UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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SAMSUNG ELECTRONICS CO., LTD., :
SAMSUNG DISPLAY CO., LTD., :
and SONY CORPORATION, :
Petitioners, :
v. : Case IPR2015-00863;
IPR2015-00887
SURPASS TECH INNOVATION LLC, :
Patent Owner. :

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DEPOSITION OF THOMAS CREDELLE

Redwood Shores, California

Wednesday, October 28, 2015

9:32 a.m.

Job No.: 95817

Pages 1 - 131

Reported by: JENNY L. GRIFFIN, RMR, CSR, CRR, CLR
LICENSE NO. 3969

Deposition of THOMAS CREDELLE, held at:

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Pursuant to notice, before Jenny L. Griffin, RMR, CSR, CRR, CLR

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A P P E A R A N C E S (Continued)

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INDEX OF EXHIBITS

(Attached to transcript)

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Papers and Previously Marked Exhibits Referred to and not attached to the deposition:

(Continued)

Papers and Previously Marked Exhibits
Referred to and not attached to the deposition:

EXHIBITS	DESCRIPTION	PAGE
Sony-1016	Supplemental Declaration of Thomas Credelle in Support of Petition for Inter Partes Review of US Patent No. 7,202.843	61
1003	U.S. Patent Application Publication No. 2003/0156092 A1 (August 21, 2003)	63
1005	Certified Translation of Japanese Laid Open Patent Application No. 2002-13224	79
Paper No. 4	Corrected Petition for Inter Partes Review OF US Patent No. 7,202,843, No. IPR2015-00863	87
1001	U.S. Patent No. 7,202,843	112

P R O C E E D I N G S

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THOMAS CREDELLE,

being first duly sworn or affirmed to testify to the truth, the whole truth, and nothing but the truth, was examined and testified as follows:

- - -

MR. HELGE: Good morning. My name is Wayne Helge for the patent owner, Surpass Tech Innovation LLC.

MR. HANLEY: I'm Walter Hanley from Kenyon & Kenyon LLP. I'm representing the petitioner Sony.

MS. CARNIAUX: Michelle Carniaux, Kenyon & Kenyon, also representing petitioner Sony.

MR. WILSON: Paul Wilson, Covington & Burling, representing the petitioner Samsung.

EXAMINATION BY MR. HELGE:

Q. Good morning, Mr. Credelle.

A. Good morning.

Q. My understanding is that we're here for a deposition in the matter of inter partes review of U.S. Patent No. 7,202,843 in Case No. IPR2015-00863.

Is that your understanding as well?

A. It is.

Q. Can I have you please state your name and

address for the record.
A. My name is Thomas Credelle, 626 Ray Court, Brentwood, California 94513.
Q. Okay. And, Mr. Credelle, I'm going to hand you a notice of deposition that is already of record in this case. This is Paper No. 18, so I'm marking this as Exhibit 18.
Have you seen this paper before?
A. No.
Q. If you look at the cover sheets, do you see it says "Case IPR2015-00863" in the middle there?
A. Yes, I do see that.
Q. And that's the case that we're talking about today; correct?
A. Correct.
Q. And the patent number is 7,202,843; that's the patent we're talking about today here?
A. Correct.
Q. And your name, Thomas Credelle, that's the notice of deposition of Thomas Credelle; is that correct?
A. That is correct.
Q. That's you?
A. That's me.
Q. Super. And on the next page, it does say the

deposition will be taking place on October 28, 2015, at 9:30 a.m., which is now; correct?
A. That's correct.
Q. And this is the location that's indicated here on this paper.
This is the location where we're having this deposition; correct?
A. I agree, yes.
Q. And you're appearing in response to this notice of deposition; correct?
A. That is correct.
Q. So even though you haven't seen it before, you agree that this is why we're here.
A. This is why we're here. I agree.
Q. Mr. Credelle, I haven't gone over any of the ground rules of depositions, but I assume that you've been deposed before; is that correct?
A. That's correct.
Q. How many times?
A. Once.
Q. Once. Okay.
And in what matter was that?
A. That was Alien v. Avery Dennison.
Q. And?
A. I was an expert. I was a patent -- I was

deposed as an expert.
Q. Okay. I presume that they went over the ground rules before you were deposed in that matter?
A. They did.
Q. I'm going to going through a couple here just for clarification, just to make sure we get them on the record here.
I'm going to ask you, are you taking any medications today that would affect your testimony?
A. No.
Q. Is there any reason why you wouldn't be able to give true and accurate testimony today?
A. No.
Q. Another ground rule which I've already seen probably the need to state is that we can't interrupt each other. The court reporter can only take one testimony at a time or one person's words down in the transcript at a time.
A. Sure.
Q. And so --
A. Like I just did.
Q. Exactly. You got it.
A. I won't do that.
Q. Thank you.
We want to make sure we get all the testimony

on the record.

There's another guideline that is unique to this -- well, somewhat unique to this forum before the Patent Board, and this comes from the Patent Office "Trial Practice Guide." I'm going read this paragraph to you. The paragraph is:

"Once the cross-examination of a witness has commenced, and until cross-examination of the witness has concluded, counsel offering the witness on direct examination shall not, A, consult or confer with the witness regarding the substance of the witness's testimony already given or anticipated to be given except for the purpose of conferring on whether to assert the privilege against testifying or on how to comply with the Board order; or, B, suggest to the witness the manner in which any questions should be answered."

Does that paragraph make sense to you?

A. Yes.

Q. You understand the restriction on conferring with your own counsel, for example, during breaks or even once I've concluded giving -- taking your testimony, and it then switches over to their chance to ask you questions.

Do you understand that?
A. I understand that.
Q. Okay. So, if I can ask you, you were deposed in -- you said it was Alien v. who?
A. Avery Dennison.
Q. Okay. And you were appearing on which side?
A. On the side of Alien Technology. It concerned a patent, a patent from Alien that was challenged by Avery, and I was one of the patent authors.
Q. I see. Okay. Great.
So you were deposed as the inventor, or as an expert?
A. Perhaps both, but certainly as an inventor.
Q. Understood.
How long ago was that?
A. That was about ten years ago, approximately.
Q. Were you employed with Alien at the time that you were deposed?
A. Not at the time. It was after I left Alien Technology.
Q. Did you prepare an expert report for that case?
A. I did not.
Q. So you've never submitted a report as an expert before; is that right?
A. I have submitted reports as an expert on other

cases, but they haven't gone to deposition --
Q. I see. Thank you.
A. -- yet.
Q. I'll ask you then, what did you do to prepare for this deposition today?
A. To prepare for this deposition, I read my declaration, which was completed in March. So I reread the declaration, and I reread the patents that -- the original '843 patent as well as the patents we cited.
Q. Did you read all of those patents that you cited?
A. Yes.
Q. Does that include Suzuki?
A. Suzuki.
Q. Nitta?
A. Nitta; correct.
Q. How long ago did you do that review of your declaration?
A. Over the past week, I've reviewed that.
Q. Had you reviewed it anytime after March until last week?
A. No.
Q. As you were going through it, did you see anything in that declaration that, given the chance, you would have done differently?

A. No.
Q. Did you review the petition again?
A. I did review the petition.
Q. Do you recall if it was the original petition, or the corrected petition?
A. I don't recall. It was the latest copy. So I believe it was the corrected. May I ask my attorney?
THE WITNESS: Was that the corrected?
MR. HANLEY: Was that the corrected?
THE WITNESS: I believe it was the corrected, but --
BY MR. HELGE:
Q. Okay. You said it was the latest?
A. The latest.
Q. Okay. Understood. Thank you.
And did you also review that over, say, the last week?
A. Correct.
Q. Had you looked at that again anytime since March?
A. No.
MR. HANLEY: Objection. Lacks foundation.
BY MR. HELGE:
Q. Did you look at it in March?
A. No. Actually, I did not look at the completed

in March. Just my declaration.
Q. So you prepared your declaration without having reviewed the petition first?
A. That is correct.
Q. Okay. Well, who did you talk to in preparation for this deposition?
And just for clarification, I'm asking just identification of people, not contents of those conversations.
A. Sure. Primarily Michelle.
Q. Anybody else?
A. And Walt.
Q. And when you say "Michelle" and "Walt," you're referring to counsel sitting next to you; correct?
A. Right.
Q. Anybody else?
A. And part of the meeting was -- I'm bad with names. How can I forget? Paul. Yeah.
Sorry, Paul.
MR. WILSON: Okay.
BY MR. HELGE:
Q. And by "Paul," you're referring to the gentleman there?
A. Yes.
Q. Was there anybody else at those meetings?

A. No.
Q. Did you talk to anybody over the phone about the deposition?
A. I talked to Michelle over the phone.
Q. You didn't talk to any colleagues?
A. No.
Q. Have you talked to any colleagues at all about this case or any of the testimony that you've given in this case so far?
A. No, I have not.
Q. You mentioned Alien Technology.
Was there a Michael Marentic working at Alien Technology when you were there?
A. The name does not ring a bell. Possibly after I left.
Q. Are you aware that Mr. Marentic is a testifying expert in one of the cases related to this case also dealing with the '843 patent?
A. I was not aware of that.
Q. So you weren't aware that he was deposed earlier this month?
A. No, I was not.
Q. Okay. Are you aware of any of the events that have occurred in a related case dealing with the '843 patent, a related case before the Patent Trial and

Appeal Board?

MR. HANLEY: Objection. Vague.

BY MR. HELGE:

Q. It's okay. You can answer.

THE WITNESS: I'm sorry. What did you say?

MR. HANLEY: I objected to the question as vague. He is correct, however, that notwithstanding the objection, you can answer; and the board, if it comes to an issue between us related to the objection, will deal with it at a future time.

THE WITNESS: Okay.

Can you repeat the question, please.

BY MR. HELGE:

Q. Are you aware of any of the events that have occurred in a related case dealing with the '843 patent and that related case is also before the Patent Trial and Appeal Board?

A. I have seen the reference to a case with Sharp that was specified or stated in the response of the patent owner. So I'm aware that there was some activity related to Sharp and the '843.

Q. When you say "the response," are you referring to the preliminary response that was filed by Surpass in June?

A. Yes.

Q. Okay. And so did you review that preliminary response in preparation for this deposition?
A. I did read that response in preparation for this deposition.
Q. So as I understand from your testimony today, the first time you reviewed the corrected petition for inter partes review of US Patent No. 7,202,843 was within the last week; is that correct?
A. That's correct.
Q. As you reviewed that corrected petition, did you spot any errors in technology or logic or reasoning?
A. I detected no errors in logic or reasoning. I did detect some wording that was maybe not as clear as it could be; but, generally, it was very accurate.
Q. So you agree with the characterizations in that corrected petition; is that right?
A. I do.
Q. Mr. Credelle, I'm going to hand you what's been premarked by your counsel here as Exhibit 1014.
MR. HELGE: Walter, I don't think we need to have this marked as an exhibit here.
Do you agree with that? Are you okay with that?
MR. HANLEY: I don't see that we need to confuse the record with duplicate exhibit numbers.

MR. HELGE: Agreed.
BY MR. HELGE:
Q. Mr. Credelle, does this document look familiar to you?
You can look through it as much as you like.
MR. HANLEY: While he's doing that, can you just tell me what -- I'm sorry. Never mind.
I was going to ask you what the exhibit number was because -- it's down there, but the print is kind of small.
THE WITNESS: This looks familiar to me. This looks like my declaration for this case.
BY MR. HELGE:
Q. So this is the one you reviewed in the last week or so?
A. Yes.
Q. This is the one you agreed with?
A. Yes.
Q. You didn't spot anything you would want to change?
A. No.
Q. So on the cover page, it says "Declaration of Thomas Credelle" right there in bold letters; correct?
A. That's what it says.
Q. And that's you?

A. That's me.
Q. Great.
And if you look to the last page, which on the bottom with a Bates number, it says page 38, but the type, using, say, Microsoft Word, shows 37.
Are you on that page?
A. I see that page.
Q. Is that your signature there?
A. That is my signature.
Q. And that's your dated --
A. That's when I dated it.
Q. So before last week, that was the last time you had reviewed this declaration on March 16, 2015?
A. That's right.
Q. Can you please turn to Paragraph 16.
Feel free to read to yourself quickly and just let me know when you're complete.
A. Okay.
Q. Can you explain to me the scope of the opinions that you're providing in this declaration?
And if you need me to be more clear, just let me know.
A. Yes. Please expand.
Q. Are you providing an opinion on the proper claim construction of any terms in the '843 patent?

A. For this case, I'm using the generally accepted terms for the claim construction, so I did not do any special claim construction definitions.
Q. So you didn't perform an analysis of what any specific term means according to, let's say, some methodology that you might have?
A. I performed my -- an analysis to the extent that none of the terms seemed confusing to a person of skill in the art; that they would understood the terminology. So no special construction was required.
Q. Are you providing in this declaration an opinion on whether Claim 4 is invalid?
A. Yes.
Q. So your opinion is that Claim 4 is invalid; is that right?
A. That's my opinion.
Q. Can you show me where in this declaration you reached that conclusion?
A. The Claim 4 has several elements.
So do you want to go through the elements one by one?
Q. I'm happy to do this however you would like to answer the question.
A. Okay. Well, let's go to 4.
So the first elements of Claim 4 are regarding

the basic elements of an active matrix LCD.
Q. Can you tell me where you're looking right now?
A. So starting on page -- well, Paragraph 40.
Q. Okay. I'm there.
A. So at the bottom of Paragraph 40 in the last sentence, it states, In my opinion, these elements constitute nothing more than a conventional AMLCD panel. It was well known to those of ordinary skill in the art at the time of the purported invention of the '843 patent.

So this relates to the first part of Claim 4.

Moving to Paragraph 48, Suzuki describes the driving circuit that divides a frame period into plurality of temporal subfields. It supplies data voltage -- signal voltages to each of the liquid crystal cells of an LCD panel in each subfield of the frame period.

So this covers the multiple pulses of the Claim 4.

In "The Nitta Reference," Paragraph 49:

"Nitta also teaches an LCD device and driving method to improve picture quality of an LCD device."

To the extent that Suzuki doesn't completely describe an AMLCD, the Nitta reference completely describes the AMLCD referred to in the Claim 4.

Nitta also, at the bottom of Paragraph 49, recognizes there's a "blurriness" issue which is fixed by multiple pulses.

Further, at the bottom of page 21, it states:

To solve this problem, Nitta discloses a control circuit that divides a frame period into a plurality of temporal subdivisions referred to as 'fields' and applies a data voltage to every pixel of an LCD panel in each field.

Finally, in Paragraph 54 -- actually, on page 25 -- it says:

"Likewise, it is my opinion that a person of ordinary skill in the art would have recognized that the data voltages carried by the data lines of Nitta are applied to the liquid crystal elements of the pixel of the LCD panel to effect a change in the brightness level, and the data voltages generated by the driving circuit of Suzuki would likewise be applied to the liquid crystal elements of the LCD panel for the same purpose."

That purpose is to achieve the proper transmission rate or transmittance of the LCD.

So that -- from those excerpts, I believe that the Suzuki and Nitta reference fully describes the elements of Claim 4.

Q. Is that all that's required to render a claim invalid, in your opinion?

A. It's -- there's a prior art that renders obvious the Claim 4 of the purported invention. If all the elements are present in prior art, it is obvious. That is my understanding.

Q. I'm going to ask my question again.

Is that all that's required to render a claim obvious, in your understanding?

A. It's my understanding that if all of the claim elements are existing in prior art, then the claim is invalid.

(Clarification requested by the court reporter.)

THE WITNESS: If all of them are present in prior art, then the claim is invalid. That is my understanding.

BY MR. HELGE:

Q. Just to get a clear record, your understanding is that if all of the claim elements are present in the prior art, then that claim is invalid.

Is that your testimony?

A. That is my testimony.

Q. Based on that understanding, you are rendering an opinion in this declaration that Claim 4 is invalid, based on a combination of Suzuki and Nitta; is that correct?
A. That is correct.
Q. Based on that same understanding, are you providing an opinion in this declaration whether Claim 5 is invalid over a combination of Suzuki and Nitta?
A. Yes.
Q. Based on that same understanding, are you providing an opinion that Claim 6 is invalid, based on a combination of Suzuki and Nitta?
A. Yes.
Q. Based on that same understanding, are you providing an opinion that Claim 7 of the '843 patent is invalid, based on a combination of Suzuki and Nitta?
A. Yes.
Q. Based on that same understanding, are you providing an opinion in this declaration that Claim 8 of the '843 patent is invalid, based on a combination of Suzuki and Nitta?
A. Yes.
Q. And based on that same understanding, are you providing an opinion in this declaration that Claim 9 is invalid, based on a combination of Suzuki and Nitta?

A. Yes.
Q. And are those opinions independent -- never mind. I'll withdraw that question.
I'd like to focus on Paragraph 4 of your declaration for a moment.
A. Okay.
Q. In the third sentence of Paragraph 4, you state that you participated in research and development products related to optical materials and flat-panel displays including LCD devices.
Do you see that?
A. I see that.
Q. What other types of flat-panel displays did you look at?
A. I looked at electron-beam-based flat-panel displays and plasma flat-panel displays as well as active matrix LCD.
Q. When you say "plasma flat-panel displays," would it be correct to say that that's what we call now plasma display --
A. Plasma panel. Right.
Q. Plasma panel, right.
A. Yes.
Q. A "PDP," for example?
A. Yes.

Q. Okay. And you mentioned active matrix LCD devices; is that right?
A. I did.
Q. Did you deal with any other types of LCD devices?
A. I was familiar with the operation of passive matrix LCD devices, but they are not appropriate for television, which was RCA's interest. So the main focus was on active matrix LCDs.
Q. You mentioned that passive matrix LCD panels are not appropriate for television.
Was that RCA's view?
A. Yes.
Q. Was that your view as well?
A. Yes.
Q. Have passive matrix LCD panels ever been used for television, in your estimation?
A. Not to my knowledge.
Q. Have they ever been used for computer monitors?
A. Yes.
Q. Have they been used for computer monitors that are required to display moving images?
A. They are used for computer monitors, and the computer can't dictate what content the user may try to display. But the response time of a passive matrix LCD

is too slow for motion video.
Q. Is motion video the same as a moving image?
A. Yes.
Q. So if we were to draw a Venn diagram, those two would be completely overlapping?
A. Well, a moving image wouldn't necessarily have to be video; it could be computer graphics. So it may not be a complete overlap.
Q. So, for example, if somebody were moving a mouse on a computer screen, how would you characterize that?
A. That would be a moving image and not a video clip.
Q. Let's take a look at -- you've got one figure in here. It shows up a couple times, and I just wanted to find the best version of it. I think page 11 may be better than page 14. So let's take a look at page 11.
A. Sure.
Q. This is part of Paragraph 31, or at least it follows Paragraph 31.
Do you recognize that image?
A. I do.
Q. Do you recall where it came from?
A. It came from a textbook.
Q. And I believe it was the O'Mara textbook?

A. Yes.
Q. Do you own a copy of that textbook?
A. I have in my possession a copy of the textbook.
Q. Are you borrowing it?
A. Borrowing it.
Q. Who are you borrowing it from?
A. The attorney firm purchased it, so I have it in my possession.
Q. Did they purchase it on your recommendation?
A. I suggested several textbooks that might be appropriate for this case, and this was the one that they chose to procure.
Q. What were the others?
A. The Lueder textbook.
Q. How do you spell that?
A. L-U-E-D-E-R. It's also one of the exhibits.
Q. Any others?
A. None that were of the right time era. So there were other textbooks that I had identified that were older but not as appropriate.
Q. You say "not as appropriate."
Do you mean simply because of time, or was there some content in there that also was not quite right?
A. The content wasn't as detailed as this

particular textbook, so I recommended that this would be a good representation of an active matrix LCD circuit that was well known to persons of skill in the art in the time frame.

Q. Do you think there's anybody with skill in the art that would look at this and say it's not an active matrix LCD panel?

A. No.

Q. Let's take a look at that little circle in the middle.

Do you see that there?

A. I do.

Q. It looks to me like that is calling out different parts of the panel and providing some names for them.

Do you agree with that?

A. I do agree with that.

Q. Can you tell me -- do you see the data line there?

A. Yes.

Q. Can you describe for me what the data line is and what it's doing?

A. The data line takes an analog voltage from the data input block and will provide a voltage to the liquid crystal capacitor when the transistor is turned on by the gate line.

Q. I'm glad -- you got to the punch line about the gate line, didn't you?

Is there anything else you want to say about the gate line or the function that it provides or the purpose of it being there?

A. The only function of the gate line is to act as a switch to a row of transistors so that in a line-by-line basis, data will be provided to the LCD panel. Specifically, charge or voltage will be provided to the capacitors shown as "LC" and "Storage capacitor" in this diagram.

Q. "LC," what does that stand for?

A. Liquid crystal.

Q. And why is that shown as a capacitor?

A. Liquid crystal is shown as a capacitor because there's two electrodes on either side of the liquid crystal material. So it forms a capacitor, and it's a resistive material, highly resistive material.

Q. Does anybody ever show liquid crystals -- or a liquid crystal capacitor as a resistor in a diagram?

MR. HANLEY: Objection. Vague.

THE WITNESS: It is not shown as a resistor only, but it has resistance.

///

BY MR. HELGE:
Q. -- but it wouldn't be shown as a resistor in that -- that standard --
A. No.
Q. -- active matrix panel?
A. No, it would not.
Q. So the "LC" that's marked here is a liquid crystal capacitor; is that right?
A. That's correct.
Q. And you would actually have liquid crystal material between those two plates; right?
A. Yes.
Q. And one plate would be a pixel electrode?
A. One plate would be a pixel electrode connected to the drain of the transistor, and the other electrode would be a common electrode on the opposite piece of glass in the liquid crystal cell.
Q. Can you tell by looking at this diagram whether that second electrode is arranged on a piece of glass?
A. The second electrode is not indicated in this drawing because this is just a drawing of the active matrix side of the LCD.
Q. But the bottom plate on that LC capacitor would represent that second electrode; right?
A. Actually, the dot -- if you look at the dot

that connects the two capacitors, that dot would represent the common electrode.
Q. I see. And so the LC capacitor is really just the LC material; is that right?
A. The LC capacitor is the LC material -- let me rephrase.
The capacitor is formed by the LC material between two electrodes. One is the pixel electrode, and one is the common electrode, as I stated.
Q. You mentioned earlier about the storage capacitor as well, and it appears that that's arranged right next to the LC capacitor; is that right?
A. The storage capacitor is a capacitance in series with the liquid crystal capacitance to aid in the storage of charge on the pixel electrode.
Q. I have a few questions about what you just said.
The first one is that it's in series, but doesn't it show to be in parallel here on this diagram?
A. I stand corrected. You're right. It's in parallel. I may have said "series." I -- the two capacitors are in parallel.
Q. And the next thing you said was that it tends to "aid in a storage of charge on the pixel electrode"; is that right?

A. Yes.
Q. What do you mean by "aid in the storage of charge"?
A. So liquid crystal materials have certain resistance, and the concept of an active matrix LCD is to store charge for a frame time and allow the voltage to switch the molecules.
If that charge were to leak off before the panel was refreshed one frame time later, then the voltage would not achieve the proper level and the transmittance would not be at the proper level.
Q. And so how does the storage capacitor help or prevent that from happening?
A. So the --
MR. HANLEY: Objection. Lacks foundation.
BY MR. HELGE:
Q. Please let me ask another question.
Does the storage capacitor help or prevent that from happening?
MR. HANLEY: Objection. Compound.
BY MR. HELGE:
Q. Well, then, let's just ask this question again.
Does the storage capacitor prevent that from happening?
A. The storage capacitor adds capacitance to the

pixel such that the decay time, which is the resistance times the capacitance, is longer -- RC.

(Discussion held off the record.)

BY MR. HELGE:

Q. So the storage capacitor adds capacitance to the pixel so that the resistance time --

A. So that the -- I said "RC."

So the time constant of a system such as a capacitor is the resistance times the capacitance, so you want that number to be much longer than a frame time.

A frame time is typically 16 milliseconds. So you want the response time, the RC time, to be much longer than 16 milliseconds.

Q. So if you don't have a storage capacitor there, you're relying or you're building that RC constant, the time constant, based solely on the capacitance of the LC capacitor; is that right?

A. And the resistance of the material.

Q. And the resistance of the material.

And so if you don't have the storage capacitor, you may have, let's say, decay of the desired transmittance within a frame period; is that right?

A. That's correct.

Q. And that's undesired; right?

A. Undesired.
Q. And people of ordinary skill in the art know that?
A. They would know that.
Q. And they would avoid that?
A. They would take great pains to avoid that.
Q. On this diagram, we also see letters R, G, B, R, G, B along a row.
Do you see that?
A. I do.
Q. Does that refer to the color being displayed by each of those pixels?
A. That refers to a -- what's known as a "color filter" in an active matrix LCD.
The LCD element itself does not have any color itself. It transmits light from a light source, and it either allows a small amount of light or a large amount of light through that liquid crystal material.
And then the light goes through a color filter, like a red, green, or blue color filter, so that the output to our eyes is a red, green, or blue dot.
Q. So none of these pixels emit their own light, for example?
A. That is correct.
Q. Where does the light come from?

A. The light comes from a light source behind the LCD in some cases or, in some cases, from the ambient light.
Q. Would that be like a reflective LCD panel?
A. That would be like a reflective or transflective LCD panel.
Q. And is that different for passive matrix LCD panels?
Well, let me be more clear. That's a bad question.
The general operation with regards to light that you just explained, do passive matrix LCD panels operate differently?
A. They operate in a similar matter.
Q. They don't emit their own light; the pixels don't?
A. That is correct.
Q. They would have a back light as well or a side light or reflect ambient light?
A. That's right.
Q. So we've talked about active matrix and passive matrix LCDs.
Are you aware of any other types of LCD panels?
A. Yes.
Q. Can you name, let's say -- actually name as

many as you can, and we can sort of knock them out one by one.

A. Okay. Ferroelectric LCD is a type; optically controlled birefringence LCD is a type; cholesteric LCD is a type. That's probably enough.

Q. You mentioned one -- it had a name that I hadn't heard before, but I have heard of bi-stable.

And I'm just wondering, is that similar to bi-stable, or would that be a different type?

MR. HANLEY: Objection. Vague.

THE WITNESS: Bi-stable LCDs are another type of LCD material.

BY MR. HELGE:

Q. So here we have at least four different types.

We have ferroelectric, optically --

A. -- controlled birefringence.

Q. We have cholesteric and bi-stable.

A. And bi-stable is a twisted -- is a nematic liquid crystal material.

Q. Twisted nematic?

A. Nematic. Sometimes twisted, sometimes not.

Q. Do all of those types of LCD panels differ -- I'm going to get an objection for a compound question, so I'm not going to ask it.

Let's talk about bi-stable briefly just because that one is an easy one to say.

You mentioned that sometimes it's twisted and sometimes not; is that right?

A. Uh-huh.

Q. And so does that affect the components of the panel itself, or is that simply a characteristic of the LC material?

A. The -- you're pointing to the active matrix circuit?

Q. That's right.

A. The bi-stable display does not use an active matrix circuit. So there's a characteristic of addressing the scheme and the design of the liquid crystal materials to create a bi-stable state.

Q. It doesn't use the active matrix circuit?

A. It does not.

Q. And we know the passive matrix doesn't use the active matrix circuit?

A. Passive matrix does not.

Q. And so the controlled --

A. OCB.

Q. OCB. That's a great way to put it.

So the OCB LCD panel, does that use an active matrix circuit?

A. Yes.

Let me rephrase.

It usually would use an active matrix circuit because its attribute is a fast-switching material, but it could be addressed passively as well.

Q. So you could use either circuitry?

A. You could.

Q. So in the ferroelectric LCD, does that use an active matrix circuitry?

A. No.

Q. What does that use?

A. It relies on the inherent switching capability of the ferroelectric liquid crystal material to switch on or off and hold its state without an active matrix hold circuit.

Q. You mention an active matrix hold circuit.

Can you tell me what you mean by that?

A. Sure. The active matrix LCD is called the "hold circuit" because it takes all of the data in during the addressing time and holds the voltage on the pixel for a complete frame time until it's addressed again. So it's very unique to an active matrix LCD.

When you say a "hold-type display," that would imply an active matrix because you are holding the data through a switch on each pixel.

Q. We may have to come back to that later too.

A. Okay.
Q. Okay. So we've talked about ferroelectric. We've talked about OCB.
Cholesteric, we haven't talked about yet.
Does that use an active matrix circuit?
A. Typically, no.
Q. What does that use?
A. It's liquid crystal material that, again, switches its state and holds its value after it's switched so that it does not require an active matrix to hold the signal on the panel.
Q. And is that a property of the LC material itself?
A. It's a property of the LC material.
Q. What sort of circuitry would it use?
Is it more like a passive matrix circuitry?
A. Essentially, it's like a passive matrix, yes.
Q. And so am I correct in saying that we've really talked about six different type of active matrixes -- excuse me -- we've talked about six different types of liquid crystal displays so far. We've talked about active matrix, passive matrix, ferroelectric, OCB, cholesteric, and bi-stable.
Is that correct?
A. We have talked about those six categories, but

I would not characterize them the same way you just did.
Q. Okay. Please correct me.
A. The liquid crystal is one part of the equation, and then the driving circuit is the second part of the equation.
So we've talked about liquid crystal, a so-called twisted nematic liquid crystal which is used in an active matrix, and it's also used in a passive matrix.
We've talked about cholesteric, which is used in typically passive matrix; driving, bi-stable, passive matrix; ferroelectric, passive matrix; OCB, active matrix, typically.
And there's actually one that I didn't mention that I just thought of is smectic liquid crystal. If you would like to --
Q. How would you spell that?
A. S-M-E-C-T-I-C.
Those are also typically a passive matrix or laser addressed because they're thermally responsive.
So there's been a lot of development of LC materials and devices over the past several decades.
Q. One thing I didn't say about the rules today, and that is when you want to break, as long as there's not a question pending on the table, we can take one.

So please let me know whenever you're ready.
A. Thank you.
Q. So in terms of these types of LC materials, let's talk about overdriving.
A. Overdriving?
Q. Overdriving.
A. Okay.
Q. So would it be easier for us to go through these one by one based on the LC material and ask about overdriving, or should we talk about the circuitry in terms of overdriving?
What would make more sense from a technical perspective?
A. Well, overdriving is a technique that does apply primarily to active matrix LCDs, so we should restrict to active matrix LCDs would be my recommendation, but we can do as you wish.
And the liquid crystal material is -- characteristics is what dictates the need or not for overdrive.
Q. So what type of liquid crystals need overdrive?
A. Typically -- especially in the time frame of 2003 -- liquid crystal materials' response time to an applied voltage was slow enough such that in moving images or video, you would have a smear or blur.

So the response time was longer than one frame time, which would be typically a 60th of a second.
So the twisted nematic materials that have slow response would be a candidate for overdrive.
Q. And you said only active matrix?
A. Only active matrix.
Q. No passive matrix?
A. I'm not sure how you would implement an overdrive in a passive matrix addressing scheme.
Q. Would you use overdriving with any of these other LC types we've been talking about this morning other than twisted nematic?
A. The LCD material is a candidate, although it is fast-switching on its own. There may be some benefit, but I have not researched that.
Q. Any others?
A. No.
Q. Do you recall the driving waveform shown in Suzuki?
A. Yes. I believe I do.
Q. How would you characterize that driving waveform?
Anything peculiar about it?
A. They have -- a drive waveform that consists of a higher-than-target voltage pulse which they call

"overshoot" and a second pulse they call "overdrive," which is either higher or lower than the target value in order to achieve a proper transmittance of the panel.

Q. How about the polarity of the signals?

A. The polarity of the signals are inverted each frame, which is very typical of an active matrix LCD.

Q. Why is that typical?

A. LCD -- especially twisted nematic LCDs -- but, in general, all respond to the RMS voltage applied -- root mean square voltage applied.

Liquid crystals can also be damaged by a DC voltage applied because the electric field will cause changes to the liquid crystal material and will degrade its properties.

So all LCDs, to my knowledge, are driven with AC waveforms. So the net DC voltage is zero on the liquid crystal, and then the liquid crystal will last for the life of the product.

Q. So it's more about longevity of the LC material than it is about image quality, for example?

A. Well, the degraded image is image quality; but, yes, it's not about any local image quality.

So you have to preserve the properties of the liquid crystal because if they degrade, an applied voltage will not give you the right luminance or

transmittance.
Q. But it's not about correcting blurriness, then; is that right?
A. It's not about correcting blurriness.
Q. Okay. And did you say that this is only used in active matrix LCD panels?
A. No. I said all LC materials that I'm aware of are sensitive to DC voltages applied. So in a passive matrix, circuitry would also have inverting voltages on some periodic basis to prevent this problem.
Q. So inversion driving is applicable to both passive matrix and active matrix?
A. That's correct.
Q. With an inversion driving scheme, what else has to be different than, say, for example, if you were driving with the same polarity in every subfield or every frame?
A. Anything else? I'm not sure I understand your question.
I just told you that a DC field would destroy the liquid crystal. So the AC field has to be balanced so that there's no DC on the liquid crystal. That's the primary requirement.
The frequency of the inversion can be adjusted based on the properties of the liquid crystal, and a

higher frequency will result in a better image quality, typically. Less flicker.
Q. Okay.
MR. HELGE: We'll go off the record at -- we've got the time right on here, don't we? 10:28.
(Recess taken.)
MR. HELGE: We'll go back on the record at 10:37.
BY MR. HELGE:
Q. Mr. Credelle, I've got to ask you: We talked earlier this morning about the prohibition from conferring with your counsel about your testimony that you've already given or that you're going to give.
And you haven't talked to them about that; right?
A. I did not.
Q. Let's take a look at page 8 of your declaration.
A. If I might, may I make one more comment about the active matrix if we're leaving that subject for now?
Q. Please.
A. The -- you asked about the storage -- about the liquid crystal capacitor, and I would like to just say that the liquid crystal capacitor is not a constant capacitor; and that is, the capacitance changes as the

voltage -- as the liquid crystal molecules move so that the voltage would actually decrease below the target level.

So that is a feature or a characteristic of liquid crystals where the storage capacitor, which doesn't change with applied voltage, helps that response-time problem.

But that is a known characteristic of twisting nematic liquid crystals and how you drive them. You have to take that into account.

Q. And so this Hitachi reference or this textbook from 1993, this stuff was known back in 1993; is that right?

A. Even before. Yes.

Q. Okay. Well, let's shift over, if we may, please, to Paragraph 24.

A. Okay.

Q. This is on page 7/8.

And please go ahead and read to yourself and let me know when you're ready.

A. Okay.

Q. You say here the person of ordinary skill in the art would have been a person with a bachelor's degree or equivalent in electrical engineering.

What do you mean by "equivalent"?

A. "Equivalent" may mean experience in the field that would sometimes be considered as equivalent to a degree. Somebody who has many years of experience in electrical engineering would be equivalent to that degree.

Q. So somebody could have a bachelor's degree in a nontechnical subject and then have working experience and meet the standard?

A. Typically, I would say a person might have an associate's degree, not a four-year degree, in electronics or some related electrical engineering discipline and learn the rest of the technology by working at a job.

Q. And that's why you say approximately three to five years of experience in designing and developing?

A. I say three to five years of experience for a degreed engineer who then becomes familiar with electronic displays and driving circuits for electronic displays, which is obviously a subset of all of the disciplines of electrical engineering.

Q. And you mentioned here both designing and developing.

A. Correct.

Q. What value or what characteristics are added through the design experience?

A. A design of an LCD device may include many features. It may include the choice of liquid crystal materials. It may include the choice of cell gap between glass plates. It may affect -- it may include the mechanical frame that is put around the LCD and the interconnecting circuitry that's used.

Specifically, the LCD driving circuit would be choosing the drivers for the gate driver and the source driver and how the voltages are supplied to those two driver chips.

Q. What value would be added through the developing?

Is that a synonym of "design" from your perspective, or is that something different?

A. To me, the process is first design and then develop the product, so it's kind of a continuum design with choosing the elements. Developing the product would be putting them all together, in my definition.

Q. I see. And so somebody without this experience or without this technical background would not be a person of ordinary skill in the art of the '843 patent; is that right?

A. That's right.

Q. You mentioned about cell gap.

Tell me about cell gap.

A. "Cell gap" refers to the spacing between the two glass plates of a liquid crystal display and the cell gap -- the response time of the liquid crystal will be a function of that cell gap.

Q. Would you say that cell gap is similar to overdrive in the sense that changing cell gap and overdriving are both adjusting in order to improve response time?

A. Both are addressing the same issue.

Q. So as of November 17, 2003, how many years of experience did you have in designing and developing LCD devices and LCD-driving circuitry?

A. Approximately 20 -- let's see.

I started in the late '70s, so about 25 years.

Q. You started at RCA in 1970?

A. 1970.

Q. So from 1970 to 1978 or so, would you say that you weren't working in this field?

A. I was working at flat-panel technology, but not liquid crystal-based.

Q. And so does that go back to the PDPs and -- I believe you mentioned electron beam?

A. Electron beam flat-panel displays, yes.

Q. So with 25 years of experience at that time, you would agree that your understanding of LCD technology far exceeded that of a fairly recent graduate from a university; correct?

A. Yes.

Q. And this standard for a person of ordinary skill in the art, as stated in Paragraph 24 of your declaration, that's the standard that you came up with and applied in this case; is that right?

A. That's the definition I used, and that's what I applied; not my own experience.

Q. So you mentioned earlier you've only been deposed once before, but you've been engaged in a number of cases as an expert in patent cases; is that right?

A. Correct.

Q. How many patents do you think you've analyzed in the capacity of those engagements?

A. Probably 15 to 20 over the past several years.

Q. And those are the patents that are specifically at issue in those cases?

A. I'm sorry. The patents at issue is the number I'm referring to, not the prior art. That's a much bigger number.

Q. Any ballpark idea how many you've looked at through that process?

A. It -- as prior art and actual patents at issue?

I'd say typically, for every case, there may be

half a dozen patents that might be considered as prior art. So the number would be multiplied by five or six.
Q. I believe your CV said at one point that you've looked over 500 patents, right, for one case?
A. For one -- that's correct. That was not a case. That was patent analysis for a client.
Q. I see. Okay.
But you had to evaluate over 500 patents?
A. Yes.
Q. So you've read a lot of patents?
A. I've read a lot of patents.
Q. In that process, have you developed a methodology that you use when you're looking at a patent for the first time for understanding it?
A. Yes. I believe so.
Q. Could you describe that for me.
A. It depends on the goal, of course, but I tend to look at the claims first. I look at the abstract, then I look at the claims, and then I read the spec.
Q. Why do you look at the abstract first?
A. I need to get an idea of the purpose. Usually, the abstract tells you the purpose of the invention; what the inventor is trying to accomplish in their disclosure. So I get an idea.
I then look at the claims to see what is being

actually claimed, and then I would look at the spec and read that.

Q. Do you expect the abstract to contain all the details of the invention?

A. No.

Q. When you look through the claims, do you ever indicate certain terms that you think may need some more review to understand what they mean?

A. Yes.

Q. And would it be fair for me to call that process "claim construction"?

A. I think that's fair to say.

Q. Now, do you have a methodology for your own personal performance of claim construction?

A. My strategy is to -- when I see a term that is unfamiliar to me, I will look in the specs to see if it's defined in some way that gives me an understanding of that term; and if not, then I would look into other sources to see if I could understand the meaning of that term.

Q. Do you ever read the specification to try to understand the meaning even if there's no definition?

A. I would say I read the specification to understand what the inventor is attempting to invent.

So, yes, I do read the spec to understand what

is said in the claims.
Q. You read the whole spec?
A. Yes.
Q. The background?
A. The background, the summary, the figures, and the specification.
Q. Do you read the other claims also?
A. I read the claims.
Q. Right. So -- but if you find a term in one claim, you would read other claims around it to give context, maybe?
A. That would be accurate.
Q. And that's your methodology for every case, do you think?
A. I wouldn't say every case because, in some cases in my history, I've been asked to do quick evaluations of patent -- a group of patents to form a judgment on their merits; maybe their applicability to current technology or some other aspect.
So my process might be different than if it's a case where there's -- like an IPR or a trial case.
Q. So if it's an IPR or a trial case, do you give it more careful analysis?
A. Of course.
Q. And you would look more at the specification

and the claims and the figures and all these things you've already mentioned; right?
A. That's right.
Q. Is there anywhere else you would look to try to understand the meaning of the term?
A. If I don't understand a term, I look into resources that I have, perhaps, at hand.
For me personally, the Society for Information Display has a wealth of knowledge related to display technology -- literally years of papers -- so I will sometimes look at a paper that is on the topic and try to see if I then understand more clearly the concept.
Q. Have you heard of a term called "file history" or "prosecution history"?
A. Yes.
Q. What does that mean to you?
A. It's a complete record of the patent office's examination of a patent and all of the office actions and the final conclusion of all of that effort.
Q. Have you looked at the file history for this '843 patent?
A. I did.
Q. Okay. You did that as a part of preparing for your declaration?
A. Yes.

Q. Did you look at it again in preparation for your deposition?
A. I scanned it briefly; but, yes. So I scanned it.
Q. So you're aware that Claims 1 through 9 of the '843 patent issued?
A. I'm aware of that without office action.
Q. So you're aware that the first action was an allowance, a notice of allowance?
A. I am aware of that.
Q. You mentioned earlier this morning that you felt that none of the terms in the '843 patent required any specific construction, and you simply applied a plain and ordinary meaning; is that right?
A. Yes.
MR. HANLEY: Objection. Lacks foundation.
MR. HELGE: Walter, what foundation did that question lack?
MR. HANLEY: Well, you said "any of the terms in the patent." The patent has a lot of parts. I think, if I recall, the testimony was directed to the specific claims at issue in this IPR.
MR. HELGE: Thank you. That's a great point.
BY MR. HELGE:
Q. Mr. Credelle, you mentioned earlier this

morning that you felt that none of the terms in Claims 4 through 9 of the '843 patent required any specific instruction, and you simply applied a plain and ordinary meaning; is that right?

A. That is correct.

Q. Mr. Credelle, could you please turn to Paragraph 43.

It looks like you're already there.

A. I saw what page you were on.

Q. Do you see in the middle there we have Exhibit Sony-1009 at 18, and we have this illustration here?

A. Yes.

Q. And you mentioned earlier a Lueder textbook.

Is this the textbook referred to in Paragraph 43?

A. It is.

Q. And the image shown on page 18 here, this is, according to your evaluation, an active matrix LCD that uses TFTs, or thin-film transistors, for the switching devices; is that correct?

A. That is correct.

Q. And in this image, we also have what looks to be a liquid crystal capacitor and a storage capacitor; is that right?

A. That is correct.
Q. And so that would be capital C, lowercase LC, capital C, lowercase S.
Is that right? It may be subscript.
A. Yes. That's correct.
Q. Okay. If you back up one paragraph to Paragraph 42, you mention:
"It is my opinion that those of ordinary skill in the art at the time of the purported invention knew that a thin-film transistor, or TFT, was commonly used as a switching device for the pixels of an active matrix LCD panel."
Do you see that?
A. I see that.
Q. Why were TFTs commonly used as switching devices in an active matrix LCD panel?
A. A transistor acts as a switch to control the flow of charge to the liquid crystal capacitance so that the voltage can be applied to a pixel. It's a thin-film transistor as opposed to a single-crystal transistor because it has to be deposited on a piece of glass. And it's deposited as layers of material in thin films to form a transistor, typically with amorphous silicon or polysilicon as the active material.
Q. Are there other types of transistors besides a

thin-film transistor or a single-crystal transistor?
A. There are many kinds of transistors in integrated circuits. The thin-film transistor is of the category called "field effect transistor" or FET.
There are also bipolar transistors and many other categories which maybe you don't need to go into.
But the thin-film transistor is the type called a "field effect transistor."
Q. So are bipolar transistors not used in liquid crystal display panels?
A. Not to my knowledge.
Q. This last sentence in Paragraph 42 states:
"The O'Mara textbook further states that 'current production displays employ . . . a MOS thin-film transistor, TFT . . ."
Do you see that?
A. Yes.
Q. What do you think O'Mara means by "current production displays"?
A. What he means is displays at the time that were in production that utilized active matrix LCDs. So --
Q. Is that focusing on active matrix LCDs, do you think?
A. As opposed to?
Q. Any other kind of LCD.

A. It was directed to active matrix LCDs because active matrix LCDs are the type that uses thin-film transistors.
Q. So this couldn't be, for example, a passive matrix LCD that he's talking about?
A. That is correct.
Q. Do you know O'Mara?
A. I have met him.
Q. You didn't talk to O'Mara about this reliance that you've made in your declaration on the text, though; correct?
A. No, I did not.
Q. And "MOS" stands for metal oxide semiconductor; is that right?
A. That's right.
Q. Mr. Credelle, I'm going to hand you what's been premarked as Exhibit 1016 in this case.
Does this look familiar to you?
A. Yes, it does look familiar to me.
Q. What is this document, then?
A. This was a supplemental declaration that I did review these two documents, Ernst Lueder and William O'Mara's books, and that, as it says, experts in the field of LCD device, these are experts -- I'm sorry -- experts would rely on these textbooks to do

their work, and that experts such as myself would -- could rely on these books to form an opinion about the state of the art at the time of the invention.
Q. And so these diagrams that you've incorporated into your declaration, these are reliable diagrams?
A. Yes, they are.
Q. And they accurately reflect the structure of active matrix LCDs?
A. They reflect a very typical example of an active matrix LCD.
Q. Do you personally rely on these documents in other contexts, not necessarily related to this case?
A. These textbooks?
Q. These two textbooks mentioned here.
A. I have used them in the past as references for liquid crystal technology or other aspects covered in those textbooks, but not for this case.
Q. When you say it is my -- excuse me.
In Paragraph 3, when you say, "It is my opinion that experts in the field of LCD devices and LCD driving circuitry would reasonably rely on textbooks," are you speaking on your own behalf only?
A. I'm expressing my opinion that experts would rely on these books to represent an active matrix LCD.
Q. Did you talk to any other experts about the

reliance on these books before you made this statement?
A. No, I did not.
Q. Did you have any other basis for making this statement other than your own personal opinion about these references?
A. It's my opinion that these references represent a typical description of the art.
Q. Because they're accurate?
A. Because they're accurate.
Q. And both of these references were used in this case based on your recommendation; is that right?
A. I suggested these textbooks to be used as background, but my primary analysis was based on the cited Suzuki and Nitta references.
Q. Why don't we take a look at Suzuki.
A. Okay.
Q. I'm going to hand you what's been premarked as Exhibit 1003 in this case.Mr. Credelle, does this document look familiar to you?
A. Yes, it does.
Q. And how does it look familiar?
A. It is a copy of the Suzuki patent, the application.
Q. And taking a step backwards, are you aware of how many grounds have been instituted in this case?

A. In our particular case?
Q. That's right.
A. Yes.
Q. Okay. And which grounds or ground have been instituted?
A. The Suzuki plus Nitta. Ground 1, I believe it is.
Q. And do you know which claims are attacked or, in your opinion, rendered invalid by Suzuki and Nitta?
A. 4 through 9.
Q. Do you know personally any of the inventors of the Suzuki reference?
A. I believe I do not.
Q. Do you know Patrick Burns at Greer, Burns and Crain?
A. I do not.
Q. Can you please open up to Paragraph 4 on page 11.
A. Okay.
Q. There's a statement here about four lines from the bottom where it talks about displaying moving images.
Do you see that?
A. I see that, yes.
Q. And do you recall we talked earlier this

morning about moving images in video?
A. I do remember that.
Q. And you said that moving images may not include video?
A. Moving images could be -- includes video but could also conclude nonvideo moving objects.
Q. What characteristics are different between moving images and video?
MR. HANLEY: Objection. Lacks foundation.
BY MR. HELGE:
Q. In your opinion, Mr. Credelle, and based on your characterizations earlier this morning, what differences do you see between moving images and video?
A. A moving image is exactly what it says, an image that is moving across a display.
A video signal would be a repetitive set of frames of data that represent some content, like a TV show or a movie, typically called "video."
In both cases, the liquid crystal is being refreshed at the same rate. But in the case of a moving images -- and I think you used the example of a cursor -- that would be a moving image across a screen, whereas I said a video would be more as a -- like a movie or a TV show.
Q. And so what I get from that is you see a

difference in that a video is based on a video signal; is that right?

A. A video would typically be based on a video signal, whereas a computer screen or some animated graphics would be based on a computer source of data. Both are moving images.

Q. Let's take a look at Figure 1 of Suzuki. It's on page 2.

Do you have a good understanding of all the elements in this figure?

A. I believe that I do.

Q. So there's image data up in the left-hand corner.

Do you see that?

A. Yes.

Q. How would you describe that image data?

A. That would be typically data coming from a source such as a computer, or it could be a tape recorder, a video playback machine. But it is data that represents the -- what wants to be displayed.

Q. "What wants to be displayed"?

A. Yeah. It wants to be displayed.

Q. Okay. And it moves into the data conversion part generally; is that right?

A. Correct.

Q. What's the general function of the data conversion part?
A. The data conversion part function is to determine a set of voltages that can be used in this -- for this LCD to reduce blur.
Q. What about the frame memory 12 next to that?
A. The frame memory 12 is where data is stored, because this particular design looks at the current data and the previous data to make a decision about the voltage that should be applied to the liquid crystal pixel.
Q. And the "operational unit 32" is a subset of data conversion part; right?
A. Yes.
Q. And what is the operational unit 32's purpose or function?
A. The purpose of the operational unit is to determine the magnitude of the signals that will be applied to the LCD, which may be higher or lower than the target value.
Q. So those signals, are they shown on this diagram?
A. Those signals are called "OSD" and "ODD."
Q. Do you recall what those abbreviations stand for?

A. Overshoot and overdrive.
Q. And those signals are transmitted from the operational unit to where?
A. They go to the -- as indicated, to the Timing Control Unit 14 and then to the Source Driver 16.
Q. What does "DRV" stand for?
A. Drive.
Q. What does that mean?
A. To me, it means the signals that are used to drive the pixels to their target value, but the data is still digital.
Q. Why would they use "DRV," do you think, at this point if the data is still digital?
MR. HANLEY: Objection. Calls for speculation.
THE WITNESS: I would agree.
I don't know why they chose that particular nomenclature.
BY MR. HELGE:
Q. Do you think there's something that might be more accurate?
MR. HANLEY: Objection. Vague.
THE WITNESS: So I can answer that.
"Data signals" or "data levels" might be more accurate.
///

BY MR. HELGE:
Q. Is there anything else included in that DRV other than the digital data that's going to be used for the panel?
A. This is a block diagram, so I can only speculate, but I believe the DRV is the digital data going to the source driver, whereas the arrow on the side of the source driver is providing the timing signals to control the flow of information to the panel.
Q. And those timing signals are going from where to where?
A. They come from the timing control unit, and the timing control unit looks at the signal coming in and picks up the frame rate and the line rate and other required elements to properly drive the LCD.
So that looks at the timing signals, which I believe they call "TIM,"and that controls the source driver and the gate driver, whereas the data flows to the source driver indicated by "DRV."
Q. And what is "VSE"?
A. Voltage signal. The source driver converts the digital data to analog voltage levels.
Q. You mentioned earlier this morning in your declaration testimony -- well, I'm not seeing it right now -- but I believe you mentioned that Suzuki doesn't

show the details of the liquid crystal panel.
Do you agree with that?
A. I agree. They do not show the details of the panel.
Q. So this voltage signal, we don't know anything more about this than this is one arrow with a voltage signal going from "source driver 16" to "liquid crystal panel 20"; is that right?
A. That's correct.
Q. And "gate driver 18," we see a signal "GT" coming over to the liquid crystal panel; right?
A. That's correct.
My assumption is they go to the source and gate of a thin-film transistor array, but it's not specified.
Q. And you assume that because you're not aware of an overdriving technique that is used in a passive matrix LCD panel; is that right?
A. That's correct. Passive matrix LCDs are not used for moving images for the reasons I mentioned this morning. But the response time is much too slow.
Q. Is there any discussion in Suzuki about substrates?
A. Substrates?
Q. Do you recall?
A. I don't recall any discussion about substrates.

Q. Did you look for anything at Suzuki dealing with substrates?

A. I read Suzuki. It wouldn't have been relevant to their invention, but I don't remember any discussion about substrates.

Q. You mentioned it wouldn't be relevant to their invention.

Why would it not have been relevant to their invention?

A. Their invention is about how to drive an active matrix LCD with a faster speed of response of the liquid crystal molecules.

So it wouldn't be necessary to describe the details of an active matrix construction with such elements as back substrate, front substrate, edge seal.

So I think they assumed that was known to their -- in the art, so they did not describe those details.

Q. I'm going to ask you about your statement here. You say their invention is about how to drive an active matrix LCD with a faster speed of response of the liquid crystal multiplexers.

Do you recall giving that testimony a moment ago?

A. Yes.

Q. Where in Suzuki does it say "active matrix"?
A. It does not say "active matrix." It's my assumption that it is an active matrix.
Q. And that assumption is based on the fact that passive matrix does not use overdrive --
(Clarification requested by the court reporter.)
BY MR. HELGE:
Q. And your assumption is based on your experience that overdriving is not used in passive matrix; is that correct?
A. That's one of my assumptions.
Q. What other assumptions do you have?
A. The other assumption is that the device they're describing is for moving images and utilizes source and gate drivers. So that informs me that it is likely an active matrix.
In fact, I don't think of any other -- I can't think of any other type display it would be. But they do not describe in detail the active matrix portion shown in Figure 1, No. 20.
Q. Any other assumption?
A. No.
(Exhibit A is marked.)
BY MR. HELGE:
Q. I'm going to mark here Exhibit A, and I'm going

to hand this to you and hand a copy to your counsel.
Mr. Credell, have you seen this document before?
A. No, I have not.
Q. Would you like to read the title to me out loud, please.
A. "Overdriving Compensation Method to Shorten the Response Time of a TN/STN Passive Matrix Liquid Crystal Display."
Q. Would you agree with me that based on that title, this patent publication is directed towards an overdriving technique for a passive matrix liquid crystal display --
A. Yes.
Q. -- from the title?
I'll read the first sentence of the abstract for you, at least up to the first comma:
"The present invention discloses an overdriving compensation method to shorten the response time of a passive matrix liquid crystal display."
Did I read that correctly?
A. You did.
Q. And based on that first sentence, would you agree that this patent publication is probably directed

towards an overdriving technique with a passive matrix liquid crystal display?

MR. HANLEY: Objection. Calls for speculation.

THE WITNESS: So I speculate that that is their meaning.

BY MR. HELGE:

Q. I'll have you turn to Paragraph 13, and this is on page -- well, it's the first page with all the text.

Do you see Paragraph 13 there?

A. Yes. Describing Figure 3?

Q. That's correct.

And it says:

"Figure 3 is a diagram schematically showing the driving waveforms of the pixel at the first column and the nth row of the passive matrix LCD according to the present invention."

Did I read that correctly?

A. You did.

Q. Please turn to Figure 3.

Mr. Credelle, are you familiar with this sort of driving waveform?

A. Yes, I am.

Q. Okay.

A. Excuse me. I'm familiar with passive matrix driving waveforms, not this specific implementation

here.
Q. Absolutely understood.
So as I just read Paragraph 13, we were talking about the first column and the nth row of the passive matrix based on this driving waveform.
Do you have any understanding or analysis that would lead you to believe which of this waveform is dealing with the first column?
A. No. Because there's no indication of starting and stopping on this diagram.
Q. Can I ask you what you mean by "starting and stopping"?
A. There's no indication if the drawing represents Column 1 or Column 10 or Column 50 or Column 100 because it's not indicated on this drawing.
Q. So even though Figure 3 is described as showing the waveform of the pixel at the first column, you're not sure which column is shown in this figure; is that right?
A. It doesn't indicate. It shows "Common 1" and "Segment N." So you could make an assumption that's the first column and nth segment, but I'd have to read the specification to determine if that's accurate.
Q. Well, then, I'll refer you to Paragraph 18.
A. Okay.

Q. Take a look at Paragraph 18.
A. (Witness complies.)
Okay. I've read Paragraph 18, and I would agree that the two waveforms represent a row and a column; however, compared to the drawing of Figure 1, the "segments" are columns, and the "common" are rows. So there's an interchange.
So if we assume those labels are interchanged, then they represent a signal on a pixel that comes from a common electrode and a segment electrode.
Is that fair?
Q. That's fair. That's fair.
So if we refer back to Figure 1, if you were to identify this pixel from Figure 3 on Figure 1, could you point to any of them and say, yeah, that's probably it?
A. It would be the upper right.
Q. I agree. Okay.
You also read Paragraph 18.
Did you see there how this voltage level V prime was described?
A. Yes.
Q. How is it described?
A. It's described as "higher/lower than the traditional high-level driving voltage V2."
Q. Okay. And you see a little bit of the line

below.
It's called an "overdriving voltage V prime"?
A. Yes. It says "Overdriving voltage V prime."
Q. Would you please take a look at Paragraph 8 in the "Summary of the invention."
This is the bottom left-hand side of that first column.
A. I see it.
Q. Do you see the first line:
"One objective of the present invention is to shorten the response time of the passive matrix LCD adopting the APT driving method."
A. I see that.
Q. Did I read that correctly?
A. Yes.
Q. Would you agree that this patent publication is probably directed towards an overdriving method for passive matrix LCD to reduce response time?
A. This patent application does appear to address overdrive for passive matrix, yes.
Q. And do you see Paragraph 7 right above it --
A. Uh-huh.
Q. -- where it talks about -- again, the first sentence here:
"Blurring will appear in the moving

pictures of the LCD adopting the traditional APT driving method because the TN/STN LCD response time is too slowly"?
A. Yes.
Q. And so from that, is it fair for us to infer that this invention is directed towards improving the quality of moving images displayed on a passive matrix LCD?
A. I would agree that this addresses speeding up the response such that moving images are less blurry.
Q. On a passive matrix LCD?
A. On a passive matrix LCD.
MR. HELGE: We've been going about an hour. Would you like to take a quick break?
THE WITNESS: I'd like to get more water.
MR. HELGE: Let's go off the record at 11:32.
(Recess taken.)
MR. HELGE: We're going back on the record at 11:45.
BY MR. HELGE:
Q. Mr. Credelle, let's take a look again at Exhibit A, which is the Chien reference. Specifically, let's take a look at Figure 3.
A. Yes.
Q. As you go from the first frame to the second

frame, what happens to the levels being applied to each column and each row or each column and each segment?
A. The common electrode is unchanged. The segment electrode increases in voltage to V prime.
Q. Okay. So there is, as you said before, an overdriving for V prime; is that right?
A. That's correct.
Q. What about the direction of V prime from second to third frame? What happens?
A. The polarity is inverted, as I mentioned earlier, to have a DC bias that's zero on the liquid crystal.
Q. Okay. If we were to compare Figure 3 of Chien, Exhibit A, with Figure 2 of Suzuki, is it correct that both of these methods are using inverted polarity techniques?
A. Yes. They both use inverted polarity.
Q. And that's because of the resilience of the LC molecules?
A. To DC.
BY MR. HELGE:
Q. I'm going to hand you what's already been marked as Exhibit 1005. This is the Nitta reference.
Mr. Credelle, does this document look familiar to you?

A. Yes.
Q. Do you recognize it as the Nitta reference?
A. Yes.
Q. Did you review this reference before the deposition today?
A. Yes, I did.
Q. Within the last week; correct?
A. Yes.
Q. Do you have a good understanding of what's in Nitta?
A. Yes.
Q. Let's take a look at Figure 14. Figure 14 appears on page 18 of the document.
Do you see it there?
A. Figure 8, or Figure 18?
Q. Figure 14 on page 18.
A. Oh, there it is. I see it.
Q. Okay. Do you see there at the bottom it mentions in Field 1 and Field 2 two different things: With data conversion and without data conversion?
Do you see that?
A. I see that.
Q. What is your understanding of Nitta's use of the term "data conversion"?
A. My understanding is the data conversion pulse

is computed based on the current frame data and previous frame data to generate a signal to accelerate the liquid crystal response.

Q. And so your opinion is that data conversion is overdriving; is that right?

A. It could be referred to as "overdriving."

Q. Could it be referred to as anything else?

A. It could be called "overshoot."

Q. Let's take a look at Paragraph 15 on page 4.

Are you there on Paragraph 15?

A. Yes.

Q. Just read that to yourself and let me know when you're through.

A. (Witness complies.)

Okay.

Q. Nitta talks about resolution conversion as well, doesn't it?

A. It does.

Q. Is resolution conversion the same as data conversion?

A. No.

Q. What is resolution conversion?

A. It refers to mapping a data input signal that is not a one-to-one match to the liquid crystal display because the frame rate or the number of pixels may be different, so it has to scale or convert a signal to be compatible with the LCD.

Q. Is there a signal discussed or a video signal discussed in Paragraph 15 here?

A. It mentions a television device which has moving picture display, and it says "a resolution conversion means is needed for displaying display signals of these different resolutions in the same way." So the resolution is converted.

For example, a VGA signal, Vector George Alpha, is mapped to an XGA screen. There has to be a conversion, so Nitta describes such features.

Q. And he calls that "resolution conversion"?

A. Yes.

Q. Do you see NTSC signals there?

A. I do.

Q. Are you familiar with NTSC signals?

A. Very familiar.

Q. Can you describe them generally?

A. Generally, they refer to the video signals, broadcast television-type signal. So there's formatting of a certain number of lines and, in some cases, interlaced as part of the NTSC signal standard.

Q. Is there a standard resolution presumed for an NTSC signal?

A. Not precisely. But at this time frame, in the 2000 time frame, NTSC usually referred to 480 lines of active information and 525 scan lines.
Q. And that signal was standard, regardless of the resolution of your display; right?
A. That's right.
Q. So you needed to convert that signal to match the size of the display in your screen?
A. That's right.
Q. Is that why Nitta talks about doubling up certain pixels or scanning two rows at a time?
A. No. They actually talk about mapping resolution in various formats -- in some cases, interlaced signals; in some cases noninterlaced signals -- so that the information is displayed properly. That may involve addressing two lines at a time, but it's not part of the data conversion step.
Q. Is it part of the resolution conversion step?
A. It would be -- I would call it "resolution conversion."
Q. Can you direct me anywhere in Nitta for the disclosure of data impulses?
A. Data impulses?
Q. That's right.
A. One example -- and I will continue to look --

is in Paragraph 9 where it states "the liquid crystal control circuit that converts display control signals and display data that are supplied from outside into liquid crystal control signals and liquid crystal display data for driving the signal driver circuit."

So those would be the drive impulses to the display.

Q. So even though it doesn't use the term "impulse," you've interpreted it as such?

A. Correct.

Q. Is that consistent with how you've read Nitta in its entirety?

A. Yes. The display signal provided to the display via the data lines would be considered data impulses or signal levels to drive the LCD.

I can continue to look, if you'd like me to, to find other examples.

Q. If I run a search and I don't find the term "impulse" in Nitta, would that mean anything to you in your analysis of Nitta --

A. No.

Q. -- because you say display data is in the form of an impulse?

A. "Impulse" is a broad term, but it means to -- in an active matrix context, the signal is going to the

data lines to a person of skill in the art.
Q. Is there any specific shape that that impulse would take in a waveform?
A. The shape of the waveform? As we discussed earlier, the polarity would be inverted frame by frame, typically -- sometimes line by line -- and the output voltage level would be set to achieve the right gray level for each pixel, so the magnitude of the signal would be adjusted.
Q. What about the shape of the waveform?
A. The shape of the waveform is typically a square wave.
Q. Do you see any square waves that you characterize as data impulses in these figures?
A. For example -- so Figure 2 shows display data, so I think from a display data standpoint, that probably is a good representative figure.
Q. Figure 2?
A. It shows display data increasing and the display brightness following.
Since much of Nitta was concerning the resolution processing, most of the figures relate to the scan voltage pulses.
Q. Well, that brings up a good point.
What do you think the frame rate was that Nitta

was dealing with?
A. The typical frame rate would have been either 60Hz or, perhaps, in some cases, 30Hz.
Q. In what cases would it be 30?
A. An NTSC signal that is interlaced coming into the display would be 30Hz frame rate.
Q. Oh. So that's about 35 seconds --
A. 33 milliseconds --
Q. Okay.
A. -- approximately.
Q. Can you display an NTSC signal on a passive matrix LCD?
A. Yes.
Q. What do you think the frame rate was in Suzuki?
A. In Suzuki?
I would surmise that the typical frame rate would be 60Hz.
Q. And why --
A. It wasn't specified because that would be the normal refresh rate for a liquid crystal display to prevent flicker or varying brightness during refresh in the time frame.
Q. In Japan; right?
A. In?
Q. In Japan.

A. I don't understand your comment.
Q. You say the typical frame rate would be 60Hz to prevent flicker, and that's Japan; right?
A. In Japan and the US, the frame rate would be 60Hz.
In Europe, it would be 50Hz.
Q. Let's take a look at the corrected petition, which I'm going to mark as 4. It's submitted as Paper 4 in the case.
Mr. Credelle, does this look familiar to you?
A. Yes, it does.
Q. And does this look like the corrected petition that you recently reviewed in preparation for this deposition?
A. I have no way of determining that without knowing the corrections, so I believe it is the latest copy.
Q. Counsel did not share with you the corrections that were made to the corrected petition?
A. No.
Q. You went through for me earlier the elements of Claim 4 when you talked about how you had opined on the invalidity of Claim 4 based on your combination of Suzuki and Nitta; is that right?
A. That's correct.

Q. In your opinion, how does Suzuki control a transmission rate?

A. Suzuki controls the transmission, which is the transmittance rate as defined by the '843, by applying a series of pulses, usually two, to the pixel where there are two pulses per frame of data. One pulse is called "overshoot," and one is called "overdrive."

Q. And what's the effect of applying those two pulses in one frame?

A. The combination of those two pulses is to accelerate the motion of the liquid crystals, number one; and to achieve the proper luminance value, number two.

Q. Why don't you turn to pages 19 and 20 of this corrected petition; the bottom of page 19, the top of page 20.

We're going to use the last three words on page 19 where it begins, "Thus, two data."

Why don't you finish reading that sentence to yourself for me.

A. Just that one sentence?

Q. That's right.

A. Got it.

Q. Do you see the quotation marks in that sentence?

A. Yes.
Q. And it says:
"So that the time integral of the actual transmittance and the time integral of the target value of the transmittance become equal."
Is that right?
A. I see that.
Q. Would you agree that that quotation is addressing how this petition contends that Suzuki controls the transmission rate of a liquid crystal device?
A. Not entirely.
Q. Okay. What else is missing?
A. The transmission rate of the liquid crystal, which is the transmittance of the liquid crystal, is controlled by both the first pulse and the second pulse.
This -- so, in toto, the two pulses are applied to control the transmission rate.
This parenthetical comment refers to the action of the second pulse to achieve proper transmittance or luminance by a combination of the two pulses.
Q. So is it your opinion that each pulse viewed individually controls transmission rate of a liquid crystal device?

A. Each pulse adjusts the transmittance or transmission rate of the liquid crystal device.

Q. And is that the same as controlling the transmission rate of a liquid crystal device according to the '843 patent?

A. I believe it is equivalent.

Q. And that conclusion is based on what you stated was the plain and ordinary meaning of the '843 Patent Claim 4; correct?

A. Correct.

Q. Because you didn't apply any construction?

A. Right.

Q. In your view, are there other ways to control a transmission rate of a liquid crystal device?

A. The transmission rate of a laser drive current is controlled by applying a voltage to a pixel.

Q. Is that it?

A. One voltage, two voltages, ten voltages. Controlling the transmission rate means controlling the transmission or transmittance of the pixel, which is controlled by voltage.

Secondarily, it could be controlled by refresh rate because, as we discussed earlier, if the voltage decreases with time, that would change the transmission rate of the pixel. So the refresh rate becomes an

important element as well.
Q. So your view is that any variation in voltage is, in effect, controlling the transmission rate?
A. Yes.
Q. That was the view that you used when you prepared your declaration; correct?
A. That's right. I'm assuming you're using the term "transmission rate" as described in the '843.
Q. Is there a different meaning?
A. "Rate" can be interpreted in different ways.
So in this case, it's described as transmission level for an amount as opposed to describing a rate of change. So it's a little confusing, but that's clear from the specification.
Q. Okay. So you did review the specification when determining how to interpret transmission rate; is that right?
A. That's right.
Q. But you only used that to evaluate transmission rate and not the phrase "control the transmission rate," for example?
A. "Control the transmission rate" means control the transmittance level. So -- I understand control. I didn't have to use any instruction or teaching for '843.
Q. Now, you told me earlier that you rendered an

opinion on the invalidity of all the claims, 4 through 9; correct?

A. Yes, I told you that.

Q. Take a look at page 24, the bottom of page 24.

Do you see that bold header dealing with Claim 7?

A. Yes. It describes Claim 7.

Q. That's right. From the beginning of that bold header until the end of that section which is the bottom of page 25, do you see any instance in which the petition refers to your declaration?

A. No, I do not.

Q. Okay. Let's take a look at the language of Claim 7 which is, again, there on page 24.

And I'm not going to ask you to read it aloud, but I just want you to be familiar with that language before I ask you my next question.

A. (Witness complies.)

Yes. Okay. Go ahead.

Q. Let's go back to your declaration, and I want you to show me where you render an opinion on Claim 7 and the language that's in Claim 7.

A. I'd like to refer to page 25, Paragraph 54.

I'm describing here that the Suzuki and Nitta are addressing blur in the display of moving pictures by applying a plurality of data pulses; and further, the data lines are used to convey the data voltages to the pixels, and those data lines could be used in the manner of Suzuki. And the manner of Suzuki was described as calculating an overdrive from frame data.

I do make comments with respect to Jinda.

Would you like me to recite those?

Q. No. I mean, I think we need to focus on Suzuki and Nitta.

A. All right.

Q. Or at least I should say my question is focused on Suzuki and Nitta.

A. All right.

In Paragraph 48, I guess finally, it refers to -- I refer to a driving circuit with the plurality of fields or data is supplied to two subfields with the drive circuit taught by Suzuki, the data applied to the LCD with the Suzuki references.

But I did not explicitly describe the exact sequence of Claim 7. But in the references -- I could read from the references that's --

Q. To clarify, I'm not asking about the references.

My question is directed towards the declaration.

A. Okay. So that would be the -- what I could find from the declaration.
Q. And as you went through that declaration, you did not find any language where you say, My opinion is that Claim 7 is invalid in view of the combination of the Suzuki and Nitta; is that right?
A. Not those words explicitly.
Q. Do you find those words addressing Claim 5 at all in your declaration?
And specifically what I'm asking for is some opinion --
A. Explicitly states?
Q. That's right.
A. I believe those are not explicitly stated.
Q. What about for Claim 6?
Do you specifically state your opinion that you believe Claim 6 is invalid in view of Suzuki and Nitta?
A. I did not use those exact words in my declaration.
Q. What about the Claim 8?
Do you specifically state your opinion that you believe Claim 8 is invalid in view of Suzuki and Nitta?
A. Paragraph 46, I expressed my opinion that the use of a gate driver to convey scan voltages to switching devices of an LCD panel was well known to

those of ordinary skill in the art at the time of the invention.

Q. And so your view now is that is directed towards Claim 8?

A. That would be directed towards Claim 8, by my reading.

Q. Do you specifically state in your declaration that you believe Claim 9 is invalid in view of Suzuki and Nitta?

A. Paragraph 54, I state that it is my opinion that a person of skill in the art would have combined the AMLCD panel taught by Nitta with the driving circuit disclosed by Suzuki. Both seek to address the issue of blur in the display of moving pictures by applying a plurality of data voltages to each pixel of the LCD device within a single frame period.

And, I guess, finally in Paragraph 54, towards the bottom, it is my opinion that a person of ordinary skill in the art would have recognized that the data voltages carried by data lines are applied to the liquid crystal elements to effect a change in the brightness level, and the data voltages generated by the driving circuit of Suzuki would be applied to the liquid crystal elements for the same purpose. That would be to provide an image.

Q. So that's Claim 9?
Okay. Do you agree that passive matrix LCDs include no transistors within the panel itself?
A. That would be the normal definition.
Q. So if you had a passive matrix LCD panel, there would be no need to include a switch, for example?
A. Within the pixel, that is correct.
Q. And within the matrix of pixels?
A. That is correct.
MR. HELGE: Shall we take a break for lunch?
THE WITNESS: That would be good, yes.
MR. HELGE: We'll go off the record at 12:24.
(Luncheon recess.)
BY MR. HELGE:
Q. We're back on the record at 1:32 p.m.
Mr. Credelle, I want to tackle something that we didn't talk about this morning, which deals with Nitta.
A. Okay.
Q. And that is your testimony, as I understand it, that basically all LCD panels are going to use an inversion-type driving method; is that right?
A. I hesitate to ever use the word "all," but certainly the vast majority would use inversion.
Q. Okay. Is there anything in Nitta that would

indicate to you that Nitta does or does not use inversion?

A. I do not believe Nitta went into any detail about that aspect of a basic liquid crystal display because it is so basic.

I don't believe he went into any detail about that inversion process.

Q. Okay. Take a look at page 17 of Nitta and specifically Figure 1.

A. Okay.

Q. Do you see that figure where at the top it says "Prior Art," and at the bottom it says "Present Invention"?

A. Uh-huh.

Q. Is there anything from that brightness waveform or that brightness graph that would indicate to you whether Nitta uses an inversion-type driving method?

A. Nothing about this figure would inform that.

Q. Okay. If you compare that with Figure 2 from Suzuki, which is on page 3 --

A. Yes.

Q. -- if you see at the top of Figure 2 of Suzuki, the transmittance increases in the first Subfield 1 and then decreases in Subfield 2; is that right?

A. That's correct.

Q. And it -- why does it decrease in Subfield 2?
A. It decreases because the overshoot value would create too much luminance; so, therefore, to achieve the target value of luminance or transmittance -- those two are equivalent -- the signal is applied such that the target value is reached at the end of the frame and the luminance is balanced.
Q. And so is it correct that the transmittance decreases during Subfield 2 due to the applied voltage?
A. Due to the applied voltage, yes.
Q. And then the applied voltage is not greater than the target value in Subfield 2; right?
A. It's actually less than this example; less than the target value.
Q. Now, is that decrease in Subfield 2 in the transmittance, is that a result of inversion-type driving?
A. No.
Q. Okay. What is it a result of?
Can you please explain to me one more time?
A. If you look at element -- bracket (c), that voltage level is less than the target. So it's a lower drive voltage, which would bring the -- normally bring the brightness down. So it's bringing the brightness down as a result of applying a calculated pulse.

And Suzuki does that so that the areas A1 and A2 in the upper figure are balanced or equal.

Q. But you would characterize the bottom part of Figure 2 of Suzuki to be inversion-style driving; correct?

A. That is correct.

Q. Is that because in the first subfield, you're above that common voltage and in the second subfield, you're below it?

A. That's right. That would be the definition of "inversion driving."

Q. And because you're below it in the second subfield, that brings the brightness level down in Subfield 2; correct?

A. No. It comes down because the level of voltage in the negative direction is less than the target value.

The liquid crystal responds to the RMS voltage. It does not respond to the instantaneous voltage.

So they're comparing it to a waveform as shown in the dotted line, target value plus target value minus. That would be the standard case.

And then the Suzuki case is the higher and then the lower in an absolute-value sense.

Q. So in Nitta, if I look at Field 2, it appears that the display response brightness in the Field 2 --

do you see that?
A. In the present invention description?
Q. That's right.
So the second -- the lower half of the diagram -- and I'm looking at Field 2, which is the second half of the one frame --
A. Yes.
Q. -- right?
It appears that that brightness is constant at Gradation B across that field.
Does it appear that way to you as well?
A. It does appear that way.
Q. That would indicate that whatever voltage is being driven in that field matches the target value; correct?
A. Not necessarily; but likely, it would be a target. It would be the standard voltage that is not enhanced.
Q. So if Nitta applies, as I think you said before, a data-converted pulse in the first field --
A. Correct.
Q. -- it would be driving a normal pulse in the second field?
A. That is my interpretation.
Q. Okay. Whether you're looking to combine Suzuki

and Nitta, is it important to consider from a technical perspective whether both of them are using an inversion-style driving method?

A. To -- that would not be critical to combine.

Q. And why is that?

A. Because inversion is the standard driving method for an LCD. And both arts apply higher or lower voltages in order to accelerate the liquid crystal response within a frame time. So both are achieving the same result, and the fact that the voltage is inverted is somewhat irrelevant.

Q. So you don't feel like you need to evaluate that to see whether they're compatible, then?

A. That's correct.

Q. Are you aware of whether Suzuki discloses response times in the pixels?

A. Can you elaborate what you mean by "response times in the pixels"?

Q. Well, so you had talked to me before, and you said that Suzuki is probably dealing with 60Hz frame rate; right?

A. Yes.

Q. Isn't the response time important when you compare it against the frame rate to determine whether there's going to be blurring, for example?

A. The response time of the liquid crystal molecules is important compared to the frame rate, yes.
Q. And are you aware whether Suzuki deals with response time of the liquid crystal molecules -- or, excuse me, are you aware of whether Suzuki discloses response time of liquid crystal molecules?
A. I believe he does not -- I'd have to check, but I think he discloses that he's accelerating the response time or he's speeding up the response time. I can't recall whether he specified a certain number of milliseconds. I can check if you like.
Q. If you'd like to, please. I want to make sure we get accurate testimony on that.
A. Sure.
(Witness complies.)
So Suzuki does refer to frame time in Paragraph 39 at 16.6 milliseconds, which would be the 60Hz that I suggested.
And he also suggests that the liquid crystal is -- response time is sped up to be complete in one frame time.
So by that implication, he's saying that the response time of the liquid crystal would be 16 milliseconds or less after applying the overshoot and overdrive pulses.

Q. Do you have a system or an assumption of what the response time of the LCD molecules would have been, according to Suzuki?

MR. HANLEY: Objection. Calls for speculation. And vague.

THE WITNESS: So, again, I'll speculate that the response time of the liquid crystal molecules was greater than 16 milliseconds because there was blur.

BY MR. HELGE:

Q. Do you agree that the response time of an LC panel that is positive matrix is greater than 16.6 milliseconds?

A. Yes. It's much greater.

Let me be more specific.

We are talking about displays for, like, computer displays with lots of pixels. It is possible to have a very -- a one-pixel STN display that can be faster; but a display used in a computer or a video application, response time is much slower.

Q. What would be the application for a one-pixel STN display?

A. There are no applications that I'm aware of other than a shutter for some application, but there are small STN displays that are used in some applications where the response time can be faster, but they're

typically not used for video or moving images.
Q. Because it's one pixel?
A. Because it's a few pixels.
Q. How many?
A. STN displays can be built with seven pixels or more.
Q. Are the applications with, say, for example, avionics or automotive? Anything like that?
A. A clock, for example, would have seven segments. So it would be a very trivial STN display that still is used in some products.
Q. A clock. Like a digital clock?
A. Like a digital clock.
Q. We went through all the parts of the active matrix LCD a little bit this morning, but I don't think we've done that on a passive matrix LCD.
A. Okay.
Q. Do you have a good understanding of a passive matrix LCD panel structure?
A. Yes.
Q. Could you explain to me generally how a passive matrix LCD works?
A. Sure.
Q. Let's start with a panel first.
A. A passive matrix panel would have an array of

row electrodes, for example, in the horizontal direction, and vertical electrodes -- column electrodes in the vertical direction.

And where each set of electrodes overlap, a pixel is formed.

These electrodes are reasonably wide electrodes compared to the center-to-center spacing, so a pixel is formed at every intersection.

Inside the panel, there is liquid crystal and other lining layers that comprise the STN LCD.

Q. And then LC molecules between the two --

A. Glasses.

And I should point out that a passive matrix display has one set of electrodes on the lower substrate and the second set of electrodes on the upper substrate.

Q. And as a result of that, the driving circuitry is also going to be arranged to correspond to those substrates; correct?

A. Yes.

Q. So, for example, the driving circuitry that's going to be serving the row electrodes will be on the same substrate as the row electrodes, and the driving circuitry that is going to be serving the column electrodes will be on the same substrate as the column electrodes?

A. That is correct.
Q. And we talked before that Suzuki doesn't talk about substrates at all; right?
A. That's correct.
Q. How is the driving circuitry in a passive matrix already different from the driving circuitry in an active matrix LCD?
A. Okay. Let's see if I can do this succinctly.
In a passive matrix display, the row electrodes are scanned one by one, similar to the scanned voltages of an active matrix.
The data electrode -- data voltages are applied to the column electrodes. The voltage on the row is typically a high-voltage pulse when it's being addressed; and the data, the voltage that's on the column at that moment on that row, will be energized.
For the rest of the rows in the addressing scheme, that pixel is still seeing extraneous voltages from all the other data on that column.
Therefore, the resulting involvement on the pixel that's -- that I mentioned will be the correct voltage applied for one line time plus all the other voltages that are applying on the -- for the other pixels within that column.
And so an RMS voltage is developed across that

pixel. It's always being addressed. It's always seeing some voltage.

And the contrast ratio, the level of on-state versus off-state, will be dictated by the number of lines you have in the display and the amount of the voltage you provide during that select period.

Q. And is there a common term to refer to the scan voltages that are applied to the column electrodes?

A. Well, in my example, the scan voltages or select voltages would be applied to the row in the example that I gave you.

Q. Good point. Let me ask that question.

Is there a common term that's used to describe those scan voltages?

A. You said it: "Common."

Q. Common. Okay. So it might be referred to as "V" common" or "Vcom"?

A. No. It would be "common voltages" because there are many in contrast to an active matrix display which has one voltage typically referred to as "Vcom" or "V common."

Convention for STN displays or passive matrix displays is that the segment electrodes contain the data. So the "on" or "off" signal is intended to be applied to a pixel that comes into the segment

electrodes.
Q. And by "segment," you mean the rows; correct?
A. The columns.
Q. The columns.
And so that's consistent with active matrix; correct?
A. That's consistent with active matrix.
However, in passive matrix, you can interchange the functionality because both sides are the same, effectively. Both substrates look the same.
Q. Can a passive matrix panel be driven by active matrix driving circuitry?
A. No.
The active matrix driving circuitry provides gate voltages on the gate lines or the scan lines and data voltages on the column lines, and those voltages would not be appropriate to drive a passive matrix LCD.
Q. Why would they not be appropriate?
A. The voltage levels are not the same so that the display wouldn't operate.
Q. Does Suzuki disclose the voltages being used to drive the panel?
A. He does not, to my recollection, because, again, he assumed common active matrix LCD, in my opinion.

But he did not go into describing what would be the gate voltage applied to the gate lines.
Q. So based on Suzuki's disclosure, there is no way to conclude that gate signals indicated as "GT" in Figure 1 are of a voltage too low to drive a passive matrix panel; is that right?
A. That would be correct since the voltage isn't specified.
Q. Is it important to consider LC response times when evaluating the compatibility of Suzuki's driving circuitry and Nitta's driving panel or display panel?
A. Would it be -- can you repeat that again?
Q. Absolutely.
Is it important to consider LC response times when evaluating the compatibility of Suzuki's driving circuitry and Nitta's liquid crystal display panel?
A. Not really. The response time -- in the sense that the response time is typically longer than desired in both cases, Suzuki and Nitta were creating a system that would fix that problem.
If the response time was extremely short in one case versus the other, then there would be no need to use their invention.
So my opinion is that both Suzuki and Nitta are addressing the problem of slow response --

slower-than-desired response with the circuit and a system to speed up the rate of change of the liquid crystal molecules.

Q. You may have already answered tangentially, but you mentioned earlier this morning about active matrix hold circuit.

A. Uh-huh.

Q. And I'm curious how a passive matrix panel achieves a similar function.

A. It really doesn't. Inherently, the passive matrix display voltage waveform on a given pixel is the sum of the voltages on all the pixels and the common electrode applied to the pixel.

So it is always being driven by some voltage, and it is the RMS, root mean square, voltage on that given pixel that drives the liquid crystal molecules whether that's a high value or a low value, but it's always being addressed by data pulses.

That's in contrast to an active matrix display where the data from the source driver is impressed on the liquid crystal capacitor. And then that capacitor, along with the storage capacitor, is disconnected from all the voltages, so it floats by itself. It's held for one frame time until it's addressed again.

So those are quite different processes.

Q. You mentioned a moment ago the word "inherently."

And I'm wondering, do you have understanding of what it means to rely on a theory of inherency when looking at prior art?

MR. HANLEY: Objection. Vague.

THE WITNESS: Not in the legal sense.

So you may elucidate if you like.

BY MR. HELGE:

Q. Well, I'm wondering a couple things, then.

I'll ask you this: Do you know what the standard of proof is in an inter partes review?

A. I understand the concept of anticipatory and obviousness statements that relate to claims in an inter partes review. But if there's an exact definition of "proof," I'm not aware of that exact definition.

Q. So you didn't look at any reference or exhibit and say, "I'm going to weigh this evidence and say, 'Yes, it's more likely than not that something is disclosed,'" or anything like that?

You simply found the reference, you found the evidence, and you said, "It's here. Move on."

Is that right?

A. I evaluated the evidence and the two references we've cited and stated that they describe a certain function or a certain device or a certain method, and then, as you say, move on to the next element of a claim, for example.

So, in toto, I'd say all the elements are satisfied or not. And, in this case, yes.

Q. Okay. Thank you.

Let's take a look at Exhibit 1001.

I'm sorry if I was indicating that we were done.

A. No, I didn't think so.

Q. Probably not too much longer.

Mr. Credelle, does this look familiar to you?

A. It does.

Q. And what document is this, then?

A. This is the '843 patent.

Q. And when was the last time you reviewed this?

A. Probably yesterday.

Q. I'm going to ask you quite a few questions about this document; but sometimes it's going to be with reference to some other document.

So, for example, I'm going to pull up your declaration and look specifically at Paragraph 28.

And as I ask you this question, feel free to refer to the '843 patent in formulating your answer.

A. Did you say page 28?

Q. I'm sorry. Paragraph 28.
A. Okay.
Q. In the second sentence, a little ways down, you're talking about the driving circuit of the '843 patent.
And I'm going to begin -- this is actually on the fifth line at the end. It says:
". . . includes a source driver that generates two corresponding data impulses according to the two pieces of pixel data and applies them to the pixel electrode of the corresponding pixel."
Do you see that?
A. Yes, I do.
Q. Do you agree that the driving circuit of the '843 patent generates two pieces of pixel data in each frame period?
A. That is what is described in the patent.
Q. And so you agree that's how it's disclosed?
A. That's how it's disclosed.
Q. Okay. In the next sentence, it states:
"The '843 patent further states that the source driver generates corresponding data line voltages according to the plurality of overdriven data included in the frame signals."

Do you agree that the source driver of the '843 patent generates line voltages according to plurality of overdriven data?
A. Yes.
Q. And if you were to look through the figures, can you tell me where that source driver is shown?
A. Well, it's shown on Figure 3.
Q. Okay.
A. And that's the only place it's drawn in figures.
Q. Okay. Now, that source driver is applying overdriven pixel data to the LCD panel; is that right?
A. Yes.
Q. And that source driver is receiving that overdriven pixel data from the blur clear converter; correct?
A. Correct.
Q. Were you aware of any figures that disclose embodiments of the blur clear converter?
A. The blur clear converter as described by the patent would be -- is shown -- at least in Figure 7 and Figure 8. Those are two examples.
Q. Okay. And, in fact, the specifics of the patent refers to Figure 7 as the "first embodiment" and Figure 8 as the "second embodiment."

A. That's correct.
Q. Are you aware of whether the Chien patent discloses any third embodiment?
A. I do not believe it is in the third embodiment.
Q. Let's turn to Figure 7, then.
A. Okay.
Q. There's a line at the top coming out of this blur clear converter labeled "C(2)."
A. Correct.
Q. Do you see that?
And what is C(2), do you recall?
A. That's a timing signal. It's at twice the rate.
Q. And it's at twice the rate for what reason?
A. Because there's going to be two frames of data written during every frame time of incoming data.
Q. Okay. And do you see the signal coming out of the second image memory?
A. I do.
Q. And do you see the labels "GN," "GN(2)"?
A. Yes, I see that.
Q. And do you know what those signals are?
A. Those are the result of the processing circuit, and they are shown as higher voltages than normal voltages. That would be output to the display.

Q. So that is two overdriven data output per frame; correct?
A. Per frame, yes. That's correct.
Q. Let's take a look at Figure 8.
And this is the second embodiment of the blur clear converter; correct?
A. Correct.
Q. Do you see the output from the blur clear converter labeled C(2)?
A. Yes.
Q. And is it again timing signals?
A. That's a timing signal, just like in the other embodiment.
Q. Okay. And coming out of the processing circuit, 74, do you see two marked data there?
A. Yes, I do.
Q. And "GN-1" and "GN-(2)"?
A. Yes.
I believe there's a typo in that figure, but that's what it says.
Q. Okay. What typo?
A. I believe it -- to be compatible with the spec, it should say GN minus 1 and GN minus 1(2).
Q. Okay. Are those also overdriven data?
A. Those are overdriven data.

Q. Let's take a look at Column 2, lines 16 to 18.
A. Okay.
Q. And I'll read it out loud.
"It is therefore a primary objective of the claimed invention to provide a driving circuit of an LCD panel and its relating driving method to solve the problem mentioned above."
Did I read that correctly?
A. You did.
Q. What do you believe the "its" refers to, I-T-S, where it says "its related driving method"?
A. To me, that means the driving method to drive the LCD panel to achieve the goals stated in the patent.
Q. So is it referring back to the driving circuit?
A. Well, in this case, it's a method. So it's a driving method, not a circuit. But it's the driving method to achieve the stated goal.
Q. Okay. Just -- I think we're talking past each other a little bit here.
A. Sorry.
Q. If it says here "a driving circuit of an LCD panel and its relating driving method," I'm just wondering, "its" refers back to something?
A. I'm sorry. I see what you're saying, yes.
Q. And I was just wondering, what do you think

that refers back to?
A. The driving circuit.
MR. HELGE: Can we take five minutes?
MR. HANLEY: Sure.
MR. HELGE: We're off the record at 2:08.
(Recess taken.)
MR. HELGE: Going back on the record at 2:13 p.m.
BY MR. HELGE:
Q. Mr. Credelle, can we go back to Figure 1 of Suzuki, please.
A. Okay.
Q. We started talking about the different parts of this figure, and just a couple clarifications for me, please.
Do you see within the operational unit, there is something labeled "DIF"?
A. I see that.
Q. And what does that refer to?
A. That refers to a difference calculation. It's the output of the data comparison unit.
Q. Okay. And what is the data comparison unit comparing to output DIF?
A. It's comparing the previous frame data stored in Data Memory Unit 12a and the incoming data image data

for the next frame.
Q. And that is both original data that's not overdriven or overshot; correct?
A. That's original data, unprocessed.
Q. Okay. And the first operational unit receives that DIF data; correct?
A. Correct.
Q. And then the first operational unit outputs OSD; correct?
A. Correct.
Q. And you said "OSD" is overshoot data?
A. Yes.
Q. That DIF value is also input into the second operational unit?
A. Correct.
Q. Where is the overdrive data generated?
A. It's generated from the third operational unit.
Q. And at any point does the overshoot data pass through the third operational unit?
A. It does not.
Q. Does the third operational unit determine the overdrive data with reference to the overshoot data?
A. Indirectly, because it uses the same DIF signal in its calculation.
Q. And the third operational unit outputs the

overdrive data; correct?
A. Correct.
Q. And does it generate the overdrive data?
A. It calculates the overdrive data. So, yes, it would generate -- so-called generate the overdrive data.
Q. Okay. And it calculates the overdrive data based on that DIF signal?
A. Correct.
Q. Based on anything else?
A. It isn't specified in the patent that the operation of that unit -- all it says is that it's set up so that the luminance is balanced -- the output target luminance is balanced compared to the target value without processing.
So it adjusts the value such that it achieves proper response of liquid crystal and right luminance.
Q. And when you talk about that, you're referring again back to the areas A1 and A2 in Figure 2; correct?
A. That is correct.
Q. So those values want to be balanced?
A. Yes.
MR. HELGE: I have no more questions.
EXAMINATION BY MR. HANLEY:
Q. Mr. Credelle, I believe earlier you said with regard to the Suzuki reference that it describes an LCD

driving circuit that would be used with or is applicable to an active matrix LCD display?

A. Yes, I said that.

Q. If -- I'd like to point you to a couple of sentences in Suzuki, and I want you to tell me whether those sentences have any bearing on the opinion that you've given or the perception you've expressed that Suzuki relates to a driving circuit for an active matrix display.

A. Okay.

Q. First of all, if you would please look at Paragraph 8.

A. Yes.

Q. And do you see there, it says:

"It is an object of the present invention to improve the moving image display performance of a liquid crystal display device. In particular, the improvement in the moving image display performance is intended of a liquid crystal panel for hold drive."

Do you see that?

A. I see that.

Q. Okay. And do you have an understanding of what a "hold drive" refers to?

A. I do.

Q. What is that?
A. That refers -- as I said earlier, it refers to the type of display circuitry such as found in an active matrix LCD where the data voltages are held for a full frame time before they're refreshed, before they're written again.
So each pixel has a specific voltage that's impressed on the pixel and then held for one frame.
Q. All right. And does the term "hold drive," in your understanding, also apply to a passive matrix LCD display?
A. It does not.
Q. If you look further on -- in Suzuki to Paragraph 39, please.
And you see there in the first sentence, it says, "The liquid crystal display device of this embodiment operates on hold drive" again?
A. I see that.
Q. And do you have the same understanding as to the term "hold drive" there as you expressed with regard to the prior Paragraph 8?
A. It has the same meaning.
Q. And am I correct in understanding you that the term "hold drive" is something that would be characteristic of an active matrix LCD display?

A. That's correct.
Q. But it would not be characteristic of a passive matrix LCD display?
A. That is also correct.
Q. Now, I want to turn to another exhibit that plaintiff marked, and that is Exhibit A in the published patent application.
A. Yes.
Q. And before I have you look at this, let me ask you a couple of foundational questions.
So am I correct in understanding your earlier testimony that in conducting your analysis and coming up with your opinions that you've expressed here, that you adopted the perspective of a person of ordinary skill in the art; correct?
A. That's correct.
Q. And did you adopt the perspective of such a person as of the filing date of the Chien patent, which is 2003?
A. As of 2003, that is my reference point.
Q. In so doing, did you at least posit in your mind what would be the level of skill including the knowledge base that such a person would have as of 2003?
A. Yes. That formed my opinion, what that POSA would understand.

Q. And did you sort of look ahead to what information might have been developed subsequent to 2003 and include such information in your assessment of what would be the knowledge base of a person of ordinary skill as of 2003?

A. I did not.

Q. So if you look at the Exhibit A, the Chien reference, do you see the filing date that's indicated there?

A. I see that. It's 2006.

Q. 2006. Okay.

So is it your understanding, then, that this document did not exist prior to 2006?

A. That is my understanding.

Q. So is it fair to understand, then, that based on your earlier testimony, that the content of this document would not be something that would be included in the knowledge base of someone of ordinary skill in the art as of 2003?

A. That is impressive.

Q. Now, if you look at Paragraph 21 in Exhibit A, the first sentence there says:

"The spirit of the present invention is to utilize the concept of the overdriving compensation method which is originally used to shorten the response time of a large-size active matrix TFT LCD, to shorten the response time of the passive matrix TN/STN LCD."

Do you see that?

A. I see that.

Q. What's your understanding of that sentence?

A. My understanding is that the teachings of the prior art with respect to active matrix LCDs could be applied to passive matrix LCDs by this invention.

Q. Okay. And so did you understand that that -- the application of those teachings developed relative to the active matrix LCD to the passive matrix LCD is an aspect of the invention that's described here?

A. It would be a teaching for this invention to learn from the active matrix scheme to try to apply to a passive matrix.

Q. And so under the -- do you therefore surmise in it, from the viewpoint of this inventor or these inventors here, they were doing something that was novel as of 2006 in applying those active matrix LCD driving methodologies to -- or overdrive methodology --

MR. HELGE: Objection. Calls --

BY MR. HANLEY:

Q. -- to a passive matrix LCD?

MR. HELGE: Objection. Calls for speculation.

THE WITNESS: Actually, I can't say what was in the heads of the inventor. But I would suspect that they were aware of the technology for active matrix; and whether it's novel or not is for someone else to determine, but they felt it was novel enough to write a patent.

MR. HANLEY: All right. That's all I have.

FURTHER EXAMINATION BY MR. HELGE:

Q. Mr. Credelle, as you just said, you have no idea whether this is the first overdriving application to passive matrix; correct?

A. That is correct.

Q. When you and I talked before about Suzuki, I asked you about the assumptions that you made that led you to believe that Suzuki was disclosing active matrix.

Do you recall that?

A. I recall that discussion.

Q. And you told me that it had to do with the source driver and gate driver; correct?

A. Those are two of the elements.

Q. And you told me also that you weren't aware of any passive matrix that used overdrive. Incorrect?

A. I was not aware.

Q. And you did not mention the hold drive disclosure at that time, did you?

A. We discussed the hold drive this morning.
Q. When I asked you the question about the assumptions you made that led you to believe that Suzuki was active matrix and not passive matrix, you did not tell me at that time that the hold drive disclosure was a foundation of your assumption.
Isn't that correct?
A. I would have to read back the testimony, but I -- I may have said that.
But earlier we already discussed that hold drive was an element of active matrix.
So, in total, my assumptions about this patent and this being probably an active matrix LCD would be related to both of those elements.
Q. Did you mention the hold drive at all in your declaration?
A. It is not discussed in my declaration.
Q. So if it was something you relied upon, you didn't mention it in here; right?
A. I did not mention it in the declaration.
MR. HELGE: Okay. No questions.
Back to you.
MR. HANLEY: No questions.
THE REPORTER: The time is now 2:25. My only question is, did you want a copy of the transcript; to

order a copy of the transcript?

MR. HANLEY: Yes.

THE REPORTER: Do you want a rough draft of this transcript?

MR. HANLEY: Yes, please.

THE REPORTER: And if so, do you want it this evening, or tomorrow? Do you have a preference?

MR. HANLEY: We are not in any rush.

MR. HELGE: You said two days would give you a little more time to clean it up.

THE REPORTER: Well, it will be a little cleaner; but otherwise, I can shoot it out tonight.

MR. HANLEY: We can wait.

MR. HELGE: Also for me, please.

One last thing, I think -- are you going to want to sign this, Mr. Credelle?

THE WITNESS: I can sign it.

The transcript?

MR. HELGE: Right. Are you reserving the right to sign and review?

MR. HANLEY: Yes. We reserve the right to have him sign.

Can I do one more thing before we go off?

THE REPORTER: Yes.

MR. HANLEY: I probably don't need to do this, but I want to interpose just for the record an objection to Exhibit A for lack of relevance, based on the testimony of the witness on redirect.

THE REPORTER: Okay. We are going off the record at 2:26.

(Off the record at 2:26 p.m.)

____

THOMAS CREDELLE

SUBSCRIBED AND SWORN before and to
me this ____ day of
________________, 20___.

____
Notary Public

CERTIFICATE OF SHORTHAND REPORTER

I, JENNY L. GRIFFIN, Certified Shorthand Reporter for the State of California, do hereby certify:

That THOMAS CREDELLE, the witness whose deposition is hereinbefore set forth, was duly sworn by me before the commencement of such deposition and that such deposition was taken before me and is a true record of the testimony given by such witness.

I further certify that the adverse party was represented by counsel at the deposition.

I further certify that the deposition of THOMAS CREDELLE occurred at the offices of Covington & Burling LLP on Wednesday, October 28, 2015, commencing at 9:32 a.m. to 2:26 p.m.

I further certify that I am not related to any of the parties to this action by blood or marriage, I am not employed by or an attorney to any of the parties to this action, and that I am in no way interested, financially or otherwise, in the outcome of this matter.

IN WITNESS WHEREOF, I have hereunto set my hand this ___ day of ___________, 2015.

____

JENNY L. GRIFFIN, CSR #3969

Certified Shorthand Reporter

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US 20080106540A1

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Chien et al.

(10) Pub. No.: US 2008/0106540 A1
(43) Pub. Date: May 8, 2008

(54) OVER-DRIVING COMPENSATION METHOD TO SHORTEN THE RESPONSE TIME OF A TN/STN PASSIVE MATRIX LIQUID CRYSTAL DISPLAY

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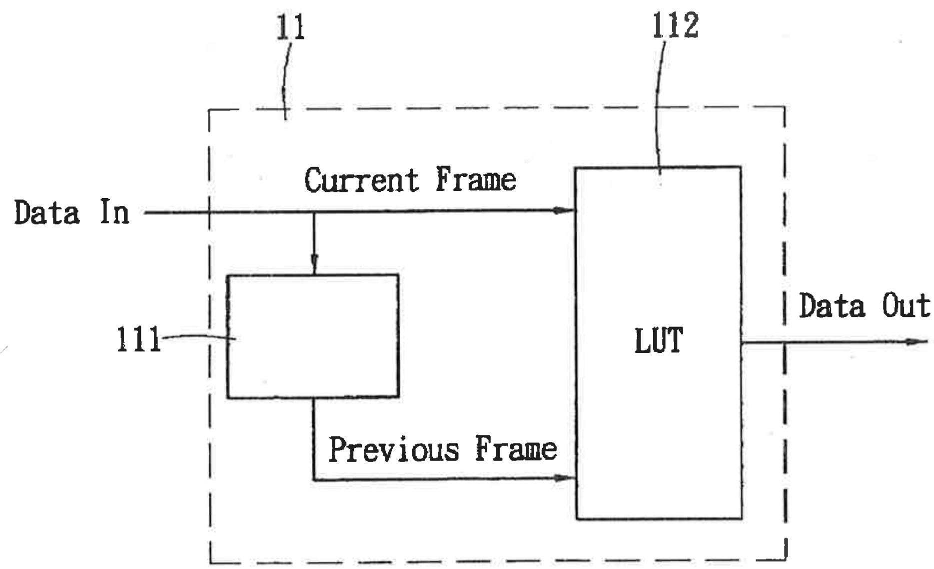
(52) U.S. Cl. 345/212

(57) ABSTRACT

The present invention discloses an over-driving compensation method to shorten the response time of a passive matrix liquid crystal display, wherein N frames are arranged into a super-frame; the data of the current frame is compared with the data of the previous frame; once the data of the current frame is different from the data of the previous frame, the pictures are determined to be moving pictures; and when the pictures are determined to be moving pictures, an over-driving voltage, which is higher/lower than the traditional high-level driving voltage/the traditional low-level driving voltage, is assigned to each of from the ith frame to the jth frame of each super-frame. Thereby, the liquid crystal can faster approach or reach the specified target brightness. So the blurring of moving pictures will be greatly reduced.



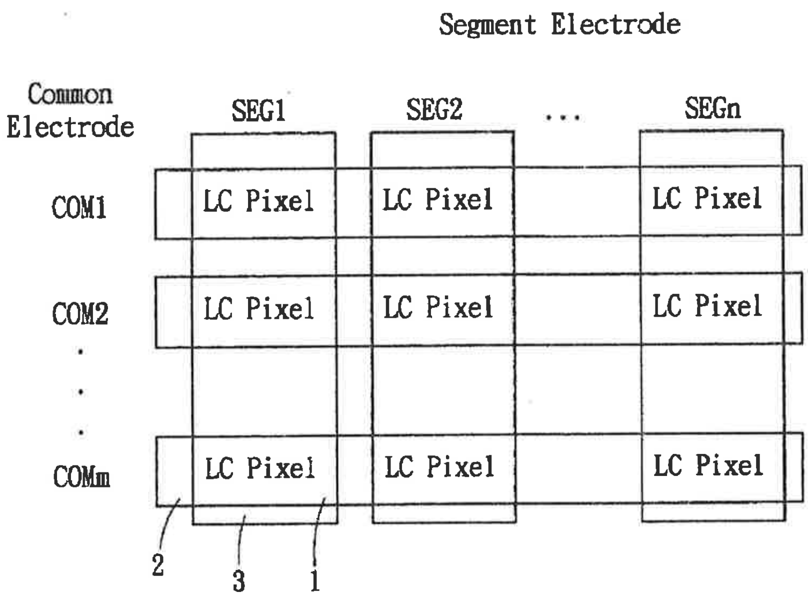


Fig. 1
PRIOR ART

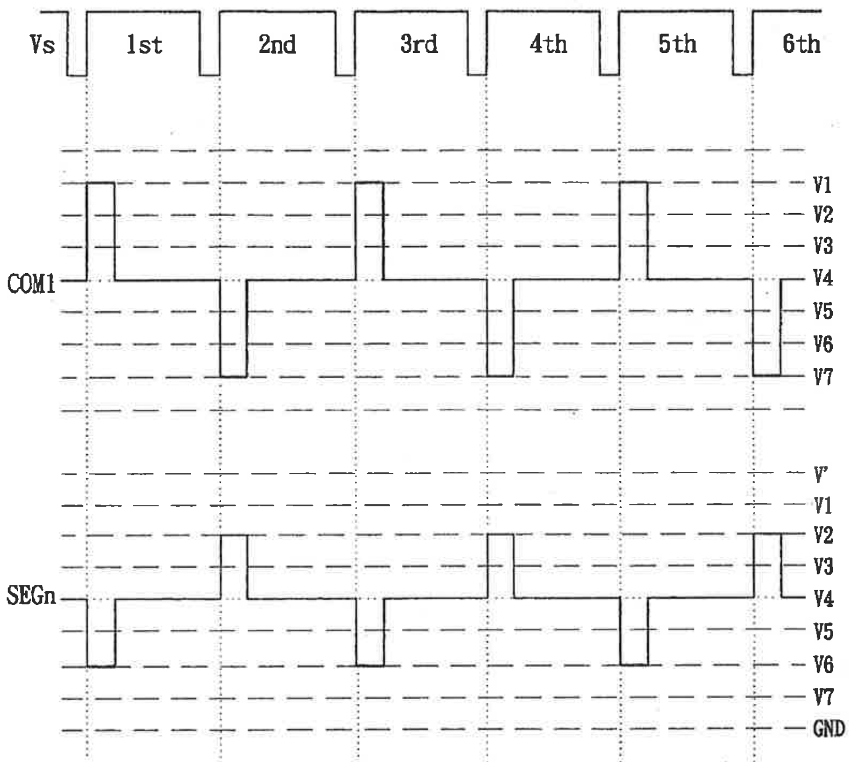
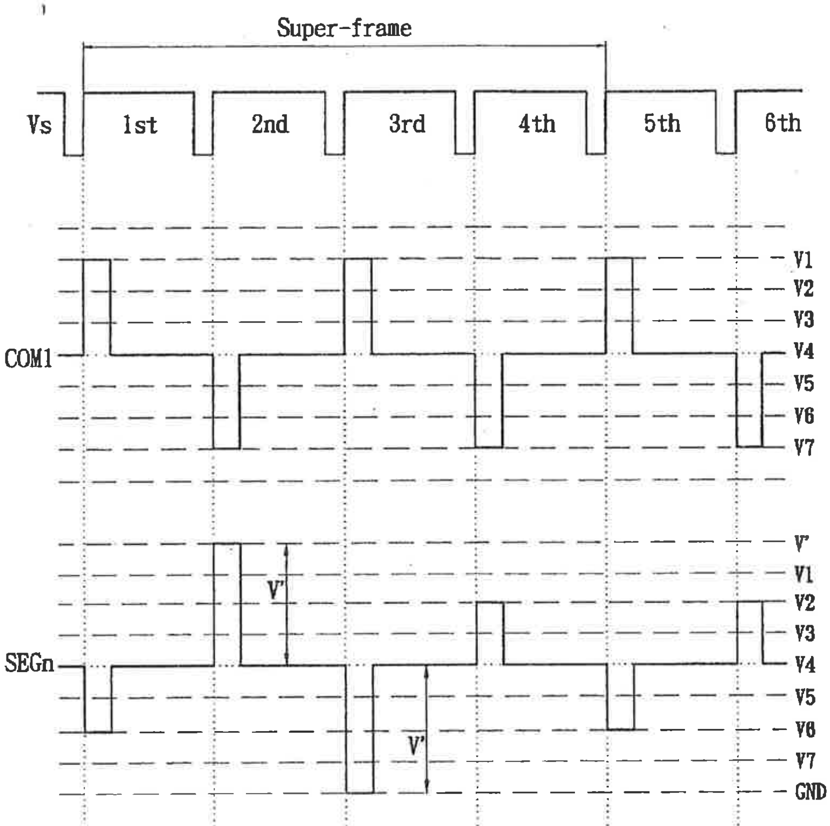


Fig . 2
PRIOR ART


Super-frame
Vs
1st
2nd
3rd
4th
5th
6th
COM1
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V2
V3
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V6
V7
SEGn
V'
V1
V2
V3
V4
V5
V6
V7
GND
V'
V'

Fig . 3

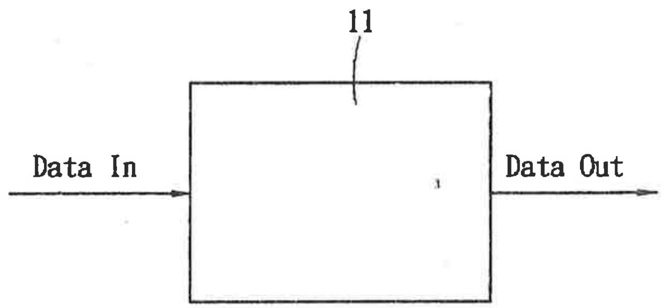
11
Data In
Data Out

Fig . 4

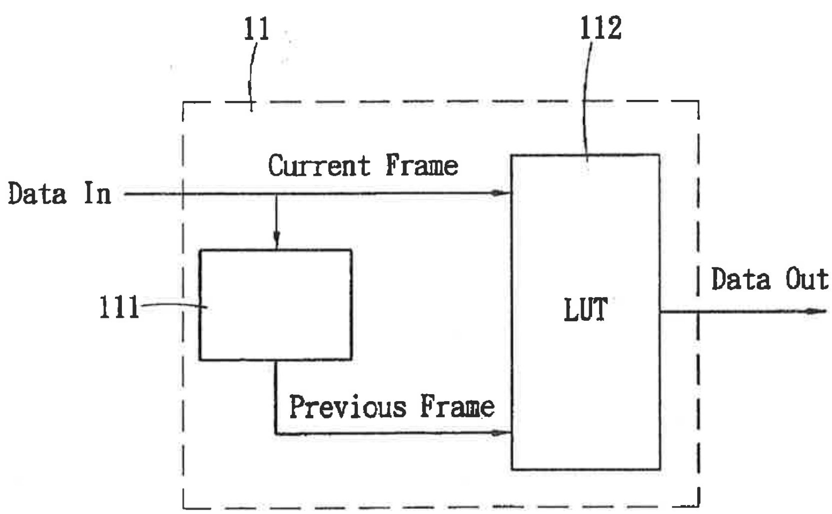
11
112
Current Frame
Data In
111
LUT
Data Out
Previous Frame

Fig . 5

OVER-DRIVING COMPENSATION METHOD TO SHORTEN THE RESPONSE TIME OF A TN/STN PASSIVE MATRIX LIQUID CRYSTAL DISPLAY

FIELD OF THE INVENTION

[0001] The present invention relates to a passive matrix-LCD driving technology, particularly to an over-driving compensation method, which enables the passive matrix TN/STN LCD adopting an APT (Alt & Pleshko theory) driving technology to display moving pictures clear.

BACKGROUND OF THE INVENTION

[0002] As LCD (Liquid Crystal Display) has the advantages of slimness, compactness and lightweight and consumes less power than the conventional CRT (Cathode Ray Tube), LCD has been gradually replacing CRT recently.

[0003] According to the driving methods, the flap-panel liquid crystal display (LCD) may be divided into the passive matrix LCD (PM-LCD) and the active matrix LCD (AM-LCD). In the passive matrix LCD, X-direction transparent ITO (Indium Tin Oxide) electrodes and Y-direction electrodes are respectively formed on two glass plates, and one glass plate is superimposed over the other one with liquid crystal filled. The intersections of the X-direction electrodes and the Y-direction electrodes are the pixels of LCD. External driving voltage is applied between the X-direction electrodes and the Y-direction electrodes to enable the rotation of liquid crystal molecules.

[0004] In the active matrix LCD, each pixel has a switch element and a complementary capacitor, and each pixel is independently driven by the elements on the pixel. In the active matrix LCD, TFTs (thin film transistors) are formed on the panel; therefore, the active matrix LCD is also called TFT-LCD (Thin Film Transistor Liquid Crystal Display).

[0005] Refer to FIG. **1** a diagram schematically showing the architecture of an m×n passive matrix LCD. The pixels **1** of a passive matrix LCD, including the common TN (Twisted Nematic) LCD and STN (Super Twisted Nematic) LCD, are not controlled by non-linear elements but are the intersections of the horizontal routings of common electrodes **2** and the vertical routings of segment electrodes **3**.

[0006] In principle, the electro-optical effect of liquid crystal, which is generated by the RMS (Root Mean Square) values of the applied voltage, is used in the operation of the passive matrix LCD. The response time of liquid crystal must be much longer than the scanning period of the driving pulse. If the frame rate is 60 Hz, the active time of each horizontal scanning line (the common electrode **2**) will be 16.67 ms, and the response time of liquid crystal is generally 200 ms, which is the necessary condition that liquid crystal responds to the RMS values.

[0007] However, blurring will appear in the moving pictures of the LCD adopting the traditional APT (Alt & Pleshko theory) driving method because the TN/STN LCD response time is too slowly. If LCD adopts a fast-response liquid crystal, the display picture may flicker, and the picture quality will be greatly reduced.

SUMMARY OF THE INVENTION

[0008] One objective of the present invention is to shorten the response time of the passive matrix LCD adopting the APT (Alt & Pleshko theory) driving method, including the TN LCD and the STN LCD, to reduce the display moving picture blurring phenomenon.

[0009] To achieve the above-mentioned objective, the present invention proposes an over-driving compensation method to shorten the response time of a passive matrix LCD, wherein for the passive matrix LCD (such as the TN LCD and the STN LCD) adopting the traditional APT (Alt & Pleshko theory) driving method, N frames containing segment-electrode picture data are arranged into a super-frame, and the current frame data is compared with the previous frame data; once the current data is different from the previous data, the pictures are moving pictures; next, an over-driving voltage, which is higher than the traditional high-level driving voltage of the segment electrode or lower than the traditional low-level driving voltage of the segment electrode, is given to each of from the ith frame to the jth frame with 2□N and 1□i, j□N, and the over-driving voltage is greater than or equal to 0 V and is lower than or equal to the highest of the LCD driving voltage. Thereby, the liquid crystal between the common electrodes and the segment electrodes can fast approach the target brightness of a specified high voltage.

[0010] Further, the present invention can respectively assign different voltages to different pictures, wherein a LUT (LookUp Table) circuit checks a table and sends out the values of the corresponding over-driving voltages, and the segment electrodes can thus correctly output the corresponding over-driving voltages. Thereby, the response time of the passive matrix LCD (such as TN LCD and the STN LCD) adopting the APT (Alt & Pleshko theory) driving method will be shortened, and the blurring of moving pictures will be greatly reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. **1** is a diagram schematically showing the architecture of an m×n passive matrix LCD.

[0012] FIG. **2** is a diagram schematically showing the driving waveforms of the pixel at the 1st column and the nth row of a traditional passive matrix LCD.

[0013] FIG. **3** is a diagram schematically showing the driving waveforms of the pixel at the 1st column and the nth row of the passive matrix LCD according to the present invention.

[0014] FIG. **4** is a block diagram schematically showing the lookup-table operation of the over-driving circuit according to the present invention.

[0015] FIG. **5** is another block diagram schematically showing the lookup-table operation of the over-driving circuit according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0016] Below, the technical contents of the present invention are to be described in detail in cooperation with the embodiments. However, it should be noted that those embodiments are only to exemplify the present invention and should not be used to limit the scope of the present invention.

[0017] Refer to FIG. **2** a diagram schematically showing the driving waveforms of the pixel at the 1st column and the nth row of the traditional passive matrix LCD. The driving waveforms of the traditional passive matrix LCD (such as TN LCD and the STN LCD) adopting the APT (Alt &

Pleshko theory) driving method include: a frame mark signal Vs, a common electrode signal COM1 and a segment electrode signal SEGn (Herein, the driving waveforms of the pixel in the 1st column and the nth row are used as the exemplification). In the traditional driving method, the identical high-level voltage **V2** and the identical low-level voltage **V6** (with respect to the reference voltage **V4**) are assigned to the segment electrodes in all frames.

[0018] Refer to FIG. **3** a diagram schematically showing the driving waveforms of the pixel at the 1st column and the nth row of the passive matrix LCD according to the present invention. In this embodiment, we suppose that a super-frame is formed of four frames (N=4); a picture-comparing circuit **11** arranged behind the data-input bus (shown in FIG. 4) is used to compare the data of the current frame with the data of the previous frame; once the data of the current frame is different from the data of the previous frame, the pictures are determined to be moving pictures; next, the picture-comparing circuit **11** flexibly assigns an over-driving voltage V', which is higher/lower than the traditional high-level driving voltage **V2**/the traditional low-level driving voltage **V6** (such as the ground voltage GND), to each of from the ith frame to the jth frame of each super-frame, wherein 1□i, j□4, and 0□V'□the highest driving voltage of the LCD. In FIG. **3**, i=2 and j=3; however, the picture-comparing circuit **11** may also assigns an over-driving voltage V', which is higher/lower than the traditional high-level driving voltage **V2**/the traditional low-level driving voltage **V6** (such as the ground voltage GND), to all the frames of each super-frame; otherwise, the picture-comparing circuit **11** may also assigns an over-driving voltage V' to the ith frame and the jth frame of each super-frame (for example, i=1 and j=4). Thereby, the liquid crystal between the common electrodes **2** and the segment electrodes **3** can faster approach or reach the target brightness of the specified high-level voltage **V2**.

[0019] The electro-optical effect of liquid crystal, which is generated by the RMS (Root Mean Square) values of the applied voltage, is used in the operation of the traditional passive matrix LCD (such as TN LCD and the STN LCD) adopting the APT (Alt & Pleshko theory) driving method; therefore, the RMS values will not cause serious flicker and show good moving picture quality in the over-driving compensation method of the present invention.

[0020] Further, the present invention may also respectively assign different over-driving voltages V' to different pictures. The picture-comparing circuit **11** compares the data of the current frame with the data of the previous frame stored in a storage device **111** inside (or outside) the driver IC. Once those two pieces of data are different, the pictures are determined to be moving pictures. When the pictures are determined to be moving pictures, an LUT (LookUp Table) circuit **112** checks a table and sends out the values of the corresponding over-driving voltages. The table checked by the LUT (LookUp Table) circuit **112** is an index matrix containing the values of over-driving voltages and can replace complicated calculation or non-linear calculation with a database of constants; therefore, the complicated calculation is omitted, and the processing efficiency is promoted. The output values of the corresponding over-driving voltages enable the segment electrodes **3** to output correct over-driving voltages V'. Thus, the response time of the traditional passive matrix LCD (such as TN LCD and the STN LCD) adopting the APT (Alt & Pleshko theory) driving method will be shortened, and the blurring of moving pictures will be greatly reduced.

[0021] The spirit of the present invention is to utilize the concept of the over-driving compensation method, which is originally used to shorten the response time of the large-size active-matrix TFT-LCD, to shorten the response time of the passive matrix TN/STN LCD. Besides, as the principle of the APT (Alt & Pleshko theory) driving method is to utilize the electro-optical effect of liquid crystal, which is generated by the RMS (Root Mean Square) values of the applied voltage, in the operation of the traditional passive matrix LCD, the RMS values of the applied voltage will not cause serious flicker in the over-driving compensation method of the present invention.

[0022] Those described above are the preferred embodiments to exemplify the present invention. However, it is not intended to limit the scope of the present invention. Any equivalent modification and variation according to the spirit of the present invention is to be also included within the scope of the present invention.

What is claimed is:

1. An over-driving compensation method to shorten the response time of a passive matrix liquid crystal display, which is applied to the traditional passive matrix adopting the Alt & Pleshko theory (APT) driving method, characterized in comprising the flowing steps:

arranging N frames of the picture data of a segment electrode into a super-frame; comparing the data of the current frame with the data of the previous frame; and once the data of the current frame is different from the data of the previous frame, assigning an over-driving voltage, which is higher/lower than the traditional high-level driving voltage/the traditional low-level driving voltage, to each of from the ith frame to the jth frame of each said super-frame, wherein 2□N, and 1□i, j□N, and said over-driving voltage is greater than 0 V and is smaller than or equal to the highest LCD driving voltage.

2. The over-driving compensation method according to claim **1**, wherein a LUT (LookUp Table) circuit checks a table and respectively assigns different values of said over-driving voltages to different pictures.

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