UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

XILINX, INC.,

Petitioner

V.

POLARIS INNOVATIONS LIMITED,

Patent Owner

IPR2023-00516
Patent No. 6,157,589

Deposition of
STEPHEN W. MELVIN, Ph.D.
Tuesday, November 21, 2023

REPORTED BY: JOHN WISSENBACH, RDR, CRR, CSR 6862

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INDEX OF EXAMINATIONS

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EXHIBITS REFERENCED

Exhibit 1003 (Deposition Exhibit 1)
Exhibit 1005 (Deposition Exhibit 2)
Exhibit 1006 (Deposition Exhibit 3)

* * * *

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BE IT REMEMBERED that, pursuant to the laws governing the taking and use of depositions, on Tuesday, November 21, 2023, commencing at 8:33 a.m., before me, JOHN WISSENBACH, CSR 6862, of San Francisco, California, appeared through videoconference STEPHEN W. MELVIN, Ph.D., at Delta, British Columba, Canada, called as a witness by the Patent Owner, who, being by me first duly sworn, was thereupon examined as a witness in said action.

APPEARANCES OF COUNSEL VIA VIDEOCONFERENCE

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ALSO PRESENT: GUS PHILLIPS, Videographer

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THE VIDEOGRAPHER: We are now on the record for the video deposition of Dr. Stephen Melvin -- the time is 8:33 a.m. November 21st, 2023 -- in the matter of Xilinx, Incorporated vs. Polaris Innovations Limited, IPR Number 2023-00516, being held in the United States Patent and Trademark Office before the Patent Trial and Appeal Board. The court reporter is John Wissenbach, the videographer is Gus Phillips, and both are representatives of GregoryEdwards LLC.

Will counsel please state their appearances for the record, beginning with the petitioner.

MR. KAPADIA: Yes. Aashish Kapadia, for petitioner, Xilinx, Incorporated.

MR. DeZERN: And David DeZern, of Nelson Bumgardner Conroy, for the respondent, Polaris.

THE VIDEOGRAPHER: Will the court reporter please administer the oath.

STEPHEN W. MELVIN, Ph.D.,
having been first duly sworn, testified as follows:

EXAMINATION BY MR. DeZERN

Q. All right. Good morning.
A. Good morning.
Q. Could you please state your name.
A. Yes. Stephen Melvin.

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Q. And Dr. Melvin, because this is a remote deposition and we aren't in the same room, do you have any materials, written or electronic, with you today?
A. I don't.
Q. Do you intend to open any materials during the course of this deposition?
A. Only the PDFs that -- that you put in the chat box.
Q. Okay. Well, I'd just ask you, if there's any materials you might want to open that you have accessible, please let me know, so that we can mark them and keep a clean record of this deposition. Is that okay?
A. Okay. That's fine, yes.
Q. And do you have access to any chat or messaging applications other than through this Zoom platform that we are using?
A. Not at the moment, no.
Q. Okay. Will you let me know if you receive any messages during this deposition?
A. Yes.
Q. And is there anyone else in the room with you?
A. No.

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Q. And will you please advise if anyone does enter?
A. Yes, I will.
Q. Okay. Dr. Melvin, you've been deposed before, right?
A. Yes.
Q. Approximately how many times?
A. 20 -- 20 to 30 times, maybe.
Q. Okay. So you know the drill. I'll ask questions. You're under oath to answer. Your counsel may object, but you still have to answer. Is that okay?
A. Yes.
Q. And if you need a break, please just let me know. We can do that. But I'd ask that you finish responding to any pending questions.
A. Okay.
Q. Any reason you can't testify truthfully to the best of your ability today?
A. No.
(Deposition Exhibit 1 was marked for identification.)
BY MR. DeZERN:
Q. All right. Now, I'm going to mark as Exhibit 1 -- which, as we discussed, I'm submitting

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through the chat. And it will upload. And I'll give you a second. Please let me know when you've got that.
A. Okay. I have it. Shall I open it?
Q. Please.
A. Okay. I see it.
Q. And is this Exhibit 1 your declaration?
A. Yes, it is.
Q. And specifically, just looking at the top of it, this is a declaration you submitted in this IPR, which relates to -- actually, the patent number's not on the top, is it? -- the -- if you go to the second page, this is about your opinions regarding U.S. Patent Number 6,157,589, correct?
A. That's correct.
Q. And could we just refer to that as the '589 patent this morning?
A. Sure.
Q. Dr. Melvin, was anyone else involved in creating this declaration?
A. Well, I worked with the attorneys on it.
Q. Your counsel defending you today?
A. Yes.
Q. And potentially other lawyers at his law firm, I presume?

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A. Yes.
Q. Did anyone else contribute to the work or analysis for your opinions in this declaration?
A. I don't recall any.
Q. Okay. And in your declaration, you provided your opinions regarding the validity of the '589 patent based on several different references, right?
A. That's correct.
Q. So I just have to -- I just want to ask a few questions about some of -- some of those opinions. And let's start with -- well, actually, we can -- if you still have the second page of your declaration pulled up, some of the opinions you provided were based on a reference which is listed here as 1005, U.S. Patent Number 5,774,402, to Lee, correct?
A. That's correct.
Q. And can we just refer to that as the Lee reference this morning?
A. Yeah, sure.
Q. Okay. So if you will flip in your declaration to page 70, I believe. Please let me know when you're there.
A. Okay. That's page 70 on the bottom or --

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Q. It is. And it should also be page 70 in the PDF.
A. Okay. There's different numbers. The exhibit page number is four off from the PDF. So which page? I think you want me to turn to page 66 of the -- the --
Q. Oh, I'm sorry. I forgot there are two page numbers. I was looking in the bottom right corner. So, yes, 66 in the middle; page 70 in the bottom right.
A. Yeah. Okay. I got it.
Q. Okay. And this is an annotated figure of Lee of one of -- of figure 3 from Lee that you provide in your declaration, correct?
A. That is correct.
Q. So I just want to kind of use this to orient -- orient us to -- to what we're talking about here. So just at a high level, can you kind of describe what is presented here and -- and generally what -- what this annotated figure is showing?
A. Yeah. In -- what I'm doing here with this figure is mapping the -- the circuitry that's disclosed in Lee onto the claim limitations. And this signal INIT is what I'm saying is -- I'm

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mapping that to the supply voltage stable signal. And the signal RST, R-S-T, is the enable signal. And what's shown in gray is the enable circuit. And what's shown in yellow is the initialization circuit.

Q. Okay. And you've got -- I believe you put some orange -- an orange bracket around the inputs to what you've labeled as the "Enable Circuit." There's three different signals there, right?

A. On the left you mean, yeah, the command signals.

Q. And those signals are, in Lee, DSF, RASB, and CASB, right?

A. That is correct. Yeah.

Q. So I wanted to ask you some questions about what those signals are precisely. And feel free to reference your declaration or point me to anywhere where you've discussed it if that would be helpful. But let's just start at the top. Well, actually, let's start at the bottom.

So what -- what is CASB? And is that how you would refer to it, or call it "CASB," or what would be easiest this morning?

A. I would refer to it as CAS. It's --

Q. CAS?

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A. The B is -- stands for "bar," meaning it's low true. But RAS and CAS are commonly used signals in DRAMs. Frequently they're low. They're low active. They're drawn with a bar over them. So what Lee has done is -- which is fairly common, is just labeled it, you know, "CASB," which is -- which is the same as "CAS" with a bar over it, meaning it's low -- it's low active. So I think we could just refer to those as RAS and CAS if you want.

Q. Okay. That works.

And what is the DSF signal?

A. That's a special mode pin that is used on certain DRAMs to enable the activation of certain modes, special modes.

Q. And so I believe in your declaration, you refer to these -- these are examples of control signals that are typically provided to a DRAM, right?

A. That's correct.

Q. And I think you had identified some other ones. There are additional control signals, such as Chip Select, Write Enable. Does that sound right?

A. Did I identify those with respect to Lee or in general? I mean --

Q. Just in general for DRAM devices.

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A. Yeah. So DRAMs have other signals, typically Output Enable, Write Enable, Chip Enable. They sometimes have different names. But those are commonly used in -- in memory -- memory devices as additional control signals.

Q. Okay. And, actually, if I could direct you to paragraph 53 of your declaration, which is on page 31 in the bottom right corner, which is 31 of the PDF --

A. Okay.

Q. -- or page 27 in the -- in the middle.

A. Yes, I see that.

Q. Okay. So I'm just looking at this statement. The -- well, let me back up.

So at the start of paragraph 53, brief explanation of CAS and RAS and those other additional control signals, such as Chip Select and Write Enable, right?

A. Yes, I see that.

Q. And then you explain, let's see, "These various input signals are used to perform specific commands by way of a command decoder," et cetera, right? Do you see that?

A. Yes.

Q. And then "Depending on the combination of

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these input signals sent from the memory controller to the DRAM device, a different command is identified and performed," correct?

A. Yes.

Q. Okay. So -- so signals such as RAS and CAS and -- or DSF, those would be individual signals provided to a DRAM normally, right?

A. Yeah. In general those are signals coming in externally to the DRAM.

Q. Okay. Those are -- those are examples of signals that come in externally to the DRAM. Got it.

And can you kind of walk me through -- again, looking back at your annotated figure of Lee, what does the -- what you have put a box around calling it "Enable Circuit," what does it do with these signals that are provided to the DRAM?

A. So there's a circuit -- there's a -- a circuit there. You see the three inputs coming into input buffers. And then there's a circuit that requires a certain sequence, or a certain pattern, if you will, of those signals. And when it gets that pattern, then it -- then SET goes out. Then the output SET is activated and then deactivated.

And I think -- there's a timing diagram in

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figure 4. I don't know if it's here. We'd have to pull up Lee. But it illustrates the -- the sequence of -- or the pattern of -- of -- of inputs that causes that to happen. So the purpose of the gray box is to -- or at least the -- box 46 is to detect that sequence on the input signals.

Q. Okay. And let me -- since you mentioned Lee and the timing diagram, let me just go ahead and mark Lee for us. If you'll give me a second.

(Deposition Exhibit 2 was marked for identification.)

BY MR. DeZERN:

Q. I've put in the chat what I've marked as Exhibit 2. Let me know when you've got it pulled up, please.

A. Okay. I have it.

Q. Okay. And if you could flip to figure 4, which I believe is the timing diagram you were just referring to. And let me know when you've got that.

A. Yeah, I have that.

I've got it.

Q. Okay. Thank you. Sorry. I just wanted to make sure I've got it, too.

Okay. So with figure 4 pulled up, if you could just kind of explain at a high level what --

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what's going on in your annotated figure 3 using these RAS, CAS, and DSF signals and reference -- referencing the -- figure 4 of Lee as needed to help me understand what's going on.

A. Yeah. So this is showing RAS -- showing CAS going low, and then there's a little arrow that is drawn down to the signal C. I'm just going to call it C. There's a little Greek symbol before it indicating that's a clock signal, PHY symbol. But let's just call it C.

So CAS goes down to C. And so this shows the causality here, where CAS goes low, causes C to go high, and that causes this -- the signal called CTL to go high. And then you have RAS going low, which causes R to go high, which then causes the signal MSH to go high; and similarly with DSF.

So the top three lines in this figure are the external pins, and everything else are the internal signals. And this is illustrating how this sequence of CAS low, RAS low, with DSF low causes ultimately SET to go high. And the SET signal going high is what will basically hold the RST signal high.

Now, one thing to understand about figure 4 is that the very last line on this figure is --

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illustrates what Lee calls -- calls the failure mode, or the error, or the case when the supply voltage stable signal doesn't trigger properly. But in the normal operation, that RST signal would be shown as high coming in from the left. And it's the -- it's the -- the ultimate goal of this whole sequence is for the RST signal to go low, which causes the -- releases the circuits out of initialization.

So -- so that very last little arrow going down to RST is not actually -- doesn't actually exist in the normal operation, but in the case that -- what Lee calls the -- the failure of the power-up signal to enable properly, then that would cause RST to go high before it goes low.

Q. Okay. So let me follow up on -- on some of that to make sure I understand.

So if we're looking at figure 4 of Lee -- and correct me if I'm wrong, but if -- if operating normally, then the RST signal, R-S-T -- again, we'll just -- we'll ignore the Greek symbol in front of it. But the RST signal, you're saying, should be high. It should already have been high regardless of the operation of -- of this -- the rest of this timing diagram that we're looking at?

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A. Yeah, that's right. And that can be seen by looking at figure 3, because in -- when -- when the INIT -- the INIT signal triggers RST to go high. And everything in figure 4 is what happens after power-on, after the voltage supply signal.

So in the normal mode, the INIT signal -- and you can see the INIT signal goes down to this gate 50 if you look at figure 3. And that's a little latch, because there's feedback. So -- so when INIT goes high, then the output goes low, which causes 52 to go high, which then will hold that NOR gate in -- in a high state -- or I mean in a low state, which will cause RST to go high.

So in the normal mode of operation, when, you know, the -- the power-up circuit works correctly, then you would see the RST signal high coming in from the left, because -- because you only need the circuit -- you only need 46 to -- to trigger it to go low in the normal mode. But the -- Lee has drawn it this way, I think, to illustrate one of the ideas, which was that even in the case that you have failed -- that the power-up supply circuit has failed, you can still --

(Discussion off the record.)

THE WITNESS: I'm sorry.

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