by way of technology and is not limited to the particular invention it is describing and attempting to protect. *EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed.

Cir. 1985); *In re Heck*, 699 F.2d 1331, 1333 (Fed. Cir. 1983). Thus, suitability for the intended purpose of taking a picture or photograph does not require producing an image of very high quality. The claims of the '565 patent also do not require any particular level of image quality.

For the foregoing reasons, Petitioner's stated rationale for using Ackland's CMOS imager as Wakabayashi's solid-state imager is not undermined by Patent Owner's argument that a CMOS imager is unsuitable for the intended purpose of Wakabayashi's imaging device. We make this conclusion while in full consideration of the objective evidence of nonobviousness submitted by Patent Owner, discussed above.

Eighth, Patent Owner asserts that Petitioner's combination of Wakabayashi and Ackland "would render the CMOS sensor of Ackland inoperable for its intended purpose." PO Resp. 31. Specifically, Patent Owner asserts:

The CMOS technology disclosed by Ackland has the intended purpose of producing an image sensor with an integrated ("on-chip") design. A POSITA would understand that the intended purpose of CMOS image sensors, such as that disclosed by Ackland, would be to integrate all of its circuitry and components on a single semiconductor chip or one plane. Ex. 2050, 24 (stating that "the most important advantage of the CMOS APS approach, however, is the ability to integrate much of the camera timing, control and signal processing circuitry onto the same silicon die"); Ex. 2066, 178 ("A CMOS imager integrates the sensor technology and digital control functions on a chip."); Ex. 2067, 38 (describing Figure 1 as "The Active-Pixel Image Sensor includes not only the photosensors but also the timing, control, and redundant readout circuits, integrated on one chip."); *Lebby Decl.*, ¶¶ 109–116, 122–124.

Id. at 31–32.

For numerous reasons, Patent Owner's argument is misplaced and unpersuasive. First, in Petitioner's proposed combination as discussed above, the entirety of what are shown in Ackland's Figure 6, labeled as "ACTIVE PIXEL IMAGING SYSTEM" and enclosed in dashed lines, are adopted for use as Wakabayashi's imager device 27, which is on one chip and substrate. Petitioner has not proposed to leave anything off or drop anything from what are shown in Ackland's Figure 6. Second, Ackland does not describe or refer to "on chip" or "single chip" with respect to its circuits, certainly not the "processing circuitry" absent from Figure 6. Ackland also does not describe that the intended purpose for the CMOS imager is to have it integrated on the same chip as the processing circuitry.

The evidence does not support Patent Owner's contention that Ackland's "processing circuitry" is required to be on the same chip as the circuits shown in Ackland's Figure 6 for Ackland's CMOS sensor to work. The evidence also does not support Patent Owner's contention that the intended purpose of CMOS image sensors, such as that disclosed by Ackland, would be to integrate all of its circuitry and components on a single semiconductor chip or one plane.

Exhibit 2050, a paper authored by two co-authors who are also named co-inventors of Ackland, indicates that an important advantage of CMOS sensors is "the ability to integrate much of the camera timing, control and signal processing circuitry onto the same silicon die," but an ability is not a requirement. Similarly, neither Exhibit 2066 nor 2067 indicates such a requirement. Further, Dr. Lebby, Patent Owner's expert, does not testify that a CMOS sensor, in order to function, requires all such components to be integrated onto the same die or chip. Also, Petitioner's assertion that a CMOS imager in which the processing circuitry is located off-chip and

separate from the CMOS pixel array was well known, as exemplified by Swift and Monroe, stands un rebutted by Patent Owner, as discussed above.

We are cognizant that Exhibit 2050 states: “Cost, size, and power constraints require integrating the image sensor along with analog and digital signal processing and interfacing elements onto the same die, as shown in Figure 2.” Ex. 2050, 22. The sentence must be read in context, i.e., relating to the performance level that may be desired in a particular situation. In other words, if there is a certain cost ceiling, and a maximum size and/or power consumption for an application, it may be necessary to integrate the CMOS sensor together with its processing circuitry all on a single chip or silicon die. It does not mean such a requirement applies to all CMOS sensors. Patent Owner has not identified anything in Ackland that expresses a cost ceiling, maximum size, or limit of power consumption for its disclosed image sensor. Claim 1 also includes no limitation on the cost, size, or power consumption of the image sensor. Further, as discussed above, Swift and Monroe are examples of CMOS sensors that operate with off-chip processing circuitry.

In any event, Petitioner is not proposing to implement the invention of Ackland, but just to use the CMOS imager disclosed in Ackland. We note that a prior art reference must be considered for everything it teaches by way of technology and is not limited to the particular invention it is describing and attempting to protect. *EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985). The use of patents as references is not limited to what the patentees describe as their own inventions or to the problems with which they are concerned, as they are a part of the literature and are relevant for all they contain. *In re Heck*, 699 F.2d 1331, 1333 (Fed. Cir. 1983).

Whatever is the intended purpose of Ackland's invention, it is of little relevance here.

For the foregoing reasons, Petitioner's stated rationale for using Ackland's CMOS imager as Wakabayashi's solid-state imager is not undermined by Patent Owner's argument that Petitioner's combination of Wakabayashi and Ackland "would render the CMOS sensor of Ackland inoperable for its intended purpose." We make this conclusion while in full consideration of the objective evidence of nonobviousness submitted by Patent Owner, discussed above.

Ninth, Patent Owner further argues:

Petitioner's proposed combination of Wakabayashi and Ackland *does not have a reasonable expectation of success* because a POSITA would understand that such a combination would retain the disadvantages of both Wakabayashi's imaging apparatus and Ackland's CMOS image sensor, while losing all of their respective benefits. "For the obviousness inquiry, "the Board must weigh the benefits and drawbacks of the modification against each other, to determine whether there would be a motivation to combine." *Arctic Cat Inc. v. Polaris Indus., Inc.*, 795 F.App'x 827, 833 (Fed. Cir. 2019). Here, there are several significant drawbacks [which] would strongly dissuade rather than motivate a POSITA from considering the alleged combination.

PO Resp. 41 (emphasis added). Patent Owner explains: "A POSITA would understand that such a modification [the proposed combination] would instead have low image quality that was available with CMOS pixel arrays at the time, as well as not obtaining the benefit of on-chip integration of timing, control, and image processing that was the recognized advantage of using a CMOS pixel array." *Id.* Patent Owner asserts: "No POSITA would be motivated to make such a modification of Wakabayashi to result in a

device that was no more efficient, smaller or less expensive and produced an inferior image output.” *Id.* at 42.

Patent Owner’s argument of lack of expectation of success is misplaced and unpersuasive. None of the contentions noted above indicates a CMOS imager with separately located processing circuitry would not work to take a picture or photograph. They actually confirm that a CMOS imager with separately located processing circuitry can, indeed, take a picture or photograph. Patent Owner cites no authority, and we know of none, that equates lack of reasonable expectation of success to having certain disadvantages relative to other configurations.

Further, Patent Owner does not discuss disadvantages of CCD imager as compared to CMOS imager with separately located processing circuitry. For instance, in the Patent Owner Response, Patent Owner notes that for a CCD pixel array, the entire CCD array must be driven to achieve the output of a single pixel. *Id.* at 13. Patent Owner describes an Achilles’ heel for a CCD imager:

CCD imagers generally used a bucket brigade design of pixel array (illustrated below) that has since been described to be its own “Achilles’ heel.” [Ex. 2053] at 1. (“The Achilles’ heel of CCDs is fundamental to the CCD operating principle—the need for nearly perfect charge transfer.”). To read out a CCD array, a single line “is scanned out from the horizontal shift register onto a capacitor which converts each charge packet to a voltage for subsequent amplification and buffering.” Ex. 2050 at 2. In other words, CCD array readout is “a process of repeated lateral transfer of charge in a MOS electrode-based analog shift-register, where “photo-generated signals are read after they are shifted into appropriate positions. Ex. 2056 at 1:52–56. This shifting process “requires high fidelity and low loss,” further requiring “[a] specialized semiconductor fabrication process . . . to obtain these characteristics.” *Id.* at 1:56–58. Higher voltages also are needed to drive the charge from each pixel through the

entire array to read out the image data. Ex. 2036 at 9; Ex. 2063 at 3; Ex. 2004 at 4.

Id. at 13–14. During oral hearing, counsel for Patent Owner also acknowledged that a CCD imager performs destructive readout which is not the case for CMOS imagers. Tr. 15:1–18. Even Dr. Lebby, Patent Owner’s expert, has testified to advantages of CMOS imagers not tied to complete integration of all associated components, i.e., lower power requirements, increased resistance to radio frequency interference (RFI) and electromagnetic interference (EMI), and flexible readout of the signal charge without destroying the accumulated charge. Ex. 2088 ¶¶ 77, 83. Thus, a CMOS imager at the time is even better than a CCD imager in some ways even with separately located processing circuitry, and is indisputably operable to take an image.

Further, the law does not require a proposed combination of prior art teachings to lead to the preferred or the most desirable implementation to support a sufficient motivation to combine. *In re Fulton*, 391 F.3d 1195, 1200–01 (Fed. Cir. 2004). That better alternatives exist in the prior art does not mean the proposed and allegedly inferior combination would not have been obvious. *In re Mouttet*, 686 F.3d 1322, 1334 (Fed. Cir. 2012).

Additionally, Patent Owner’s reference to a modification of Wakabayashi to make the combination proposed by Petitioner also is misplaced. PO Resp. 29–30. There is no modification of Wakabayashi in Petitioner’s proposal for using Ackland’s CMOS imager as Wakabayashi’s imager device. That is because Wakabayashi explicitly describes the use of a “solid-state imager.” Ex. 1006, 9:10–14. As discussed above, a CMOS imager is a solid-state imager. Thus, using a

CMOS imager is according to the design of Wakabayashi and whatever is needed to implement a CMOS imager is not a “modification” of Wakabayashi but a specific implementation. Whatever is the cost factor, the image quality factor, and the integration of parts factor associated with CMOS imagers are already included in the contemplation of Wakabayashi that solid-state imagers are used. This is *not* a situation in which only a CCD imager is disclosed and Petitioner is proposing to use, instead, a CMOS imager.

Similarly, Patent Owner’s assertion that Petitioner’s proposed combination of Wakabayashi and Ackland would require substantial reconstruction and redesign of Wakabayashi is also without merit. PO Resp. 26–29; Sur-Reply 16–19. There is nothing to reconstruct or redesign. Wakabayashi explicitly describes the use of a “solid-state imager.” Ex. 1006, 9:10–14. Using a CMOS imager is directly according to the design of Wakabayashi and whatever is needed to implement a CMOS imager is not a “reconstruction” or “redesign” of Wakabayashi but a specific implementation of what Wakabayashi expressly teaches.

Patent Owner asserts that Petitioner’s expert, Dr. Neikirk, acknowledged during deposition that a redesign of circuitry is required for a proposed modification that plugged in a CMOS chip. PO Resp. 29 (citing Ex. 2076, 85:15–86:5, Ex. 2075, 209:16–20). We have read the cited portions of the deposition and do not see acknowledgement that a “redesign” of Wakabayashi’s disclosed system is required. We see no testimony from Dr. Neikirk that Wakabayashi’s design is specifically for a CCD imager and that an implementation of a CMOS imager in Wakabayashi requires “redesign” of Wakabayashi. Instead, we find Dr. Neikirk to be indicating that realizing any specific implementation

requires design. *See* Ex. 2075, 209:13–20 (“One of ordinary skill in the art is going to have to use their knowledge to implement all of that circuitry. . . . It requires -- design regardless.”).

Tenth, Patent Owner additionally argues that Petitioner’s challenge improperly looks at the prior art with the benefit of hindsight, by attempting to use the ’565 patent as an instruction manual or template to piece together the teachings of the prior art such that the claimed invention is rendered obvious. PO Resp. 44. Citing the cross-examination of Dr. Neikirk, Petitioner’s expert, Patent Owner asserts that Dr. Neikirk “repeatedly testified that he used the disclosure of the ’565 Patent as the basis for interpreting the Wakabayashi and Ackland references for his obviousness analysis.” PO Resp. 44 (citing Ex. 2076, 64:18-65:5, 97:1–98:19). Patent Owner also points out that Petitioner’s arguments refer to the teachings of the ’565 patent and its purported objectives. *Id.* at 45 (citing Pet. 32–33).

The argument is overly-simplistic and unpersuasive. The law does not prohibit, in an obviousness analysis, all references to the disclosure of the challenged patent. It depends on the particular use of that disclosure. For instance, claim interpretation is necessarily based on the disclosure of the challenged patent. The same is true with respect to what is acknowledged in the Specification as previously known. Patent Owner does not direct us to sufficient evidence to find that Petitioner has exceeded the permissible scope of referencing the Specification of the challenged patent.

Any judgment on obviousness is necessarily a reconstruction based upon hindsight reasoning, but so long as it takes into account only knowledge that was within the level of ordinary skill at the time the claimed invention was made and does not include knowledge gleaned only from

applicant's disclosure, such a reconstruction is proper. *In re McLaughlin*, 443 F.2d, 1392, 1313-14 (CCPA 1971). That is the case here. Petitioner relies on Wakabayashi's disclosure of using a "solid-state imager," and Ackland's disclosure that its CMOS pixel array is for use as a "solid-state camera." Pet. 30–31 (citing Ex. 1027, 9:11–15, Ex. 1006, 7:59–65). That is all the motivation needed for one of ordinary skill in the art to use Ackland's CMOS pixel array and associated timing and readout circuitry as Wakabayashi's imager device 27 as discussed above.

Eleventh, citing *Wasica Finance GmbH v. Continental Auto Systems*, 853 F.3d 1272, 1285 (Fed. Cir. 2017) and *Metabolite Labs., Inc. v. Lab. Corp. of Am. Holdings*, 370 F.3d 1354, 1367 (Fed. Cir. 2004), Patent Owner notes: "The Federal Circuit has made clear that the disclosure of a genus is not necessarily a disclosure of a species." Sur-Reply 4. The observation is correct but misplaced. Petitioner does not assert and we do not find that Wakabayashi's disclosure of a "solid-state imager" is a specific disclosure of a CMOS imager. Rather, Petitioner asserts obviousness based on Wakabayashi's express teaching of using a "solid state imager," Ackland's teaching that its CMOS imager is used in a "solid state camera," and a CMOS imager being a solid state imager. Further, Patent Owner does not assert and the record does not show that the genus or class of solid-state imagers is made up of species members so innumerable that no one member can reasonably be deemed to have been rendered obvious by disclosure of the genus or class. Also, Petitioner relies on more than just a genus/species relationship for its obviousness assertion. Ackland specifically describes that its CMOS imaging system may be used as a "solid state camera." Ex. 1006, 7:59–64.

Petitioner additionally asserts that the lower costs of CMOS imagers would have motivated a POSITA to combine Ackland's CMOS imagers – instead of CCD imagers – with Wakabayashi's solid state imager apparatus to produce a low cost imaging device. Pet. 32–34 (citing Ex. 1060; Ex. 1004 ¶ 89, 92–94). Patent Owner, in response, presents persuasive rebuttal, noting that replacing the CCD array with a CMOS array would not yield much cost savings, and that the majority of those savings are actually brought about by incorporating all the relevant timing, control and image processing circuitry onto a single chip, rather than on multiple circuit boards. PO Resp. 43 (citing Ex. 1060, 54; Ex. 2060, 3). Petitioner replies that the cost advantage of CMOS imagers “is not entirely due to adding circuitry to the chip” but also because CMOS “fabrication facilities by this point in time were very standardized” and unlike CCD manufacturing, did not require new investment. Reply (citing Ex. 2076, 193:7–194:20, 44:6–47:10; Ex. 2088 ¶ 78; Ex. 1086 ¶ 35–36). Patent Owner points out that this argument does not rebut or even address Patent Owner's assertion that utilizing a camera-on-a-chip design provides the vast majority of cost savings while using CMOS instead of CCD yields a minimal amount of such savings. Sur-Reply 21–22.

Patent Owner's arguments and corresponding evidence have created substantial doubt as to Petitioner's stated motivation to combine teachings based on reduced cost. We are not persuaded by Petitioner that reduced cost would have been a motivation for one with ordinary skill in the art to combine Wakabayashi and Ackland in the manner proposed by Petitioner. However, Petitioner has no need for that stated motivation or reason to combine. As discussed above, Petitioner provides ample and sufficient motivation and suggestion to combine by identifying that Wakabayashi

teaches the use of a “solid state imager,” and that Ackland specifically describes that its device is for use in a “solid state camera,” where it is not in dispute that a CMOS imager is a solid state imager.

Twelfth, Patent Owner further relies on Exhibit 2052 – which is a website printout from a page called “Digital Photography Review” that lists various digital cameras that were released in 1997 – to support its argument that “all major digital cameras” at the time of the invention had CCD sensors, not CMOS sensors. PO Resp. 31. However, there is no indication in Exhibit 2052 of what type of sensors (CCD or CMOS) are utilized in the listed cameras. We agree with Petitioner that “[e]ven assuming this website [from which Exhibit 2052 is a printout] were a reliable source (which PO has not shown), the website never mentions anything about CCD or CMOS sensors, nor does it indicate its list is exhaustive.” Reply 7. In its Sur-Reply, Patent Owner does not rebut this observation by Petitioner. Dr. Lebby also does not provide any indication of what types of sensors (CCD or CMOS) are used by the listed cameras in Exhibit 2052.

Furthermore, Petitioner lists at least three digital cameras that used CMOS sensors in 1997: Toshiba’s Allegretto PDR-2, Sound Vision’s SVmini 209, and the ViviCam 3000. Reply 7 (citing Ex. 1091; Ex. 1088, 7; Ex. 1087, 34; Ex. 1086 ¶ 29). Patent Owner provides no rebuttal in that regard in its Sur-Reply. For all of these reasons, we do not find, as Patent Owner asserts, that “all major digital cameras” in 1997 used CCD but not CMOS imaging sensors.

Thirteenth, Patent Owner also provides Exhibit 2036, a report titled “Global Electronics Industry Market Report and Forecast, which contains a figure showing the presence and use of various types of imagers over a period of over forty years. Ex. 2036, 222. Figure 7.5 of Exhibit 2036 is

reproduced below, with a red circle added by Petitioner for showing that CMOS imagers came into existence starting in the mid-1990s (Reply 8):

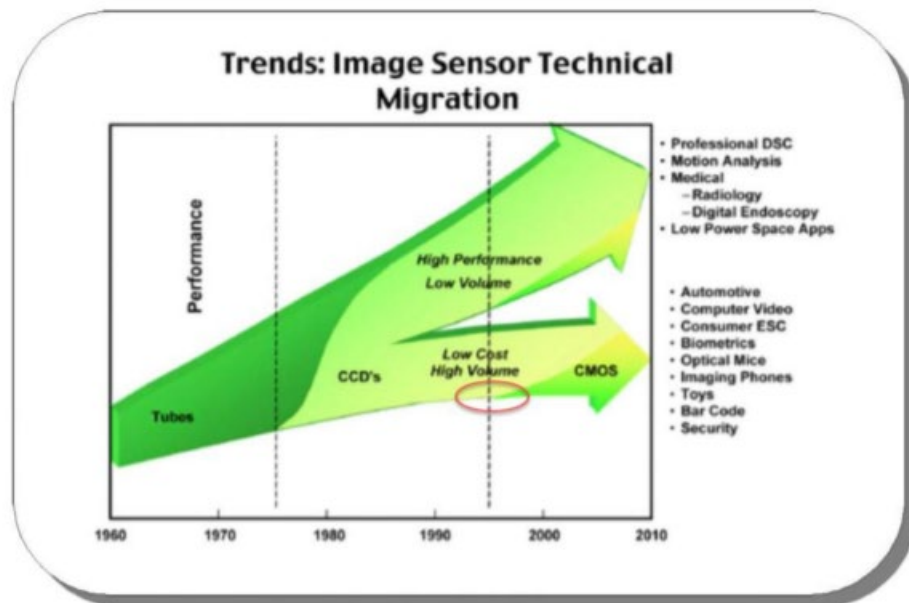


Figure 7.5: Image Sensor Migration and Materials
Source: Kodak

The figure shows the presence and use of various types of imager sensors over a period of over forty years. In the Figure, CMOS imagers are represented by neon-green color. Patent Owner asserts that Figure 7.5 illustrates the image sensor market in the relevant time frame, showing that CCD imagers (“green-yellow”) dominated the market in the 1990s and into the early 2000s, with CMOS imagers (neon green) only starting to gain market share in the late 1990s. PO Resp. 10-11.

Figure 7.5 does not show the complete absence of CMOS imagers in 1997. It shows that CMOS imagers came into existence in the mid-1990’s, certainly by 1997.

Fourteenth, Patent Owner submits Exhibit 2060, a Wall Street Journal article dated August 21, 1998 titled “Advance in CMOS Chips Help Sales of Digital Cameras.” Patent Owner cites Ex. 2060 for the proposition that a POSITA would understand that known CMOS image sensors at the time of

the invention would not be suitable for use in a portable camera for capturing digital videos and photographs. PO Resp. 30–31.

Petitioner does not, in its Reply, address Exhibit 2060. At oral hearing, however, counsel for Petitioner does discuss Exhibit 2060 substantively. Tr. 16:5–6, 19:17–21, 36:13–17, 92:20–93:24. As discussed above, the presentation at oral hearing of an argument for the first time, not previously presented in any authorized briefing, is inappropriate. Therefore, we decline to consider Petitioner’s arguments asserted at oral hearing regarding the showings of Exhibit 2060.

Although Exhibit 2060 describes that CMOS imagers experienced noise, that does not mean CMOS imagers provided such poor image quality that one with ordinary skill in the art in 1997 would have recognized that a CMOS imager does not deliver sufficient image quality to enable taking a picture in a portable camera. The cited portion of Exhibit 2060 states:

First, CMOS designers must work out the kinks, including “noise,” the industry’s term for annoying little dots or scratches on photos. “These chips have to work in low light and deliver the same vivid colors your eye sees. They have to do that running off a watch battery, for a price that everybody can afford,” says Don Lake, general manager of Vision’s U.S. unit. “There are a lot of smart people in the world, but no one’s completely figured it out yet.”

Ex. 2060, 3–4. The description is given not from the perspective of operability and workability but competitiveness in image quality and cost. None of the claims requires a minimum level of image quality whatever is the level of ambient light, and none of the claims requires certain threshold for providing vivid colors just as the human eyes can see. It is also described that “CMOS sensors have a way to go before they can match the CCD’s sharp pictures.” *Id.* at 3. The description simply indicates that a

picture taken with a CMOS image sensor is not as sharp as one taken with a CCD image sensor, not that a CMOS image sensor is incapable of being used in a portable camera to take a picture at all.

Notably, Patent Owner does not identify any testimony from its expert, Dr. Lebby, that one with ordinary skill in the art in 1997 regarded CMOS image sensors as providing such poor image quality that it is not usable in a portable camera for taking a picture. Further, Petitioner's identification of three cameras on the market in 1997 that used a CMOS image sensor refutes any contention that one with ordinary skill in the art in 1997 would have regarded CMOS image sensors as providing such poor image quality that it is not usable in a portable camera for taking a picture. Additionally, Swift and Monroe each separately refutes any such contention.⁸

Petitioner asserts that “the ’565 [patent] admits that it was known that CMOS active pixel sensor imagers result in lower noise than CCD or other solid state imagers.” Pet. 32 (citing Ex. 1001, Col. 1:65–2:19). In response, Patent Owner cites evidence alleging the opposite – that CMOS imagers have higher noise than CCD imagers. PO Resp. 15–16, 30 (citing Ex. 1060, 55; Ex. 2063, 1–2; Ex. 2060, 3–4).

In its Sur-Reply, Patent Owner asserts that the “lower noise” description in the ’565 patent is directed only to CMOS camera-on-a-chip designs known at the time of the invention, not all CMOS image sensors Sur-Reply 9. We do not find that the ’565 patent describes that CMOS image sensors of all types have lower noise than CCDs or other solid state

⁸ Monroe was filed on March 17, 1997. Ex. 1007. Swift was published on December 21, 1995. Ex. 1005.

imagers, as Petitioner asserts. Even if it does, Patent Owner is not precluded from submitting evidence to indicate that one with ordinary skill in the art would not recognize that to be so.

To the extent Petitioner asserts that CMOS imagers at the time at issue provided lower noise and thus better image quality than CCDs, it has not provided sufficient evidence to establish that to be true. Thus, it cannot rely on that assertion as motivation or suggestion for one of ordinary skill in the art to use Ackland's CMOS imager to implement Wakabayashi's imager device 27. However, Petitioner need not rely on that assertion to establish a sufficient motivation or suggestion for one of ordinary skill in the art to use Ackland's CMOS imager to implement Wakabayashi's imager device 27. It already has articulated an ample and sufficient motivation, as discussed above, based on Wakabayashi's teaching for using a "solid-state imager," CMOS imager being a solid state imager, and Ackland's describing that its pixel array is for use in a "solid state camera."

d) second circuit board

Claim 1 further recites:

a second circuit board mounted in said housing, said second circuit board being electrically coupled to said first circuit board, said second circuit board having a length and a width thereto, wherein said length and width of said second circuit board define a second plane, said second circuit board including circuitry thereon to convert said pre-video signal to a post-video signal, said second circuit board being offset from said first circuit board, said second plane of said second circuit board being substantially parallel to said first plane of said first circuit board;

Ex. 1001, 21:38–48. According to Petitioner, Wakabayashi discloses every element in the above-quoted recitation, *except* for the requirement that the second circuit board including circuitry to convert the pre-video signal to a

post-video signal. *Id.* at 48–53. Patent Owner does not argue otherwise. We are persuaded that Wakabayashi discloses all elements in the above-quoted recitation, *except* for the requirement that the second circuit board includes the circuitry to convert the pre-video signal to a post-video signal.

For instance, Wakabayashi’s first circuit board 27 is both offset from and substantially parallel to Wakabayashi’s second circuit board 29. Ex. 1027, Figs. 3, 7. Further, first circuit board 29 is electrically connected to second circuit board 39 by flexible board 51, which includes coil-shaped margin 56. *Id.* at 6:48–52.

With regard to circuitry that converts the pre-video signal from the first circuit board to a post-video signal, Petitioner asserts that camera head 100 and camera circuit 102 together constitute the video camera unit of Wakabayashi’s imager apparatus. Pet. 24 (citing Ex. 1027, 9:18–21). Petitioner further notes that Wakabayashi describes camera circuit 102 as converting an opto-electrically converted signal into a “video circuit 103 in a television signal format” and outputs the signal to the “video monitor unit.” *Id.* According to Petitioner, one with ordinary skill in the art “would have understood, or at a minimum would have found obvious, that Wakabayashi’s ‘circuit board 29’ includes the ‘camera circuit 102’ that receives opto-electrically converted signal and converts it into video signal 103.” *Id.* at 25 (citing Ex. 1004 ¶ 71). However, Petitioner also asserts the following: “Alternatively, it would have been an obvious implementation choice to instead locate this circuitry to convert the pre-video signal to a post-video signal on circuit board 39 and couple it to the power supply unit,” for several reasons. *Id.* at 25 (citing Ex. 1004 ¶ 72).

First, Petitioner notes that Wakabayashi has an expressed objective of making the video camera unit small, such that it is composed of minimally

necessary parts and is compact to realize a reduction in weight of the rotating mechanism. Pet. 25–26 (citing Ex. 1027, Abstr., 2:37–39, 3:40–44, 14:6–10; Ex. 1004 ¶ 73). Dr. Neikirk testifies that placement of the signal converting circuitry on circuit board 39 furthers that objective. Ex. 1004 ¶ 73. Petitioner explains that circuit board 39 is the larger of the two circuit boards and it provides more space than the camera head mounted on circuit board 29. Pet. 25 (citing Ex. 1027, 6:5–10, 9:15–19, Figs. 3, 5; Ex. 1004 ¶ 73). Petitioner further explains that by mounting the signal converting circuitry on circuit board 39 instead of circuit board 29, the size of circuit board 29 is advantageously reduced and the video camera unit that rotates is made smaller.” *Id.* (citing Ex. 1027, Abstr., 2:37–39, 3:40–44, 14:6–10, Fig. 3, 5; Ex. 1004 ¶ 73).

Second, Petitioner explains that the number of circuit board and configuration of circuitry across the circuit boards “was a well known engineering consideration guided by the dimensions of the intended housing.” *Id.* at 26 (citing Ex. 1005, 10:12–16; Ex. 1030, 43:38–44; Ex. 1031, 13:30–35; Ex. 1032, 15:35–46; Ex. 1004 ¶ 74). Third, Petitioner further explains that, with respect to circuitry to convert pre-video signals to post-video signals, “it was a well-known engineering consideration to move the circuitry from a circuit board directly attached to the image sensor chip to one that is remote to the image sensor chip.” *Id.* at 26–27 (citing Ex. 1004 ¶¶ 75, 76; Ex. 1005, 8:33–9:21, 10:12–16, 18:25–33, Fig. 2; Ex. 1006, 8:48–53, Fig. 6; Ex. 1007, 3:36–62, 8:8–11, Fig. 3). Dr. Neikirk testifies that one with ordinary skill in the art would have had a reasonable expectation of success for locating the converting circuitry on a separate circuit board. Ex. 1004 ¶ 76.

Petitioner’s assertions are rational and supported by the cited evidence. Notwithstanding Patent Owner’s contrary arguments, discussed below, we are persuaded that it would have been obvious to one with ordinary skill in the art to locate Wakabayashi’s camera circuit 102, which converts a pre-video signal to a post-video signal, on Wakabayashi’s second circuit board 39.

Patent Owner argues:

Ackland’s CMOS image sensor, which Petitioner relies on for the timing and control circuitry limitation, teaches an on-chip design architecture including the pixel array, timing control and signal processing on-chip that contradicts, or teaches away from, Petitioner’s proposed modification of Wakabayashi to have the second circuit board include the signal processing circuitry to convert the pre-video signal to post-video signal. For example, even if a POSITA would be motivate by “the size of circuit board 29 [being] advantageously reduced and the video camera unit that rotates [being] made smaller,” as alleged by Petitioner, a POSITA would implement an on-chip CMOS design described by Ackland, which would place all of the timing and control circuitry and signal processing circuitry to convert pre-video signal to a post-video signal on a single chip or plane, rather than place them on separate circuit boards as Petitioner proposes. Petition, 25. *Lebby Decl.*, ¶¶ 123–124.

PO Resp. 47. The argument is unpersuasive, for several reasons.

As we already discussed and determined above when analyzing the “image sensor” limitation of claim 1, Ackland does not describe that its processing circuitry is implemented on the same chip as the CMOS pixel array. We rejected Patent Owner’s contention that Ackland would have been understood by one with ordinary skill in the art as specifically describing an on-chip design in which timing and control circuitry, signal processing circuitry, and CMOS pixel array are all located on the same chip.

Even assuming that Ackland describes that its CMOS pixel array and the processing circuitry that converts a pre-video to post-video circuit are located on the same chip, a prior art reference must be considered for everything it teaches by way of technology and is not limited to the particular invention it is describing and attempting to protect. *EWP Corp.*, 755 F.2d at 907; *In re Heck*, 699 F.2d at 1333. Petitioner is not proposing to make the invention of Ackland, but to take Ackland's CMOS pixel array and associated timing and readout circuitry, as shown in Ackland's Figure 6, and use them as Wakabayashi's imager device 27.

The evidence of record does not support that Ackland's CMOS pixel array can only be useful in an imager device if it is located on the same chip as the processing circuitry which converts a pre-video signal from the pixel array to a post-video signal. There is no such "teaching away" or "contrary" disclosure in Ackland. In contrast, Petitioner has presented reasoning with rational underpinning why one with ordinary skill in the art would have wanted to place the processing circuitry of Wakabayashi on circuit board 39 and would have had a reasonable expectation of success in so doing.

Patent Owner also argues:

Petitioner's asserted rationale of making the video camera unit small that is "composed of minimally necessary parts" contradicts Petitioner's proposal that places Ackland's alleged timing and control circuitry on the circuit board 29 because Petitioner's argument increases the number of components that then would be required by actually implementing Ackland's on-chip integration for the CMOS imager. Petition, 25 (citing Wakabayashi, Abstract, 2:37–39, 3:4–44, 14:6–10). Following Petitioner's rationale further, a POSITA would also have moved the timing and control circuitry to the other circuit board 39, to make the video camera unit smaller, which would result in the

timing and control circuitry and the circuitry to convert pre-video signal to a post-video signal on the same circuit board 39, rather than on separate circuit boards as required by the Challenged Claims. *Lebby Decl.*, ¶ 124.

PO Resp. 48. The argument is misplaced. That Petitioner's argument, if applied to the timing and control circuitry, would lead to a conclusion that it also would have been obvious to one with ordinary skill in the art to locate the timing and control circuitry on circuit board 39, does not undermine anything Petitioner has proposed. Petitioner did not rely on this rationale to locate Ackland's timing controller 20 on Wakabayashi's circuit board 29. Obviousness does not necessarily lead to only a single result, e.g., where to place the timing and control circuitry. There is no conflict between the timing and control circuitry being placeable on circuit board 29 under one rationale, and on circuit board 39 under another rationale. Both positioning well could have been obvious to one of ordinary skill in the art.

Patent Owner further argues that in support of Petitioner's argument that "it was a well known engineering consideration to move the [processing] circuitry from a circuit board directly attached to the image sensor chip to one that is remote to the image sensor chip," Petitioner erroneously cites to Ackland as one such example. PO Resp. 48 (citing Pet. 26–27). Patent Owner asserts that Ackland provides no teaching that the processing circuitry is remote to the image sensor chip. *Id.* at 49. We agree with Patent Owner, in part, in that we find Ackland does not describe the referenced processing circuitry to be located on a circuit board separate from the circuit board containing Ackland's pixel array as Petitioner contends. However, this mischaracterizing of Ackland is harmless, because Dr. Neikirk, Petitioner's expert, as well as Petitioner, provides other examples of such remotely located processing circuitry, e.g., Swift and

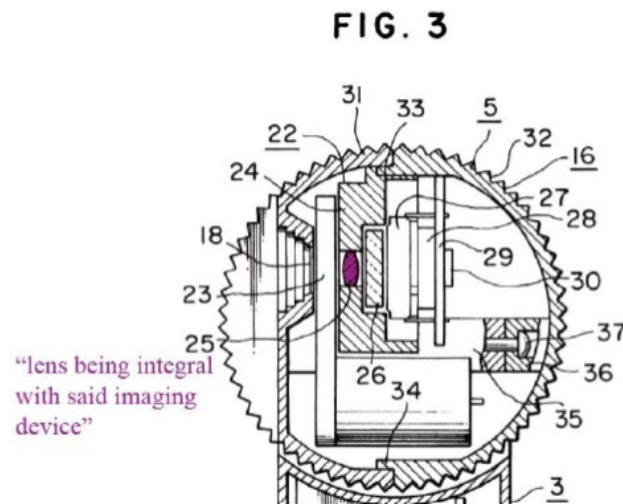
Monroe (Exs. 1005, 1006). Pet. 27, 28; Ex. 1004 ¶ 76. These other examples are not controverted, on this record, by Patent Owner or Patent Owner's expert, Dr. Lebby.

e) lens

Claim 1 further recites “a lens mounted in said housing, said lens being integral with said imaging device, said lens focusing images on said array of CMOS pixels of said image sensor.” Ex. 1001, 21:49–51.

Petitioner accounts for this limitation on pages 54–55 of the Petition.

Pet. 54–55 (citing Ex. 1027, 2:51–54, 5:56–65, 6:11–19, Fig. 3; Ex. 1004 ¶¶ 127–130). Specifically, Petitioner identifies Wakabayashi's lens 25 in lens case 24 secured to mounting plate 28 fixed to camera case 16, and explains that lens 25 focuses image on imager device 27. Pet. 54. These elements are shown in an annotated Figure 3 of Wakabayashi appearing on page 55 of the Petition, showing a cross-sectional view of Wakabayashi's imager apparatus, as reproduced below:



The figure is an annotated Figure 3 of Wakabayashi showing a cross-sectional view of Wakabayashi's imager apparatus. Ex. 1027, 3:49–56.

Patent Owner does not present argument regarding this limitation, separate from its argument, already discussed and rejected above, about Wakabayashi not disclosing the claimed image sensor having an array of CMOS pixels. We are persuaded that Petitioner has adequately accounted for the limitation of “a lens mounted in said housing, said lens being integral with said imaging device, said lens focusing images on said array of CMOS pixels of said image sensor.”

f) video screen

Claim 1 further recites “a video screen, said video screen being electrically coupled to said second circuit board, said video screen receiving said post-video signal and displaying images from said post-video signal.” Ex. 1001, 21:52–55. Petitioner accounts for this limitation on pages 55–57 of the Petition. Pet. 55–57 (citing Ex. 1027, Abstr., 1:6–15, 2:40–45, 4:44–46, 5:7–12, 9:14–38, 10:1–7, 10:15–17, Figs. 1–3, 10, 11; Ex. 1004 ¶¶ 132–136). Specifically, Petitioner identifies Wakabayashi’s liquid crystal display 6 as having liquid crystal panel 38 coupled to circuit board 39. *Id.* at 4:44–46, 6:5–10. Wakabayashi describes that the imager allows a user to monitor an image on a display to adjust the angle of the video camera while imaging a subject. *Id.* at 1:6–15. Liquid crystal display 6 is accommodated within housing 3. *Id.* at 4:44–46. Dr. Neikirk testifies that Wakabayashi’s circuit board 39 includes a driver circuit for liquid crystal panel 38 and that Wakabayashi’s liquid crystal display 6 displays images from video signal 111 outputted from circuit board 39 and allows a user to monitor an image. Ex. 1004 ¶ 133.

Patent Owner provides no counter argument with respect to this limitation. Petitioner’s assertions are consistent with and supported by the cited evidence. We are persuaded that Wakabayashi discloses “a video

screen, said video screen being electrically coupled to said second circuit board, said video screen receiving said post-video signal and displaying images from said post-video signal.”

g) power supply

Claim 1 further recites “a power supply mounted in said housing, said power supply being electrically coupled to said first circuit board to provide power to said array of CMOS pixels and said timing and control circuitry, said power supply also being electrically coupled to said second circuit board to provide power thereto.” Ex. 1001, 21:56–61. Petitioner accounts for this limitation on pages 57–59 of the Petition. Pet. 57–59 (citing Ex. 1027, 4:44–49, 6:7–10, 6:21–27, Fig. 5; Ex. 1004 ¶¶ 137–140).

Specifically, Petitioner explains that Wakabayashi discloses that its portable imager apparatus is powered by battery 45 disposed within housing 3. *Id.* at 58 (citing Ex. 1027, 6:21–27). Petitioner explains that one with ordinary skill in the art would have understood that, because battery 45 is the only disclosed source of power, it would provide power to both circuit board 29 and circuit board 39. *Id.*; see Ex. 1004 ¶ 139.

Patent Owner does not present argument regarding this limitation, separate from its argument, already discussed and rejected above, about Wakabayashi not disclosing the claimed image sensor having an array of CMOS pixels, amplifiers, and timing control circuitry. Petitioner’s assertions are consistent with and supported by the cited evidence. We are persuaded that Petitioner has adequately accounted for the limitation of “a power supply mounted in said housing, said power supply being electrically coupled to said first circuit board to provide power to said array of CMOS pixels and said timing and control circuitry, said power supply also being electrically coupled to said second circuit board to provide power thereto.”

For the foregoing reasons, after consideration and balancing of the evidence presented by the parties, both for and against obviousness, we determine that Petitioner has proved, by a preponderance of the evidence, that claim 1 is unpatentable in that the claimed subject matter would have been obviousness over Wakabayashi and Ackland.

5. *Independent Claim 31*

Unlike claim 1, which recites a first circuit board and a second circuit board, claim 31 recites a planar substrate and a circuit board. What claim 1 recites for the first circuit board is recited by claim 31 for the planar substrate, and what claim 1 recites for the second circuit board is recited by claim 31 for claim 31's circuit board. Thus, Petitioner's and Patent Owner's arguments are essentially the same as those discussed above for claim 1, and our analysis is the same, except that Petitioner now has to account for (1) a planar substrate having a length and a width defining a first plane and electrically connected to Wakabayashi's circuit board 29, (2) the first plane being offset from and substantially parallel with a second plane defined by the length and width of Wakabayashi's circuit board 29 and circuit board 29 and the planar substrate being positioned in a stacked arrangement, (3) the converting circuitry has to be located on Wakabayashi's circuit board 29 rather than circuit board 39, and (4) the battery has to power both the planar substrate including the array of CMOS pixels and corresponding timing and control circuitry, and Wakabayashi's circuit board 29.

Annotated Figure 7 of Wakabayashi appears on page 65 of the Petition and is reproduced below:

1004 ¶ 71. Specifically, Wakabayashi states: “The camera head 100 and the camera circuit 102 surrounded by dotted rectangles [in Figure 22] constitute the video camera of the present invention.” Ex. 1027, 9:18–21.

Petitioner explains that camera circuit 102 receives an opto-electrically converted signal generated by the solid state imager device in camera head 100. *Id.* (citing Ex. 1027, 9:10–18). Petitioner further explains that camera circuit 102 converts the opto-electrically converted signal into video signal 103 in a television signal format and outputs video signal 103 to a video monitor unit. *Id.* (citing Ex. 1027, 9:10–18, Fig. 22). On that basis, i.e., that camera head 100 and camera circuit 102 together form one camera unit, Petitioner asserts that one with ordinary skill in the art “would have understood, or at minimum would have found obvious, that Wakabayashi’s circuit board 29 includes camera circuit 102 that receives opto-electrically converted signal and converts it into video signal 103.” *Id.* at 25 (citing Ex. 1004 ¶ 71).

In summary, Petitioner’s position is that because Wakabayashi’s camera head 100 includes imager device 27 which is on circuit board 29, and because Wakabayashi describes camera head 100 and camera circuit 102 as together forming Wakabayashi’s video camera, it would at least have been obvious to one with ordinary skill in the art that camera circuit 102 as the remaining portion of the same camera unit also would be located on circuit board 29. The reasoning articulated by Petitioner has rational underpinning. We are persuaded thereby notwithstanding Patent Owner’s argument to the contrary, discussed below, while also considering the objective evidence of nonobviousness discussed above.

Patent Owner argues that Figure 22 of Wakabayashi is only an abstract “circuit block diagram,” not a physical view of actual components,

and therefore the fact that camera heads 100 and camera circuit 102 are enclosed in a dotted rectangle should be given little weight. PO Resp. 50. The argument is misplaced, because Wakabayashi expressly describes, in text, that “[t]he camera head 100 and the camera circuit 102 surrounded by dotted rectangles [in Figure 22] constitute the video camera of the present invention.” Ex. 1027, 9:18–21. Petitioner is not relying solely on its own speculation of the meaning of the dotted rectangle in Figure 22.

Furthermore, as Petitioner correctly notes, Wakabayashi specifically describes that its video camera includes circuit board 29. *Id.* at 6:12–14 (cited at Reply 24). That disclosure is consistent with and further supports Petitioner’s position that it would have been obvious to one with ordinary skill in the art to locate camera circuit 102 on circuit board 29. We also find persuasive the following testimony of Petitioner’s expert, Dr. Neikirk:

Because the video camera includes “camera circuit 102,” which “generates a video signal 103 in a television signal format” and circuit board 29—the only circuit board in the video camera—a person of ordinary skill in the art would have understood “camera circuit 102” is located on “camera circuit board 29”—not circuit board 39. This is consistent with my explanation in deposition. While I initially misspoke, after reviewing Wakabayashi, I explained that “[g]iven that Wakabayashi has clearly stated that block 100 and 102 are both in the video camera, and then has furthermore said the video camera is as shown in Figure 4, then those circuits . . . all got to be connected to board 29” and that “clearly it’s not on [circuit board] 39.” Ex. 2076 (9/30/20 Neikirk Dep. Tr.), 235:20–237:17, 242:16–243:6.

Ex. 1086 ¶ 39 (cited at Reply 24). Even Patent Owner’s expert, Dr. Lebby, appears to agree that in Wakabayashi’s disclosure, camera circuit 102 is on circuit board 29. Ex. 2088 ¶ 114 (“[C]amera circuit board 29 includes elements that would have to be removed and redesigned (e.g., circuits for

driving the solid-state imager device, a synchronization signal generator circuit), including circuitry 100, 102 and 104 in Figure 22 shown below:”).

Patent Owner argues that Wakabayashi expressly describes that circuit board 39 includes a signal processing circuit for video camera unit 5. PO Resp. 50 (citing Ex. 1027, 6:7–10). That is true, but Wakabayashi does not specifically identify camera circuit 102 as that processing circuit. There is no conflict between that disclosure and Petitioner’s proposing to locate camera circuit 102 on circuit board 29. Other processing circuits may be located on circuit board 39, such as one which takes the output from circuit 102 and puts it on video monitor unit 113. In any event, the alleged ground of unpatentability is based on obviousness, not anticipation. Even if Wakabayashi describes that camera circuit 102 is located on circuit board 39, that does not preclude an obviousness rationale which would have it located on circuit board 29. Patent Owner’s argument does not undermine Petitioner’s obviousness assertions.

Patent Owner further argues that Petitioner’s reasoning to locate camera circuit 102 on circuit board 29 “would be contrary to Petitioner’s own argument that a POSITA would want to have the video camera unit be composed only of ‘minimally necessary parts.’” PO Resp. 51 (citing Pet. 25 (discussing claim 1)). The argument is misplaced, because Petitioner is not required to apply the same obviousness rationale when accounting for different independent claims. Petitioner has applied one rationale to claim 1, and a different rationale to claim 31. We see nothing wrong with that. More than one configuration could have been obvious to one with ordinary skill in the art, so long as the articulated reasonings are proper and sufficient. Each independent claim provides Petitioner a new stage on which to make its case, and Petitioner need not deliver the same performance on each stage.

6. *Dependent Claims 6 and 36*

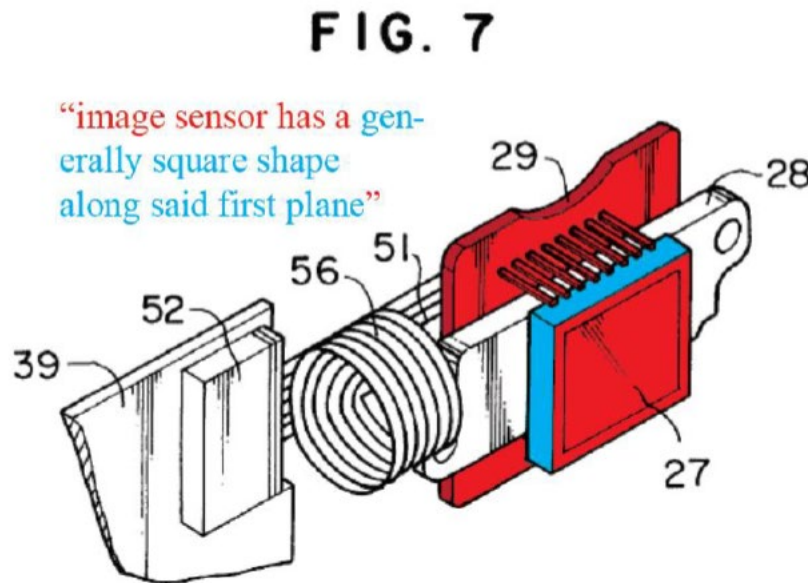
Claim 6 depends from claim 1 and further recites “said power supply” is a battery. Ex. 1001, 22:8–9. Claim 36 depends from claim 31 and further recites “said power supply” is a battery. *Id.* at 26:42–43. Petitioner notes that Wakabayashi’s power source is battery 45. Pet. 28 (citing Ex. 1027, 6:21–27, Fig. 5). Patent Owner provides no separate argument with regard to claims 6 and 36, additional to those it presents for claims 1 and 31, already discussed and rejected above. We are persuaded by Petitioner that Wakabayashi’s disclosed power source is a battery.

For the foregoing reasons, after consideration and balancing of the evidence presented by the parties, both for and against obviousness, we determine that Petitioner has proved, by a preponderance of the evidence, that claims 6 and 36 are unpatentable in that the claimed subject matter would have been obviousness over Wakabayashi and Ackland.

7. *Dependent Claim 32*

Claim 32 depends from claim 31 and further recites “said image sensor has a generally square shape along said first plane.” Ex. 1001, 26:29–31. Petitioner asserts that Wakabayashi, specifically in Figure 7, discloses “imager device 27” as being generally square shape along a first plane. Pet. 71. Petitioner further asserts: “[T]o the extent it is argued that additional disclosure is required, at minimum, it would have been an obvious implementation choice to use a square shaped circuit board along the first plane.” *Id.* Petitioner produces a color annotated version of Wakabayashi’s

Figure 7, reproduced below, to show the shape of Wakabayashi's components 27 and 29 identified as the claimed image sensor:¹⁰



Pet. 72. Figure 7 illustrates the structure of Wakabayashi's video camera. Ex. 1027, 3:64–65. We find that imager device 27 has a square shape, that circuit board 29 has a generally square shape, and collectively imager device 27 and circuit board 29 have a generally square shape along a first plane as Petitioner asserts and shown in the above-reproduced illustration.

Patent Owner notes that circuit board 29 has beveled edges and a semicircular divot along the top edge. PO Resp. 53. Patent Owner characterizes those features as providing a “complex geometry” to allow for a “movable camera head unit.” *Id.* Patent Owner further asserts that a POSITA would not be motivated to make circuit board 29 square because “board 29 is plainly designed for a particular purpose and mode of operation described in Wakabayashi.” *Id.* at 53–54. Patent Owner further states: “For

¹⁰ Petitioner identifies imager device 27 and circuit board 29 (to which imager device 27 is connected by soldering) together as the claimed image sensor. Pet. 60.

that reason as well, it would not be obvious for a POSITA to change board 29 to have a generally square shape as recited in the Challenged Claim 32.” *Id.* at 54.

Patent Owner’s argument is misplaced and unpersuasive. Claim 32 does not require the image sensor to be precisely square. Rather, the pertinent language in claim 32 is just “generally square shape.” Ex. 1001, 26:29–31. It is not necessary for circuit board 29 to be precisely square. Features present in circuit board 29 such as “beveled edges” and a “semicircular divot” do not push the configuration of circuit board 29 beyond “generally square.” The bevel edges are slight and do not change the overall generally square shape. The same is true for the divot on the top edge. Patent Owner provides no explanation as to why circuit board 29, even with the beveled corners and the divot on the top edge, does not have a generally square shape. It is unclear if Patent Owner even contends that circuit board 29 does not have a generally square shape. To the extent Patent Owner does make that assertion, we disagree.

Because imager device 27 is square along a first plane and is mounted on circuit board 29 which is generally square along the same plane, we find that what Petitioner has identified as the claimed image sensor, i.e., imager 27 mounted on circuit board 29, is generally square along a first plane. Petitioner has adequately accounted for the limitation of claim 32.

For the foregoing reasons, after consideration and balancing of the evidence presented by the parties, both for and against obviousness, we determine that Petitioner has proved, by a preponderance of the evidence, that claim 32 is unpatentable in that the claimed subject matter would have been obvious over Wakabayashi and Ackland.

III. CONCLUSION

Petitioner has proved by a preponderance of the evidence that claims 1, 6, 31, 32, and 36 of the '565 patent are unpatentable on the grounds of unpatentability as summarized in the following table:

Claims	35 U.S.C. §	Reference(s)/ Basis	Claim Shown Unpatentable	Claim Not Shown Unpatentable
1, 6, 31, 32, 36	103	Wakabayashi, Ackland	1, 6, 31, 32, 36	
Overall Outcome			1, 6, 31, 32, 36	

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