UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD

CASE IPR 2020-00475
U.S. Patent No. 9,186,052

----------X

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

Petitioners,

v.

CELLECT, LLC,

Patent Owner.

----------X

CONFIDENTIAL DEPOSITION

VIA ZOOM VIDEOCONFERENCING

OF

DEAN NEIKIRK, PH.D.

Thursday, October 8, 2020

Reported By:

LINDA J. GREENSTEIN

JOB NO. 1040

CONFIDENTIAL - DEAN NEIKIRK, PH.D.

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CONFIDENTIAL - DEAN NEIKIRK, PH.D.
October 8, 2020
10:59 A.M. EST

Confidential Deposition held via Zoom Videoconferencing of Dean Neikirk, Ph.D., taken by Respective Parties, before Linda J. Greenstein, a Certified Shorthand Reporter and Notary Public of the State of New York.

CONFIDENTIAL - DEAN NEIKIRK, PH.D.

A P P E A R A N C E S:
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THE COURT REPORTER: Good morning.

We're here in the Matter of Samsung versus Cellect.

Today is Thursday, October 8, 2020.

Counsel, do you agree that the witness will be sworn today remotely?

MR. CAPLAN: Yes, we do.

Jonathan Caplan on behalf of Cellect.

MR. DAVIS: Yes. This is Jim Davis on behalf of petitioners.

THE COURT REPORTER: Thank you.

You may proceed.

DEAN NEIKIRK, PH.D., having been first duly sworn, was examined and testified as follows:

EXAMINATION BY
MR. CAPLAN:

Q. Good morning, Dr. Neikirk. Nice to see you this morning.

A. Good morning.

Q. Good morning.

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So just a couple kind of administrative matters similar to when we went through this last week a little bit.

We'll generally go for about an hour. If you need a break at any time -- obviously we will break about every hour, but if something comes up in between, just let me know.

Just when you're answering your questions, do give your counsel a chance to object and so that the court reporter can get it all down so we don't talk over each other.

MR. CAPLAN: And, Jim, I assume it's okay with you, but since Dr. Neikirk's background I assume hasn't changed since last week, I'll just forego those questions because we've covered that already, so we'll just move on from that.

Okay?

MR. DAVIS: That's fine on our end.

MR. CAPLAN: Okay. Great.

BY MR. CAPLAN:

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Q. Okay, Dr. Neikirk, today we're going to be talking about the IPR, it's -- I'm trying to get the right number -- it is IPR 2020-00475, and it involves U.S. Patent 9,186,052.

Does that sound familiar?

A. Yes, I understand that.

Q. I believe you have your papers that you put in your declaration and the petition and the related references and exhibits?

A. Yes.

Q. Okay.

A. Yes, I did.

Q. So certainly we're going to use Exhibit -- I think it's 1001. Let me just make sure. Yes, Exhibit 1001. Actually, the '052 patent, so we're making some reference to that so you may want to pull that out and then we'll go through a couple of the other references.

MR. CAPLAN: And, Linda, I know we did this last week, but we will be using the exhibit numbers from the IPR which are

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in the record.

I will identify the particular exhibit numbers for the record.

THE WITNESS: Yes. That's fine.

BY MR. CAPLAN:

Q. So, Dr. Neikirk, if you just pull out the '052 patent, Exhibit 1001, just so we'll have that, we'll be referring to it periodically.

A. I have it in front of me.

(Exhibit 1001 for identification, U.S. Patent 9,186,052, shown to witness.)

BY MR. CAPLAN:

Q. And the '052 patent, Exhibit 1001, that is the subject of your declaration in this IPR proceeding; right?

A. Yes, it is.

Q. Okay. In particular, your testimony was made in connection with Claims 1, 3 and 7 of the '052 patent; is that right?

A. So I did one declaration and so I could keep track of which was in which

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petition.

Q. I understand, sure.

A. My declaration covered Claims 1, 3, 7 and 2. I believe 2 is the other petition, though, if that's correct.

So, yes, 1, 3 and 7 are certainly covered by my declaration.

Q. Great. Okay.

Now, I'm also going to be making reference to -- we'll start off today with Exhibit 1015, that's the Suzuki patent, so if you can pull --

A. And I do have that in front of me as well.

MR. CAPLAN: Just for the record, the Suzuki patent, it's Exhibit 1015 from the IPR, and it's U.S. Patent 5,233,426.

(Exhibit 1015 for identification, U.S. Patent 5,233,426, shown to witness.)

BY MR. CAPLAN:

Q. Okay. To start generally, Dr. Neikirk, can you describe kind of your

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understanding of what is shown in the Suzuki patent, which is used -- which you used in connection with your testimony in this IPR.

MR. DAVIS: Objection to form.

A. So I considered Suzuki only in combination with Swift and Ricquier for Claim 2, so I'd have to -- I would actually go to my discussions under Claim 2 in terms of I have a background discussion of -- of Suzuki there. That's in my declaration.

Q. Okay. Before we do that, I just want to make sure. Why don't you pull out your declaration, which I'm assuming you have there, Exhibit 1004. We'll be referring to that as well today. That's your declaration.

(Exhibit 1004 for identification, Declaration of Dean Neikirk, Ph.D., shown to witness.)

BY MR. CAPLAN:

Q. Do you have that?

A. I do.

Q. And I believe -- and I'm looking

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at the table of contents, but there is a Ground -- Ground 1.

Is Ground 1, which you have, and it says -- I'm looking at page 3 of 256 of Exhibit 1004.

A. Yes.

Q. You do rely on Suzuki in combination with Wakabayashi and Ackland.

Do you see that?

A. Yes. That is correct. I misspoke. I was looking down to Section B.

But, yes, for the table of contents, it's labeled under Section B, and its Claim 1 and it's Wakabayashi in view of Ackland and Suzuki, that is correct.

Q. Okay. And, again, if you can just provide your understanding of what the Suzuki patent is describing as it relates to you using it in this IPR.

MR. DAVIS: Objection to form.

A. If we look at Suzuki itself, so Exhibit 1015, page 1, as the first sentence in the abstract says that "the invention provides a compact camera head for

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solid-state image pickup device," so certainly in terms of the area of the patent, that is I think a reasonable description of it.

If we go to page -- the page numbers in my declaration, the table of contents lists the page numbers from the -- from the document and not the exhibit numbers, so there's -- but there's no page number at the bottom, so let me find them, so they're off just a little bit.

So it's supposed to be page 96 of the document, but that's actually page 99 of the exhibit number.

So if we went to page 99, you can see there in paragraph 150, for instance, I pointed out that Suzuki discloses this compact camera head of a given size, and I discussed that further on the next page, page 100 in paragraph 152, and, in particular, noting that the solid-state image pickup chip is 8.5 millimeters and that the outer diameter of the camera head is 10 millimeters.

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So in terms of what Suzuki taught that is relevant for Claim 1, he taught sizes of chips, sizes of boards that have to fit inside camera heads.

Q. Do you know what kind of solid-state imaging device is described by Suzuki; in other words, the particular type of solid-state imager?

MR. DAVIS: Objection to form.

A. So Suzuki refers to a solid-state image pickup chip in Column 2 at line -- what is that -- line 38.

Flipping further, I think Suzuki generally refers simply to a solid-state image pickup device and does not further narrow that.

Q. It doesn't say the particular type of solid-state imager technology it uses, does it?

A. No. It says that it's a solid-state image pickup device.

Q. If you look at the first page of the Suzuki patent, Exhibit 1015, do you see there's some boxes on the top left?

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There's a box 22 and a box 30.

Do you see those?

A. I'm sorry, which page are you looking at?

Q. The first page of Suzuki.

A. Okay. I'm there.

And the question concerned?

Q. Do you see on the top left there's some numbered boxes and you see one box says "22" in it in brackets, and it says "Filed."

Do you see that?

A. I see that.

Q. Okay. And then underneath that you see there's a bracketed number 30.

Do you see that?

A. I do.

Q. So is it your understanding that the Suzuki patent was originally filed in Japan on December 28th of 1990?

Is that your understanding?

A. That would be how I would read that line, yes.

Q. And it was filed -- the Suzuki

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patent, as an application, before it became a patent, was then filed in the U.S. December 12th of 1991.
Is that your understanding?
A. I believe that's what that line would mean, yes.
Q. All right.
And earlier you explained or you had pointed to the abstract also on page 1 of Suzuki, where you said it relates -- the Suzuki patent relates to a compact camera head for a solid-state image pickup device.
Do you recall that?
A. Yes, that's what I said.
Q. Were you familiar with the camera head market in 1991?
MR. DAVIS: Objection.
Form.
A. In a broad sense, I was purchasing cameras to put on microscopes in my teaching lab and research laboratories.
Q. What kind of microscopes were those?
A. The microscopes were Nikons, but

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the cameras were not.
Q. Well, what were you using those Nikon microscopes for?
A. To examine, inspect and take pictures of integrated circuits.
Q. Were those Nikon cameras kind of high-end or high-quality imaging devices?
I assume you needed a quality image; is that right?
A. They were Nikon cameras. I've forgotten honestly what brand they were. They were aftermarket attachments, and they were I think of typical quality.
I don't know whether they were classified as high-performance or not.
Q. And for that purpose, you just were purchasing cameras to work with those Nikon devices?
A. That's correct.
Q. Were you studying the particular cameras you were purchasing at that time?
A. Well, I was certainly aware -- I was certainly well-aware of a lot of the technical material in the general area

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because I was working in focal point arrays.
Again, as I think I've described in my background, about my background, I was primarily interested in the infrared as opposed to the visible, but in order to understand how people were building focal point arrays, I made myself generally aware of both visible and infrared technologies.
Q. So the focus of your study was or your research was infrared, which is not visible; is that right?
MR. DAVIS: Objection to form.
A. So at the time, of course in a research environment, typically we're trying to do the problems that industry is not yet ready to tackle. The problems that they knew as, at least at the time, insurmountable. That's what we do in a laboratory research -- university research laboratory.
The infrared wavelengths were harder than the visible wavelengths. That's why we were working on them.

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But, yes, I was concentrating on infrared as opposed to visible.
Q. Okay. And when you were acquiring these cameras to -- let me just go back here and make sure -- when you were purchasing cameras to put on your microscope at that time, we're talking about 19 -- I think I said 1991 was the time frame -- the cameras you purchased at that time, do you know what type of image sensor they used?
A. I don't recall.
Q. Okay. Is that the sort of thing you would have looked at, though?
A. No, honestly not.
We wanted to make sure it would interface with the microscope and that the price was acceptable to our research grants.
Q. Uh-huh. So as you sit here today, you can't recall if it was a CCD image array in the cameras that you purchased, can you?
A. No. I don't recall.

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Q. And you can't remember if it was a CMOS image array in those cameras either then?

A. As I said, I don't recall what kind of sensor it was.

Q. And I assume you didn't have an understanding the year earlier, in December of 1990, as to what was the state of the camera head market at that point; is that right?

MR. DAVIS: Objection to form.

A. I don't think I'd characterize it that way.

Again, as I explained, I was broadly familiar, and in some cases in some greater detail, about how people were making focal point arrays for use both in the infrared and the visible wavelengths.

As to what was inside the camera head that I bought -- that we bought for those microscopes, as I just told you, I wasn't paying attention to that, but that doesn't mean I wasn't aware of the field.

Q. If you were aware of the field

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then, what was the -- kind of the standard type of pixel array that was used in the camera you would have bought at that time?

MR. DAVIS: Objection to form.

A. Well, again, I don't recall exactly what was commercially available.

In terms of what was being discussed in the literature at the time, certainly CCDs were well-established and CMOS pixels were becoming established at that time, but in the -- in 1990, I don't really recall what was commercially available.

Q. In Suzuki -- I'll use your declaration. I'm looking at paragraph 152 of your declaration where you're describing Suzuki.

A. I have that in front of me.

Q. Okay, great.

In paragraph 152, you walk through some of the components in Suzuki.

A. That's correct.

Q. Okay. So I just want to go through some of these and make sure we

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understand.

So there's reference to a solid-state image pickup chip 221.

Do you see that in paragraph 152?

A. I do.

Q. Okay. So what is your understanding of that component in Suzuki?

MR. DAVIS: Objection to form.

A. Exactly what you said. It's a solid-state image pickup chip. That would be a focal point array that's just fabricated and uses solid-state devices to convert light to an electronic signal.

Q. And so that focal point array, that's where the array of pixels would be located; right?

A. Yes, that's correct.

Q. Okay. Then there is -- and you're quoting, I understand you're quoting from the Sazuki patent, but in paragraph 152, you quote the part that says: "The solid-state image pickup chip 221 is bonded to the chip connecting board 226."

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What is the function of the chip connecting board 226?

MR. DAVIS: Objection to form.

A. Well, I wasn't relying on any functionality of 226 from Suzuki in my discussion of Claim 1.

I believe that if you look at Suzuki itself, it describes 226 as a chip connecting board.

I don't know that it further describes what circuitry is or is not 226.

It simply describes it as a chip connecting board.

Q. Do you have an understanding of what circuitry would be on that chip connecting board 226?

MR. DAVIS: Objection to form.

A. I think it's merely a design choice for the designer. There may be -- I really -- I think they can put what they want there.

I wasn't relying on the teachings of Suzuki, though, as to what may or may not be in that board, but I think

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one of ordinary skill in the art would recognize they can place a variety of circuits on that board.

Q. What type of circuits go on that board?

A. Any kind I suspect that they needed in the camera. I didn't certainly try to make a list.

Q. As you sit here today, can you identify any circuits that would go on that circuit board 226?

MR. DAVIS: Objection to form.

A. As I pointed out, I was not relying on Suzuki in terms of any particular functionality on any particular board.

I was looking more at dimensions that it gave and just generalities of boards. Inasmuch as this is a design choice, I believe it would depend on what circuitry the designer wanted to use.

I think they can put it pretty much on any of those boards they wanted. I think that would be just a simple design

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choice.

Q. Then you also identify in your same paragraph 152, and you were talking about 3a and 3d in Figure 2, and you list a number of components, and we talked about chip 221 and board 226, and then you make reference to a circuit board 227.

Do you know what's the function of circuit board 227?

MR. DAVIS: Objection to form.

A. So Suzuki says in column 2 -- let's see if it's right here in this particular location.

I'm not sure it's right there in my discussion in my declaration, but if you look at column 2 of Suzuki at line 52, it says: "A circuit board 27 including a circuit for driving the solid-state image pickup chip 221 and a circuit for amplifying the video signal from solid-state image pickup 221." That's what it says.

But, again, I did not rely on those teachings in terms of any of my

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analysis.

Again, as I've just said, I think those are design choices. Those happen to be design choices that Suzuki made, but there could have been others, other design choices equally obvious.

Q. Okay. Let me just take a look -- I'm going to talk to you a little bit more about the part in Suzuki you just identified in column 2 between lines 50 and 55.

And as you read, it says, "circuit board 227, including a circuit for driving the solid-state image pickup 221."

Do you see that?

A. I do.

Q. So what is a circuit -- why does it need a circuit for driving the solid-state image pickup 221?

A. Well, there are many sorts of driving circuitries.

Driving circuitry, sometimes people use that phrase to describe timing. Sometimes they use that phrase to describe

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control. Sometimes they simply use -- they use that phrase to describe providing power. All of those things are, broadly speaking, referred to as driving circuitry.

I don't think that in -- this disclosure is not really saying anything in particular. It just says driving circuitry for the solid-state image pickup chip. That's all it says.

Q. And what is your understanding of what Suzuki says and what we're looking at? What is the function of the driving circuit in Suzuki that's described in column 2 there?

MR. DAVIS: Objection to form.

A. Exactly what he's said. It's driving circuitry. I just gave you some examples. There's undoubtedly others, but I don't think Suzuki is providing any specific requirements there.

It's a broad-based statement about putting driving circuitry on circuit board 227 -- yes. Yes, 227, circuit board 227.

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Q. So it's your testimony that a driving circuit could do anything a designer wanted it to do? There's no constraint based on what Suzuki says; is that right?

MR. DAVIS: Objection to form.

A. No, it's not. That is not what I said. I gave you specific examples of things that are sometimes referred to as driving. Power supply can be referred to as driving. Timing and control could be referred to as driving circuitry.

Other types of access signals, reset signals, all those things, broadly speaking, are in the category of driving circuitry.

So, no, I didn't say that no one has any idea what they are. There are a lot of examples, though, and Suzuki has not further narrowed it or said what kind. It's just a broad general statement.

What you put where is an option available to the -- to a designer.

Q. So it's your testimony that

given the context of what's described in Suzuki, there's no particular constraint on the options for the driving circuit and the functions that it would perform in Suzuki; is that right?

MR. DAVIS: Objection.
Form.

A. I don't think that's how I phrased it. I think that Suzuki says what they say. That there is driving circuitry -- a circuit for driving solid-state image pickup 221. That could be many different things. I gave you several examples. I think it's a design choice.

Q. Now, a driving circuit that provides power, is directed to power, that would be a different circuit than a driving circuit that is directed to timing control.

Would you agree with that?

A. I think each of those, there would be a number of circuits that could fulfill that function. But, yes, I believe those are different functions.

Q. So those would be different

circuits for -- you identified timing, control and power, right, those were the three options you identified?

MR. DAVIS: Objection to form.

A. I identified timing and control, I identified power as examples, not that that's an exhaustive list of things that some people might refer to as driving circuitry.

I mentioned a couple of other examples -- reset signals -- but those -- sometimes people refer to those as control signals.

There's a lot of different names for similar functions and many circuits that can provide those functions.

Q. So the timing and control circuit would be different from a power circuit -- let me rephrase that.

We're talking about at least two types of driving circuits: One for power and another for timing and control.

Those would be two separate circuits; is that right?

MR. DAVIS: Objection.
Form.

A. I would expect that circuitry used for providing power would be of a different sort of circuitry than one that would be broadly referred to as providing timing or as providing control signals.

Q. Okay. And you previously testified that -- I believe it was board for the pickup chip 221 -- that's where the pixel array would be located; right?

A. I'm just trying -- yes, 221. I'm just trying to make sure I've got my numbers right.

Yes, that's correct.

Q. Okay. And with respect to 221, circuit board 227 in Suzuki would be characterized as off-chip then; is that right?

A. Well, the circuit board 227 and circuits made on that board, I would say yes, that's not on the chip; and, hence, is off-chip.

Q. And there's also reference in

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your declaration to connector board 228.
Again, I'm referring to paragraph 152.
Do you see that?
A. Yes, on page 100 of my declaration, I quoted the section where they're talking about chip connecting board 226, circuit board 227 and then connector board 228 are arranged in such a manner, and then from there it goes on to talk about an arrangement, yes, that's correct.
Q. What's your understanding of the term "connector board"? What does that mean?
MR. DAVIS: Objection.
Form.
A. So Suzuki refers to 228 I believe that one time and provides no other particular discussion as to what other circuitry may or may not be on that board, that it is a connector board.
If you look at page -- at Figure 2, for instance, of Suzuki, and you see 228, it contains what would appear to be

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some components mounted on the surface of it, but I don't know that that's what they are.
But if you look at what emerges from the right, you see 228P, which he describes as external lead pins. And at column 2 at line 60, he says the external lead pins 228 are mounted on the connector board 228 and are adapted to be connected to the plug 4 so as to send the signals to the camera control unit 3.
Other than that, I assume he refers to the connector board because it has pins designed to connect to something externally as discussed in that section.
The sketch that he shows, I don't know what those other boxes are on the other side of 228. Whether that's circuitry, not circuitry, he doesn't say.
Q. Now, a CCD pixel array -- let me rephrase it.
A CCD pixel array would require an external driving circuit for power, wouldn't it?

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MR. DAVIS: Objection to form.
A. Every solid-state imaging device I know requires a power supply, and so a CCD would, a CMOS would, a microbolometer would, a photo diode would.
They all require some source -- well, with the possible exception of the simplest photo diode, which generates a photo current, all of them typically require bias; in other words, a power supply.
Q. You would agree that a CCD pixel array would use an off-chip driving circuit for power, wouldn't you?
MR. DAVIS: Objection to form.
A. Well, a CCD, as well as every other or pretty much every other solid-state imaging device I know, requires power. That power is -- unless the battery is somehow integrated into the chip and that power is off-chip and has to be provided to the chip, and any circuitry involved in that power supply might be located off-chip.

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I suppose it could be located on-chip, but it wouldn't be unusual to locate it off-chip.
Q. A CMOS pixel array would not require an off-chip driving circuit for power, would it?
MR. DAVIS: Objection to form.
A. No. No, that's not correct.
The transistors in a CMOS pixel, in order to operate, require power supplies. They don't operate in the absence of power. They don't operate.
So a CMOS pixel array certainly also requires a power supply.
Q. Right. But a CMOS pixel array that's manufactured on a CMOS manufacturing line could run off the same voltage for the whole device; isn't that correct?
MR. DAVIS: Objection to form.
A. It depends on how it's designed.
If it's CMOS, you need more than one bias, because the N channel transistors operate one way and the P channel transistors operate another, so you need

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two voltages at a minimum.

Q. But you wouldn't require an off-chip driving circuit for power for a CMOS pixel array device, would you?

MR. DAVIS: Objection to form.

A. No, I wouldn't agree with that. They require off-chip supplies of power and inasmuch as that is driving the transistors on-chip, that might well be characterized as driving circuitry, and that's required for a CMOS just like it is for a CCD. The details might be different, but they both require it.

Q. How are the details different between CCD and CMOS?

MR. DAVIS: Objection to form.

A. It depends on the chip. It depends on what logic levels were used for the CMOS, when -- 5 volts, 3.3 volts. It depends on the technology node.

CCDs, similarly, it just depends on the design of the chip in terms of what voltages it's designed to operate on.

Q. You would agree that a CCD pixel

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array device requires higher voltage to operate than a CMOS pixel array device, wouldn't you?

MR. DAVIS: Objection to form.

A. I don't think that's -- excuse me -- I don't know that that's universally true.

It would not be unusual for them to use different voltages, but I couldn't say that there is no CCD in existence that could not operate from, for instance, a 5-volt power supply.

Q. Are you aware of any?

A. I haven't done the research on that. There was no need for this -- for the purposes of this declaration, that was not a relevant topic for me so I haven't looked.

Q. Going back to the mid '90s, let's just talk about 1997, in particular, was it your understanding that a CCD imager device or -- strike that.

In 1997, was it your understanding that a CCD pixel array device

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had the same power requirement as a CMOS pixel array device?

A. In terms of their power requirements or voltage requirements?

I'm sorry, power requirements, I honestly don't know which was lower power or higher power. I think CMOS was generally viewed as being lower power consumption than CCD in terms of the voltage levels that were required.

I honestly don't know what was available for the CCDs at that particular point in time, standard CMOS logic -- '97 -- I don't know whether we dropped the 3.3 volts yet or not or whether it was still 5 volts. I honestly don't recall.

Q. But in 1997, the way you would read out a CCD pixel array, sometimes referred to as a bucket brigade, but you had to push the charge across all of the pixels and the CCD array to get the image data out; is that correct?

MR. DAVIS: Objection to form.

A. So depending on how the CCD was

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designed, whether it was -- you can design so that there's some parallelism, but, typically, yes, you have to push them at least across everything in one row or one column. That's true.

Q. Okay. And in 1997, a CCD pixel array to be read out in the way you just described required more voltage than what a readout of a CMOS pixel array at that time; is that right?

A. I don't know that that was a requirement. I'm sure you can find examples that were higher voltage, but I don't know that there aren't examples where they were similar. I honestly don't know.

Q. Do you have an understanding of how the camera head -- let's talk about the solid-state image pickup device in Suzuki.

What's your understanding of how that device would have been manufactured in 1991?

MR. DAVIS: Objection to form.

A. I don't think Suzuki cares. It just says it's a solid-state

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image pickup head. In terms --

Q. I'm asking you -- I'm sorry.

A. In 1991, I'm sure it was done with integrated circuit techniques.

Q. Do you know what kind would have been used at that time, what kind of manufacturing technique would have been used to manufacture the image pickup device 221 at that time?

MR. DAVIS: Objection.
Form.

A. I imagine it involved oxidation, diffusion, ion implantation, photolithography, metal and potentially polysilicon depositions, etching.

All of those manufacturing steps would have been used.

Q. That would have been a process that was tailored to manufacturing that particular chip; right?

MR. DAVIS: Objection.
Form.

A. So I think that as we discussed before other articles, there are certain --

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for instance, substrate requirements for CCDs that are different than for CMOS.

And, yes, the processes were probably optimized for one or the other.

So, yes, I think the fabrication process for a CCD is different than for a CMOS chip.

Q. Do you know what was the average size of a CCD pixel in 1997?

MR. DAVIS: Objection to form.

A. No, not for CCD specifically.

In terms of general IC fabrication in '97, I honestly don't recall what technology node we were at -- '97.

I think in '97 we were probably under one micron for lithographic feature sizes, but that doesn't determine the pixel sizes and I don't know. I don't recall.

Q. And do you have an understanding of what was the pixel size -- and micron, it sounds like what you were using, for a CMOS active pixel sensor at that time, in 1997?

MR. DAVIS: Same objection.

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A. I don't recall with any great specificity. I think it was on the order of a few microns, but I don't really recall with any more specificity than that.

Q. In your declaration, in paragraph 153, you talk about some of the size measurements that are provided or the size details provided in Suzuki.

Do you see that?

A. I do.

Q. I'm sorry, do you see that, paragraph 153?

A. Yes, I do.

Q. Okay. And then you highlight a portion of Suzuki where it talks about the solid-state imager pickup chip being one-third of an inch, which is 8.5 millimeters as used.

Do you see that?

A. I do.

Q. Did you do any calculations in terms of the number of pixels that would fit into -- what could be generated with an image pickup chip of that size?

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A. No, I did not.

Q. Do you have an understanding of how many -- the number of pixels that could be generated with an image pickup sensor or an image pickup chip of that size?

A. I wasn't counting pixels, and so, no, I haven't done any -- any calculation of that.

Q. Do you have an understanding of how many pixels do you think would fit in an image sensor of that size in 1991?

MR. DAVIS: Objection to form.

A. So for an 8.5-millimeter size chip, no, I don't know.

Q. If you could determine the number of pixels that would fit or could be generated by an image pickup chip at that time, would it be different for CCD pixel array versus a CMOS pixel array in terms of the number of pixels?

A. I don't know.

MR. DAVIS: Object to form.

A. Perhaps, but I don't know.

It's not -- it was not an issue

in my inquiry. Nowhere in the claims that were considered was there any limitation related to number of pixels, so I didn't look at that.

Q. What's your understanding of how many pixels you would have needed in 1997 to have an image of acceptable quality generated by this image pickup chip?

MR. DAVIS: Objection.
Form.

A. I think it very much depend on who was defining acceptable.

I don't know. No number in particular is in my head.

Q. We previously spoke about the consumer camera market. We talked about the Wakabayashi reference.

Do you have an understanding of what would be acceptable for a consumer camera like it's described in Wakabayashi?

MR. DAVIS: Objection to form.

A. I don't think Wakabayashi indicated a particular array per pixel count. And, again, that was not something

that I looked into. I don't recall off the top of my head.

It certainly has changed over the years, but what it was considered to be in '90 or '95 or '97, I don't recall precisely.

Q. And so it's your testimony that the Suzuki reference is really only used by you in this IPR for the size of the -- this pickup, the image pickup chip; is that right?

A. So for Claim 1, as I've discussed starting on page 99, my declaration, the teachings that I thought were relevant -- first, that it's for a miniature -- to use his words, a compact camera head for a solid-state image pickup device.

All of these references I've looked at are for solid-state imaging devices and they all are interested in size.

Suzuki I think shows one of ordinary skill that using available

knowledge at the time that a size of -- and to use the claim language was between 2 and 12 millimeters. Suzuki illustrates a chip that's 8.5 millimeters and that they want this to fit inside a camera head. They specify the outer diameter as being 10 millimeters, I believe.

Which means all of the components that go inside have to be smaller than 10. And the chip is given as 8-1/2. That's bigger than 2 millimeters.

So I think what Suzuki teaches one of ordinary skill is that having a chip between 2 and 12 millimeters was known at the time.

Q. So your testimony, at least in connection with Suzuki, isn't based on the particular type of pixel array that's in Suzuki; is that right?

MR. DAVIS: Objection.
Form.

A. Suzuki discloses a camera head that uses a solid-state image pickup device. Very clearly. That's all he

restricted it to, which could be many different things. He gives sizes.

Beyond that, no, I don't -- I'm not looking to Suzuki for any more details about the imager itself because he's open. He says it's solid state. He didn't say what kind.

Q. So it's your testimony that Suzuki could be any type of solid state -- any kind of solid-state pixel array, it doesn't matter.

That's your testimony; right?

MR. DAVIS: Objection to form.

A. I don't think that's how I said it.

Suzuki simply requires a -- let's see -- to use an image pickup, so a solid-state image pickup chip.

In terms of what that would teach to one of ordinary skill in the art, that could encompass a number of different types. That's what's Suzuki teaches and I believe that's what one of ordinary skill in the art would take away.

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Q. And what types could it be then?

A. Well, it could be, as examples, an active pixel CMOS device. It could be a CCD pixel device. It could be a photo diode pixel device.

Actually, it could be a microbolometer pixel. That's a solid-state device too.

Suzuki doesn't limit it.

Q. So it doesn't matter what kind of solid-state imager device it is in connection with your testimony in this case on Suzuki?

MR. DAVIS: Objection.

Form.

A. Yes, I wouldn't -- Suzuki says -- Suzuki teaches sizes. In terms of what one of ordinary skill in the art would learn, be taught by reading this, they would be shown that something in the size range of 2 to 10 -- 12 millimeters, and more specifically around 8-1/2 millimeters, the chip itself was something that could be done. That's what this teaches.

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That the outer diameter of the housing is 10 millimeters. That everything could fit inside a 10-millimeter space. That's what this teaches.

It is obvious based on this that a size between 2 and 12 millimeters would have been available to one of ordinary skill.

Q. So in terms of the size then, if -- strike that.

Why don't we move onto the next reference I want to talk about, which is the Ricquier reference.

I think it's going to be Exhibit 1033.

(Discussion held off the record.)

THE WITNESS: My exhibit number is labeled 1038. I'm not sure whether I heard the right exhibit number.

MR. CAPLAN: There's actually two Ricquiers. There's 1033 and 1038.

Did you have both of those, Dr. Neikirk?

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THE WITNESS: I have 1038. I'm going to have to dig for 1033.

MR. CAPLAN: Why don't we take a short break here and let Dr. Neikirk look for that, and then we'll come back in 10 minutes or so.

Is that all right?

THE WITNESS: That's fine.

(A recess was taken.)

BY MR. CAPLAN:

Q. Dr. Neikirk, we were about to switch to the Ricquier reference, to move our discussion onto that.

And there are two exhibits, Exhibit 1033 and Exhibit 1038.

Do you have both of those?

A. I do not. I have 1038.

Q. Okay.

A. And I was looking at my declaration at page 194, is I think the only place where I mention 1033, and that was just in whether it was publicly available.

But reading that at paragraphs

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307 and 308 on page 196, it seems to indicate they were both in the same volume. I don't have 1033 in my -- in my stack of documents.

Q. Okay. Well, I do have a couple of questions -- let me just back up.

So the article itself, the Ricquier reference itself I believe is the same in both of those.

There's just the kind of qualifiers or -- not qualifiers, but information about access and publication, which is different.

So I'll ask you a couple of questions on things that are in 1033 and we'll see how it goes, but I understand that you don't have the reference.

MR. CAPLAN: Is that something we can get over to Dr. Neikirk? Can we --

MR. DAVIS: I think it was sent to Dr. Neikirk, but we can talk about that at our next break.

MR. CAPLAN: All right.

MR. DAVIS: It --

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MR. CAPLAN: I don't think it's going to be an issue. We'll see how it goes.

BY MR. CAPLAN:

Q. If you can pull out then Exhibit 1038, that is what's been referred to as the Ricquier reference.

(Exhibit 1038 for identification, Ricquier reference, shown to witness.)

BY MR. CAPLAN:

A. Yes, I have it.

Q. So I'm going to ask you some questions about that.

But beforehand, or as a start, if you go to, it's page 3 of 16. I believe that's kind of the first cover page.

And this is -- it talks about -- it's proceedings from -- I don't know if it's "SPIE" or "SPEE," I don't know how you pronounce it, the International Society for Optical Engineering.

A. Yes, that's correct.

Q. So first question is, what's

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your understanding of the SPIE organization?

A. Well, I was a member of the SPIE starting in probably the mid '80s and up through perhaps the mid 2000s. I don't recall when my membership lapsed.

But it was a technical society, as its name implies, it was for the -- the "P" actually stands for photo optical engineers. The original SPIE was Society of Photo -- I think actually it was Photo Instrumentation Engineers.

As you can see by that page you just referenced, the name -- the SPIE was still the initials, but they just wrote it as "International Society for Optical Engineering."

It was a technical society where research and a variety of material was presented at conferences and published in conference proceedings, very broadly related to all sorts of optical systems.

Q. Was it focused on research work?

A. Not necessarily. There were

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people from industry, many people from industry, as well as from academia.

It usually was about things that were considered at least at the time to be cutting edge, so if it was a commercial product, it would have typically been a new one. Not something that had been available for five or 10 or 20 years usually.

Q. You testified you were a member of the organization for a time period.

Did that time period include the 1990s?

A. As I recall, yes. I was a member for I think over 20 years off and on. I may have let my membership lapse occasionally, so in any given year I couldn't tell you for sure.

Q. Sure. And was it a source -- were the SPIE publications a source of information that you regularly looked at, reviewed, considered?

A. Yes, it was. A fairly large fraction of my conference publications were published -- were presented at and then

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published -- presented at SPIE conferences and then published in SPIE conferences' Proceedings. So, yes, that was a very -- in fact, probably more common for myself and my research group than the other professional society, the IEEE.

I also attended and made presentations there, but I'd say I did at least as much or more at SPIE.

Q. Okay. And it's called, at least the title or heading, is "Proceedings."

Is that just like a summary of articles? I just want to make sure -- I'm not sure exactly what that is describing.

A. So in order to present at an SPIE conference, you had to submit an abstract and that would be reviewed by the program committee. I was on several program committees over the years, for instance.

The abstracts were reviewed for technical content and relevance to the session. There would typically be many sessions.

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If you were accepted, then you would attend and present, but you would also submit a Conference Proceedings Paper, which would contain a written record of the things that you were going to present on.

Frequently, given that many of the oral presentations were limited to 10 to 15 minutes, the Conference Proceedings Papers usually had much greater detail than the oral presentation did.

But the Proceedings were published then. It was fairly common that your -- you had to submit the Conference Proceedings Paper before the actual conference occurred, and when attendees arrived, they would be given a copy of the Proceedings.

That's -- that changed over the years when they shifted to more electronic submission, then I think you usually got it after, but the Proceedings was the written documentation that went along with the conference talks.

Q. You testified about your

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involvement with the organization.

Did your colleagues in academia kind of across the country also have a similar level of interest in SPIE, certainly at that time?

A. Yes. Again, the two -- really, there were only two societies that covered a lot of these kind of systems and devices. One was the IEEE and the other was the SPIE.

Q. So those skilled in the art at the time would likely be looking at those two organizations and their publications about developments in the field for image arrays, the pixel arrays that we've been talking about; is that right?

A. Yes. I think that is a -- you would look -- the IEEE publishes a number of what are frequently called archival journals that are not necessarily associated with oral presentation at conferences.

And the SPIE, although I think they had a monthly proceedings journal, but

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mostly their publications were connected to the oral presentations at conferences.

Q. Now, I'm going to ask you a question, and this is from Exhibit 1033, which I understand you don't have. We'll work on trying to get you one, but I'll ask you the question anyway since we're here and we're on the topic.

In Exhibit 1033, and I'm looking at page 8 of 18, there's a page that talks about a conference committee, and it identifies a conference chair and then a program committee.

And one of the -- on the program committee is one Joseph Carbone. I don't know if that's a name that you recognize. It says "CID Technologies."

A. No. I don't -- don't recall the name.

Q. And how about CID Technologies, is that a company that you were aware of at the time?

A. Again, I don't recall it, no.

Q. Then there's also a James S.

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Flores on the program committee from Ball Aerospace Systems Group.

Are you familiar with Mr. Flores?

A. I don't recall Mr. Flores.

I certainly do recall Ball Aerospace.

Q. What is Ball Aerospace?

A. One of many, many defense contractors. They were very active in imaging systems.

Q. What kind of imaging systems?

A. Imaging systems ranging from the far infrared to the ultraviolet, so lots of different kinds of imaging systems.

Q. Did you do work with Ball Aerospace?

A. I don't think I did any work with Ball, no.

Q. But it's your testimony that that was a known company with expertise in the imager art; is that right?

MR. DAVIS: Objection to form.

A. I couldn't say off the top of my

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head what their primary expertise was in. It wouldn't surprise me, but I just don't recall.

Q. So turning back to Exhibit 1038, the Ricquier article.

(Previously marked Exhibit 1038 for identification shown to witness.)

BY MR. CAPLAN:

Q. You can turn to the start of the article, which should be on page 8 of 16 for Exhibit 1038.

A. So in my document for 1038, the start of the article itself is on page 8 of 16.

Q. Correct. Okay.

So let's start with, what is your understanding of what's being described in the Ricquier article?

MR. DAVIS: Objection to form.

A. Well, so as -- so I will -- my discussion in my declaration begins on page 108.

Q. Okay.

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A. And I have an overview.

The title of his article was: "The CIVIS sensor: A Flexible Smart Imager with Programmable Resolution."

The first sentence in his abstract says: "For time critical industrial machine vision applications, a dedicated imager has been developed."

And then he goes on to describe "a square 256-by-256 imager was fabricated in the standard 1.5 CMOS technology."

So this was for a solid-state imager made using the CMOS technology with some specific characteristics that he found or his group was particularly interested in.

I think he identified their group as IMEC, which is in Belgium, and if I recall, IMEC is an academic as opposed to an industry laboratory, if I remember correctly.

Q. Just going back to the title of the article that you read, it talks about this -- or the CIVIS sensors, the

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C-I-V-I-S, and that's defined at the bottom, it looks like page 8 of 16, computer-integrated vision system.

Are you familiar with that CIVIS project or system?

A. So this was a project that was funded -- co-funded, it says, by the Commission of the European Union.

I don't recall this specific one. There were, I'm sure, many, and this particular name, I don't recall.

Q. And then it also mentions in that same line at the bottom the Espry II Project (ph.)

Does that have any meaning to you?

A. No, I don't recall that meaning.

Q. So you were looking at the abstract when we first started talking about it, and in those first couple of lines -- let's start with the beginning.

It talks about "industrial machine vision applications."

What's your understanding of

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machine vision applications at this time, which is -- what are we talking about -- 1994?

MR. DAVIS: Objection to form.

BY MR. CAPLAN:

A. I'll --

Q. Go ahead. I'm sorry.

A. Go ahead.

Q. I'll reframe the question just so it's clear.

So in 1994, what's your understanding of industrial vision machine applications?

MR. DAVIS: Objection.

A. So "machine vision" is a term -- was a term and still is a term that broadly refers to acquiring, and then, in some cases, further processing images by machines as opposed to people.

Here he says "industrial machine vision," so I assume the applications that he was more interested in -- or this particular project -- this was a European Union-funded project, which is similar to

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the National Science Foundation.

Usually funding programs have some broad theme, and then under that theme a lot of specific work is done.

I would assume that the broad theme probably for this was to look at focal plane arrays, solid-state devices that would be suitable for use in capturing images, so that makes it machine vision, and I assume that they were interested in using that in industrial rather than scientific applications, so presumably not for a telescope, but for a robot or a part recognition tool or any number of things.

Q. And so your testimony where you were talking about you're assuming the applications they were interested in and the broad theme, those are your personal assumptions; right? That's not based on any express description of that in Ricquier, is it?

MR. DAVIS: Objection to form.

A. Well, in the third paragraph of the introduction, so on page 8 of

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Exhibit 1038, the second sentence -- what is it -- third sentence: "This is a valuable asset because speed is important in a lot of industrial applications."

So he identifies it, industrial applications.

If you go on to page 9, the first -- well, it's a continuation of a sentence that started on page 8: "Imitating human visual functions using analog CMOS structures."

He's discussing -- there's more background. There's a lot of references here. So he's identifying things that were of interest to the research community and the industry at the time.

Q. I just want to make sure I see the part on page 8 that you were just referring to.

A. If you look at the third paragraph under "Introduction."

Q. I got it. Okay.

A. And the third sentence.

Q. Got it.

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A. The next sentence gives a specific example, and he's talking about inspection tasks, which was a -- certainly of great interest to industry at the time, were ways of inspecting parts that usually or might well come by very quickly. Many parts passing by the vision system.

Q. Going back to the abstract, if you look at the second line, I believe it's the third sentence, it talks -- well, I'll just go through it from the beginning:

"For time critical industrial machine vision applications, dedicated imagers were developed. A camera can be programmed to operate in several resolutions. This is done by binning the signal charges of neighboring pixels on the sensor plane itself."

Do you see that last sentence?

A. I do.

Q. What is meant by that term "binning" or "binning the signal charges"?

A. Let me look forward to see if he explains how he was using it.

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So if you look -- this refers to neighboring pixels, so let's see.

Q. Do you have an understanding of binning in general, and then I'll ask you in the context of the Ricquier reference?

MR. DAVIS: Objection.

A. Binning can be used in a number of different ways. That's why I was looking to see how he used it.

You can -- sometimes people refer to storing signals -- storing signals as binning. Storing them temporarily in groups sometimes is referred to as binning.

Another use is where you only collect data from a small subset of all of your data. Sometimes that's referred to as binning.

And given that he's doing a number of these things, I was trying to determine if he's -- he talks about making the readout window programmable, and if you look at page 13, he shows you some different zooms, if you will, and he's talking about collecting data that

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potentially changes quickly.

So if you only collect data from a subset of all of the pixels, you can usually do that more quickly than if you try to collect all.

Again, binning can be used in a lot of different ways, so I was trying to determine how he was using it.

So if you look on page 10 of Exhibit 1038.

Q. Okay.

A. And you look at the second full paragraph on the page that begins:

"By using the K reset switches and the G reset switch in an appropriate way..."

Q. Yes.

A. "...it is possible to accumulate charge packets of different pixels or different column amplifiers on the integration capacitors according to different patterns." And then he talks about "by controlling the clocking scheme, the resolution of the imager can be

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altered."

So this is examples of collecting subsets of data, and although I don't think he uses binning there, I would think that that's, broadly speaking, part of what he's thinking.

Q. Is binning a function that's implemented in commercial products that have pixel arrays?

A. So as I just discussed, it can be used in many different ways.

And commercial products when? At this time or --

Q. 19 -- we'll talk in the mid '90s; in particular, 1997.

A. So I honestly don't recall whether there were commercially available sensors that allowed you to select a subset of pixels and only acquire data from those while ignoring all the rest. It might have been. I don't know.

To complete an earlier answer about binning, that same paragraph I was reading on page 10, if you go to that

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second full paragraph, last sentence, he talks about: "To limit the complexity of the timing controller realized in an off-chip driving unit, only timing configurations of some common patterns are provided, apart from the normal resolution 1 star 1.

"Also, the addition of pixel charges in 2 star 2, 4 star 4 and 8 star 8 neighborhoods was foreseen."

I believe what he's referring to there is the ability to either collect the data from each pixel individually, that's 1 star 1; or add together the signals on 2 star 2. So four pixels. And then collect that, if you will, average signal over the four and so on. That is a form of binning as well.

Q. So in that sentence you were just reading on page 10 of 16, there was a phrase you read and it's in the parenthetical, "realized in an off-chip driving unit."

Do you see that?

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A. I do.

Q. And I believe it's referring to the timing controller that's realized in an off-chip driving unit.

Is that your understanding?

A. That's what it says, "the timing controller (realized in an off-chip driving unit.)"

Q. So what is the timing controller in Ricquier?

MR. DAVIS: Objection.

Form.

A. Well, the function he's discussing in the rest of that sentence are functions that relate to addressing and timing of acquiring data from pixels.

So it's timing and control; "timing controller" specifically is what he called it. Controller because it impacts which pixels you look at. Timing, because it impacts the timing of when you collect data.

There are many circuits that could do that, although the general

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function would be clear I think to one of ordinary skill by looking at, for instance, Figure 1 of Ricquier, which is shown on page 9.

Q. And what does Figure 1 show in connection with the timing control?

A. So Figure 1 is labeled --

MR. DAVIS: Objection.

Form. Sorry, go ahead.

A. Figure 1 on page 9 is labeled: "Schematic Representation of the Sensor Architecture."

You see his pixels illustrated above. He happens to have drawn four. And then he indicates certain control signals, K reset and G reset, which he mentioned on page 10 in the sentence I read to you, which are used to both time and determine which pixels to read data from.

Q. Okay. So it's your testimony that looking at Figure 1 of Ricquier on page 9 of 16 that there are four pixels shown at the top portion of Figure 1; is that right?

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A. He's illustrated four on the top, yes.

Q. Okay. And then at the bottom of Figure 1, the lower portion of Figure 1, there's a K reset and a G reset and you referred to those as control signals; correct?

A. He describes on page 10 that using -- I think it's in that paragraph. Let me find it.

So it's actually at the beginning of that paragraph. Second full paragraph on page 10:

"By using the K reset switches and the G reset switch in an appropriate way, it is possible to accumulate charge packets of different pixels or of different column amplifiers on the integration capacitors according to different patterns."

So those are control. They have to be timed as well. These are not only things you just simply set and never change ever again.

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Q. And is the timing shown in that Figure 1 on page 9?

MR. DAVIS: Objection.

Form.

A. Well, on Figure 1 on page 9, the circuitry to provide G reset and K reset is not illustrated at all, so neither -- the circuitry necessary to do timing and control is not actually illustrated.

He's illustrating where the control signals are applied to the focal point array.

Q. So in that Figure 1 that we're talking about, let's just talk about the K reset. There's an arrow under the K reset.

Do you see that?

A. I do.

Q. And what is that arrow pointing to?

A. That's the input to the switch, so that's the control signal. So he illustrates these as simple switches.

Well, you don't build in -- he says that this was done in standard 1-1/2

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micron CMOS technology.

The schematic circuit diagram figure he showed is the classic presumably single pole, single throw switch.

Well, that's not implemented as a light switch with a mechanical flip in CMOS.

This would be either a or several transistors on the actual chip.

Q. And this Figure 1 is the same Figure 1 that you've used in a highlighted form in your declaration on page 109; is that correct?

A. That is correct.

Q. Okay. In particular, in paragraph 163, which actually starts on page 108, you talk about the Ricquier's CMOS photo diode array.

Do you see that?

A. Yes, I talk about his array is 256-by-256 square array, yes.

Q. And then you also say in that paragraph 163 "using the timing controller implemented on an off-chip driving

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circuit."

Right?

A. That is correct.

Q. Okay. Now, what is the "driving circuit" that you're referring to there?

MR. DAVIS: Objection to form.

A. So Ricquier refers to a timing controller. The claim language is "timing and control circuitry."

So from the '052 patent, the claim language is "timing and control circuitry." Ricquier uses the phrase "timing controller."

In neither situation is a specific circuit given. It's a general, I think one of ordinary skill would understand there are many ways to implement. They'd understand the function, and seeing Ricquier would see the same function, timing and control.

Q. Is it your testimony that Ricquier does not describe the actual timing controller?

MR. DAVIS: Objection.

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Form.

A. Ricquier, as I read to you on page 10, specifies that the timing controller is realized in an off-chip driving unit.

He identifies things it does, such as provide K reset and -- operate K reset switch and G reset switches, so he gives a functional description, but he doesn't give a specific circuit.

Again, one of ordinary skill would understand there are numerous ways to implement a circuit with that function.

Q. So the timing controller function described by name in Ricquier, if that's how you pronounce it, is a well-known feature that a person of skill in the art would know how to implement based on what Ricquier -- or "Ricquier" -- says?

MR. DAVIS: Objection.

Form.

A. So they would understand that the functions of the timing controller that

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are needed. Ricquier describes those.

They would also understand there are numerous different circuits that could be used to provide that.

Q. So it's your -- it's your testimony that the description and function provided in Ricquier for the timing controller is sufficient for a person of skill in the art to understand and implement that feature; is that right?

MR. DAVIS: Objection.

Form.

A. I don't -- I think one of ordinary skill in the art would recognize there are many structures that could provide a function like that.

Q. So --

A. Numerous different circuits.

Q. And so a person of skill in the art could implement one of them; is that right?

MR. DAVIS: Objection.

Form.

A. I don't know that they'd know

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which one. They might.

I think they have options, yes.

Q. So if they understood it could be several and they understood the differences between the several options, they could implement any one of them as they desired.

Is that your testimony?

MR. DAVIS: Objection.

Form.

A. You know, in the context of my declaration and examining this claim language, the plain and ordinary meaning, that's not something I've tried to -- to -- I have not rendered an opinion on that.

I haven't really thought through all of the possibilities related to that so I couldn't say as I sit here right now.

Q. In Figure 1 that we've been looking at in Ricquier, would you agree that the circuitry that's all shown in Figure 1 is all on the same chip; is that right?

A. So the circuitry illustrated in

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Figure 1, I don't know that he explicitly states -- well, let's see. He has some amplifiers illustrated. Let's see if he explicitly states those amplifiers are on-chip.

So he talks about his actual -- what he called practical realization, starting on page 11.

He clearly discusses the pixels themselves and he does talk about integration capacitors at the output amplifier.

Q. I'm sorry, just where are you reading from?

A. I'm sorry. It's the second full paragraph from the bottom.

He states in the -- I believe it's the fourth sentence:

"The second poly layer was used exclusively for the realization of the compact linear capacitors, the integration capacitors at the output amplifier, the coupled capacitors, C couple, and the load capacitors, C load."

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So the component shown in Figure 1 that correspond to those, he is clearly saying that they use the second poly layer of the chip to do that -- that circuitry.

So that would indicate it is on-chip.

Q. You've already testified that the timing controller that is referred -- that is identified on page 10 of 16 is not actually described or illustrated in Ricquier.

MR. DAVIS: Object to form.

A. So I don't believe Ricquier has a figure with a circuit diagram.

He has a functional description in that paragraph we were discussing earlier, and he identifies the timing controller as being realized in an off-chip driving unit.

Q. In the same Figure 1 that you've illustrated in your declaration at page 109 and you've highlighted, you've highlighted in yellow information that corresponds to signals from a circuit board, including

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timing and control circuitry thereon; is that right?

A. That's how I labeled them, yes.

Q. So it's your testimony that the K reset signal coming into the structure shown on Figure 1 is part of the timing and control circuitry; correct?

A. That's exactly what Ricquier teaches, yes.

Q. Okay.

A. He calls it timing controller.

Q. So all that structure we just went over, you just testified, is all on-chip; correct?

MR. DAVIS: Objection. Form.

A. No, that's not at all what I said.

The structure that's on-chip is C load. Not K reset.

K reset is a signal line that's provided from the off-chip timing controller. That's clearly discussed on page 10 of Ricquier in the second full

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paragraph.

K reset is a signal being applied. It's not on the chip.

Q. I'm going to come back to that, but just something about the pixels themselves in that Figure 1.

Are those passive pixels or active pixels?

A. In Ricquier, he uses a photo diode, and I think these would generally be considered to be passive pixels because there is no amplifier located in each pixel.

Q. There's an amplifier for the whole column; is that right?

A. Yes, there are two amplifiers that he shows. He has column amplifiers and then he has a global amplifier.

Q. Okay. So we were talking about the K reset and the G reset and those signals, and I think we were talking about this section before.

On page 10, which we've been talking about, in that second full

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paragraph, in fact, you even read this into the record before, it makes reference to the K reset switches and the G reset switch.
Do you see that in the first line?
A. I do.
Q. That is the structure shown on or in Figure 1; correct?
MR. DAVIS: Objection to form.
A. The switch is shown and the control signal has a name: K reset or G reset.
The control signal is provided by the timing controller, which Ricquier states is realized in an off-chip driving unit.
So the switches are certainly shown as a structure in Figure 1, although it's a schematic circuit diagram and isn't implemented in CMOS as an electromechanical switch.
Q. So what's shown in Ricquier in this Figure 1 is not implemented in CMOS.

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Is that your testimony?
MR. DAVIS: Objection.
Form.
A. No, absolutely that is not what I said.
Ricquier says that he used standard 1-1/2 micron CMOS technology.
All I was pointing out is the symbol he shows in Figure 1 is a schematic circuit diagram signal. That is not a physical object.
The implementation of that in CMOS would be done with CMOS transistors. Not with an electromechanical switch.
Q. All right.
But then just to wrap up this line of questioning then, that the K reset switch and the G reset switch, in contrast to the K reset signal and the G reset signal, but those switches are on-chip with the pixel ring; is that correct?
MR. DAVIS: Objection to form.
A. Given the description of the fabrication on page 11, yes, I believe that

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the implementation of that switch is on-chip.
The control signals, and hence the signals generated by timing and control circuitry as described by Ricquier as a timing controller, are provided from an off-chip location.
Q. If you turn back to page 8 of 16 in Ricquier -- and I apologize if I'm mispronouncing -- but on page 8 of Exhibit 1038 in the -- it's the fourth paragraph on the page, the last line.
It says: "A CMOS technology was chosen because it offers the selective addressability together with the possibility of further co-integration of processing electronics on the same chip."
Do you see that sentence?
A. I do.
Q. A CMOS pixel array was understood to be addressable, the pixels were addressable; isn't that right?
A. The way Ricquier's design and many others were set up using rogue column

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addressability, yes.
Q. And that was understood -- so let's talk about the time in '97 -- to be a feature of a CMOS pixel array; correct?
MR. DAVIS: Objection.
A. I think, broadly speaking, yes, that was seen as an -- a feature that was easily implemented in CMOS.
Q. And it was also understood at that time -- and let's talk about in the '90s, but, in particular, 1997 -- that another benefit of using CMOS technology for pixel arrays was to have co-integration of electronics on the same chip with the pixel array; isn't that right?
MR. DAVIS: Objection.
Form.
A. So I can't -- the way Ricquier phrased it, which is a good way to phrase it, "the possibility of further co-integration." It is an option. It's a possibility. You might choose to do it. You might choose to not do it. It's a design choice.

Q. But, in fact, that was the trend in 1997, was to have integration of all the components on a chip for the CMOS pixel array devices; right?

MR. DAVIS: Objection.

Form.

A. I don't think I'd agree that it was necessarily the trend to integrate all. Depends on what you mean by "all."

Some? Certainly. I don't know what -- you said "all electronics." I don't know what you mean to include in all.

Q. You would agree to -- I'll rephrase it.

Then you would agree in 1997 it was the trend in the industry to integrate many circuitry components on the CMOS pixel array all on-chip with the array; is that right?

MR. DAVIS: Objection.

Form.

A. Again, I don't think I could agree to that. You said "many."

That it was recognized that

because you're using standard CMOS you have the opportunity to build other CMOS circuitry on-chip. I think that was widely recognized.

In terms of the design choices as to how much to put on-chip versus off-chip, I believe that was viewed as a design choice.

And some people might try to integrate more. Some people might choose to integrate less. So I don't really know what you meant by "many."

Some? You know, there are many pixels, obviously, so there are many transistors on there.

I think it was recognized that you had the option to add other circuitry on-chip, but you also had the option to leave it off.

Q. And you were aware of the term "camera-on-a-chip" back in the mid '90s and '97, in particular, weren't you?

A. I think camera-on-a-chip has been a term that's been used for quite a

while, and certainly at that particular time. I don't think it had a precise definition.

Q. Dr. Fossum often wrote about camera-on-a-chip in his articles when he was describing his work with CMOS pixel array devices, didn't he?

MR. DAVIS: Objection.

Form.

A. I think he frequently used that term. I don't know who introduced it to the -- to the world, but I think he did, yes, frequently use that in his publications.

Q. And one of the reasons that it was of interest is because if you have a CMOS manufacturing fab, facility, and you can integrate all of the components on the same production line, that would be a benefit in terms of reducing costs for manufacturing; is that right?

MR. DAVIS: Objection.

Form.

A. Again, you used the phrase

"all." There are frequently components used. I believe the '052 illustrates the components that they use for doing conversion to video that were not compatible with CMOS integration, and I believe those skilled in the art at the time, those working in the field recognize that some things were relatively easy to put on on-chip, other things were not.

And, again, it's a design choice. Once you start realizing that you probably are going to have to place some components in different places, then you start looking at whether you want to put more in one place or less.

Q. Would you agree, though, that the cost would be lowered if you could put more components on a particular chip that's manufactured in a CMOS process than if you had to separate out the functions across multiple chips?

MR. DAVIS: Objection.

Form.

A. Not necessarily.

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As long as there are some components you have to have -- then let's call it your component count. At some level, you reduce it. You not going to go to one, perhaps. Then it starts to become a design choice.

It may very well be that some of the components that you wish to use are commodity items and are very low cost. You might choose to put it on-chip. There would be some costs associated with it because the dye size goes up. You might choose to put it off-chip. There would be a different set of costs associated with that. Purchase component mounting.

But I don't think it's -- it's not simple -- as simple as saying "put as many things as you can on-chip." It's actually never that simple.

Q. What's the impact of having the timing controller either on-chip or off-chip on the operation of the pixel array?

MR. DAVIS: Objection to form.

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A. Well, I think in Ricquier's example, apparently there was no deleterious consequence of putting it off-chip because they put it off-chip.

It is worth noting one of his objectives was to operate -- for instance, on page 10 he said that he wanted to do row selection at 2-1/2 megahertz. I think he mentioned some speed information. Where else does he do that.

On page 14, he talks about getting -- the last paragraph -- 125 full images per second, data rates of 10 megahertz and so on.

So I think his -- I think in the introduction -- I'm trying to find where he mentioned this. In the abstract he talks about "imager operated at data rates up to 10 megahertz providing about 125 full frames per second."

In the middle of the fourth full paragraph on page 8 he talks about "a valuable asset because speed is important in a lot of industrial applications."

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I think in his example he was concerned about speed. It's clear that placing the timing controller off-chip did not have a negative impact apparently in achieving high speeds as he desired, so there's an example of trying to see whether moving something off caused anything bad to happen.

But to do these trade-offs you have to pick a metric. For Ricquier, I think he was identifying speed as a potential metric and then evaluate pros and cons.

Q. Is there any portion of Ricquier that you can identify where there was a comparison between an on-chip timing controller versus an off-chip? Because you testified that there was no deleterious effect from having it off-chip, but I'd like to understand what your basis is for that.

MR. DAVIS: Objection to form.

A. He achieved the speeds he apparently desired. In particular, he

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identified speeds of, in his abstract, 125 full frames per second, data rates up to 10 megahertz. He did that with an off-chip controller.

If the off-chip controller was causing it to be operate too slowly to achieve what he stated, it might be possible that putting it on-chip would improve it. It might not. I don't know.

But clearly he was able to do it with off-chip controller.

Q. It doesn't say why they did not have an on-chip timing controller, does it?

A. No. It says that he was able to realize it in an off-chip driving circuit.

Q. Does the location of the timing controller have an impact on the integration period for the pixel array?

MR. DAVIS: Objection.
Form.

A. Well, the integration period that some of the timing and control information necessary to determine that is provided by the timing and control

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circuitry. Whether it's on-chip or off-chip, again, I think it's a design choice.

Again, in Ricquier, he could achieve -- in order to get 125 full frames a second and a data rate of 10 megahertz, that would suggest his integration time was relatively short, and accomplishing that using an off-chip timing controller apparently was possible. That's what he shows.

Q. If you turn to page 9 of Exhibit 1038.

A. I'm there.

Q. Okay. It's the first paragraph, it's not the first full paragraph, but it talks about -- let me see -- in the middle of that paragraph, it talks about "our work is closely related to this research, emphasizing the development of a multi-purpose flexible sensor architecture that can be used as a module in further sensor systems on a single chip."

Do you see that?

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A. I do.

Q. Okay. So what is your understanding of what's being described here in Ricquier?

A. Well, you didn't read the previous sentence:

"In other CMOS sensors, processing capacity was integrated in the edges of the photo diode array, exploiting the possibility to access a whole row of data at once."

So he's indicating that it was -- it would be possible in CMOS, as we discussed, to choose to put some circuitry on.

They're dealing with one row. He didn't talk about what specifically they were going to do with that.

I don't really think it's saying much other than what it did. There's an interest in multipurpose flexible sensor architectures.

Well, he's illustrating a flexible sensor in that he built the

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256-by-256 imager, but if in a given application he only needed 4-by-4, he could do it. That's a flexible sensor architecture. He did that without placing the timing and controller on-chip, for instance.

So flexible sensor architecture is a very broad phrase. It depends on how you're going to use it.

Do you want to be able to do high-speed subframes, do you want to be able to do just -- do you want to be able to average 4 pixels together because the scene you're viewing is in some sense low resolution, so you might as well average 6 -- that's what he means by flexible sensor architecture, I think.

You do have choices.

Q. And when he talks about a module in further sensor systems on a single chip, that's describing all the circuitry for the CMOS pixel array and imager device being on a single chip; right?

MR. DAVIS: Objection.

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Form.

A. I would take this to indicate that that might be a possibility. I don't think it says -- and I think that anybody building these recognizes that you can rarely put everything in the same place.

If you need to process an analog signal into video and you need a band-pass filter, for instance, certainly at this time frame you are not going to put that band-pass filter on-chip.

On-chip inductors were very poor in performance. People built their band-pass filters off-chip, so one in the art would recognize that almost certainly you are going to have some components elsewhere. But it becomes a design choice as to how much you put where.

Q. But on a single chip doesn't mean on a single chip in Ricquier?

MR. DAVIS: Objection.

Form.

A. He was talking about a multipurpose flexible sensor architecture,

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so I don't think he's saying that every single component necessary, for instance, to produce a video output that you could connect to a TV set was going to necessarily be all on one chip.

This is -- this is not a necessity. It's certainly indicating that because you're using standard CMOS you have options that are easier than they might otherwise have been, but it's not something you have to exercise all of those on a single chip.

MR. CAPLAN: Can we take a 15-minute break here.

(A recess was taken.)

BY MR. CAPLAN:

Q. We are talking about the Ricquier reference, or the "Ricquier." I'm going to have to find out how to pronounce it.

Do you have happen to know that individual? Have you ever meet him?

A. No, I have not, and I don't know how to pronounce it properly either. I

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certainly can't pronounce it properly.

Q. It sounded certainly very elegant when you did it with an accent, so I'm unnerved but...

So we were talking about the location of the timing controller, which you've testified Ricquier or Ricquier says is off-chip.

And one question I have, there's a Section 4.6 in Ricquier, which I believe is on page 14, and you've kind of looked at this before, but on page 14, Section 4.6.

A. Yes, I see that.

Q. Does the location of the timing controller, whether it's on-chip or off-chip, affect the speed or the readout that is referred to in Section 4.6?

A. Well, these are the rates that he achieved using an off-chip timing controller, so I think this certainly demonstrates it doesn't decrease the time below these speeds.

Whether it would be different, I don't know, depending on where he might put

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it, but it worked for this.

Q. Is it your understanding that the location of the timing controller on-chip versus off-chip would affect the speed?

MR. DAVIS: Object to the form.

A. I don't know. I haven't done any kind of analysis for that.

That wasn't an issue in my examination of any of the claim terms or the art.

Q. Okay. Also on page 14, the Section 4.5 under the heading "Temporal Noise," do you see that?

A. I do.

Q. What is temporal noise, so we understand?

A. Well, his first sentence says, under that section: "This type of noise manifests itself as variations of the output signal of one particular pixel."

So he defines what he's going to talk about that. He talks down below a little bit further about the spectral

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distribution of the noise, which is talking about the frequencies at which different types, amplitudes, are present.

In that sense, it's temporal. If you make the measurements in the frequency domain then it's not really temporal.

But if you're looking at a time varying signal, then you can do a -- transform into the frequency domain. I think he shows response -- that's Figure 4.

Actually, I don't think he shows any graphs for this. But he does talk about doing the spectral distribution, to try to determine whether there's 1 over F noise or not.

Q. And in that same section, 4.5, in the second paragraph, the last sentence in that paragraph, it says:

"To obtain the same signal-to-noise ratio for the 1-to-1 resolution, the parasitic capacitance always present at the output amplifier should be further reduced."

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What's your understanding of that sentence and what's it describing here in the context of Ricquier?

A. I have not looked at this.

It was, again, not relevant to my analysis. It says what it says, that there's a parasitic capacitance at the output amplifier.

The last paragraph says:

"The dominant noise source was related to column amplifiers."

So look at that entire paragraph. He talks about "best results for the 2-by-2 resolution."

It says, "this lies in the availability of an optimal capacitance value at the output amplifier," but these four resolutions are 1-by-1, 2-by-2, 4-by-4 and 8-by-8.

So presumably he's suggesting that it was -- well, he says there's an optimal capacitance value at, and depending on how you group these, their capacitance changes. I assume that's what he's

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discussing about. I really haven't looked at this carefully.

Q. So as you sit here today, you don't have any further understanding of that, that portion of Ricquier; is that right?

MR. DAVIS: Objection.

Form.

A. Again, it had no relevance to my analysis. I really haven't tried to parse this out, no.

Q. If you turn back to page 12 of Exhibit 1038, there's a heading 4.2: "Behavior Under High Illumination Conditions."

Do you see that?

A. I do.

Q. In the first sentence it says:

"When increasing the illumination more and more, a smear effect can be seen on columns that contain highly illuminated parts. These columns turn completely white," including the second sentence there.

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What is the "smear effect," and if you're familiar with the smear effect, what is it?

A. Well, I think he's explaining what it is. The multiple pixels may -- there may be signals on some pixels that are not representative of light falling on those pixels.

Q. And at the end of 4.2, the next-to-last sentence, it says that:

"Measurements have shown that with a spot illumination exceeding five times the dynamic range, the smear effect becomes prominent."

Do you see that?

A. I do.

Q. What's your understanding of that part of the Ricquier description in 4.2?

A. Exactly what it says.

If the spot illumination is by dynamic range, I assume that says maximum, 5 times larger, then the smear is important.

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Again, it's not -- was not part of my analysis. I think it says what it says.

Q. So it's describing that when you get more illumination on the CMOS pixel array that Ricquier is describing, you run into a problem with the smear effect; isn't that right?

MR. DAVIS: Objection.

Form.

A. Well, he -- earlier in the paragraph he discusses general characteristics of devices in the pixels, and that if you have enough photon-induced charges that those charges can diffuse, and that will affect what happens -- the electrical signal that you can see in other pixels. That's what I think he's discussing. I think that's true for many solid-state image sensors.

Q. But it's the case for the CMOS pixel array that is described in Exhibit 1038 that the more illumination you get, the greater problem you have with this

smear effect; right?
MR. DAVIS: Objection.
Form.
A. Well, I think he's -- he states that it's when it's five times the dynamic range, so if it's big enough, there's a smear effect.
You -- typically below some threshold, there is none.
Q. Are you familiar -- besides from its use in this article, are you familiar with that term "smear effect"?
A. Well, the physics that he's describing, which is that photo-generated charges in one location can affect electrical properties of devices at another location, I am certainly familiar with that, and that is a common problem in all solid-state imaging devices.
Depending on how they're laid out and in what intensities, the number of photo-generated carriers you generate, there's always some risk if you generate enough that those carriers will diffuse to

a location you don't want them in.
Q. Is there a term for that in the industry or in the field?
A. I don't know whether there's only one term for that. I don't know.
Q. If you turn to page 15 of 16 of Exhibit 1038 in the "Conclusion" section, heading 5.
A. I have it in front of me.
Q. Okay. The last sentence, it says: "Compared to CCD imagers, the S/N is quite bad, but for the intended industrial applications, it is sufficient."
Do you see that?
A. I do.
Q. And "S/N" is referring to signal-to-noise; right?
A. Yes, that stands for signal-to-noise ratio.
Q. So the conclusion from Exhibit 1038 is that there is -- well, let me rephrase it.
What is your understanding of that statement in the conclusion of

Exhibit 1038?
A. Exactly what it says.
Compared to CCD imagers, the signal-to-noise ratio is quite bad. But for the intended industrial application, it is sufficient.
In other words, whether a given signal-to-noise ratio is bad or not depends on whether you care.
Here he's saying it was worse than CCD, but it wasn't so bad that it made the sensor not useful for its intended application.
Q. And that intended application was machine vision; right?
MR. DAVIS: Objection.
Form.
A. So earlier in the discussion, he was talking about a machine vision application, yes.
Q. And we previously talked about the Wakabayashi reference, which you referred to as a consumer camera; right?
A. I may very well has used that

phrase.
Q. Okay. Is a --
MR. DAVIS: My objection got cut off again. Objection to form. Thank you.
BY MR. CAPLAN:
Q. Let me just rephrase the question.
A consumer camera is not an industrial application that's contemplated in Exhibit 1038, is it?
MR. DAVIS: Objection.
Form.
A. I don't know. The context of the high-speed discussion he's given, I'd say that he was looking at things that were a lot harder than consumer cameras.
Q. A lot harder how?
A. Well, he identifies a frame rate of 125 full images per second and a data rate of 10 megahertz.
I don't think that's -- that would be something I would not necessarily expect to be required for a consumer video camera in the mid '90s.

Q. Is that really based on the speed or the frequency, the 10 megahertz and 125 images per second, that's what you're talking about? It's a higher requirement than a consumer camera based on that frequency?

A. Yes. Standard video is 30 frames per second. He's achieving about four times that.

Q. And what about the quality of the image in terms of the clarity of the image, or I guess in the past you've talked about in the context of signal-to-noise?

A. I don't know that he's specified other than that his signal-to-noise was, for the intended application, sufficient.

I don't know, you know -- many industrial applications are fairly stringent, I guess, in terms of image quality, trying to tell one small part from another small part, but I don't know. It's not something I've considered.

Again, it was not related to any claims that I've analyzed.

Q. You don't have any basis in Exhibit 1038 for the particular requirements for the image quality for their industrial applications, do you?

MR. DAVIS: Objection.
Form.

A. He specified that it was sufficient for intended industrial applications. That's all he said.

And I didn't -- certainly didn't do any independent inquiry. It's not relevant to any claim language and I didn't -- there's nothing I looked at for my declaration.

Q. So you don't have a basis in Exhibit 1038 to say that one of the industrial applications is a consumer camera, do you?

MR. DAVIS: Objection.
Form.

A. I -- whether it could or could not include something that could be used for a consumer camera, I don't know.

I think what he shows is

something that, at least with respect to frame rate, would exceed the performance of what I would expect to be a consumer camera. But, again, I don't see that that's a relevant -- I did not conduct any inquiry based on that because consumer camera is not claim language.

Q. And what does it mean in that conclusion language that we talked about that the signal-to-noise is quite bad for the Exhibit 1038 imager compared to a CCD imager?

MR. DAVIS: Objection.
Form.

A. Only what it says. I don't know what else he means by that. Quite bad. That's all he said.

Q. It's worse than a CCD imager of that era; correct?

A. Well, he didn't actually say which CCD imagers -- excuse me.

MR. DAVIS: I just said objection to form. Thanks.

A. He didn't say which ones. I

don't know. Again, not part of my inquiry.

Q. You didn't investigate what were the overall signal-to-noise qualities of CCD imagers in 1997 versus CMOS imagers in 1997, did you?

MR. DAVIS: Same objection.

A. There was no claim language related to noise at all. There was nothing to suggest that that was an inquiry I needed to conduct, so, no, I did not.

My general knowledge is -- we've discussed before that generally CCDs were usually viewed as being lower noise than CMOS, but that's a generic or general statement. Given applications require different things.

Q. How big is the imager device that's described in Exhibit 1038?

A. So here it says it's a square 256-by-256 imager. I don't believe -- I'm trying to see whether he actually gives a pixel size.

I'm not sure he gives the overall dimensions, but he calls it a

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square imager. That much, he does state.

Q. He does call it a square imager? Where does he say that?

A. On page 8 in the abstract.

"This square 256 star 256 imager was fabricated."

Q. Do you know if it was perfectly square?

A. Well, he described it --

MR. DAVIS: Objection to form.

A. Ricquier described it as square. As one of ordinary skill in the art reading what he said, I think one would take it as it's stated. That it is square.

Q. So it would be approximately square, at least?

MR. DAVIS: Objection. Form.

A. Well, there is claim language related to something being -- let's see -- I want to get the modifier correct. There's a dependant claim to that effect -- actually, it's faster if I just look at the patent.

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So the claim language, I believe, is "generally square," and, again, I was using plain and ordinary. I've not done a claim construction inquiry. I think one of ordinary skill in the art would recognize that square is certainly within the category of generally square.

Q. Okay. I want to turn now to -- I guess, I don't know, it feels ironic, but the next reference, the -- I'm not sure how to pronounce that one either. It's Exhibit 1041. I don't know if anybody else knows how to pronounce it: "Dierickx," D-i-e-r-i-c-k-x.

Did you know Mr. "Dierick" or "Dierickx," Dr. Neikirk?

A. No, I do not.

Q. How do you pronounce it?

A. I've been saying "Deerix."

Q. Good enough for me.

Do you have a copy of that Exhibit 1041?

A. I do. It's in front of me.

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(Exhibit 1041 for identification, Dierickx reference, shown to witness.)

BY MR. CAPLAN:

Q. Dierickx is describing a -- well, why don't I ask you.

What is the Exhibit 1041 describing?

A. Well, the title --

MR. DAVIS: Objection to form.

A. The title is "Circuit Pixel Device and Method for Reducing Fixed-Pattern Noise in Solid-State Imaging Devices," so, once again, this is about solid-state imaging devices, and there are many teachings in Dierickx, but among them is having an amplifier in each pixel, so, for instance, as illustrated, I believe, in Figure 6.

Q. Okay. Are you all set? I didn't know if you were looking for something.

A. No, no, I was going -- that's discussed on page 110 of my declaration, paragraphs 166 through 168.

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Q. Okay. Just going back to the title when you read it, part of it refers to fixed-pattern noise.

What is fixed-pattern noise?

A. So Dierickx itself -- again, I'm just looking through the first page, paragraph 6 and following, to see if he describes it.

So I think there are line numbers -- it's in paragraph 6.

Q. Okay.

A. About two-thirds of the way down, and he discusses, for MOS image sensors, the applications requiring high image quality, that their output signal has an additional nonuniformity caused by the statistical spread on the characteristics of the electronic components composing the active pixel."

So I think down a little bit later, the last sentence:

"If no precautions are taken, this nonuniformity called fixed-pattern

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noise or FPN is seen as a snow-like shape over the image being taken with a CMOS or MOS image sensor with active pixels."
So I think I described it the other day when we were discussing this, is if you uniformly illuminated all pixels in the array, the apparent signal would not be the same at every pixel in the array. That's fixed-pattern noise.

Q. Well, in Dierickx, it's describing an active pixel sensor, isn't it?

A. So certainly the embodiment illustrated in Figure 6, where there's an amplifier in the box labeled "1 pixel," that's certainly an active pixel.
I think everywhere -- certainly there are other figures where he draws a box and says it is an active pixel.
So I'm just looking -- I don't know whether he ever discloses one that is not, but certainly with most of them, if not all, are active pixels, yes.

Q. So this is -- Dierickx is

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describing -- just kind of turn to I guess page 1, we'll use the paragraph numbers.
In paragraph 2, it says that Dierickx "relates to a solid-state imaging device manufactured using CMOS or MOS technology." Right? Do you agree with that?

A. That's what it says, yes.

Q. What's the difference between -- it says "CMOS or MOS."
What's the difference between the two?
I know there's a "C" that's different, but what is the difference in meaning between those two?

A. In CMOS, you build both P channel and N channel transistors on the same chip, in the same chip.
And in MOS, without the "C," you either build all P channel or all N channel.

Q. In paragraph 5, it talks about CCDs compared to CMOS.
Do you see that?

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A. I do.

Q. And do you agree that at least at the time of Dierickx, CCD-based camera systems provided a better image quality than CMOS-based camera systems?
MR. DAVIS: Objection to form.

A. Well, more specifically, what he said is that CCD-based camera systems have less noise fluctuation in the image compared to CMOS or MOS-based camera systems, and then the following, the next sentence, "Therefore, CCD-based camera systems are nowadays preferred in applications wherein a high image quality is required," and he gives two examples, "such as video or still camera applications."
So he's certainly identifying some -- under certain circumstances, CCD can have advantages.

Q. Do you agree with that at the time, 1996-1997?
MR. DAVIS: Objection.
Form.

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A. I don't know that it would necessarily be right in every possible video application in the world or every possible still camera application.
Certainly in high-performance situations, scientific ones, astronomy, there's no question in my mind that CCD was superior.
For a video camera used for teleconferencing or something like that, I don't know whether I would necessarily agree or disagree.

Q. So in Dierickx, it says that CCD-based camera systems are preferred for video applications.
Do you agree with that or not?

A. He says "a high image quality is required such as video or still camera applications."
So I would read that as indicating that in a video or still camera application where a high image quality is required, and he doesn't define how high is high.

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But if it has to be the highest possible, I think he's saying that CCD would be a potentially better choice.

Q. What's your understanding of high image quality as it's used in Dierickx?

A. I don't think he ever says anything further and I haven't tried to do any -- I can't read behind -- between the lines.

You know, I can only speak to applications that I was familiar with. I think I've used astronomy on many occasions where low light noise is critical. So, in fact, in that application, a cooled CCD was the best choice and not even room temperature, but actually cooled.

Q. But my question is, what's your understanding of a high image quality for -- let me rephrase that.

What's your understanding of a high image quality for a video application as used in Dierickx?

MR. DAVIS: Object to form.

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A. And I believe I answered. I don't know what Dierickx means.

Q. Okay. How about, what's your understanding of a high image quality for a still camera application as described in Dierickx?

MR. DAVIS: Objection.

Form.

A. Well, again, I don't know what he's thinking. I told you about one camera application that I can think of, which was for astronomy, astronomical purposes, that's a very highly specialized one.

But Dierickx doesn't say -- he doesn't give an example, I don't believe, of what he considers to be high image quality.

Q. Is there anything in Dierickx that leads you to believe that the Dierickx reference is referring to cameras used for astronomy purposes?

MR. DAVIS: Objection.

Form.

A. No, I don't think there's

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anything one way or the other, although its general objective is to improve performance of CMOS or MOS technologies. That's the whole point, is to reduce one of things he identifies as a problem.

Q. Is a still camera application something akin to the Wakabayashi patent that we've been talking about?

MR. DAVIS: Objection.

Form.

A. Wakabayashi describes outputting video. Video is not generally what you'd call a still camera output.

Q. Okay. Is Wakabayashi an example of a video application that Dierickx is describing?

MR. DAVIS: Objection.

Form.

A. I have no idea whether it's the type that Dierickx is describing.

Q. Okay.

A. It is -- they are both related to solid-state imaging devices. There's no question about that.

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Q. But as you've testified before, there are a lot of different implementations of solid-state imaging devices; right?

A. That's correct, and one of ordinary skill in the art would be aware of the literature, the patents on all of those.

Q. But if you were holding a device which has a CCD imager pixel array in it, you wouldn't call that a device with a CMOS pixel array imager, would you?

MR. DAVIS: Objection.

Form.

A. So if I understand your question, you're asking me if I would call a CMOS device a CCD?

Q. Correct.

A. No, I would not.

Q. In Dierickx -- or "Dierickx," I don't remember how I'm saying it -- in Exhibit 1041, where is the timing and control circuitry with regard to the pixel array?

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A. I certainly didn't look to Dierickx or any teachings related to timing and control in my analysis, as set forth, for instance, on page 110 of my declaration. I don't know that he discusses timing and control specifically. I have not looked to that.

Q. You would agree that Dierickx describes a CMOS image array with active pixel sensor -- with active pixels; right?

A. I'm sorry, could you repeat the question again?

Q. Sure. You would agree that Dierickx describes a CMOS image array with active pixels; right?

A. Yes. Dierickx is describing an array and they are made up of active CMOS or MOS pixels, apparently.

Q. Okay. And can you -- let me rephrase it.

Based on your review of the Dierickx application or Dierickx reference, where is the timing and control circuitry that would work with those active pixels in

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the Dierickx description?

MR. DAVIS: Objection.

Form.

A. So as I just testified, I was not relying on Dierickx for that so I really didn't examine it.

There is one discussion of timing sequence in paragraph 66 on page 5, referencing Figure 7, but I see nothing in that discussion that would indicate whether that timing sequence would be on-chip or off-chip.

Q. Okay. If you please look at paragraph 11. It's on page 14 of 20 of Exhibit 1041 in paragraph 11.

A. I'm there.

Q. And starting the fourth line down, it says:

"This device comprises a matrix of active pixels as well as electronic components or circuits located by preference at the edges or border of the matrix of pixels."

Do you see that?

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A. I do.

Q. What's your understanding of that description in Dierickx with regard to other circuitry, and, in particular, timing and control circuitry relative to the pixel array?

MR. DAVIS: Objection to form.

A. If you keep reading in the paragraph, he says: "At the expense of forming an image sensor with an unusual large area said electronic components or circuits can also be integrated in said pixel," which would not be timing and control.

He further says: "Said electronic components or circuits comprise at least one amplifying circuit, which is common to a group of pixels, such as a column or row."

So he gives examples of such circuitry. The circuitry that he specifically uses examples are amplifiers.

And at least in the rest of that paragraph, continuing onto page 2, I see

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nothing that would suggest other circuitry. Maybe it is. Maybe it isn't. But the only examples he gives are amplifiers, I believe.

Q. Now, active pixels versus passive pixels, that's described a little bit in paragraph 6 of Dierickx.

And my question is, do you agree that passive pixels have less functionality than active pixels; is that correct?

MR. DAVIS: Objection to form.

A. No, I wouldn't agree with that phrasing.

Q. What is the difference between passive pixels and active pixels in the CMOS imager?

A. An active pixel has an amplifier integrated with the pixel. A passive one does not.

Q. So then the active pixel, as you just testified, has an additional component which is the amplifier with it; right?

A. Yes. Actually, maybe more than one component, but in some cases, in fact,

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I believe other ones I pointed to in my declaration, it's the addition of a single transistor, but, yes, additional components comprising an amplifier.

Q. So the active pixel has additional components and functionality over a passive pixel; is that right?

A. If by functionality it provides --

MR. DAVIS: Objection.
Form.

THE WITNESS: Excuse me.

A. If by functionality you mean it provides amplification, yes, it certainly does, and I believe I already told you that, yes, there are additional components compared to a simple passive.

I'm not -- I suppose there could be some passive pixel that had extra components in it. But in general terms, I'd expect an active pixel to have more components than a passive one.

Q. For the same reason, an active pixel would be more expensive to

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manufacture than a passive pixel; right?

MR. DAVIS: Objection.
Form.

A. Not necessarily.

Manufacturing costs track more closely dye area than transistor count.

Q. But the more functionality you put into the dye, the more expensive it is to manufacture.

Isn't that the case?

MR. DAVIS: Objection.
Form.

A. Not necessarily. Sometimes, but it depends a lot on dye area.

Q. Is it your testimony that the passive pixel would be less expensive -- strike that.

So it's your testimony that an active pixel would be less expensive to manufacture than a passive pixel?

A. No. I said you can't necessarily say the active is more expensive than the passive. That's what I said.

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Q. Is there a difference in the size area that's occupied by a passive pixel versus an active pixel?

A. There may or may not be. It depends on how one chooses to lay out the pixels.

Q. So it's completely up to the designer?

A. Well, yes, actually. You could lay out large pixels. You can't make it irreducibly small because you have a line limit to your fabrication process, but you have choices as to, for instance, how much of the pixel actually absorbs light, the fill factor. You have choices as to how to use size, the other components. So, yes, it is largely by the designer.

Q. So is it your testimony that the active pixels have additional components in them over passive pixels, but you don't know whether or not it would be more expensive to manufacture active pixels versus passive pixels; isn't that right?

MR. DAVIS: Objection.

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Form.

A. What I said was is that manufacturing costs tends to track dye size more than it tracks transistor count.

If you built a passive pixel with a large fill factor and it had a certain size pixel, you perhaps -- a design choice would be to build an equivalent size pixel that was active, but where the photo detector has a smaller fill factor.

In that case, the total dye area would stay the same. And then it's not clear that one would be more expensive than the other.

Q. You didn't investigate the relative costs between manufacturing active and passive pixels in connection with your opinions in this matter, did you?

MR. DAVIS: Objection.
Form.

A. I have been teaching CMOS fabrication since 1985, and as an important part of my class, I cover -- it is about manufacturing, and part of what we talk

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about are costs.
And in the industry you usually specify cost per wafer, not -- because that's the manufacturing process. You handle wafers, so it's called wafer starts per week. You don't count the number of chips per week. You count the number of wafers.
So that's why I said the manufacturing cost tends to track the area of the dye because on one wafer, the larger the dye, the fewer you get.
It was the wafer cost that drove -- the wafer manufacturing cost that drove things, if you were dyeing, then each dye is more expensive. So it's area of the dye that tends to drive. Not the only factor for sure, but it tends to be one of the important factors.
Q. But you haven't expressed an opinion in this case about the cost to manufacture a standard passive CMOS pixel array in 1997 versus an active CMOS pixel array in 1997; right?

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MR. DAVIS: Objection.
Form.
A. No claim had the word "cost" or anything related to cost.
I did analyze whether it would have been obvious to combine the references I did. They're in the same field, solid-state cameras.
So, no, I did not render any opinion about cost because it wasn't relevant to my analysis. I do know about costs.
Q. And you don't have any opinion about the average size of a dye for a CMOS passive pixel array versus a CMOS active pixel array in 1997, do you?
MR. DAVIS: Objection.
Form.
A. Again, I did not perform any analysis concerning an average size.
I did point to a specific reference that gave a size, 8-1/2 millimeters, in particular.
But I didn't try to find an

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average size because, again, that's not relevant to my analysis.
Q. Okay.
MR. CAPLAN: This is probably a good point to break for lunch, at least on the East Coast. I'm not sure if it's okay for you.
But you want to come back at 3 o'clock or noon Pacific?
THE WITNESS: So that would be about 50 minutes.
MR. CAPLAN: Is that all right? Okay. Great. Thank you.
(A luncheon recess was taken from 2:09 p.m. EST to 3:00 p.m. EST.)

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A F T E R N O O N S E S S I O N
(Time Resumed: 3:00 p.m. EST)
DEAN NEIKIRK, PH.D.,
having been previously duly sworn, resumed and testified as follows:
CONTINUED EXAMINATION
BY MR. CAPLAN:
Q. Dr. Neikirk, we were in Exhibit 1041, the Dierickx reference, and if you could turn there to page 15 of 20; in particular, paragraph 19.
A. You said the exhibit, page 15. Paragraph 19?
Q. Paragraph 19.
A. I have that in front of me.
Q. If you go down, it's the fourth line in paragraph 19, the sentence that starts "an example."
Do you see that?
A. I do.
Q. So it says: "An example of such camera system is a video or still camera or camera integrated in a multimedia device such as a personal computer equipped with

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video functionality or with video and speech functionality."
Do you see that?
A. I do.
Q. So does that give you or what is your understanding of the video or still camera described in Dierickx in light of what's described in paragraph 19?
MR. DAVIS: Objection.
Form.
A. Again, exactly what it says.
A multimedia device such as a personal computer, and I would take it to indicate that he's stating that using his inventions you can achieve something with high enough performance presumably at lower cost than the CCD system.
Q. I'm just not sure I understood your answer because it looked like your answer was in the context of CCD systems.
A. No, I said the inventions of Dierickx for MOS or CMOS provided a performance that was high enough for the application he identified, and given that

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that was the focus of his -- his stated focus was reducing fixed-pattern noise.
Clearly he was trying to improve the image performance of CMOS or MOS arrays.
MR. DAVIS: John, I think it was a transcription error. It says "in" instead of "than."
(Discussion held off the record.)
BY MR. CAPLAN:
Q. In the same paragraph 19, Dr. Neikirk, at the bottom of that paragraph, it says: "As is well-understood by a technologist in the relevant field, for this purpose the integrated circuit containing the pixel matrix and the peripheral circuits are packaged and mounted inside a camera housing with the lens at the same place where a photographic film would be located."
Do you see that?
A. I do.
Q. What's your understanding of

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what's being described in this part of Dierickx?
A. Again, exactly what it says.
Using the solid-state imaging device in a camera in the location that normally photographic film would be placed. Exactly what it says.
Q. And it's also saying that the pixel array and other circuitry are all located in the same location; right?
A. Well, actually what it says is that the pixel matrix and the peripheral circuits are packaged, which doesn't preclude the possibility that they were two chips in a common package, but of course the peripheral circuitry that I believe Dierickx focuses on relates to amplifiers, and he didn't really discuss other peripheral circuitry. Perhaps it's on-chip, perhaps it's not.
But it certainly does say that the pixel matrix is packaged and mounted inside a camera.
(Reporter clarification.)

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BY MR. CAPLAN:
Q. So is it your testimony that the peripheral circuits referred to in this paragraph 19 are referring to the amplifiers that are used in the active pixels of Dierickx?
A. So I don't think Dierickx specifies any particular details of peripheral circuitry except as what you might see in column -- in Figure 2, for instance, which related to the amplifiers, or, for instance, in Figure 5, also related to amplifiers.
Other than that, I don't think he really gives much in the way of details about possible examples of peripheral circuitry.
Q. Well, you identified Figure 2 in Exhibit 1041. If you can just turn to that just so I understand on the record what's shown here.
It looks on the top -- the upper portion of Figure 2 there are four active pixels; is that correct?

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A. Yes, I believe that's what he's trying to -- yes.

Q. And those active pixels would include the amplifier that makes it an active pixel; is that correct?

A. They would include amplifiers in the pixel, but as shown below, there is another amplifier that he shows which is number 11.

Q. And what is the purpose of that amplifier 11?

A. So in -- so it's the exhibit page 16 in paragraph 33.

Q. Yes.

A. He says that: "In this figure an arbitrary array of 2-by-2 active pixels is drawn with one column amplifier in this text, also referred to as the amplifying circuit." That's it.

Q. Is that column amplifier the amplifier for the active pixel?

A. No, it's a column amplifier.

Q. So it's different?

A. Yes, it's different.

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Q. Just so to be complete, then there's additional circuitry shown on the lower portion of Figure 2.

Can you just describe the other circuitries there, and I'm talking in particular it looks like elements 12 and 9, in particular.

A. So in column 41 on page 16 of the exhibit he discusses Figure 2. He discusses switches. He discusses that the output current of sub-circuit is the current source 12, and using various switches, it's used to calibrate.

So the very first sentence in that paragraph is another method consisting of calibration of current sources.

Remember that his overall goal is to reduce fixed-pattern noise which is due to variations from one region to another. And so, for instance, being able to calibrate that out is a way of trying to do that. I don't know that that's specifically what he's talking about here.

Q. That was my next question, is

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that other circuitry we're looking at in Figure 2, would that be an example of the peripheral circuits that are referred to in paragraph 19?

A. It may be, it may not. I don't know that he used anything that explicitly says that that's the only possible peripheral circuitry or that it has to be on-chip, but it's the only example I see of something that's connected to, for instance, an entire column as opposed to being inside individual pixels.

Q. If you could turn back in Dierickx, back to paragraph 6 on page 14.

A. I'm there.

Q. In the middle of that paragraph it talks about some of the features and functions of active pixels, and it says, it starts with -- a third of the way down, the sentence starts "for this reason," and so I'll read it for the record:

"For this reason, active pixel image sensors are potentially less sensitive to noise fluctuations than

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passive pixels."

Do you see that?

A. I do.

Q. Do you agree with that?

A. Well, we should back up and read what the reasons were.

The previous couple of sentences, second sentence in paragraph 6, "An active pixel is configured in the means integrated in the pixel to amplify the charge that is collected on the light sensitive element."

And then it says:

"Passive pixels do not have said means and require a charge sensitive amplifier that is not integrated in the pixel and is connected with a long line towards the pixel."

So presumably -- he doesn't really identify which reason in the numerous -- is it just because there's an amplifier in the pixel? Is it because there is a long line connected in the pixel? I haven't really analyzed this to

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try to decide what I think he's specifically trying to address.
Q. And as you sit here today, can you -- my question is, do you agree with the statement that active pixel sensors are potentially less sensitive to noise fluctuations than passive pixels?
A. Well, he says "potentially." Lots of things are potentially less sensitive.
I would think it would depend on what the source of the noise fluctuation was, as to whether adding an amplifier would reduce sensitivity to that or increase sensitivity to that.
Q. In the next sentence in that paragraph 6, it says:
"Due to the additional electronics in the active pixel, an active pixel image sensor may be equipped to execute more sophisticated functions which can be advantageous for performance of the camera system."
Do you see that?

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A. I do.
Q. Do you agree with that statement?
A. Well, let's look at the functions he identified.
"Said functions can include filtering operation at higher speed or operation in more extreme illumination conditions."
He did not identify what kind of circuitry he's going to add to the pixels to do those things. That there might be something you could add, I suppose.
So I haven't really looked at that, and I can think of pros and cons, so I don't know whether I agree or disagree.
I suspect under some circumstances I would agree. There might be other circumstances under which I would disagree.
Q. As you sit here today, you can't say "yes, I agree with that statement in paragraph 6"; is that right?
MR. DAVIS: Objection.

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Form.
A. As I sit here today, I think that this is a very complicated topic and so there might be circumstances where I'd agree with it and other circumstances where I wouldn't.
I have not done the kind of analysis that would be required to try to determine whether I would always agree or always disagree with such a statement.
Q. You were relying on Exhibit 1041 for your opinions in this matter; correct?
A. For very specific teachings, of which this is not one.
Q. But you looked at the whole document before you relied on a portion of it; right?
A. Of course.
MR. DAVIS: Objection.
Form.
BY MR. CAPLAN:
Q. Why don't we turn to the Wakabayashi reference, which is Exhibit 1027.

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(Exhibit 1027 for identification, Wakabayashi reference, shown to witness.)
BY MR. CAPLAN:
A. I have it.
Q. I know we've talked about this exhibit before so we'll get to some particular new questions.
We can turn to Figure 7 of the Wakabayashi patent, just as an example.
A. I have Figure 7 in front of me.
Q. Okay. Just so -- I'm jumping off point for this discussion.
Can you just explain the functions and relationships of the imager device 27, the camera circuit board 29 and the circuit board 39 in Wakabayashi shown in Figure 7?
MR. DAVIS: Objection to form.
A. Well, so as an example, I discussed this and illustrated on 42 of my declaration, and the image sensor 27, a generally square shape on first plane; 29, a first circuit board with a length and

width defining a first plane; and 39, a second circuit board having a length and a width defining a second plane.

Those are some of the features that are illustrated by Figure 7.

Q. And the image sensor 27 includes the photo detector array; is that right?

A. I believe Wakabayashi always refers to it as a -- I want to use his words -- always refers to it as a solid state -- I just want to use -- I don't want to be loose about his wording.

He calls 27 -- I'm trying to find the first spot for -- an imager device. That's in column 5 at line 57.

But he refers to his -- sorry, I'm still trying to find it. He always refers to it as a solid state -- and I don't remember whether he calls it imager, imaging device -- that's all I was trying to find.

But element 27 is where that would be present, yes.

Q. And we never really talked about

the claims yet, we'll get to that, the claims of the '052 patent, but in the claims it does talk about circuitry to convert pre-video signals to post-video signals.

Do you recall that?

A. Yes, I believe it may be more than one claim, yes.

Q. Sure. And it's your testimony in this matter that board 39 is where that pre-video to post-video circuitry is located; right?

A. So in my analysis in my declaration, let me find that element with respect to Wakabayashi. So that is discussed beginning on page 82 of my declaration as an example, "Element 1.f" is how I labeled it, and that does include reference to a second circuit board defining a second plane, and that circuit board including circuitry thereon to convert pre-video signal to post-video.

In my analysis of that, which I believe -- it's both here and it's earlier.

This particular -- so if you look at paragraph 128 of my declaration, I actually point us back -- sorry, it's to Section VIII.A, and in that particular discussion back at VIII.A, let's go there, I do discuss my opinion that it's obvious to locate that circuitry on circuit board 39, so that's in VIII.A. it starts at page 28.

So really I think the appropriate discussion is roughly pages 45 of my declaration, paragraph 71 up through 74, and in paragraph 71, 72, 73, I try to go over where Wakabayashi has identified locations for various things.

And in paragraph 74, I am -- it is my opinion that it would be obvious to put that conversion from pre-video to post-video on 39, and then on page 48 give some of the reasons why I think one of ordinary skill would be motivated to do that. 39 is bigger, there's more space, easier to put it on 39 than 29 and so on.

Q. But board 39 is not where the pre-video to post-video conversion

circuitry is located in Wakabayashi, is it?

A. That's correct.

As I state in the middle of page 48, furthermore, by mounting this processing circuitry on circuit board 39 instead of circuit board 29, the size of circuit board 29 is advantageously reduced and the video unit -- video camera unit that rotates is made smaller.

So, yes, it is -- in Wakabayashi, he shows one configuration and he puts it on 29.

It's my opinion that one of ordinary skill would recognize that you can move it to 39 and that there would be advantages to do so. In fact, putting it either place is simply an obvious design choice.

Q. But board 29 in Wakabayashi is where the pre-video to post-video conversion circuitry is located in your opinion; correct?

A. I -- so I don't think it's in my opinion.

Wakabayashi discusses the various circuits. He talks about the block diagram of Figure 22, for instance, and based on that discussion, Wakabayashi does show an embodiment or implementation where he places the pre-video to post-video conversion circuitry, which I believe is in block 102 of Figure 22, he places a dotted line around 100 and 102, and I think it's somewhere around column 5 -- I'm not sure exactly now where it is -- he identifies that those components would be both the solid-state imaging chip and circuit board 29.

I think that's simply a design choice. That's one obvious place to put the conversion from pre-video to post-video, one obvious place to put it is in 29. The other obvious place to put it is 39.

Q. It's not the obvious place.

It's where Wakabayashi actually put it; isn't that right?

A. Well, I think that there are two

obvious places to put it. Wakabayashi gave one embodiment and he chose to put it on 29.

I discuss in paragraph 74 of my declaration why it's my opinion that one of ordinary skill would have found it obvious and been motivated to consider and, in fact, place it on 39 as opposed to to 29 because -- just because Wakabayashi showed it on 29 doesn't mean that's the only place it could be. There's got to be two places, 29 or 39. I think they're both obvious choices.

Q. Wakabayashi doesn't say alternatively, stick it, stick the circuitry that's on 29 onto board 39, does it?

A. I don't believe he does, but he also doesn't say that he expressly limits the circuitry to be only on 29.

There's no express teaching that says it must be on 29. That is not in here.

Q. Okay. If it's your testimony

that that pre-video to post-video conversion circuitry could be on board 39, couldn't it be on a different yet other board or location than Wakabayashi?

A. Well, Wakabayashi only has two circuit boards, 29 and 39. That Wakabayashi could have chosen to have three boards, yes, that's a possibility.

Again, I think it's just a design choice. But what he does disclose is two.

Q. If you were to put the pre- to post-video conversion circuitry on board 29, would that affect the cost of manufacturing the Wakabayashi device?

A. I would not expect it to.

I have discussed in paragraph 74 a number of things that I do believe it would impact. For instance, the size of circuit board 29, which would have an impact on the potential size of the video camera unit. That's the piece that moves.

Making that smaller or lighter, he goes to great length talking about

making sure that the hinges don't have to be terribly strong. He talks about a lot of those things that relate to the size and weight of that video camera unit, which is, if you look at Figure 2, I don't know whether that's 5 or whether it's 17, honestly -- I think it's 5 -- but the video camera unit is the piece that moves.

Q. Is it your testimony that by moving the pre-video to post-video -- well, strike that.

If you moved the pre-video to post-video circuitry to board 39, what is the purpose of board 29 at that point?

A. Well, board 29 supports the image sensor, and board 29 can support other circuitry. For instance, it could support timing and control.

There are -- I don't remember what else -- let's see, what else does he say in his disclosure about 29.

But there could be filter capacitors. There could be any number of components.

Q. So then you would agree that if you were to move the pre-video to post-video conversion circuitry from board 29 to board 39, it would require redesigning other aspects of the Wakabayashi device; right?

MR. DAVIS: Objection. Form.

A. No, I wouldn't phrase it that way. The other circuitry might very well require no redesign whatsoever. The output from the sensor goes into the pre-video to post-video conversion circuitry. It's just a question of getting that output to that circuitry.

Well, the wiring is already present on the board. Would the layout of the board be different? Sure. But, again, it's just a design choice.

Q. Did you analyze what changes would need to be made to Wakabayashi if you moved the pre-video to post-video circuitry from board 29 to board 39?

A. Well, only in the general

context, as I've stated in my opinion, that I think that is an obvious design choice, that relocating that circuitry would lead to things that would be well within the skill of one of ordinary skill with great expectation of success.

It's just rearranging traces on a board. They had to arrange them one way. You arrange them another way. It's just a design choice.

Q. So then you agree if it's just a design choice, you would still have to change the design to accommodate that move from circuitry on board 29 to board 39; right?

A. Well --

MR. DAVIS: Objection to form.

A. Wakabayashi doesn't provide a layout for board 29 to start with, so one of ordinary skill in implementing Wakabayashi, as he happened to have disclosed it, would also have to have done a design.

In either case, one of ordinary

skill in the art reading the art has to use their own knowledge and creativity. And one of those things would be Wakabayashi doesn't identify specific circuitry or how that would be represented by components with a specific layout of a printed circuit board. You'd have to do that design either way, whether the video -- pre-video to post-video conversion is done on 29, whether it's done on 39.

One of ordinary skill would have to do the design, yes, but they'd have to do both designs. Wakabayashi doesn't provide a design, a layout, a component selection process.

Q. So you agree, though, that Wakabayashi illustrates a design where the pre-video to post-video conversion is on board 29; right? You agree with that?

A. So in terms of block level functionality, Wakabayashi discloses a video -- pre-video to post-video conversion placed on board 29.

He doesn't provide with great

details about what those components are, how to lay out the printed circuit board, where to solder what component, but at the block level, he does identify that that circuitry would reside on 29, and in my opinion it's obvious to one of ordinary skill that could have equally well decided to put it on 39.

Q. It's your testimony that you don't know what else is on board 29 besides the pre-video to post-video conversion circuitry; right?

MR. DAVIS: Objection to form.

A. I'm not sure that's exactly how I said it.

I don't think Wakabayashi details -- well, he does detail a few things. Let me look.

So in column 9 starting at line 9, he's generally talking about Figure 22, and he states that the camera circuit 102 includes a camera signal processing circuit, synchronization signal generator circuit and so on," generates --

So he identifies in broad terms two things. He also says "and so on," so whatever other components the designer felt were necessary.

Q. So it's your testimony that it's obvious to move and so on from board 29 to board 39 as well; is that right?

MR. DAVIS: Objection to form.

A. Not and so on.

It would be obvious that you can move circuitry from one to another. That's a design choice.

Q. Would you agree then if you start moving circuitry from one board to another -- strike that.

Would you agree that if you start with a design at the outset which has certain components or circuitry on one board and you want to start moving some of that circuitry and components to another board, that would entail redesigning the overall product?

MR. DAVIS: Objection to form.

A. So if one did the design work to

place the components one place and they have to do that, they weren't given a design by Wakabayashi, then the design placing the components on a different board is a different design, but in either case, one of ordinary skill had to do the design, and it's my opinion that that design is not substantially different. They're just two obvious places to put it.

So in your hypothetical the premise was you already had the design. Well, I don't agree that you already had the design. Somebody had to do that, and Wakabayashi didn't do it.

Q. So is it your testimony then that if you moved the pre-video to post-video conversion circuitry from board 29 to 39, you would still have other circuitry remaining on board 29 even after you made that change?

A. That's not what I testified.

I said you might. Depends on the overall design, what the requirements were for the various pieces of that design.

Q. Is there anything in Wakabayashi that suggests you should move some circuitry or components on board 29 onto board 39?

A. Well, Wakabayashi doesn't actually give the circuitry details for anything that he discloses. There's no question that he discloses one embodiment where the video -- pre-video to post-video would be on board 29. There's nothing that says that you are expressly limited to that.

So I think, again, it's a design choice that one of ordinary skill in the art would be able to make. Put it one place, put it the other. It's got to be on one of the two boards.

Q. Would you be able to eliminate board 29 all together in the design of Wakabayashi?

MR. DAVIS: Objection to form.

A. Well, the solid-state imaging device 16 would have to be mounted to something, and I think the most obvious

thing to do is the way Wakabayashi did it, with 29, where you solder the device into that board. There has to be electrical and physical support for that chip.

Would it be possible in the universe of all things to come up with a way to do it without using a circuit board, sufficient such as illustrated by 29? I don't know. I suppose, maybe, but I don't know.

Q. So it's your testimony that Wakabayashi would be combined with the Ackland reference? And so the record is clear, Ackland, which you've spoken about in the past, is Exhibit 1006.

A. Sol I have -- my testimony or my opinion is that for certain of the claim limitations in the '052, that the combination of those two would render those obvious, yes.

Q. I have a question about your declaration.

In your declaration, I believe you referred to the imager -- I was looking

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for something in particular. Give me one second here.
Go back, actually, to what you were just talking about, with the move of circuitry from board 29 to 39.
If you were to move the pre- to post-video conversion circuitry from board 29 to 39, how much would that reduce the size of board 29?
MR. DAVIS: Objection to form.
A. Sol I have not tried to put a percentage reduction on it to that.
It would depend on the size of the various components used to do that.
If we were to use Figure 7 -- well, actually, cross-section would be better. So if you look at page 74 of my declaration, I've got Figure 3 from Wakabayashi reproduced with some labeling, the image sensor and the first circuit board 27 and 29.
Q. Okay.
A. And with the reduction of components necessary to be placed on 29

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while still mounting the image sensor 27 on it in the same manner as Wakabayashi illustrates -- what is that -- a reduction in area of -- I don't know -- maybe a third, I haven't put a ruler to it.
Q. How do you know that?
A. Well, I'm looking at the approximate cross-sectional drawing shown in Figure 3.
Q. But you testified that Wakabayashi doesn't actually show you the components that are actually used; is that right?
A. That's correct. And that's why I said potentially as much as. Assuming that you solder 27 to 29 in this same way it's illustrated.
Q. Why would you have to do that?
Why would you have to keep it the same way? If you change other things, why keep that?
A. I think I testified just a few moments ago that I don't know that you would have to do it that way. I haven't

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considered that because Wakabayashi discloses the chip that 27 is mounted and soldered to 29.
Could you come up with another way to do it? Again, I think I testified just a few minutes ago in the universe of all possibilities, maybe.
Q. Is there any component you could not move to board 39?
A. Again, it's not --
MR. DAVIS: Objection to form.
BY MR. CAPLAN:
Q. I'm sorry, I didn't hear that.
I think there was an objection and I didn't hear an answer.
A. It's not something I've considered. I haven't -- I haven't tried to decide -- Wakabayashi discloses "and so on." I haven't tried to establish what "and so on" might or might not include.
Q. So you don't know, actually, as far as that goes?
MR. DAVIS: Object to form.
A. As I sit here right now, I've

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not done any such analysis.
Q. Is there any component described in Wakabayashi or needed for Wakabayashi that you couldn't move to board 29?
MR. DAVIS: Objection to form.
A. Well, I'm going to paragraph or column 9, where he describes circuitry involved in the camera circuit 102 and specifies some things that it includes.
And considering he said, once again, "and so on," I have not tried to do an analysis to determine whether everything included in "and so on" could be moved or not. I just haven't done any such analysis.
Q. Do you know how large the components or the boards are in Wakabayashi, particularly boards 29 and 39?
A. Not with any specificity other than the descriptions shown, the size -- the approximate sizing, and I have discussed in my declaration about what I believe one of ordinary skill in the art would expect this -- I always forget

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whether it's 5 or -- whether it's -- the moveable part, approximately what its size would be.

Q. So is it your testimony -- well, let me just...

Could you do away with board 29 all together?

MR. DAVIS: Objection. Form.

A. I have not considered that situation. I don't know. I haven't done the analysis.

Q. Is there an optimal location of the circuitry and components for boards 29 -- restate.

For board 29, is there an optimal location for the circuitry and components on board 29?

MR. DAVIS: Objection to form.

A. Again, Wakabayashi only points to things such as synchronization signal generator circuit, the camera signal processing circuit and so on.

And until you have a specific

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design, I don't think you can decide about optimal locations.

I do believe, as I've stated, that it would be obvious to locate the pre-video to post-video conversion circuitry to 39. I've given you a number of reasons in my declaration why one of ordinary skill in the art would consider that, and I don't see anything that would teach one of ordinary skill that they must put it on 29.

Q. But you agree that Wakabayashi gives an exemplary -- not exemplary -- gives an actual arrangement for its device which has imager device 27 and circuit board 29 and circuit board 39, and it explains the functions for those. That's what Wakabayashi actually teaches.

Do you agree with that?

MR. DAVIS: Objection to form.

A. What Wakabayashi teaches is arrangements physically of the various boards and the imager device.

He discusses circuitry in a

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block form, so he doesn't actually give any circuitry at all. He gives a block description. And he does identify places to locate certain of those functions either on 29 or 39.

So, yes, I would agree he does show an example. I didn't see any place where he says "this is the only way you can do it."

I believe one of ordinary skill in the art would recognize that these are design choices. And, for instance, the pre-video to post-video conversion circuitry, it has to be somewhere. It's either got to be on 29 or it's got to be on 39. There are only two choices.

Wakabayashi showed it on 29. He taught nothing that said you cannot put it on 39. I think they're both obvious choices. He chose to disclose one of the two.

Q. There's nowhere on Wakabayashi that you can identify, though, that says "put any particular component somewhere

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else" that is described in Wakabayashi, is there?

MR. DAVIS: Objection to form.

A. I think it's correct that Wakabayashi does not provide any -- what's the right phrase -- any explicit restriction as to where to put components.

Q. And you have no opinion as to the optimal location of components that are described in Wakabayashi, do you?

MR. DAVIS: Objection to form.

A. Well, the only component that I was considering in this case is the pre-video to post-video conversion circuitry, and in terms of optimal, deciding whether something is optimal depends on what your design goal is.

So there's an implicit assumption there which you haven't specified.

I've given a number of reasons why I believe one of ordinary skill in the art would recognize that moving it could lead to a smaller moveable camera, and that

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given Wakabayashi, that might be desirable.

I would agree that he taught -- Wakabayashi -- apparently he could get it small enough for his purposes by putting it on 29, but that doesn't mean someone else might not want to make it smaller still.

Q. So you would agree there's nothing in Wakabayashi that says "take this information that we described for our device for the purposes we describe, and amend it or change it further to get further new aspects of any particular feature," there's nothing in Wakabayashi like that, is there?

MR. DAVIS: Objection to form.

A. There's nothing in Wakabayashi that says "you must put it on 29." He never says "you must put it on 29, you may not put it anywhere else."

And by not providing an express statement that says "you cannot move it," one of ordinary skill should use their ordinary creativity and their ordinary understandings of circuit designs and

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layouts.

And in my opinion, they would recognize that you could put the pre-video to post-video conversion circuitry on 39.

Wakabayashi teaches nowhere that you are not allowed to do that.

Q. Wakabayashi also has a driving circuit; right?

A. At least one, yes. He talks about driving circuit or circuits. I don't remember whether it was plural or not.

Q. And that's driving circuits on board 29, isn't it?

A. So I have to find -- until I find it, I don't remember whether it's on 29 or 39.

Again, it's got to be one place or the other. So driving circuitry -- let's see. I'm looking at column 9 right now, trying to see whether that's where it describes -- uses anything including the word "driver" or "driving."

Q. Well, in the same portion of column 9 that we've looked at before, it

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looks like lines 9 through 14.

A. Yes, thank you.

I see a sentence there that says "a camera head 100, which includes a wide receiving lens, a solid-state imager device, a circuit for driving the solid-state imager device and so on generates an optoelectrically converted signal 101," and in that case he's talking about functionally what he called 100, which he describes there as a camera head. And he does mention driving -- circuit for driving, but, of course, again he says "and so on," so it could be a variety of different things. It could be there.

Q. So is that driving circuit, circuitry or component you could move off of board 29 based on what's shown in Wakabayashi?

A. He certainly I don't believe anywhere says "you cannot move it," and by -- he gives a disclosure where in general it's located on or -- on 29.

But I don't think -- in fact,

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I'm confident he doesn't say "you must place it on 29."

Now, I didn't consider, I don't believe, that it's an issue as to whether one might move it to 39. I didn't consider that issue because the circuitry at issue was the location of the video -- the pre-video to post-video conversion circuitry.

Q. If board 29 fits in its current location in Wakabayashi, why would you -- what's the motivation to reduce the size of that board if it works as set forth in Wakabayashi?

MR. DAVIS: Objection to form.

A. Well, I think Wakabayashi might suggest that it works. It doesn't suggest that it couldn't be better.

This is the embodiment he presented. He didn't say there is no other embodiment that might match my claims, for instance. Now that would be claims.

But I don't think this would tell one of ordinary skill in the art to

never consider the possibility of making this moveable head even smaller or even lighter.

Q. But that's not what Wakabayashi did. Wakabayashi did what it shows; is that right?

MR. DAVIS: Objection to form.

A. Well, Wakabayashi disclosed what it disclosed. It didn't limit it to that and I don't know whether he ever did anything else, but certainly in this patent, that's what he illustrates.

Q. So if you want to reduce size, why not just move -- if you're trying to reduce the size of a Wakabayashi device, if that's your view of what you can do with Wakabayashi, why not move all of the circuitry off of board 29?

MR. DAVIS: Objection to form.

A. I think it's a design choice.

You might choose to move some and make it somewhat smaller. You might choose to move more.

At some point, it probably isn't

going to be smaller than 27, the image sensor. So at some point making it smaller is now set by that as opposed to circuitry on 29. I think these are simply design choices --

Q. So you can --

A. -- one of ordinary skill in the art would be capable of making. These are just design choices.

Q. So you can move any of the components or boards just for the sake of moving it; is that right?

MR. DAVIS: Objection to form.

A. I did not say that you moved them just for the sake of moving them. I gave you motivations. Making it smaller, making it lighter.

Q. Okay.

MR. CAPLAN: We've gone for about an hour so take a break here?

15 minutes good?

THE WITNESS: Fine.

MR. CAPLAN: Thank you.

(A recess was taken.)

BY MR. CAPLAN:

Q. Dr. Neikirk, kind of picking up with the topic we were talking about with Wakabayashi, if you can turn in your declaration, it's page 47, Exhibit 1004, and I believe it starts in paragraph 74.

A. I'm there.

Q. And you were talking before the break about some of these issues about your testimony as to what's obvious or not.

And, in particular, paragraph 74, you're talking about motivation about how a person ordinary skill would be motivated, find it obvious to put that pre-to post-video conversion circuitry on board 39; right?

A. That's correct.

Q. Okay. And you give a reason there, and one of the reasons you give is because board 39 is the larger of the two boards, and therefore there's more space.

Do you see that?

A. Yes, that's at the top of page 48, yes.

Q. Right. So first of all, how much larger is board 39 than board 29?

A. I haven't tried to calculate a multiplier. I would have to figure -- Figure 5 of Wakabayashi, in particular, I'm looking at page 33 of my declaration.

Q. Page 33?

A. 33. And I have added colors. In particular, the color for circuit board 39 in green, and you can see that it occupies a substantial fraction of the space in the housing.

Q. And do you know what circuitry is located on board 39?

A. Well, I believe that back in paragraph 74 on page 47 of my declaration, I culled out from Wakabayashi, that's in column 6 -- is that right -- I'm trying to find -- there's a quotation there:

"Circuit board 39 includes a signal processing circuit, a driver circuit, a systems circuit, a power supply circuit and so on."

And -- let's see. Yes, so you

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can see that I believe the citation is in column 6, lines 5 through 10 of Wakabayashi, and that discusses things on 29.

Q. And do you know how much of circuit board 39 is occupied by the circuitry and components identified in Wakabayashi?

A. No --

MR. DAVIS: Objection. Form.

A. Wakabayashi doesn't give any specific actual circuitry components. He gives general functional description.

He provide no layout, no express design for how to arrange components on a board, how to interconnect those components using traces on the board and so on. It's a generic description.

I think that one of ordinary skill in the art using their ordinary skill would recognize that they have design flexibility and, in fact, more with locating components on 39 because it is

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larger.

Q. But in the actual design of Wakabayashi or what's shown of Wakabayashi, you don't know what limitations are -- let me rephrase that.

Is it your testimony that there is space available on board 39 to move the pre-video to post-video circuitry, and if that is your position, how do you know that?

A. Well, as I've stated --

MR. DAVIS: Objection. Form.

A. -- it's obvious to one of ordinary skill in the art that you could relocate.

Wakabayashi doesn't provide any express statement that you may not. He doesn't say "you must place it on 29."

And similarly, he's rather vague about what's on the rest of 29 and 39. He uses "and so on."

One of ordinary skill in the art would have to do a design regardless.

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When looking at Wakabayashi, I think it's clear that he wants the size of the moveable camera head -- I always think of it as being element 5, I'm not sure that's really quite the right element number. But if you look at most of the figures, it's clear I'm talking about the moveable part.

But that has to be small and light to accomplish the mechanics that he wishes to have. The rest of the housing, so I think broadly it is 2b, which contains the circuit board 39, he places no particular guidance as to whether that might be desirably slightly larger, slightly smaller. He's, I think, completely silent about that.

So one of ordinary skill, understanding they have to do a design no matter what, I think would recognize that they might gain design flexibility by placing the conversion, video conversion circuitry on 39, and, in particular, the ability to reduce the size and weight of

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the moveable camera head.

Q. The moveable camera head is not a feature of the '052 patent, though, is it?

A. No, it's not.

Q. So when you're looking at Wakabayashi with respect to the claims of the '052 patent, the moveable camera head doesn't really focus into it, does it?

A. Well --

MR. DAVIS: Objection. Form.

A. It factors in, as I've pointed out in paragraph 74, page 47 to 48 of my declaration, this design would fit Wakabayashi's own goals.

One of ordinary skill in the art reading Wakabayashi, I believe, it is my opinion that they would have recognized that they could go even further. They're not required to. But, again, there are two design choices. If you put the video conversion circuitry on 29, you put it on 39.

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Two obvious choices, both well within the -- within the skill of one of ordinary skill, and I'm simply pointing out that if you pick the obvious choice of putting it on 39, then that discloses the claim limitations of the '052, or certain claim limitations.

Q. I think you may have broken up for a minute there.

THE COURT REPORTER: Did you say "or certain claim limitations"?

THE WITNESS: Yes. I think I may have said before that something like "the claims of the '052."

Well, obviously it's not all of the claims. It's limitations of the '052.

BY MR. CAPLAN:

Q. So it's your testimony that there is no place in Wakabayashi other than board 29 or board 39 to put the pre-video to post-video conversion circuitry?

A. Well, I think Wakabayashi discloses two boards and a battery.

I don't think one of ordinary

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skill in the art would normally put circuit on a battery. I suppose they might be able to. That they could have added a third board. Wakabayashi I don't think says you cannot add a third board.

Again, there's no express statement that you are never allowed to add another board.

Q. Why not just use a camera-on-a-chip design in Wakabayashi?

MR. DAVIS: Objection to form.

A. If there was a camera-on-a-chip design available at the time we're talking about that included video conversion circuitry, I'd say that's another obvious choice. So now -- I apologize -- there's not just two places. Perhaps there are three places you could put it.

Q. And part of the reason also in your paragraph 74 is, you say: "By mounting the process and circuitry on board 39 instead of 29, the size of the circuit board is advantageously reduced in the video camera unit that rotates is made

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smaller, number 1" -- I'm sorry -- "and the video camera unit that rotates is made smaller."

Right? Do you see that?

A. Yes. That's about the middle of the paragraph. It's on page -- about in the middle of the page, yes.

Q. And then you cite two examples from or language from Wakabayashi that those were features; right?

It says: "A video camera unit made compact to realize reduction in weight."

Do you see that?

A. Yes, that's in his abstract.

I would say that that's an identification by Wakabayashi of something that he's trying to accomplish.

Q. And then further down, you also quote, and it's underlined, it says, "since the video camera unit is composed of minimally necessary parts."

Do you see that?

A. I do.

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Q. So that was the design of Wakabayashi, to have -- to use minimally necessary parts.

Do you agree with that?

A. Well, I think that that is -- again, this is all in the abstract. I believe that's in the abstract. It might have been in column 2.

But, again, as general goals, I think that's what he's identifying. He hasn't given a component-by-component design anywhere. One of ordinary skill is still going to have to do that.

So the definition of "minimally necessary parts" is rather dependant on the exact design.

Q. But you would agree that Wakabayashi at the outset was interested in compact -- being compact to realize a reduction in weight and composed of minimally necessary parts; right? You agree with that?

A. I think what he's pointing out is that he is trying to make a camera unit

made compact. He's pointing out things to try to do.

I don't think he's given any express statement that you must do this and not do something else.

These are goals. I think he presents a design where he feels that his selection satisfies the general constraints.

But I don't believe that that in any way, shape or form suggests that, for instance, moving the video conversion circuitry, the pre to post-video, is precluded.

In fact, minimally necessary parts would suggest moving it. But apparently he felt that his version was acceptable leaving it where it was.

I don't think any of that is incompatible with his teachings.

Q. But the Wakabayashi teaching was exactly what's in Wakabayashi; right?

A. No. That was an embodiment. He provided no teaching that

says that the minimally necessary parts requires the video conversion circuitry.

He didn't define this expressly anywhere. I think that's up to the designer to think about.

And he showed a design where he could accomplish at least enough of his goals to be designed and considered acceptable.

Had he believed that the minimally necessary parts required the video conversion circuitry, then I would have thought he would have said you must place it on circuit board 29. He never said that.

Q. Okay. You do agree that circuit board 29 is where he actually put the pre- to post-video conversion circuitry; right?

A. In the discussions that he's provided about the circuit functional boxes labeled in Figure 22, including 100 and 102, I believe that he is showing that the video conversion circuitry is inside 102, inside that dotted box, and that includes

circuit board 29, yes.

Q. You've talked a little bit about Ackland today, the Ackland patent, Exhibit 1006. I want to turn to that for a little bit.

(Previously marked Exhibit 1006 for identification, Ackland patent, shown to witness.)

BY MR. CAPLAN:

Q. On page 39 of -- not page -- paragraph 39 of your declaration, it's page 19, if you'll turn to that.

A. I'm there.

Q. The beginning of paragraph 39 talks about the Ackland reference, and you cite Ackland for the feature of a pixel array with timing and control circuitry separate from the processing circuitry.

And my question here is, where does Ackland show timing and control circuitry separate from the processing circuitry?

A. Well, in Figure 3, he shows a block labeled "signal timing and control

190," which is separate from the pixel, obviously.

In Figure 6, he shows a dotted box labeled "active pixel imaging system" and inside of that box is "timing and control," and he has an arrow pointing out of that that says "to processing circuitry."

Q. Okay. Were you done? I'm sorry, I didn't want to --

A. I reference Figure 6, and I just described it in my text on page 20, I pointed to Figure 6.

Now, if you look at Figure 6, you see timing and control, which is separate from processing circuitry.

Q. When you say it's separate from the processing circuitry, what do you mean by "separate from"?

A. Exactly as it's shown. It's not the same as. It's separate from the processing circuitry.

Q. Is it -- I'm sorry?

A. No, no, go ahead.

Q. Is it on-chip or is the timing and control circuitry on-chip with the processing circuitry in Ackland?

A. I'm sorry, would you repeat the question?

Q. Is the timing and control circuitry on-chip with the processing circuitry in Ackland?

A. I think Ackland discloses that the processing circuitry is on-chip.

I don't think Ackland says the processing circuitry is on-chip.

Q. Does it say it's on-chip or off-chip?

A. I don't think it says it's on-chip. Given Figure 6 -- let's see what he says. I have to look at the text for processing circuitry.

So he says in column 8 at line 40 -- I think that's line 48:

"Output signals from the amplifiers 18 are provided to the common output line 19 in serial fashion based on timing and control signals from timing

control 20. The output signals are routed to suitable processing circuitry not shown." He indicates these are output signals.

I see nothing there that would suggest to me that the suitable processing circuitry that is not shown is on-chip.

Q. Do you see anything in Ackland that says that the suitable processing circuitry is off-chip?

A. I don't know that he ever uses the words "on-chip" or "off-chip" in Ackland itself.

He does describe Figure 6 at column -- well, it starts at column 59, but he describes -- it says that "exemplary imaging system 1 shown in Figure 6."

Q. I'm sorry, make sure I'm in the right spot. You said --

A. Column 7.

Q. Oh, column 7.

A. Column 7, sorry. And the paragraph starts at paragraph 59, where he describes a plurality of single poly

silicon active pixels 36.

He proceeds to say that "exemplary imaging system 1 is shown in Figure 6." "System 1" -- I'm not sure he ever uses the "number 1" -- but looking at Figure 6, again, as I pointed out, the "to processing circuitry" is clearly separate from timing and control.

Q. And what are the components that make up the timing controller 20 that's shown in Figure 6?

A. So I think we had this discussion the other day.

There are numerous circuits that could be used for the signal timing controller. Ackland itself, this reference doesn't give you a specific circuit.

Q. And it was your testimony that a person skilled in the art would understand there would be a number of options and a person of skill in the art would be able to implement some of them; correct?

MR. DAVIS: Objection to form.

A. I believe that I stated my

opinion that one of ordinary skill in the art would recognize there are many circuits that could provide this functionality.

Given the specific details of the rest of the array, I believe they could implement it in more than one way, but they would be capable of implementing.

Q. In Ackland itself, referring to Figure 6, there is a description in Ackland of the operation of the pixel array, and that -- would that also inform a person of skill in the art as to how to implement the timing and control circuitry?

MR. DAVIS: Objection to form.

A. It would partially inform that. He has a row decoder 10, which suggests a bus control, the double-headed arrow.

I don't provide -- I don't think he says anything more than functionally it's a row decoder 10. Again, this could be implemented I think with numerous -- many different circuits.

The circuit choices for row decoder would influence the circuit choices

for the timing controller.

Q. Okay. Anything else in Ackland that would influence the design or components used for the timing and control circuitry?

MR. DAVIS: Objection.

Form.

A. Well, influence, yes. I think -- let's see. 18 are his -- what phrase did he use for component 18 -- he describes it as a plurality of output amplifiers.

He does describe this as providing a single analog output on line 19.

Q. What column are you in? I'm sorry?

A. Oh, 19 is an amplifier that is in column -- I'm sorry, I found it and now I've lost it again. Give me one moment.

18. I was looking for 18.

So if you look in Column 7 at line 65, it describes a row decoder 10 and a plurality of output amplifiers 18, and it further discloses somewhere that it

produces a single analog output on line 19.

There would have to be circuitry that interacts with the timing controller to make sure that those amplifiers are in some sense multiplexed. They aren't all on at the same time.

Q. So is it your testimony that what's described in Ackland would, in fact, provide the information a person of skill in the art would need to implement one of the options available to one of skill in the art for the timing and control circuitry?

MR. DAVIS: Objection.

Form.

A. I think that one of ordinary skill in the art would have many circuit choices to make for the row decoder 10, the timing controller 20 and the amplifier blocks 18, and depending on any specific one of those, say, choices in 10 and in 18, would influence the variety of choices that would work for 20.

In other words, there are many

circuit combinations here. The block functionality I think they would recognize generally and have numerous circuits to work with.

Q. There is no driving circuit described in Ackland, is there?

MR. DAVIS: Objection.

Form.

A. So one of the advantages that Ackland specifies is discussed in a paragraph in Column 7, and right around 20 he says: "This is effectively the same timing if the transfer gate 113 were a clock. Neither a clock nor its associated driving circuitry is required."

So this is a specific part of operating the pixels. He's saying by going to the single polysilicon approach you would not need, that is not presumably the only driving circuitry or the only timing circuitry.

You have to operate the transistor switches in the pixels that he illustrates. That requires driving

circuitry, for instance, but he is eliminating some.

Q. You testified previously that Wakabayashi, the imager device in Wakabayashi has and requires a driving circuit.

Do you recall that?

A. I don't think that's how I phrased it.

Wakabayashi certainly discloses having drivers. He doesn't disclose the specifics of those drivers because he is open to any solid-state imaging device and the specifics of those drivers would depend, among other things, on that.

Q. But Wakabayashi, in fact, describes an imager device which requires a driving circuit; correct?

A. No, I don't think -- what he said was that there were drivers.

He doesn't say -- and he did say, I believe, drivers for.

Ackland doesn't say there are no drivers. He illustrates a specific one

that you don't need because of a single polysilicon.

All circuits require some drive.

Q. We talked about this earlier today, but in Wakabayashi, in the Exhibit 1027, in column 9, it was at line 12, it does describe a circuit for driving a solid-state imager device.

Do you recall that?

A. I believe you quoted it accurately. He doesn't describe it. He says it exists. And does not say what that circuit is. Provided no details.

Q. Okay. You admit that Wakabayashi describes an image device with a circuit for driving the solid-state imager device; right?

A. So can you point me to the specific location in Wakabayashi again?

Q. Sure. In column 9, if you look, it should be between lines 10 and 14.

A. Yes. What he describes is a camera head 100, which includes a wide receiving lens, a solid-state imager

device, a circuit for driving the solid-state imager device and so on generates an optoelectrically converted signal 101 which is input into camera circuit 102. That's the complete citation.

He certainly mentions a circuit for driving the solid-state imager, certainly. But he gives no further details as to what kind of circuits he might classify as drivers because he didn't specify what the solid-state imager was.

Q. But you agree the Wakabayashi patent does describe a driving circuit for the solid-state imager; right?

A. With -- yes, without specifying any details about what that driving circuit may or may not be.

Q. You also agree that the Ackland reference describes a pixel array, an imager, a CMOS imager pixel array that does not require a driving circuit; right?

MR. DAVIS: Objection to form.

A. No. What he said was -- let's get the whole statement. So I'm trying to

find -- there's more than one location that's relevant to this. Where was that -- I'm sorry, I had it just a moment ago.

Q. That's all right.

A. I'm trying to find it again. There. So he specifically -- this is in Column 7, and the paragraph starts at line 17.

And he specifically talks about biassing the transfer -- the transistor gate 108 to VSS causes the transistor 113 to be off all the time except when electrons are transferred from under the photo gate 101 into the diffusion node 115.

So he's stating that, for instance, there is a transfer for gate, 108, which would have to be driven by VSS, but not all the time.

He further states that this is effectively the same timing as if the transfer gate 113 were clocked, "neither a clock for its associated driving circuitry." The clock's associated driving circuitry.

He didn't say the driving circuitry of the pixel. He said neither a clock nor its associated driving circuitry is required.

So, in fact, that sentence is talking about the clock and the clock's driving circuitry.

The beginning of that paragraph is illustrating that, as an example, gate 108 must be driven by VSS for part of the time and not by VSS at other times.

But he called out the driver, driving circuitry, but it was in reference to the clock.

Q. The Ackland CMOS pixel array does not require a driving circuit, does it?

A. No. What he said was it doesn't require a clock driving circuit. That's not the same statement at all.

Q. I'm asking you, Dr. Neikirk, is a driving circuit required for the Ackland CMOS pixel array?

MR. DAVIS: Objection to form.

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A. What Ackland discloses is what Ackland discloses.

He discloses that there is no driving circuitry for a clock required.

He also discloses that you must connect the transfer gate on a way to VSS at certain times and not to others.

Applying a voltage is driving something. Now, he didn't call that driver circuitry, but his only reference where he did describe something as driving circuitry was specific to a clock. Not to the pixels at all. So I would not agree that nothing in Ackland's design could possibly be characterized as driving circuitry.

Wakabayashi was open as to what one might consider to be driving circuitry. He didn't exclude one thing and include another.

The only thing that Ackland excluded was clock driving circuitry.

Q. But you can't identify a driver circuit expressly described in Ackland, can you?

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MR. DAVIS: Objection.
Form.

A. I believe I just gave you an example in paragraph -- in column 7, paragraph beginning at line 17, he's talking about a transfer gate 108.

Well, that's illustrated in Figure 3, and he discusses that it needs to be connected to VSS, but he also says not all the time. He says all of the time except when electrons are transferred.

Which means that you have to have circuitry that either provides VSS or turns it off, and I believe that one of ordinary skill in the art would recognize that that falls into the general category of driver circuitry.

Ackland provides no express statement what is and is not drivers, driving circuitry, and neither does Wakabayashi.

Q. In general, CMOS pixel array imagers do not require off-chip driving circuits, do they?

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MR. DAVIS: Objection.
Form.

A. No, I wouldn't agree with that at all.

Q. Do you agree that CCD pixel array imaging devices require off-chip driving circuits?

MR. DAVIS: Same objection.

A. Well, we haven't defined what all the possibilities for driving circuitry is.

I believe that CCDs have circuitry that would be viewed as driving circuitry. You probably can find an implementation where it's on -- off-chip. I don't know that you can't find one that's on-chip.

Q. What would you have to change in Wakabayashi to put the Ackland CMOS pixel array into the Wakabayashi design?

MR. DAVIS: Object to form.

A. This is not an exercise in unplugging one component and plugging another.

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One of ordinary skill in the art is going to have to use their skill to implement any of this. Wakabayashi gives very generic descriptions of functional block circuitry with no details. He doesn't tell you how to build that circuit.

One of ordinary skill in the art, I believe, could -- and Ackland similarly doesn't give details of how to -- the actual circuitry contained in his blocks 10, 20 or 18.

One of ordinary skill in the art is going to have to use their knowledge to implement all of that circuitry.

So I couldn't point to one thing in Wakabayashi and say "unplug this and plug this in in Ackland." That's not the exercise. It requires -- design regardless.

(Reporter clarification.)

BY MR. CAPLAN:

Q. Is it your testimony that Wakabayashi is just essentially a blank canvas to design a device under the general

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guidelines of Wakabayashi?

MR. DAVIS: Objection to form.

A. I certainly never used the words a blank canvas. Clearly Wakabayashi is not a blank canvas. It has numerous teachings.

Q. And which of them are you following and which of them are you not following in your combination with Wakabayashi and Ackland?

MR. DAVIS: Objection to form.

A. I don't think it's a case of not following.

It's a case of what would be obvious design choices to one of ordinary skill.

Wakabayashi discloses explicitly an image sensor and two circuit boards, batteries, housings. Certainly he discloses those.

Exactly how to implement those, I believe that's -- Wakabayashi doesn't tell you where to put a capacitor on a given board. That's within one of ordinary skill in the art's skill.

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So it's not a question of, "oh, I'm going to ignore this and keep that."

It's what it teaches, what one of ordinary skill in the art would know. And, in many cases, in looking at specific claims, one of ordinary skill in the art is aware of all of this literature -- Ackland, Wakabayashi, Swift -- all of those, because they're all in the same fields, and would recognize that some details that are more one place than another. But there's never every detail, so they're going to have to do their own design no matter what, but that's not a blank canvas.

Q. But, again, you testified previously there is nothing in Wakabayashi that says look at the teachings of Wakabayashi as a jumping off point to modify the location of every component that's described in Wakabayashi, is there?

MR. DAVIS: Object to the form.

A. I never testified -- I never used the word "jumping off point," so I didn't testify to that.

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Q. So you agree that Ackland, the teachings of Ackland don't represent a module that you would just plug into an existing product that's described by Wakabayashi; is that correct?

MR. DAVIS: Object to form.

A. I think I said this is not an exercise in unplugging one thing and plugging it into another.

All of these references require additional design to implement and one of ordinary skill in the art would be capable of doing that.

It's an obvious thing to combine and they would have the skill necessary to produce the rest of the functionality.

Now, there are many circuit choices. There's not just one, but there are many. That's not an unplug one thing and plug in another.

Q. If you were implementing Wakabayashi as it described, would you have to change the process for implementing Wakabayashi as it's described if you were

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going to then implement Wakabayashi combined with Ackland?

MR. DAVIS: Objection to form.

A. Well, Wakabayashi requires certain block functionality, and most -- in fact, I think virtually all, if not all of that block functionality is either separate from Ackland or is also described in Ackland in block functional form; for instance, timing and control.

So you're doing it for both of them. Neither gives you the circuit level, schematic circuit diagram of every functional block. So I'm not sure I'd say you're necessarily modifying anything in Wakabayashi.

Q. But it's your testimony, Dr. Neikirk, that you're not modifying an existing Wakabayashi design to accommodate a merger with the Ackland CMOS pixel array, is it?

A. No, I don't think I said that.

Wakabayashi is silent as to the type of solid-state imaging. Ackland is

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CMOS.

Now, that combination I believe is obvious. But Ackland clearly provides further information about the solid-state imaging device, which Wakabayashi expresses no -- no preference one way or the other. Never says.

Q. But Wakabayashi is not silent on the type of solid-state imager device.

It actually shows a particular structure that Wakabayashi describes, doesn't it? There is a -- let me rephrase it.

There is a proposed design for a device shown in the Wakabayashi patent, isn't there?

MR. DAVIS: Objection to form.

A. Which identifies a focal point array as a solid-state imaging device. That's all it says.

Q. But there are --

A. There are many -- and there are many such solid-state imaging devices. Wakabayashi did not express a

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preference for one type of solid-state imager sensor with respect to another.

Q. So is it your testimony as you sit here today that there's nothing in Wakabayashi that tells you the particular type of solid-state imager device it contemplates using?

A. Wakabayashi describes that focal point array as a solid-state imaging device. That's all he says.

Q. And there's nothing else in Wakabayashi that informs you as to what particular type of solid-state imager that would be that's contemplated for use in Wakabayashi?

A. Well, Wakabayashi indicates a pre-video output. He indicates pre-video -- he indicates conversion to video format.

So -- well, he just says that's somewhere in the camera block.

I don't -- I don't know that he does. He calls it a solid-state imaging device, that it has to convert optical signals into electrical ones. He describes

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that. But other than that, I don't think he's provided anything that would tell me one type or another.

Q. So it's your opinion and it's your testimony today that you don't have any further view on the actual type of solid-state imager that is represented by Wakabayashi other than it's just generically a solid-state imager; is that correct?

MR. DAVIS: Objection to form.

A. So Wakabayashi discloses that it's a solid-state imager. He discloses other circuitry, but none of that circuitry tells me -- none of that circuitry -- he only gives block functionally. He doesn't give me a circuit.

There's nothing there that allows me to reverse engineer to a specific type of solid-state imager. At least I see nothing there.

Q. Okay.

MR. CAPLAN: Well, I'm not sure when we started this session, but I

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certainly need a break now, so break now for 15 minutes.

THE WITNESS: Okay.

MR. CAPLAN: Thank you.

(A recess was taken.)

BY MR. CAPLAN:

Q. Turning in your declaration to page 111.

A. I'm there.

Q. And under the heading for "Motivation to Combine Wakabayashi and Ricquier."

A. Yes.

Q. So I want to start here.

We've been talking about the Wakabayashi reference, and you agree that the Wakabayashi does not provide the details -- strike that.

It's your testimony that Wakabayashi doesn't provide details on the type of solid-state imager that's described in Wakabayashi; isn't that right?

MR. DAVIS: Objection.

Form.

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A. I don't know that that's the way I said it. I believe Wakabayashi was silent as to which type of solid-state imaging sensor could be used within Wakabayashi.

That certainly includes not giving all the details because if you don't -- if you haven't even specified which type, you haven't given all the details.

Q. Now, you testified earlier that Wakabayashi in your view was a consumer camera; is that right?

MR. DAVIS: Objection.

Form.

A. It is -- I think I referred in sort of general terms that it looked like Wakabayashi was describing something that was a consumer camera, yes, I believe I used that phrase.

Q. Okay. And a consumer camera would be a device that the expectation of the consumer would be it would generate an image at a quality or a signal-to-noise level that would be worth looking at, would

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be good enough for people to take pictures and be able to look at them and appreciate them.

Would you agree with that?

MR. DAVIS: Objection to form.

A. You know, I certainly haven't -- in some broad sense, but I think there's an enormous range that would fall into that.

Q. Well, what kind of range would it be for a consumer camera, as you referred to Wakabayashi?

A. Well, some photographers might be exceedingly demanding. Others might be using a videoconference link like we are, where the quality of the video is not all that grand and -- but it still suits the purpose. I think it just depends on what that consumer wanted.

Q. Now, the Ricquier reference -- I'll get the number. It's 1041 -- 1041.

Ricquier we talked about earlier, and you agreed that described a --

A. Ricquier is not Exhibit 1041. It's Exhibit 1038.

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Q. You are right. I picked up the wrong one, so thank you.

A. I'm sorry. I just didn't know whether we were talking about Ricquier or --

Q. No, no. You were right.

We spoke earlier about it, and Ricquier, or "Ricquier," whatever it is, is -- it's a passive pixel array; isn't that right?

A. Yes, Ricquier shows photo diodes without an amplifier in each pixel.

Q. So that's referred to as a passive pixel?

A. I think the broad classification that much of the art that we're taught discussing used an active pixel is the one that contains the amplifier and the passive is one that does not.

Q. Okay. So what's the motivation or the reason to combine Wakabayashi with Ricquier and its passive pixel array?

A. Well, Wakabayashi, as I've stated in paragraph 169, does not expressly

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state that its imager device 27 includes an array of CMOS pixels.

One of ordinary skill looking to implement, as Wakabayashi describes it, let's use -- from his title, for instance, "Imager Apparatus with Rotatable Camera Head," would be clearly motivated to seek other information about solid-state imagers, and CMOS imagers are certainly one type.

Ricquier is a specific example that provides a number of details. I think they'd be aware of both Ricquier and I point out Dierickx and other references.

So in paragraph 170, I pointed out that Ricquier is in the same field, in this field of art, image sensors for use in cameras. It's pertinent to the problems of Wakabayashi, for instance, a solid-state image sensor.

Ricquier points out specific advantages of this type, so that would be one reason to pick selective addressability, multiple resolutions.

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So all of those things would be reasons why one of ordinary skill in the art would look to Wakabayashi in light of Ricquier.

Q. So the first reason you gave, or one of the first reasons you gave for combining Wakabayashi and Ricquier is that they're both in the same field because they're both solid-state imagers; is that right? That's one of the reasons?

A. Yes.

Q. So under that rationale, you would suggest combining Wakabayashi with any other solid-state imager; is that correct?

A. There are many obvious combinations that would lead to a variety of different features. They're all possibilities.

Q. And how would you decide which one -- which of all the possibilities that would be appropriate to combine with Wakabayashi?

A. Well, if it's obvious -- they

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could look at all of them. They're all possibilities. They're all obvious.

It doesn't mean that you discard one because of another. They're both obvious, or all three. I've done other combinations of Wakabayashi with Ackland. That's also an obvious combination. They're both obvious.

It's not exclusive. You don't -- it's not that you just if you have one you cannot have the other. They're both obvious.

Q. It says in your paragraph 170, you say that: "Like Wakabayashi, Ricquier is in the same field of art and is analogous art to the '052 patent. All are in the same field related to active CMOS image sensors for use in cameras."

Is that right?

A. Yes, that's what I said.

Q. Okay. Now, we just established that Ricquier, in fact, is not an active pixel array, is it?

A. No, that's correct. They're all

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-- so Wakabayashi is also not an active pixel.

They are in the same general field. They're related to image -- solid-state imaging sensors for cameras.

It's analogous art to the '052 and they are related. They're related to -- Ricquier to CMOS, Wakabayashi to solid-state image sensors is.

But, you're correct, Ricquier is not an active CMOS device and Wakabayashi is not limited to CMOS. It's any solid-state imaging sensor.

Q. And you go on in paragraph 170, and you say that, "Ricquier is reasonably referring to the alleged problems identified in the '052," and the first one you identify is "minimizing the size of the device."

Do you see that?

A. I do.

Q. Now, we were talking about this a little bit earlier with Wakabayashi and board 29 and 39, and I believe you

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testified that one reason that you could move from pre- to post-video signal converting circuitry from 29 to 39 is that you could make board 29 smaller.

Do you recall that?

A. I believe I did say that both in testimony and in my deposition -- my declaration, excuse me.

Q. And how much smaller would a person of skill in the art try to make board 29 from where it's described in Wakabayashi to have it then changed?

MR. DAVIS: Objection to form.

A. I think you asked me before how much smaller could it be. I gave you some examples.

But I don't think that this is a -- a question of a precise 25 percent smaller, 10 percent.

These are general goals and I believe that this art relates to those general goals.

I don't think the '052 specifies that you need to make it 10 percent smaller

or 20 percent smaller either.

Q. And you also identify low-cost as a factor; right? That part of the problem you're trying to solve.

So how would modifying Wakabayashi with Ricquier address the low-cost factor?

A. Well, I think one of ordinary skill in the art recognize that different solid-state image sensors typically had different costs.

As we discussed at some length, CMOS has the advantage of not requiring the specialized fabrication lines; hence, cost -- the barrier to enter the market is lower. And I think people widely recognized or expected that CMOS image sensors would likely be lower cost than other alternatives. I mean, that was pretty -- a common expectation of knowledge.

But in terms of a specific amount lower, again, I don't think the '052 says you need to reduce the cost 10 percent

or 20 percent. You're just generally selecting things that you think will impact that.

Q. Did you determine that combining Wakabayashi with Ricquier would reduce the cost of producing an imaging device as opposed to just following the initial teachings of Wakabayashi?

MR. DAVIS: Objection to form.

A. Wakabayashi doesn't teach not to use a CMOS sensor. Your question seems to suggest that.

Following Wakabayashi you could select any solid-state image sensor.

In terms of would the choice of CMOS as opposed to a gallium arsenide base focal point array, would that be expected to reduce the cost. Yes, one of ordinary skill in the art would expect a silicon device to be less than a gallium arsenide device, but I don't think either of those is failing to follow the teaching.

You are open to choices in Wakabayashi for the device.

Q. Your declaration says that Ricquier is pertinent to one of the problems that are identified in the '052 patent, one of those problems being low-cost.

My question is, what did you determine about combining Ricquier with Wakabayashi that affected the cost of the resultant product?

A. And I believe I answered that question. I pointed out that, one, it's well-known to, I believe, those of ordinary skill at the time. The expectation was that CMOS sensors would cost less than other alternatives. So selecting CMOS for use in Wakabayashi would cost less than other choices.

Most likely less than a CCD, but certainly less than a gallium arsenide array, which has greater optical efficiency, but substantially greater manufacturing costs.

Q. When you mentioned other alternatives, and I know you identified CCD

and gallium arsenide, any other alternatives that would be in that category by where you would select CMOS and it would be less expensive?

A. Mercury cadmium telluride arrays were available at the time. They were very expensive because the material was very exotic and very expensive --

(Reporter clarification.)

A. -- to manufacture with, and I can't give you an exhaustive list. I didn't try to form one. I think, as I just pointed out, it was pretty common knowledge that CMOS promised lower manufacturing costs than non-CMOS alternatives.

Q. One of those non-CMOS alternatives would be a CCD-based device; correct?

A. Yes, I would agree that that's a non-CMOS alternative.

Q. And what in Wakabayashi suggested a combination with Ricquier? In particular, you mentioned the ability to change resolution in Ricquier.

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And my question is, what in Wakabayashi suggested that that was a problem that needed to be addressed in Wakabayashi and warranted combining it with Ricquier?

MR. DAVIS: Objection to form.

A. Yes, I think you misunderstand my argument or my opinions here.

It's not a question of what Wakabayashi detail by detail specifically discloses. This is a combination that's obvious to one of ordinary skill.

The fact that Ricquier provides other features compared to some other choice for focal point array is a choice, and potentially one that would be advantageous in some use. It might not be in some other. It doesn't mean it's not an obvious combination.

You could select many different CMOS focal point arrays. They're all obvious. Ricquier is an example. Ricquier happens to provide some advantages of their CMOS over some other CMOS arrays.

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Q. But, again, you can't identify anything in Wakabayashi that suggests there's a problem in the design of Wakabayashi that needs to be addressed by, let's say, Ricquier?

MR. DAVIS: Objection to form.

A. I don't think Wakabayashi says one way or the other. I don't think it suggests that there is not a situation where adjustable -- let's see -- let's use the multiple resolutions would be -- I don't think he teaches that that would not ever be an advantage. Neither does it say he would be. He just doesn't address that particular feature. But I don't think that means that it's not an obvious combination.

Q. You also make reference -- and we're still in paragraph 170 -- about Ricquier has a timing controller that's located off-chip. Do you see that? It's on page 113, but it's in paragraph 170.

A. Yes, I see that.

Q. Why is that a factor in combining Ricquier with Wakabayashi?

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A. Well, as I say in that sentence, it adds flexibility and selection from several design choices for fitting the components into the available space and placement of circuitry to allow for a more compact camera head.

So what this teaches is that this is a choice one of ordinary skill in the art. You either put it on-chip or you put it off-chip.

What Ricquier shows you is that you can certainly put it off-chip and expect that it will function. That gives you a design choice. I mean, there are only two: On-chip or off.

Ricquier is showing that of the two choices, both of which in my opinion are obvious, Ricquier shows that you have every reason to expect to succeed if you put it off-chip.

Q. Ricquier, though, when we discussed Ricquier earlier, was directed to machine vision; right?

MR. DAVIS: Objection to form.

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A. This specific example he used was developed for use in industrial machine vision applications. That's what he says in the first -- second paragraph on page 8 of Exhibit 1038.

The sponsors were clearly interested in Vision Systems, that's the name of the project that was provided funding for this, so that was the specific example certainly that Ricquier mentioned.

Q. So it's your testimony that you're not actually modifying the design of Wakabayashi with teachings from Ricquier; is that right?

MR. DAVIS: Objection.
Form.

A. I don't think I said it that way at all.

Wakabayashi has a number of teachings, certain block specifications and so on. It's a question of what would be obvious to one of ordinary skill in the art in light of teachings of Ricquier in trying to build a system.

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They're not trying to copy Wakabayashi beginning to end. But Wakabayashi discloses options, design choices. Two circuit boards, for instance.

And I think it's a question of these combinations show one of ordinary skill in the art that there are a set of -- a limited set, small collection -- of design choices at the functional block level, and that it suggests to them that they would have a reasonable expectation of success.

Q. Now, would your opinion be different if Wakabayashi was, in fact, a CCD, had a CCD pixel array?

MR. DAVIS: Objection to form.

A. I certainly haven't done any such analysis because Wakabayashi didn't disclose a CCD so far as I can see.

It's a solid-state image sensor that one of ordinary skill in the art, given the very high level of functional description in Wakabayashi, recognized that the functional blocks might be similar for

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the two, or even the same.

I suppose that's a possibility, but it's not an analysis I've done.

Q. And you previously testified that a CCD, a pixel or a device is a type of solid-state imager; correct?

A. Yes, I did.

Q. But you didn't analyze the combination of Wakabayashi with any reference on the basis that Wakabayashi was a CCD or had a CCD pixel array, did you?

MR. DAVIS: Objection to form.

A. I would have had no reason to do such an analysis.

Wakabayashi doesn't limit it to CCD and CCDs are not at issue here. CMOS sensors are.

Q. In paragraph 171, I'm just going to pick this language, but in paragraph 171, you make a reference, it's in the fourth line -- you talk about -- the third and fourth line -- you talk about "implementing Wakabayashi's solid-state imager device."

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Do you see that claim language?

A. I do.

Q. So I want to know, what are you referring to when you're talking about, when you use this phrase "Wakabayashi's solid-state imager device"? What is that referring to?

MR. DAVIS: Objection.

Form.

A. Well, Wakabayashi points to 27, a device that converts optical light into an electrical signal.

Now, Wakabayashi -- and I'd have to go back to check -- he uses -- he uses a terminology to discuss the rotating camera head. I don't recall whether he calls that a camera head.

When he refers to the solid-state imager device, I believe he's always referring to the focal point array, which he usually refers in his drawings was element 27.

Q. So it's your testimony, your opinion in this matter, that there's a

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motivation to combine Wakabayashi with Ricquier, which we've been talking about in paragraphs 169 to 171; right?

A. Yes, it certainly is. That's exactly what I stated in paragraphs 169 through 171 of my declaration.

Q. Now, in paragraph 172, you start addressing a further combination, where it's your view or it's your opinion that you have a combination of Wakabayashi and Ricquier, and that combination itself, there's a reason to further combine that with the Dierickx reference; is that right?

A. That is correct.

Q. So what is the shortcoming of the combination of Wakabayashi and Ricquier that gives rise to a need to combine that combination with another reference?

A. No, I think that's a false premise. It's not a shortcoming. They are different.

Both combinations are obvious. A combination of Wakabayashi with Dierickx is obvious. The combination of Wakabayashi

with Ricquier and Dierickx are obvious.

It's not a question that one has to be deficient for the other to become obvious. They're both obvious. They do lead to different collections of features, but all of those collections of features in either case are obvious.

Q. Before I go on from this, when you give an opinion that you're combining Wakabayashi with Ricquier, you would agree that that combination does not describe an active pixel CMOS array; right?

A. I believe I stated that with specificity, yes.

Q. Okay. So if you were to combine Wakabayashi with Ricquier, and Ricquier has passive pixels, why would you then take that combination and add the Dierickx reference to it?

A. So, again, you're asking me to assume that one had -- that one of ordinary skill had one and not the other, and that's not true.

One of ordinary skill would have

them both. One of ordinary skill in the art would recognize that combining Wakabayashi with Ricquier would provide a certain set of characteristics. Combining Wakabayashi with Dierickx would provide a different set of characteristics.

With a combination of Dierickx, you get the additional characteristic of an active pixel.

Now, would one of ordinary skill in the art decide you could never use the passive because you can use the active? That's not what I said.

They would see that you gain certain features, which might well be very advantageous in certain circumstances, but Ricquier demonstrated that without the amplifiers he could get desirable performance in other circumstances.

Both combinations are obvious. One does not eliminate the other. They're just both obvious combinations each leading to separate sets of features.

Each of those sets of features

would have its own collection of advantages and disadvantages. They'd be different, but it doesn't mean that one is obvious and the other is not.

Q. If Ricquier -- you agree that Ricquier describes a passive pixel CMOS array; right?

A. Yes. That's correct.

Q. And you agree that Dierickx describes an active pixel CMOS array; right?

A. Yes, that's correct.

Q. So why would you combine an active and passive pixel CMOS array and an active pixel CMOS array?

A. I think I just addressed this.

There's no reason not to. There's no teaching in one that says you can't do the other.

I do think that those of ordinary skill saw that under certain circumstances having amplifiers in the pixels could lead to certain advantages.

They might lead to potentially

other disadvantages. The reference -- yes, it's Dierickx, for instance.

He is particularly concerned with fixed-pattern noise. The incorporation of amplifiers into each pixel provides more components that could contribute to fixed-pattern noise if the gain in each amplifier is slightly different than another. Ricquier doesn't do that.

So one of ordinary skill in the art would recognize that there are pros and cons of each combination, but I don't believe that that means that they would dismiss one and not -- and only do the other.

They each have advantages, they each have disadvantages, as every implementation does.

Q. So paragraph 173 you talk about motivation to apply Dierickx in implementing Wakabayashi's imager apparatus.

Do you see that?

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A. I do.

Q. Okay. So one question is, when you reference the quote-unquote "imager apparatus," what are you referring to when you talk about Wakabayashi's imager apparatus?

A. Well, so the teachings of Ricquier and Wakabayashi -- I mean Ricquier and Dierickx relate to Wakabayashi's focal point array -- I'll use that phrase -- 27.

They also relate to, for instance, where to place certain circuitry.

So the imager apparatus can be a little bit bigger than just the focal point array. And I believe that, for instance, in -- let's see -- well, Dierickx places the amplifier there -- let's see -- Ricquier -- actually, I'm thinking of a different reference where it for instance pointed to -- was it timing and control -- I think it was image processing separate from timing and control.

But in any case, each of these references will teach things about the

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focal point array. At least Ricquier and Dierickx are providing details about the focal point array, which impacts how the rest of the circuitry is done.

Wakabayashi calls out certain classes of circuitry functional blocks. All of that acts together in arriving at a final actual design of a working circuit.

Q. So when -- but my question is, when you refer to Wakabayashi's quote-unquote "imager apparatus," what part of Wakabayashi are you talking about?

Is it the entirety of the Wakabayashi disclosure?

MR. DAVIS: Objection.

Form.

A. Well, it's certainly related to, and I believe I just said this, to the image sensor 27 -- let me try to use the right numbers, excuse me. And I risk using different words than what Wakabayashi used.

There is a solid-state image sensor 27. There's electronics on 29 and 39, and the teachings in Ricquier and

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Dierickx are -- influence what is done elsewhere; for instance, on circuit board 29.

So that's why I used imager apparatus. It's not just the chip 27 only. That relates to other things in Wakabayashi.

Q. So imager apparatus, as you used it in your declaration, is the disclosure in Wakabayashi -- I think it was Figure 7 with the imager 27, circuit board 29 and the other circuit board 39, that's what you're referring to?

MR. DAVIS: Objection.

Form.

A. No, I think that's -- that's taking it to the extreme.

I think I am referring to broadly Wakabayashi's desire to build an imager apparatus and his disclosures of or their disclosures of certain functional blocks that will be used in conjunction with the focal point array. That's what I mean by imager apparatus.

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Q. But can you identify in Wakabayashi the components or the blocks that are the imager apparatus as you're using it in this declaration?

MR. DAVIS: Objection to form.

A. So Wakabayashi, for instance, points in Figure 22 to blocks 100 and 102 contained in a dotted box and specifically says that constitutes the video camera.

So that would be a partial example. But in that -- so I think actually the only thing missing -- the next thing Wakabayashi does is pre-video to post-video -- no, he doesn't do that in there.

So I think broadly this certainly impacts everything in that dotted line box, although it has its greatest impact on the camera head.

But circuit board -- so 102 includes camera signal processing, synchronization signal generator and so on, and they -- those, as well as the "and so on," which is a very broad statement, is

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impacted by teachings about the focal point, which is given by Ricquier and Dierickx.

Q. So the imager apparatus, it's a quoted term in the paragraph 173 of your declaration on page 114, that is referring to the dotted line components in Figure 22 of Wakabayashi.

That's your starting point; is that correct?

MR. DAVIS: Objection.

Form.

A. No, I wouldn't characterize that as necessarily a starting point.

I would say that generally that phrasing is -- and the teachings of Ricquier and Dierickx are mainly at issue in that dotted line box.

But I didn't sit down and write a list that says only this is there and nothing else is.

I think that broadly the components that would fall within the dotted box in 22 that include camera head

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100 and camera circuit 102 are related to what are the teachings of Ricquier and Dierickx are going to provide.

Q. I'm just asking to understand what is the imager apparatus in Wakabayashi that you're referring to, and it sounds like you're focused on that dotted line in Figure 22 containing a circuit, or the box is 100 and 102; is that correct?

MR. DAVIS: Objection to form.

A. I don't think I used that word.

I don't think I used the word "focus," but I did say that I think the things that are largely influenced for Ricquier and Dierickx would fall generally in that block.

Q. Okay. And in paragraph 173, you start off with that imager apparatus of Wakabayashi would be modified by the teachings of Ricquier; correct?

That's the parenthetical statement; right?

A. Yes.

Q. And then you're applying

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Dierickx on top of that; is that correct?

A. I don't think I'd phrase it as "on top of." It's the combination of the three, yes.

Q. So how are you combining Ricquier and Dierickx to modify Wakabayashi?

A. Well, I've explained how Wakabayashi doesn't provide any details about what kind of focal point array is present.

Ricquier provides details of a focal point array with adjustable resolution, for instance.

Dierickx points out advantages of placing an amplifier in each pixel -- actually points out the potential disadvantages with fixed-pattern noise, but that's what he's discussing, is trying to mitigate against that.

So one of ordinary skill in the art reading these three references together I think would see it as an obvious solution to use an active pixel CMOS focal point

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array with Wakabayashi.

Q. But you -- I'm sorry.

A. And one that, in terms of some general and even more specific characteristics, are described by Ricquier and Dierickx.

There are other references that would also be obvious combinations. There are numerous obvious combinations that lead to different sets of features.

Wakabayashi and Ricquier together is one. Wakabayashi, Ricquier and Dierickx is another.

Both obvious. Different features.

Q. What are the advantages of active pixels -- I'm sorry -- what are the advantages of passive pixels over active pixels?

A. They don't have --

MR. DAVIS: Objection to form.

A. They don't have amplifiers so you don't have to worry about amplifier variability from pixel to pixel.

They have fewer component counts per pixel, which, in principle, might lead to a smaller pixel size.

There are pros and there are cons.

Q. And what are the advantages of active pixels over passive pixels?

A. Well, among other things, active pixels have gain in the pixel, so if you have a problem where you want to overcome loading of interconnects, then the amplifier can help.

But you will also now have more components in each pixel. There are pros and there are cons to each of these choices.

Q. And why would you modify Wakabayashi with both, with active pixels and passive pixels?

A. Again, it's not -- it would be obvious to one of ordinary skill in the art to look to CMOS and to look to active pixels.

These are simply two examples of

art that teaches some of the things you need to know to do it. There are others. They're all obvious.

But just because there's one obvious combination doesn't mean the other combinations don't exist or aren't obvious. Each one leads to a different feature set.

Some of them would lead to feature sets that are different from the '052. Some of them lead to feature sets that disclose everything in various claims of the '052. Both of those were obvious.

The only question I'm addressing is, is the '052 patent obvious. I'm not going to look at all of the other obvious combinations because if they don't -- that doesn't mean they're not obvious.

Q. If you can combine an active pixel sensor with a passive pixel sensor, you would lose the benefit of the passive pixels if you made that combination, wouldn't you?

MR. DAVIS: Objection to form.

A. You gain certain things, you

lose others.

Ricquier also teaches designing it, doing it in such a way that you have the ability to bend to use lower or higher resolution. You can implement that with active pixels. There's nothing that would stop you from doing that. The design would be somewhat different, but there are other things about Ricquier's teachings.

What you would gain from Dierickx is the ability to overcome loading effects due to interconnects. That's one of things the amplifier does.

So you get some things, you have more component counts, you lose those things, but Ricquier has to be careful about loading of interconnects.

Ricquier provides advantages in terms of doing sub-array scanning and binning, which aren't discussed in Dierickx. It doesn't mean you can't do them.

Q. Are you done? I'm sorry.

A. I'm done.

Q. You can't have a pixel that is both passive and active at the same time, can you?

A. No, I never --

MR. DAVIS: Objection to form.

A. I never said you did.

Q. Okay. So you can't combine an active pixel array with a passive pixel array, can you?

MR. DAVIS: Objection to form.

A. No, I wouldn't say it that way at all.

You can modify one. Now, that means it's not a passive pixel array anymore. But that doesn't mean it's not a functional and obvious combination.

It's -- it's silly to say that you cannot add an amplifier to a passive pixel. That's exactly what an active pixel is. It's a passive pixel plus an amplifier.

Q. And how is the combination of Wakabayashi with Ricquier and Dierickx a low-cost -- a low-cost advantage by the

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combination?

A. Well, Ricquier says that he used standard CMOS technology, which one of ordinary skill in the art would expect to be low-cost in the sense that the fabrication facilities, their costs are amortized over many products, including products that aren't optical sensors.

Dierickx is also a MOS, that for CMOS sensor, which means you could, again, use a standard CMOS process to fabricate.

That's where you would expect to see potential advantages in terms of cost of the imaging chips.

Q. Wakabayashi includes more than just an image sensor, though; right?

The image sensor is only one component of Wakabayashi; is that correct?

A. Wakabayashi certainly contains more than just the device that converts light to an electrical signal. We'd want to call that the imaging chip. Certainly it contains more than that, yes.

Q. So if you change the image

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sensor in Wakabayashi, you're going to have to make other changes in Wakabayashi to work with the changed image sensor; is that correct?

MR. DAVIS: Objection to form.

A. Well, Wakabayashi never picked one to start with, so you suggest that changing it leads to change in the circuitry.

That presumes there was already a circuit design, which is not there in Wakabayashi. Wakabayashi didn't specify which kind of solid-state image sensor.

So once you pick one, you develop the rest of your circuit design.

You don't -- you're making it sound like there already existed a complete circuit design. Well, that would only exist if you pick the sensor, which Wakabayashi doesn't pick.

Q. Wakabayashi, you would agree Wakabayashi describes a design for, as you call it, a consumer camera that incorporates an image sensor and other

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circuitry and boards to work with that image sensor; correct?

MR. DAVIS: Objection to form.

A. Wakabayashi is -- Wakabayashi is presenting at the functional block level and at the physical level of boards, mechanical arrangements, hinges, connecting means, mechanical -- he discloses all of these things. And that is ultimately to lead to a complete system.

But, again, the choice of a specific focal point array technology would be one that would have impacts on the exact implementation of the circuitry necessary to provide the functional blocks that Wakabayashi picks.

He doesn't give you a circuit board layout and a component list. It's not -- it's not a, you know, build it in your house -- that's a bad -- it's not a list at the part level and a layout level of the electrical layout. He doesn't give a schematic circuit diagram.

One of ordinary skill would

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understand that selecting a focal point array technology, that then there are a variety of circuits, many circuits that could produce each of the functions described in Wakabayashi.

But broadly, those would all be necessary to produce the overall system that Wakabayashi describes.

Q. If Wakabayashi just said it was a camera with a solid-state imager, would that change any of your opinions in this matter?

MR. DAVIS: Objection.

Form.

A. I'm not sure I understand your hypothetical.

What aspects of Wakabayashi are you suggesting would be not in the disclosure?

Q. I'm just saying, you've testified it's your understanding that Wakabayashi appears to be a consumer camera; right?

A. That was a rough

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characterization. I don't --
Q. But I'm just saying if the Wakabayashi patent itself said it's a consumer -- it's just a camera and everything else was the same with the solid-state imager, would that change your opinions in this matter?
MR. DAVIS: Objection to form.
A. You said everything else is the same. The disclosure of two circuit boards, the disclosure of the lens, all of those components?
Q. Yes.
MR. DAVIS: Objection to form.
A. And what is the change to Wakabayashi that you're suggesting? I just don't understand the question. I'm sorry.
Q. No, if it was just characterized -- it's been a discussion point or it's been your testimony that your view was that Wakabayashi is a consumer camera.
I'm asking if Wakabayashi said, in fact, this is a consumer camera and the rest of the disclosure was the same, would

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that change your opinion?
MR. DAVIS: Objection to form.
Misstates testimony.
A. So if -- I mean, I said that Wakabayashi is probably something like a consumer camera, but if you're saying if he disclosed it was a consumer camera and that every other piece of the disclosure was identical to what it is, I don't see that that would have any impact on my -- well, it actually would support some of my arguments even more strongly because cost would be an even -- would be an absolute issue, but, no, I don't think it would change any of my opinions.
Q. And is it your testimony that there's no disclosure of what's on boards 29 and 39 in Wakabayashi?
A. No, I never said that.
Q. Okay.
MR. CAPLAN: Why don't we take a break now. It's been almost an hour.
15 minutes? Thank you.
(A recess was taken.)

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BY MR. CAPLAN:
Q. On page 87 of your declaration -- I'm sorry, paragraph 87, page 59.
A. Yes, I'm there.
Q. You state that Wakabayashi does not detail timing and control circuitry in the imager device 27.
Do you see that?
A. I do.
Q. Okay. So that is your testimony, that the timing and control circuitry is not described in Wakabayashi; is that correct?
A. What I said is that Wakabayashi does not detail. Wakabayashi refers to synchronization signal generating circuits, refers to signal processing circuits.
He refers to -- those are just examples. Those are in column 9.
He doesn't provide a detailed circuit. He describes functional block performance, or functionality, if you will. Sorry.
Q. And that's in column 9.

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What in particular are you referring to in column 9 for the timing and control circuitry?
MR. DAVIS: Objection.
Form.
A. Well, he mentions synchronization signal generator circuit and so on. Flip back -- I don't recall that Wakabayashi specifically used the phrase "timing and control."
That's why I believe one of -- one of the reasons that one of ordinary skill would look to Ackland in terms of understanding the details -- more of the details of how to obtain an electrical signal from the focal point array as required by Wakabayashi.
Q. So in combining Wakabayashi with Ackland, is it your testimony that you would put the Ackland CMOS pixel array, including timing and control circuitry, into the design in Wakabayashi?
MR. DAVIS: Objection.
Form.

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A. Again, you repeatedly seem to suggest that you unplug something and plug something else in.

Wakabayashi describes sort of functional level blocks. He doesn't give specifics of the circuitry, as I stated at the beginning of paragraph 87. So I don't believe it's an exercise of plugging Ackland into Wakabayashi or unplugging something from Wakabayashi.

It is a combination. One of ordinary skill in the art would understand that they have to actually design the circuitry to provide the functions Wakabayashi describes.

They would understand that the type of focal point array would influence the specifics with circuitry.

Ackland provides greater detail in terms of timing controls, row decoders and so on. So it's not a question of plugging it into Wakabayashi.

You're combining the two references. One of ordinary skill in the

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art would understand they need to do an actual design of circuitry and the details provided by Ackland provide greater information on how to do that.

Q. So is it your testimony then that a person who is skilled in the art or -- rephrase it.

Is it your testimony that your analysis is based on looking at Wakabayashi and Ackland for that combination and looking at both of those references and designing an imager apparatus that has particular features based on what you learn from both references?

MR. DAVIS: Objection.

Form.

A. Wakabayashi discloses certain characteristics. Two circuit boards, for instance. In order to build functional circuit boards one of ordinary skill in the art needs to go further.

Ackland provides information about what that signal will look like, as well as what needs to be provided in terms

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of timing and control.

What is obvious is that if you combine these, you will -- you will have a collection of features.

Those features happen to be the same ones the '052 requires.

You could combine other references, you'd get other collections of features. But I still -- you seem to keep asking or suggesting it's unplugging one thing and plugging in another, and that's not how I understand an obviousness argument, for obviousness to work.

One of ordinary skill is aware of all of this art plus their own skill and creativity.

Q. So when you were talking about the grounds in your declaration that you rely, let's start with Wakabayashi and Ackland, what is your starting point for that combination? What are you looking at in Wakabayashi to start your analysis?

MR. DAVIS: Objection.

Form.

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A. Again, I'm not sure I would agree with characterizing it as a starting point.

However, Wakabayashi has a variety of descriptions: Boards, mechanical arrangements, electrical functionality.

And certainly in order to produce that electrical functionality, one of ordinary skill is going to have to do some actual circuit design.

That circuit design will be influenced by the choice of focal point array, as I have testified repeatedly. And Ackland is a teaching about a type of focal point array.

Wakabayashi just says use a solid-state imager or solid state focal point array. You need more details.

I'm still not sure I would call that the starting point, but broadly speaking, the teachings of Wakabayashi augmented by teachings from other references are needed to build a complete

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functional circuit. That's why one of ordinary skill in the art would know to combine these.
Q. So then it is your testimony that you looked to the teachings of Wakabayashi with an imager device 27 and the two circuit boards, 29 and 39, and then to work with Ackland you're saying you would have to make certain changes to what Wakabayashi describes; is that correct?
A. That is not correct.
MR. DAVIS: Objection to form and asked and answered repeatedly.
Counsel, we've been over this same line of questions a number of times.
You're just repeating the same thing over and over again.
A. I never said that you changed Wakabayashi.
Q. So you wouldn't change the design of Wakabayashi then for that combination?
MR. DAVIS: Objection.
Form.

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A. Wakabayashi provides a variety of general characteristics, provides some details, illustrates that a design choice would be to use two circuit boards in specific mechanical alignment.
It doesn't mean that there aren't other obvious arrangements of circuit boards, but he does provide those.
And using Ackland to inform one of ordinary skill in the art about how to build circuitry to provide functionalities that are discussed in Wakabayashi, that's not a change.
Q. Let's move to your claim analysis. We'll start with Claim 1. It's around paragraph 103.
A. I'm at paragraph 73. It's on page 71 of Exhibit 1004.
Q. Let's go to element 1.f, which I believe is paragraph 123.
A. So element 1.f?
Q. Yes, paragraph 123.
A. I'm there.
Q. So for element 1.f, I just want

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to make sure we are clear in terms of what element in the art satisfies the -- let me step back.
Element 1.f refers to the second circuit board feature.
Do you see that? It's on page 82 to 83.
A. I see that.
Q. It's a second circuit board that has a length and a width that defines a second plane, and that second circuit board has the circuitry for the pre-video to post-video conversion and is offset from the first board, and also the planes are parallel, the first and second planes, right, that's element 1.f?
A. Paraphrased, yes, but I believe that covered all of the requirements of 1.f.
Q. I just want to confirm that it's your testimony that the second circuit board feature is satisfied by element or circuit board 39 in Wakabayashi; is that correct?

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A. To be careful, it's my testimony, my statement in my declaration is that Wakabayashi renders this element obvious.
For the requirements of a second circuit board electrically coupled to first circuit board, I certainly point to 39 of Wakabayashi. For a length and a width defining a second plane, I also point to 39 of Wakabayashi. That the second plane is parallel to first plane, I point to 39 and 29 of Wakabayashi.
The last element is that it contain the conversion -- that circuitry to convert pre-video to post-video is also required, as I pointed out in paragraph 127, Wakabayashi does disclose the circuit board include signal processing there, but I refer back to Section VIII.A in paragraph 128 for the discussion of why it will be obvious for one of ordinary skill to place the pre-video to post-video circuitry on circuit board 39.
Q. And so it is your testimony that

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that second circuit board element is not actually shown in Wakabayashi, but it will be obvious; correct?

MR. DAVIS: Objection.

Form.

A. So I believe as I just tried to go through, I pointed to all of the requirements of element 1.f that are expressly disclosed by Wakabayashi: Figure 7, Figure 5, Figure 3.

However, the location of the conversion circuitry from pre-video to post-video is not expressly disclosed on 39, but is my opinion it would be obvious to place it on 39.

Q. Okay. And element 1.f requires that the second circuit board is offset from the first circuit board; right?

A. Yes, it does require that.

Q. Okay. And it's your testimony that that's demonstrated by the first circuit board 29, or -- circuit board 29 and circuit board 39 in Wakabayashi; is that correct?

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A. Yes. Looking at Figures 5 and Figure 3, you could see that the second circuit board 39 is offset from the first circuit board 29.

Q. And in paragraph 126 of your declaration, talking about the same element 1.f, it is your testimony that circuit board 39 is not stacked behind circuit board 29; correct?

A. So stacking is not a claim term in this claim. It is in other claims.

In paragraph 126 I specifically stated it is offset, which it clearly is.

In the sentence that covers -- that moves on to page 86, I state additionally the two figures also show that circuit board 39 -- there it does say -- is not stacked behind circuit board 29, but rather is arranged in an offset position.

If you look at Figure 5, for instance, you can see that 39 is located -- there is no place where -- seen from that view.

29 in some sense overlaps with

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39 in this perspective, and so I think one of ordinary skill would not -- using plain and ordinary meaning would not view that as being stacked.

Q. Now, for element 1.k, I want to actually go to paragraph starting with 149 in your declaration. This is where you testify about Wakabayashi with Ackland and Suzuki.

Do you see that?

A. I do.

Q. And we discussed Suzuki earlier today.

And my question is, how do you combine Wakabayashi with Ackland and Suzuki? How would a person of skill in the art make that combination?

A. Well, Wakabayashi, for instance, discloses two circuit boards, various ways of doing things. Suzuki provides a different arrangement. But for Claim 1, the requirement that we're discussing relates to the size.

And Suzuki provides information

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about the size of the image pickup chip.

Now, Wakabayashi -- let me find the claim -- the actual language.

The actual language is:

"Wherein the largest dimension of said image sensor along said first plane is between 2 and 12 millimeters."

That would correspond to the dimensions of the circuit board 29 in Wakabayashi because that defines the first plane.

Suzuki provides disclosure of a focal plane array. In Suzuki, he labeled that 2 -- let me get the right one -- 221.

In Wakabayashi, that's 27.

Suzuki similarly connects that to circuit boards. Wakabayashi connects it to circuit board 29.

Suzuki is showing that it's obvious that you could make the circuit board an imager of a size of less than 10 millimeters, and that's all the teaching that I was looking for, that one of ordinary skill in the art looking for

further information about how big chips were and how big circuit boards were.

Q. My question -- let's step back.

Do you agree that this section of your declaration, heading B, right before paragraph 149, is directed to -- it says: "Claim 1 is Obvious Under 103 Over Wakabayashi in View of Ackland and Suzuki."

That's the basis of your testimony in this section; correct?

A. Paragraph 150 is very clear, and it states that to the extent that it is argued that further disclosure is required with respect to the limitation 1.k reciting a largest dimension, that this limitation will be obvious in view of Suzuki's teaching.

It is my opinion that Claim 1 is already obvious with the combination of Wakabayashi and Ackland.

I'm simply going further to point out that if it were to be argued or determined that the disclosures in Wakabayashi and Ackland are not sufficient

to determine a size limitation for circuit board 29 -- I'm sorry -- yes, 29, that Suzuki clearly shows that focal point arrays and associated circuit boards that are of a size that falls in the range of between 2 and 12 millimeters.

That's what one of ordinary skill in the art would see and understand that they could do it in that size range.

Q. And my question is that a person of skill in the art having looked at Wakabayashi and Ackland, why would they further look to Suzuki to additionally augment the combination of Wakabayashi and Ackland?

A. So it is my opinion, as I've stated, that the size is already obvious from just Wakabayashi in view of Ackland.

But if one of ordinary skill was interested in finding more information about exemplary chip -- focal point arrays and associated circuit boards and their sizes, they would find Suzuki, and Suzuki clearly discloses a size in this range.

What I'm taking from Suzuki is that it's smaller than 10 millimeters. The chip is 8-1/2 millimeters, which would tell one of ordinary skill that the circuit board is somewhere between 8-1/2 millimeters and 10 millimeters.

That makes it -- that happens to fall within the range specified by the '052 patent. They said 2 to 12. Well, it's shown in the art an example of, let's say, 8-1/2 to 10.

Q. Your testimony was just now that even without Suzuki, that this particular element, 1.k, was obvious, and you address some of that in paragraph 148?

A. That's correct.

Q. Okay. And you state in paragraph 148 that a circuit board having the largest dimension between 2 and 12 millimeters were well-known at the time.

Were boards of that size known for CCD imagers at that time?

A. Well, for use with image sensors, I think. I mean, Suzuki shows you

an example.

Boards of size somewhat larger than the image sensor chip were certainly well-known.

Image sensor chips on the order of 1 centimeter in size were well-known, so, yes, I believe that it was well-known.

Q. And Suzuki just says "solid-state imager"; right? Suzuki does not identify the particular type of solid-state imager; right?

A. Suzuki itself, I believe that is correct. Suzuki describes it as a solid-state image pickup device, although that actually -- that includes his lens, camera head and so on.

But I believe he describes it as a "solid-state image pickup chip," "solid-state image pickup semiconductor device" are phrases he uses in column 1.

Q. So I asked you just now if you were aware, again, referring to language in paragraph 148, that boards of this particular size, the 2 to 12-millimeter

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size, were known for CCD, and now I want to ask you if boards of that size were known for CMOS imagers.

A. I think that there were chips that were well-known of size about 10 millimeters or smaller, CMOS chips, and I believe we have an example elsewhere of such a chip, and that a board would be of size comparable to the size of the image sensor itself, again, I believe is an obvious result.

Q. Do you know the size of the board that's required for different size of pixel arrays? Like, is there a correspondence between millimeters for the image sensor of the overall sensor and the number of pixels in the array?

MR. DAVIS: Objection. Form.

A. You'd have to specify the pixel size and the pixel count to get at least an estimate of the size of the dye.

Then you place that in a package and mount that on a board.

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Q. So the pixel size and the pixel count do relate to the size of the image sensor, the dimensions of the image sensor; correct?

A. Certainly, yes.

Q. And is there a difference in pixel size for active pixels versus passive pixels?

A. There may be or there may not be. It depends on how someone decided to lay it out.

If you wish to have a larger photo sensitive area in a passive pixel, you can do that. You'll have a lower fill factor in the active device. It just depends on how you decide to lay it out.

Q. So do you have any support for your opinions of CMOS image sensors in this particular -- you have in these dimensions, the 2 to 12?

MR. DAVIS: Objection to form.

A. So Suzuki gives an example of a solid-state image sensor.

Q. Is it your testimony that Suzuki

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is a CMOS -- has a CMOS pixel array?

A. No, I never said that. I never suggested that.

Suzuki is a solid-state imaging device. That solid-state imaging device of the size he identified would also include CMOS devices. I believe that would be obvious to one of ordinary skill at the time.

I'm sorry, I'm looking to other sections of my declaration where size is discussed. This was related to whether it's square or not, so I'm in the wrong place.

But Ricquier illustrates a 256-by-256 and gives a pixel pitch. That's on page 121 of my declaration.

Q. Do you know what the size of that array is, though, what's the size of that image sensor?

A. 256 times 19 microns would be something a little bit bigger than 2 millimeters. It probably would be closer to -- this is almost 20 times 250. That's

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5 millimeters.

Q. That's Ricquier, though; right? So that's a passive array; is that correct? Those are passive pixels?

A. That is Ricquier and that is -- that's the pixel it is.

I would point out Ricquier says they used a 1-1/2 micron process with pixels on a 19-micron pitch. You could build quite a few transistors inside that area.

So implementing an active device, adding an amplifier consisting of only one transistor, you can fit it into that pitch. You would have less area absorbing light. That's one of the trade-offs between active and passive.

Q. But you don't have a basis in your declaration setting forth the size of the image sensor for a CMOS pixel array with active pixels, do you?

MR. DAVIS: Objection to form.

A. Well, paragraph 148 I stated that I believe it's obvious.

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In section -- it starts on page 99, which is Suzuki, again, I've stated that I believe it's obvious and there is nothing that would suggest I think one of ordinary skill in the art that this size given by Suzuki, for instance, would preclude that that would be an active pixel CMOS array.

Q. Do you have any basis to understand that Suzuki is an active pixel CMOS array?

A. I never said it was.

Suzuki says a solid-state image pickup semiconductor device.

An active pixel CMOS array would be in that category, and what I am saying is that it would be obvious to one of ordinary skill in the art that given the technology of the time, here just being an example, they would understand that pixel sizes would be such that it would be expected that you could build an imaging chip somewhere in the range of 2 to 12 millimeters.

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Q. And it is your testimony that a person of skill in the art would look at Wakabayashi along with Ackland and Suzuki to understand that teaching from the art; is that correct?

A. I've testified to two things. One -- and my declaration states two things. That even without Suzuki, I believe it's obvious.

But with Suzuki, I believe it is certainly obvious because Suzuki actually gives a dimension for a solid-state imaging chip.

Q. I'm going to move forward a little bit to paragraph 180.

A. I'm there.

Q. This is in Claim 3.

And, in particular, element 3.b, this is the image sensor on a planar substrate or an image sensor including a planar substrate, a length and a width, and that length and width defined a first plane and it includes the array of CMOS pixels.

Right? That's element 3.b?

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A. Yes, it includes an array of CMOS pixels thereon, yes.

Q. What is the element -- what are you relying on for the image sensor for element 3.b?

A. So Ricquier discloses that he built a CMOS array using standard 1.5 micron -- standard 1.5 micron CMOS technology.

Standard 1.5 micron CMOS technology uses a silicon substrate which is plane, which is flat. It is planar. It's a clear disclosure.

Q. Is that manufacturing technique one would that be used with Wakabayashi?

A. It's a manufacturing technique in terms of using planar semiconductor substrates, it would be used for virtually all semiconductor devices.

I have done work on non-planar substrates. It is exceedingly difficult and is exceedingly rare.

Virtually all solid-state semiconductor devices are on a planar

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substrate, and one of ordinary skill in the art would know that.

Q. I want to move on to 3.d, element 3.d. this talks about the first circuit board element.

So this is the first circuit board with a length and a width, it defines a second plane and this first circuit board includes timing and control circuitry thereon.

Do you see that?

A. I do.

Q. Okay. So what element are you relying on to meet this feature of element 3.d?

MR. DAVIS: Objection to form.

A. As I discuss, that it is my opinion in Wakabayashi in view of Ricquier renders this obvious.

Wakabayashi discloses image sensors for circuit boards that have lengths and widths.

The other requirement that -- just has to have a length and a width

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defining a second plane, and Wakabayashi certainly discloses that in circuit board 29.

Ricquier discusses off-chip driving circuitry, including timing and control, because he talks about timing controller -- the time and control, the drive, row selection and count selection that is coupled to the CMOS array.

And it is my opinion that it is obvious that that circuitry would either be -- so this timing and control circuitry is what has to be thereon the first circuit board.

If it is on-chip, then it is thereon on the circuit board. If it is on the board and not on-chip, it is also thereon.

So in either -- either view, the timing and control circuitry would be -- would satisfy the limitation 3.d.

Q. You previously testified that Wakabayashi does not provide details about the timing and control circuitry; right?

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A. That is correct.

Q. So for this element 3.d, you're looking to Ricquier for the timing and control circuitry; correct?

A. That is correct.

Q. And Ricquier -- you testified previously that Ricquier had an off-chip driving unit; correct?

A. That is correct.

Q. I think it was a timing controller that was off-chip?

A. Yes, that's discussed in paragraph 196 of my declaration and is clearly quoted on page 127.

Q. But like Wakabayashi, Ricquier does not show or disclose the actual timing circuits, does it?

A. Ricquier does not provide all of the details of timing and control circuitry. Although, as I pointed out on page 196, he goes through the functionalities that are necessary; for instance, the row select, K reset and G reset. That's all discussed in paragraph

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196, which would provide -- he also states that he wants to be able to do one by one, two by two, four by four and eight by eight neighborhoods.

All of those would provide one of ordinary skill greater information about how to design the circuitry. This is certainly more detail than Wakabayashi provides.

And I would observe that in paragraph 198, I further discuss the location of that circuitry, which Ricquier discloses as being off-chip, and it is my opinion it would be obvious to place that on circuit board 29. That's in paragraph 198.

MR. CAPLAN: If we can take a short break here and let me just go through the items I have left so I can figure out what we still have to get through. Okay?

(A recess was taken.)

MR. CAPLAN: Dr. Neikirk, I thank you for today.

I don't have any more questions

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for today.

THE WITNESS: Thank you.

MR. DAVIS: I have a couple of questions.

EXAMINATION BY
MR. DAVIS:

Q. Dr. Neikirk, can you open up Exhibit 1004 to page 115.

A. So Exhibit 1004 is -- oh, I'm sorry, it's my declaration. I'm sorry. Where in the declaration?

Q. To page 115.

A. Page 115. And I'm there.

Q. Do you see paragraph 174?

A. I do.

Q. In the fourth line down, do you see the reference to -- a reference to "high image quality" in quotes?

A. I do.

Q. And do you remember discussing that quoted passage in paragraph 19 regarding high image quality with Mr. Caplan?

A. I believe so, yes.

Q. How did that passage inform your opinion in paragraph 174?

MR. CAPLAN: Objection as to form.

A. So both Ricquier and, for instance, Dierickx discussed image quality.

Ricquier was talking about abilities to bin and so on.

Dierickx was focusing on ways of hoping -- in active pixel sensor arrays to reduce fixed-pattern noise.

As I've discussed in the rest of that paragraph, there are known advantages for using the amplifiers.

I think that is what would motivate one to combine these references to achieve a high image quality.

Q. Later in that paragraph you reference -- this is about two-thirds of the way down, do you see the quoted language "less sensitive to noise fluctuations"?

A. I'm just trying to find this.

Yes. So it's a discussion -- so

Dierickx is explaining that active pixels have an advantage in terms of amplifying the charge collected on the elements and that makes them less sensitive to noise fluctuations.

If there's more charge, you're generally less susceptible to fluctuations in that charge.

Q. You cite there paragraph 6 of Dierickx.

Do you rely on paragraph 6 of Dierickx?

A. So in Dierickx itself, paragraph 6 is in the "Background" section, discussing CMOS, identifying active pixels in comparison to passive pixels and their advantages, so, yes, I did rely on that.

MR. DAVIS: No further questions.

FURTHER EXAMINATION

BY MR. CAPLAN:

Q. Dr. Neikirk, in Dierickx, Exhibit 1041, the reference to the high image quality that Mr. Davis pointed you

to, and it's in your declaration, that implements a specific timing function that's unique to Dierickx, doesn't it?

MR. DAVIS: Objection to form.

A. I don't think I characterize it that way.

Dierickx is concerned about fixed-pattern noise. He discusses a number of different amplifier configurations, not just those in the pixels themselves, and ways of mitigating against offset. That's illustrated in Figure 2, for instance.

You asked me about the current source 12 in Figure 2 earlier today, and that circuitry is trying to address some of these fixed-pattern noise issues, I believe.

It's -- he does show a timing diagram in Figure 7. I don't know that that is exclusively how he's trying to prevent fixed-pattern noise.

He does say that it is timing of the method for eliminating fixed-pattern noise. That's part of it, yes.

Q. So, in fact, Dierickx provides particular timing and control circuitry that's unique to its particular desired feature; correct?

MR. DAVIS: Objection.

A. No. He produces -- and I believe we discussed this earlier -- he shows a timing diagram on Figure 7.

He illustrates where the various signals would be applied, but he actually gives no details on the circuitry to produce that timing and control. Again, it's more of a functional description.

Q. But in Dierickx, including -- prior to paragraph 19 that you've been looking at and that's referenced in your declaration, it describes in paragraph 17 and 18 the particulars, particular details about how to accomplish its goal, its amplifying circuit in adjusting the signal for the fixed-pattern noise, right, so it is --

MR. DAVIS: Objection.

Form. I'm not sure if there was

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a question.
A. My apologies, I jumped in.
Q. So there is a functional description here of the timing and control circuitry and the particular requirements for it to accomplish what the Dierickx reference is trying to describe?
MR. DAVIS: Objection. Form.
A. So -- and I think this is exactly what I said.
There's a functional description. Now, most of paragraph 18 is discussing not timing but control requirements, and there is a functional description. That's not a circuit diagram.
One of ordinary skill in the art would know that there are numerous circuits, many circuits, but, yes, I would agree that he's providing more information about the characteristics of that control circuitry, the functional requirement, that will help one of ordinary skill to select various circuits that provide that

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function, yes.
Q. And Dierickx does not have a particular circuit diagram for the timing and control. It just has that functional description; right?
A. That's correct.
Q. And you wouldn't use the timing and control circuitry from Ricquier with Dierickx, would you?
MR. DAVIS: Objection to form.
A. Well, I haven't really looked at that. I don't know.
Now, Dierickx has a specific set of control signals for his column amplifiers and -- I'm sorry, let me get these in the right order.
Ricquier has circuit control signals called out. The switching requirements in Dierickx, you know, I haven't looked.
There are clearly some similarities. There might as well be differences. I haven't really tried to do a one-to-one comparison.

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Q. But Ricquier, you testified already that Ricquier has passive pixels and Dierickx has active pixels; right?
A. Yes, certainly.
Q. And Ricquier, you already testified, does not disclose circuitry for timing and control, does it?
MR. DAVIS: Objection. Form.
A. Ricquier, as does Dierickx, provides a functional description of what's necessary in timing and control. Neither provides a specific schematic circuit diagram.
Q. But that FPN, right, fixed-pattern noise issue in Dierickx, it relies on that functional description of the timing in Dierickx to achieve the improvement or the alleged improvement in the fixed-pattern noise; correct?
MR. DAVIS: Objection to form.
A. In part, yes. Dierickx also discloses compensation amplifiers, as well as the description that we were just

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discussing, which is in paragraph 18, which refers primarily to control steps.
MR. CAPLAN: I don't have any further questions.
Thank you, Dr. Neikirk.
MR. DAVIS: We can go off the record.
(Time noted: 7:30 p.m. EST)

_____
DEAN NEIKIRK, PH.D.

Subscribed and sworn to before me this ____ day of ____ , 2020.

_____

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C E R T I F I C A T E

I, Linda J. Greenstein, Professional Shorthand Reporter and Notary Public in and for the State of New York, do hereby certify that, DEAN NEIKIRK, PH.D., the witness whose deposition is hereinbefore set forth, was duly sworn and that such deposition is a true record of the testimony given by the witness to the best of my skill and ability.

I further certify that I am neither related to or employed by any of the parties in or counsel to this action, nor am I financially interested in the outcome of this action.

IN WITNESS WHEREOF, I have hereunto set my hand this 15th day of October 2020.

Linda Greenstein

Linda J. Greenstein

My commission expires: January 31, 2021

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I N D E X

WITNESS	EXAMINED BY	PAGE
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(Exhibits retained by counsel)

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DEPOSITION ERRATA SHEET

Our Assignment No.: 1040
Case Caption: Samsung v. Cellect, LLC

DECLARATION UNDER PENALTY OF PERJURY

I declare under penalty of perjury that I have read the entire transcript of my Deposition taken in the captioned matter or the same has been read to me, and the same is true and accurate, save and except for changes and/or corrections, if any, as indicated by me on the DEPOSITION ERRATA SHEET hereof, with the understanding that I offer these changes as if still under oath.

_____

DEAN NEIKIRK, PH.D.

Subscribed and sworn to on the ____ day of _____, 20 ____ before me.

_____

Notary Public,
in and for the State of
_____.

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DEPOSITION ERRATA SHEET

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