UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

_____)

APPLE INC.,

Petitioner, Case IPR2024-00697

v. Case IPR2024-00698

RESONANT SYSTEMS, INC., US Patent 8,093,767

Patent Owner.

_____)

VIDEOTAPED DEPOSITION OF KEITH W. GOOSSEN, PH.D.

May 7, 2025

10:19 a.m. Eastern Time

Reported by: Lori J. Goodin, RPR, CRR, RSA,

California CSR #13959

DIGITAL EVIDENCE GROUP

1730 M Street, NW, Suite 812

Washington, D.C. 20036

(202) 232-0646

REMOTE VIDEOTAPED DEPOSITION of

KEITH W. GOOSSEN, PH.D.,

in the above-titled action, held on Wednesday, May 7, 2025, commencing at approximately 10:19 a.m. before Lori J. Goodin, RPR, CRR, RSA, California CSR #13959, Registered Professional Reporter, Certified Realtime Reporter, Realtime Systems Administrator, and Certified Shorthand Reporter, and Notary Public of the State of Florida, State of California, State of Maryland, District of Columbia, and State of Delaware.

1 REMOTE APPEARANCES:
2
3
4 ON BEHALF OF PETITIONER:
5 FISH & RICHARDSON P.C.
6 BY: CRAIG DEUTSCH, ESQUIRE
7 60 South Sixth Street
8 Minneapolis, Minnesota 55402
9 202-783-5553
10 deutsch@fr.com
11 AND
12 FISH & RICHARDSON P.C.
13 BY: THOMAS ROZYLOWICZ, ESQUIRE
14 1000 Maine Avenue, Southwest
Washington, D.C. 20024
15 202-626-6395
rozylowicz@fr.com
16
17
18 ON BEHALF OF PATENT OWNER:
19 RUSS AUGUST & KABAT
20 BY: KRISTOPHER R. DAVIS, ESQUIRE
12424 Wilshire Boulevard, 12th Floor
21 Los Angeles, California 90025
310-826-7474
22 kdavis@raklaw.com

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WEDNESDAY, MAY 7, 2025, 10:19 a.m.

PROCEEDINGS

* * *

Whereupon,

KEITH W. GOOSSEN, PH.D.,

a witness called for examination, having been first duly sworn, was examined and testified as follows:

* * *

EXAMINATION

BY MR. DEUTSCH:

Q. Thank you for being here today, Dr. Goossen. I will start with just a few housekeeping items and kind of the ground rules for today.

And before I do that, I just wanted to double-check. Hopefully, I have been pronouncing your name correctly. Is it Dr. Goossen?

A. Correct. Thank you.

Q. Perfect. Well, so to start, I just want to recognize that our conversation today is being transcribed by the court reporter. So, to make her job easier and ensure we can obtain an accurate record, I will try not to talk over you, of course. I will ask a question, and then provide you with an opportunity to respond.

If a question is unclear, please just ask me to clarify and I will restate or try to rephrase the question.

And if you don't ask me to clarify, I will assume that you understood the question.

Is that fair?

A. Okay.

Q. And if you need to take a break, please just let me know. I will try to take breaks, you know, every hour or so. But, we can, we can have more frequent breaks.

And I understand from counsel that you recently underwent back surgery. And so if you just need a break for that or any other reason, just let me know.

A. Okay, thank you. I will.

Q. We can do that.

Dr. Goossen, where do you currently work?

A. University of Delaware.

Q. And where are you located right now?

A. I am in my office at the University of Delaware.

Q. And, is anyone with you in your office today?

A. No.

Q. Is there any reason that you cannot give truthful and accurate testimony today?

A. There is not.

Q. Great. Just to clarify, when I use the term '767 patent, I will be referring to U.S. Patent Number 8,093,767.

And that is the patent number that is marked as Exhibit 1001 in the two IPRs that we are discussing today.

And those IPRs are IPR 2024-00697, and IPR 2024-00698.

(Whereupon, previously marked
Exhibit 1001,
first referral.)

BY MR. DEUTSCH:

Q. Does that make sense?

A. Yes, thank you.

Q. Dr. Goossen, have you ever been deposed before?

A. Yes.

Q. About how many times?

A. This is around number 20, I think.

Q. Could you describe your preparation for today's deposition?

A. Yes. I re-read my declaration and met with counsel for about an hour and a half.

Q. As part of your preparation, did you communicate with anyone else aside from counsel?

A. No.

Q. Do you recall what documents you reviewed in preparation for the deposition?

A. Well, my own declaration, of course, and the patents in suit here.

Q. Okay. Turning the '767 patent, to the best of your knowledge is this a patent that you were familiar with before being contacted to work on this matter?

A. I was not familiar with it beforehand.

Q. When were you first contacted by someone on behalf of patent owner for your work on these IPRs?

A. Oh, I think it was about a year and a half ago.

Q. And before that time, had you ever worked or performed services on behalf of patent owner?

A. No. And by time, you mean the assigning of the patents?

Q. Yes. To clarify, Resonant's.

A. No, I had not.

Q. Okay. Thank you.

Could you describe the process of preparing your declaration in this proceeding? And I am referring to what is marked as

Exhibit 1009 in this proceeding.

(Whereupon, previously marked
Exhibit 1009,
first referral.)

THE WITNESS: The declaration, or the report?

BY MR. DEUTSCH:

Q. Correct, yes.

A. Yes. That was in rebuttal to the IPRs listed, developing arguments to rebut those arguments, and writing them up and putting them in the report.

Q. Is that your typical process?

A. Well, certain sections, you know, were not written by me but were reviewed and edited by me.

So, the entire report is mine and reflects my opinions.

Q. Understood. Are you currently aware of any errors that exist in your declaration?

A. Yes, I have been reviewing it recently. I noted a very slight typo.

By the way, I have paper copies of my declaration and the patents and they are not marked up in any way.

I noticed in Paragraph 150, the second line, that should be a separate signal P, not D.

Q. You are referring to Line 2 of Paragraph 150?

A. Yes. A separate signal, that should be P from the control component to the power supply.

Q. Understood. Thank you.

Any other errors that you are aware of?

A. I don't think so.

Q. Okay. And you mentioned that you had clean copies of the declaration and patent.

Do you have any other materials with you?

A. Oh, well, I have the other report for the '882 patent.

Q. Okay. Okay. Let's turn to the

Cosper reference first.

A. I don't have a copy of that.

MR. DEUTSCH: Oh, okay. I will drop that in the Chat.

Cosper is Exhibit 1009.

(Whereupon, previously marked Exhibit 1009, first referral.)

THE WITNESS: Let me see, how do I do this? So, I guess I have to download it and then I can open it.

Okay. I have it open.

BY MR. DEUTSCH:

Q. Great. Does this look familiar?

A. Yes.

Q. So, let's start with Figure 1 of Cosper, which appears to show a mass attached to a spring; is that correct?

A. Yes.

Q. And is numeral -- or, excuse me, what is numeral 18 pointing to?

A. It is pointing to the mass.

Q. And what is numeral 16 pointing to?

A. It is pointing to the spring.

Q. And then it looks like the, you know, if I am looking at Figure 1, the lower end of the spring is attached to the mass?

A. Okay, yes.

Q. And the top of the spring is attached to something else.

What is the top of the spring shown as attached, to you?

A. In this figure, it is not labeled. Some surface, apparently.

Q. And then Figure 1 of Cosper includes text, "oscillatory motion."

A. Yes.

Q. Do you see that?

A. Yes.

Q. And then there is a straight line just to the left of that text with arrows at each end.

A. Yes.

Q. What is that referring to?

A. Well, it is sort of defining, I guess, oscillatory, meaning moving in an oscillatory fashion.

Q. You mean the mass -- the movement of the mass?

A. Yes.

Q. Okay. So, in the Figure 1 embodiment, the mass would move up and down on the page in the direction of the straight vertical line?

A. Well, this is a very schematic diagram. So, the arrows are up and down.

Q. I just want to make sure I understand what you mean by that.

The -- looking at Figure 1, the way it is drawn, the mass is depicted as moving up and down on the page in the direction of that line?

A. Yes. That is what is depicted.

Q. Okay. And then could you --

Looking left in Figure 1, there are a few other boxes and numerals that are shown.

Could you describe to me what those components are?

A. Well, can I refer to the text of the patent? That would be --

Q. Yes, absolutely.

A. So, I guess, it would have been helpful to get paper copies of this.

But, if we go to the text of the patent, and if I go to Paragraph 49 --

Q. Okay.

A. Figure 1 illustrates schematically control system for use with the mechanical resonant subassembly. The control system includes control logic, a sensor for determining a parameter of the moveable subassembly, including the mass, a sensor input, and a control output to drive the moveable subassembly at or near the resonance.

Q. And so in that paragraph, you had mentioned a Sensor 14 for determining a parameter from the moveable subassembly and then a sensor input for inputting the parameter into the

control logic of Control Circuit 12.

And so, the -- again looking at Figure 1 and the feedback control that is described, is that something that would have been understood to facilitate efficiency in generating vibration of the mass that is shown in Figure 1?

A. Well, the -- in a sense, the aim of Cosper is to maintain the mechanical system at its resonant frequency.

And I forget whether the word "efficiency" is used for that -- as a result of that.

Q. And is that, if the, through that feedback system it maintains operation at resonance, that would result in a higher gain during operation; is that right?

A. A higher gain? I'm not sure the term "gain" is here or where that term is used.

But, it will at resonance, generally mechanical system will operate at its greatest amplitude.

Q. And so in that sense it would be

facilitating efficient operation?

I don't want -- I'm trying to clarify what you said a moment ago about efficiency.

A. I didn't say anything about efficiency.

Q. Oh.

A. You asked me and I said I wasn't sure that term was used in the patent.

Q. Let me rephrase that.

So, I -- Cosper talks about, in one example, operating at resonance. And so a system like that shown in Figure 1 would operate at its greatest amplitude.

A. Well, generally mechanical system at resonance is operating with its greatest amplitude.

I'm not sure -- you know, you would have to direct me to some portion of the patent to -- I'm not sure what you are asking.

Q. That is it. That -- okay. That answers the question. Okay.

In still talking about Cosper, I would like to turn to Paragraph 85 of your declaration, which I think you have in front of you.

A. Yes.

Q. And in Paragraph 85, you talk about embodiments of Cosper that describe rotational motion of the moving mass.

And, in particular, Paragraph 85 mentions the two embodiments shown.

And what are the -- I'm sorry?

A. You mean in my Paragraph 85, yes, okay.

Q. Correct. What are the two embodiments that you are referring to?

A. Well, the one is shown there where he is basically trying to cause a mirror to oscillate sort of in a rotary fashion in order to scan an optical beam.

Q. Is there a second embodiment that you are referring to when you said the two embodiments?

A. Well, the one is in Figure 2, which I don't have in my report. And the other one is in Figure 15.

Q. Got it. Are those the only two embodiments that Cosper describes?

A. They are the only two embodiments he described in any detail.

Q. Let me ask a different question.

So, the, when you said the two embodiments, you are not including Figure 1 that we have been discussing?

A. Well, I would say Figure 1 is more of a schematic nature.

Q. Turning back to Figure 1 and Cosper's description of Figure 1 at Paragraph 50, Cosper describes one or more Sensors 14. Do you see that?

A. Yes.

Q. What are the parameters that Cosper describes Sensors 14 can detect?

A. Well, he describes any appropriate sensor may be used -- for example, optical,

magnetic, capacitive -- that may detect an appropriate parameter that may correlate the position of the subassembly from which the motion can be derived.

Q. Are there other parameters that would be detected?

A. Well, the only time the word "parameter" is used is correlating to position to derive the motion of the subassembly.

Q. And so that is the only -- or let me rephrase that.

The -- so, it is your opinion that the only parameter being detected in the system of Figure 1 is used to correlate the position of the subassembly?

A. Well, just reading that paragraph, that is the only time the word "parameter" is used.

Q. Maybe I am misusing the word "parameter."

The system would also detect position, velocity, acceleration, things like

that, correct?

A. Well, it says the Sensors 14 may detect position, velocity and acceleration.

Q. And then the signals from those sensors, could you explain what happens next?

A. What happens next? Well, I mean in terms of the patent, what he writes is that he is using the output of the sensors to derive the motion of the subassembly, by which I would assume it is primarily he is deriving the velocity.

Q. When Cosper -- in that sentence when Cosper says one or more sensors may detect position, do you have an example of what type of sensor that might be?

A. Well, he gives examples. Optical, for example.

Q. And same question for velocity sensors.

A. Well, I would guess, you know, electromagnetic, if he is looking at the EMF, would detect velocity.

Q. And how about sensors for acceleration, is there a type of sensor that would be used for that?

A. Well, in the list here, I guess I don't see it directly, no.

Q. A moment ago you mentioned the velocity sensor could be implemented as an electromagnetic sensor.

Do I have that right?

A. Well, I am making an inference there that when he says electromagnetic sensor, he is referring to, you know, something measuring the back EMF of -- if the mass is a magnet.

But, I am sort of reading ahead there, maybe. I can't remember if he describes a back EMF sensor here.

Q. All right. Let's turn to the Shahoian reference.

THE WITNESS: Again, you will have to provide it.

MR. DEUTSCH: Yes, I just dropped Exhibit 1004 into the Chat. Okay?

(Whereupon, previously marked
Exhibit 1004,
first referral.)

BY MR. DEUTSCH:

Q. I would like to talk about what is shown in Figure 2 of Shahoian. Can you tell me what Figure 2 is depicting?

A. Well, can I, just to make sure I get it right, refer to the text describing Figure 2?

Q. Yes, absolutely.

A. Okay, so, if you go to Column 6 at the top.

Q. Okay.

A. So Figure 2 is a side view of an Actuator that can provide force feedback to the user of a controller, meaning some sort of handheld, describing gaming devices, generally.

And, Actuator 100, in the next paragraph, is a moving magnet actuator, includes a Wire Coil 104, and Magnets 106 and 108.

And it -- in the third paragraph what I gather is that the coil produces a force

on the magnet and causes it to move.

Is that sufficient?

Q. Yes, it is. And you answered my next question, too. I was going to ask how the Magnet Head 105 is driven. And I think you answered that.

And so, thinking about the drive waveform, how does the drive waveform affect the vibration output?

A. I'm sorry. Where do you see drive waveform?

Q. I guess one usage of that is in Column 7, beginning at Line 34.

A. Well, okay. So, it says, "A drive waveform that," you know, "changes between positive and negative signs can be provided to the actuator to cause the oscillations."

Q. And then the next line says, "If a lower amplitude drive waveform is used, then the magnitude of vibration output is correspondingly lower."

Did I read that correctly?

A. Yes.

Q. And then, likewise, if a higher amplitude drive waveform is used, then the magnitude of vibration output would be correspondingly higher, correct?

A. That is what it reads, yes.

Q. How does the frequency of the drive waveform impact the vibration output?

A. Well, it can change the frequency of the movement, I suppose.

Q. If I am understanding you correctly, you are saying if the frequency of the drive waveform is changed, that would impact the frequency of the vibration output?

A. Well, I mean, this paragraph is somewhat schematically descriptive. But, that appears to be what he is describing.

Q. And so is it the case, is it similar to magnitude, that if the frequency of the drive waveform increases, then the frequency of the vibration output increases and vice versa?

A. Well, depending on how the circuit

is designed, it may work that way.

Q. How about for a system like what is depicted in Figure 2 of Shahoian?

A. Well, he doesn't show the driving circuit in Figure 2.

I mean, if I can, you know, back up a little bit here. With reference to Figure 2, if there is -- you know, if there is more current in the coil, there is going to be more force on the magnet.

But, other than that, I'm not sure what else to infer from this paragraph.

Q. And on that point, then, when you say there is -- if there is more current in the coil, there is going to be more force on the magnet. Can you describe that a little more in terms of the impact on the vibration output?

A. From what is written here, I couldn't make any additional inference.

Just based on Figure 2, which is somewhat schematic -- you know, in, in describing that the coil is what is causing the magnet to

move, I would infer that if there is more current in the coil, the force in the magnet is going to be larger.

Q. Understood. So, continuing down in that same discussion of Shahoian. At Column 7 beginning at Line 54, Shahoian indicates, "The linear actuator 100 provides a greater magnitude of vibrations at higher frequencies (assuming the waveform magnitude is held constant)."

Did I read that correctly?

A. That is what it says.

Q. So, in that scenario, the magnitude of vibrations is greater as the frequency has increased?

A. I guess I have a difficulty parsing that sentence, why that would be.

Q. Why what would be?

A. Why -- I mean just reading that sentence alone -- why if the linear actuator is operated at higher frequencies, it would have a greater magnitude of vibrations.

I'm not sure what he is referring to

there.

Q. Is it -- is there anything in that sentence that suggests --

A. Well, the next sentence --

Q. Sorry. I don't mean to -- no, go ahead --

A. I mean, the next sentence, I mean, indicates that at higher frequencies, you are approaching the resonant frequency.

Q. And so that seems to answer the question of why the magnitude is greater at higher frequencies?

A. Well, just reading those two sentences, what he seems to be saying is that as you approach the resonant frequency -- as you raise frequency and approach the resonant frequency, the vibrations will have a greater magnitude.

Q. And it seems like there is -- depending on what output is called for in a given scenario, that could be a good thing or that could be something that could be --

A. Well, in the context of this paragraph, it is a bad thing. He says, "needs to be compensated for, so as to provide an overall flat response."

Q. Where do you see that?

A. Well, I am finishing reading the sentence. "This gain at higher frequencies is due to primarily to the vibration occurring at the resonant frequency," would -- which can be compensated for, to obtain a more flat response.

Q. So, you are saying that is, that higher gain -- or, excuse me, the. I'm sorry.

The greater magnitude of vibrations at higher frequencies, due to the vibration occurring near the resonant frequency, is something that needs to be compensated for, or, in other words, avoided?

A. Well, interpreting that sentence, that is what he is saying. He is endeavoring to compensate for the resonance, so as to obtain a more flat response.

Q. And I think when you recited that

1 sentence, it was a little bit different than the
2 text that I see on the page.
3 And if we go back to that sentence,
4 starting with "this gain."
5 A. Uh-huh.
6 Q. It says, "This gain at higher
7 frequencies is due primarily to the vibration
8 occurring at the resonant frequency of the
9 mechanical system including actuator from
10 housing, et cetera, and, if desired, can be
11 compensated for in other embodiments to obtain a
12 more flat response."
13 And so, when Shahoian says "if
14 desired, can be compensated for," are you
15 interpreting that as it must be counteracted?
16 A. Well, it -- in the patent generally,
17 he is endeavoring to get a more flat frequency
18 response.
19 Q. And so if he says if desired --
20 A. I mean I --
21 Q. -- some might say it may not be
22 desired. If the, if the goal was a greater

magnitude of vibrations at these high frequencies, then it wouldn't be compensated for. Is that correct?

A. Just reading the, that single sentence literally, yes.

Q. Okay. If we could turn to the '767 patent. I think you said you have that in front of you.

A. Yes.

Q. And I would like to look at Claim 3 of the '767 patent. Do you have it?

A. Yes, I am looking at the claims.

Q. Okay. So, Claim 3 recites, "The linear resonant vibration module of Claim 2 wherein the linear resonant vibration module further includes a vibration sensor and wherein the control program continuously monitors output from the vibration sensor in order to adjust the frequency at which the control program changes the voltage state of the directional signal D."

A. Yes.

Q. And you had commented on that second

wherein clause and particularly, "wherein the control program continuously monitors output."

And I think, and I can -- we can turn to your declaration if it is helpful.

A. Oh, you mean in my declaration, okay.

Q. Yeah, I'm sorry.

A. You will have to tell me where I am looking here.

Q. I believe it is Paragraph 108 -- or, I'm sorry, 111. Paragraph 111.

But, let me know if there is other paragraphs that are relevant. But Paragraph 111 specifically talks about this claim limitation, "continuously monitors output from a vibration sensor."

A. Yes.

Q. And I see in Paragraph 110 -- or, excuse me, Paragraph 111, there is citations to Pages 45 to 46 of the petition, which cites the '767 patent at Column 7, Lines 9 to 14.

A. Okay.

Q. And what I am wondering is -- are there passages in the '767 patent besides Column 7, Lines 9 to 14 that you are relying on for your opinion here regarding the term, "continuously monitors output from the vibration sensor"?

A. Well, what I am citing to there is Dr. Hannaford's -- I always get mixed up declaration and report, whichever it was, where, when he discusses continuous monitoring, the only thing he appears to point to is the '767 patent itself.

So, if you have -- I don't have a paper copy of his document.

But, if you go to the cited pages, it will say where he and the '767 patent describe continuous monitoring.

Q. Maybe my question is a little bit different. I think -- let me phrase it this way.

What does it mean to you to continuously monitor, as it is used in Claim 3?

A. Well, I mean, it means that whatever

control system is using the output of the sensor as an input, it is continuously being input to that control system.

Q. Is there a certain timing requirement that would need to be satisfied in order for it to be continuous?

A. Well, I mean, you are sort of asking me to perform, you know, interpretation perhaps.

But, you know, the control program is a program and so, you know, during every cycle of the program it inputs from the sensor.

Q. So, if I am understanding correctly, it is -- well, let me rephrase that.

Can you explain what you mean by that when you say during every cycle of the program it inputs from the sensor?

A. So, just reading Claim 3 by itself, what I would interpret that is that the control program has a loop. And that loop, it monitors the sensor and it uses that information to adjust the frequency.

And so, every -- you know, it is

1 happening throughout the operation of the
2 program. I mean, the program is software, right.
3 And I can't remember if Claim 3 had
4 any construction. Should I check that?
5 Q. Sure. Yes, feel free.
6 A. Apparently it does not.
7 Q. Let's turn to Column 7, Line 9,
8 which I think is what you were just describing.
9 A. Of what? I'm sorry.
10 Q. Of the '767 patent. I'm sorry.
11 A. Yes.
12 Q. So, there the '767 patent says, "In
13 the default mode the LRVM uses continuous
14 feedback control to optimize the vibrational
15 force produced by the LRVM by continuously
16 seeking to operate LRVM at a frequency as close
17 as possible to the resonant frequency needed for
18 the LRVM."
19 A. Yes.
20 Q. And so I see in that sentence, there
21 is two places where it uses the term
22 "continuous."

Are there other portions of '767 that inform kind of what it means to use continuous feedback control?

A. Well, I mean, it would have to be in the context of the control program.

And so, the control program is a set of software. You are running code, and it is operating a loop. And every time it goes through the loop, it would have to read in the output of the sensor.

Q. Okay.

MR. DEUTSCH: Could we take a quick break? I think it has been about an hour.

THE WITNESS: Okay.

(Recess taken -- 11:17 a.m.)

(After recess -- 11:24 a.m.)

BY MR. DEUTSCH:

Q. All right, Dr. Goossen, I would like to talk about the Rossi reference.

A. Okay.

MR. DEUTSCH: And that I will drop in the Chat, unless you have a copy in front

of you.

THE WITNESS: No, I don't.

MR. DEUTSCH: This is Exhibit 1020.

(Whereupon, previously marked

Exhibit 1020,

first referral.)

THE WITNESS: Okay.

BY MR. DEUTSCH:

Q. Figure 6 of Rossi shows a circuit diagram -- or at least Rossi refers to it as a circuit diagram.

A. Yes.

Q. And I understand this diagram illustrates the circuit logic that Rossi describes as utilizing analog switches implemented by means of MOSFET transistors; is that right?

A. It appears -- they appear to be MOSFETs, yes.

Q. And I think this -- you have referred to illustrations earlier as kind of schematic or maybe there is another term.

I think Figure 6 similarly is showing the logic of the circuit.

A. Yes, I mean, when I said schematic earlier, perhaps a more appropriate word would be abstract.

Q. Okay. And so what does that mean -- or what did you mean by that with reference to Figure 6 in Rossi?

A. Well, I mean a circuit schematic is showing generally all of the circuit components and their connections.

So, it was more literal.

Q. And so in this case, for Figure 6, if you were manufacturing a circuit that was consistent with the layout in Figure 6, there would be kind of an additional manufacturing drawing or specification with additional detail; is that right?

MR. DAVIS: Objection, form.

THE WITNESS: I'm sorry, I'm not sure what you are asking. This is a circuit schematic.

BY MR. DEUTSCH:

Q. Yes, let me, let me rephrase that.

If you were to manufacture a circuit shown in Figure 6, what other documentation would typically be prepared?

MR. DAVIS: Same objection.

THE WITNESS: Well, I'm not sure. And I'm not sure what the patent itself describes in terms of additional documentation.

I mean, as a circuit designer, I mean you may want to know the particular components like what particular MOSFET, you know, a model number or something like that or some other design parameters.

BY MR. DEUTSCH:

Q. Yeah, understood. And so that is not something that is shown in Figure 6 of Rossi?

A. It is showing all of the components of the circuit. I don't believe it is leaving out any components.

Q. I think you had mentioned what the

1 particular components are as something additional
2 that is not shown in Figure 6; is that right?
3 A. No. I am just saying -- I mean you
4 asked if there might need to be more information.
5 For example, the diodes you might need to know,
6 like a model number diode or -- you know, the
7 circuit designer might have, you know, certain
8 diodes in mind to fulfill those diodes of the
9 circuit.
10 That is all I'm saying is, you know,
11 the circuit designer may have included, you know,
12 descriptions of what particular model diodes they
13 were.
14 Q. Right. So, an engineer implementing
15 a circuit shown in Figure 6 would get that
16 information somewhere in order to manufacture the
17 circuit?
18 A. I mean, it may or may not be
19 necessary. All of the components are shown.
20 Q. And if not necessary, just to
21 clarify that, you mean the engineer would just
22 make a determination of what part to use to

implement what is shown in Figure 6?

A. Yes. I mean all of the components look pretty straightforward. And so, a standard circuit designer would probably have a good understanding of what he could use.

Q. Okay. Looking at the circuit itself, Figure 6 shows four switches that are labeled SW1, SW2, SW3, SW4; is that correct?

A. Yes.

Q. Could you explain to me how those switches work in Figure 6?

A. Well, depending on the input to the gain -- the gate, I'm sorry, determines whether current flows from the drain to the source.

Q. And are the inputs labeled by those switches?

A. Yes.

Q. Okay. Let me clarify. When you say inputs, what inputs are you referring to?

A. To the gates of the MOSFETs.

Q. And what are the labels on those inputs?

A. They appear to be labeled, like the top left one, IN1.

Q. How about for the others?

A. Well, they are labeled as shown there, yes.

Q. I don't mean to belabor, just to make sure we are pointing to the same things?

A. Yes. IN1, IN1 bar, IN1 bar, and IN1.

Q. Okay. I see that. And so can you walk through an example of what happens, say for a given N1, at the left side of the diagram, how does that input on the state of the switches?

A. Well again, you know -- I prefer to read the patent's own description so I'm not interjecting anything different than what the inventor intended.

Can I go to that?

Q. That would be great. Yes, thank you.

A. So -- I'm sorry, I'm looking. Okay, I'm sorry. So, yes. Okay, Column 3, I guess

1 starting at Line 48, "Such an integrated circuit
2 as shown in Figure 6 wherein the power switches
3 of the bridge stage SW 1, 4, 3 and 2, are made
4 with as many," meaning four, "power MOS
5 transistors."
6 So, I guess he is -- that is where
7 he is describing Figure 6. And in terms of the
8 operation, one would assume he is referring to an
9 earlier figure to describe its operation, perhaps
10 Figure 4. Where the -- in Figure 4, the switches
11 are just drawn as switches.
12 And so, in Figure 4 -- you know, it
13 has been a while since I read this document --
14 Q. That is okay.
15 A. -- and, okay. So he doesn't
16 describe it well, I mean, or -- but, let me look
17 at Figure 4.
18 Yes, in Figure 4, he is using SW, a
19 number. You know, I'm not seeing where he,
20 directly refers to the figures. He goes back to
21 Figure 1.
22 Okay, so maybe we can just use

1 Figure 1. Where, again, the MOSFETs of Figure 6
2 are depicted as switches.
3 So, if we go to Column 1, Line 65.
4 "An H-bridge stage for driving the Inductive Load
5 L is shown in Figure 1 using conventional
6 symbols. Switches SW1, 4, 2 and 3 are driven
7 respectively by a Driving Signal IN1 and by
8 Inverted Signal IN1 bar, and the latter being
9 attained by means of Inverter I."
10 And the two pairs of switches are,
11 okay, coincide with the Nodes V1 and V2 such
12 that -- it is funny because I'm not seeing where
13 he says it directly, when the switch is closed
14 and when they open.
15 You know, he doesn't say
16 apparently -- I mean, directly. So, he seems
17 to -- I mean, going back to Figure 1, you know, I
18 mean, sort of somewhat indirectly refer to the
19 operation of an H-bridge in that either Switch 1
20 and 4 are closed while Switch 2 and 3 are open,
21 or vice versa.
22 But, I was looking for where he

actually writes that down and he doesn't really seem to.

Q. That makes sense.

A. Yes.

Q. And when -- just to finish that functionality, when you mentioned that either Switch 1 and 4 are closed while Switch 2 and 3 are open or vice versa, that is the result of the state of N1 and N1 bar?

A. Well, he, I mean it -- yeah, the paragraph at the top of Column 2, he is kind of saying that but not sort of very literally.

Q. What do you mean by that?

A. Well, I mean just reading it -- okay, so, he talks about two pairs of switches, namely S1, S4, and S2, S3.

So, he is pairing the switches. He, by that parentheses, grouping 1 and 4 and 2 and 3.

And, other than that he, you know, it is not very clear. So, I am just inferring from his grouping of 1 and 4 and 2 and 3, that

that is what he is meaning to say. That 1 and 4 are closed while 2 and 3 are open, or vice versa.

THE WITNESS: Are we being videotaped, recorded, the video?

MR. DEUTSCH: No.

THE WITNESS: Okay. I am trying to find a comfortable position to sit in.

MR. DEUTSCH: Yes and again, you know, let me know if you need to adjust or need a break. It is no problem at all.

THE WITNESS: Okay.

BY MR. DEUTSCH:

Q. All right. So, going back to the inputs to the switches. It looks like in some of the figures it just shows the input, you know, not connected to anything else in terms of how it is generated.

So, Figure 4, I think is an example of that.

A. Right. And Figure 1 is prior art, actually, so not part of the invention.

So, it is sort of odd, actually. I

1 didn't recall that, you know, the exact wording
2 of this patent. But it is sort of odd that in
3 his description of the invention, which is, you
4 know, I would assume starts with a brief
5 description of the drawings, he refers to how it
6 operates from Figure 1 which is prior art.
7 Q. Which portion are you referring to?
8 A. I am just looking at the figure.
9 Q. Oh, I see. The label.
10 In looking at Figure 1, would the
11 four switches no longer function in the manner
12 that Rossi describes if it was drawn with two
13 Inverter Component Is that were used to generate
14 the N1 bar signal for SW2 and SW3?
15 A. Well, it is not precisely clear in
16 the sense that Figure 1 is, I guess I would say,
17 not a complete schematic in that the switches are
18 not -- I mean they are drawn, in sort of the
19 parlance that I was using earlier, in an abstract
20 fashion. I don't know what they are.
21 Q. Yes, and so an engineer looking at
22 Figure 1 would have an understanding of the logic

that is being conveyed that then would have to make implementation decisions when actually building a physical circuit?

A. Yes, and those are not taught until Figure 6.

Q. Where in Figure 6 it is showing --

A. The actual component.

Q. -- specific types of switches. Is that what you mean?

A. Yes.

Q. Got it. Okay. So, in the Figure 6 diagram, would the switches, SW1, SW2, SW3, SW4 no longer function in the manner that Rossi is describing if a single Converter Component I were used to generate the N1 bar signal?

A. Well, I guess I would interpret that he drew it with two inverters for some reason to meet the requirements of his invention.

Q. Do you have a sense of what those requirements might be?

A. Perhaps the types of MOSFETs that he was envisioning using.

Q. What do you mean by that?

A. Well, I mean, you know, the MOSFETs especially, you know, given that he has some other circuit components here, the MOSFETs SW1 and SW2, the ones on the top that are connected to VS might be different than SW3 and SW4.

They might have different requirements in terms of what gate voltage is actually required to switch them.

You see, the circuit as drawn is not sort of symmetric from top to bottom. So, even though, you know, he has a label IN1, that could be, you know, perhaps a, how do you say -- I mean, it is not necessarily meant to convey that they are exactly the same signal, because of the different requirements of SW1 and SW4.

Q. Can you walk me through that, starting with N1 on the left and then following, you know, to the N1 at SW1 and the N1 at SW4?

A. Well, what I am saying is that -- and I think I misspoke earlier. I got the numbers mixed up.

The IN1 bar signal could have a different -- on SW2 could have a different requirement than the IN1 bar signal on SW3 because of the way he has designed the circuit.

You asked me to surmise why he put in two inverters. And that is one possibility I can imagine just looking at the circuit.

Q. Oh, I see, okay. So it would be, that would apply to N1 -- the two N1 bars.

A. Yes, I'm sorry. I misspoke earlier.

Q. I understand, okay. And the -- and that wouldn't be the case if SW3 and SW4 didn't have different requirements -- or, I'm sorry. I referred to the wrong switches.

So, the -- if SW2 and SW3 didn't have different requirements that you had referred to, then it wouldn't be the case that --

A. Well, you asked me to just surmise why he included two inverters, and that is a reason I can come up with.

Q. That makes sense. And so, if that is not the case, are there any constraints that

1 would make it unwise to use a single
2 Inverter I -- I'm sorry. Let me -- I think I can
3 clarify that question.
4 Are there any constraints that would
5 make it unwise to use two Inverter Is when the
6 same logic could be achieved with one, in the
7 scenario where SW2 and SW3 do not have different
8 inverter requirements?
9 A. I mean, he designed it this way so
10 he must have had a reason. And, I mean, as a
11 circuit designer, I would take his invented
12 circuit schematic literally, that he believed
13 there was some requirement.
14 Q. Is there anything in the description
15 of Figure 6 that leads you to that conclusion?
16 A. Well, as I mentioned earlier, the
17 patent is fairly brief. And, an innovated
18 circuit, a multiplex MPX -- oh, wait a minute.
19 What is the multiplex MPX? Okay, I
20 am not sure.
21 It is, description in Figure 6 is
22 very brief, and there is nothing in that

paragraph about the inverters.

Q. Okay. And just to clarify, there is nothing in that paragraph that specifies SW3 and SW2 are different in the way you described in your example, correct?

A. "Two integrated analog switches."

It may go to how he is, how he is contemplating the construction of the, of Figure 6, because he talks about two integrated analog switches.

So, it may have to do with how he is envisioning implementing it as integrated circuit chips that he requires, two.

Q. Where does he say that he requires two?

A. Well, he says that the H-bridge, he -- well, I'm not sure he is referring to -- what he is referring to there. He says the multiplex by means of two integrated analog switches.

So, it may mean that he meant -- I am just, you know, reading into that perhaps, but

because of the circuit chips that he is designing, he required two. Because they are on two different chips, possibly. But it doesn't say that literally in that paragraph.

Q. Okay. Let's look at Figure 1 again --

A. Okay.

Q. -- the prior art.

A. Yes.

Q. Figure 1 of Rossi is labeled, in parentheses, Prior Art.

So, in Figure 1, if I am starting at the left, the note labeled N1, and I move to the right then down, I see the Inverter I.

And then there is -- from there, there is a branch labeled N1 bar going into SW3.

And then if I continue down, to the right there is a line that continues around and up and is also labeled N1 bar and N2 SW2.

A. So, in the prior art there is one inverter. In his invention, there are two. As a circuit designer, I would assume that he had a

reason for needing two in his invention.

Q. And that is what I am trying to understand is the significance, if any, of that.

And so in the Figure 1 drawing, would the logic change if it was drawn using two Inverter Is that generate inputs for SW3 and SW2?

A. And again not knowing what the switches are, I can't answer that question.

Q. What would you need to know about the switches to answer that question?

A. About how they work. I mean, what are they.

Q. In a scenario where they are the same, they have the same characteristics or the same switches?

A. I mean, I don't know. I mean, even if they were, the top ones could require different inputs than the bottom ones, you know, or something like that.

So, I would have to, I would have to know exactly what those switches are.

Q. In that scenario, the inputs, you

are saying the inputs would be different in that scenario?

A. Well, I'm saying, you know, why in his invention he included two inverters when the prior art shows one. I would assume that there is some reason in his invention for two.

Q. But you don't have a reason sitting here today what that might be in a case where the inputs to SW2 and SW3 are the same?

A. Well, I gave you reasons that I could envision.

Q. If the inputs were different, are the -- or if the switches had different requirements, I believe those were the examples that you were talking about?

A. Well, I am saying if the -- so, I mean, I can envision in the circuit, especially because, you know, he has these additional elements, that the top and the bottom could have different input requirements.

And so that might be a reason he drew it that way. Or it could be because of the

way he was envisioning them being implemented in integrated circuits that there had to be two.

He could have believed it was a, you know, a time-dependent reason. We are looking at this circuit, sort of in a DC fashion.

In operation, I mean it could be that there had to be two inverters in order for everything to keep up to speed in his mind.

He had to have a reason for drawing that. I think I have given three reasons now.

Q. Well, and those are all dependent on scenarios where the switches are different, correct?

A. No, no. The third reason, you know, because of, he felt that in order for the circuit to keep up to speed, he had to have a second inverter for SW2 compared to SW3.

I mean --

Q. And in that scenario, the, the -- I'm sorry, I interrupted.

A. No, I'm just saying, you know, you can't just look at a circuit in a DC fashion.

1 You know, you have to think about it being
2 operated, going through cycles.
3 And so, he could have felt that in
4 order for Switch 2 to keep up with Switch 3, it
5 had to have its own inverter.
6 Q. And this -- could you remind me what
7 in the text tells you that?
8 A. Nothing. I don't think anything in
9 the text tells me that.
10 Q. Okay. Going back -- sorry to jump
11 around between the figures.
12 Going back to Figure 4. Figure 4
13 shows N1s for SW1 and SW4 and N1 bars for SW2 and
14 SW3, and doesn't show the source for those
15 signals; is that correct?
16 A. It doesn't. Just -- you know, very
17 abstract.
18 Q. And so that, it would -- the
19 significance is what is generated as input -- or
20 excuse me. Let me strike that.
21 The -- what Figure 4 depicts is the
22 signal that is being input to the respective

switches without specifying whether there is one inverter, two inverters, some other configuration?

A. No. And I would like to point out that, you know, in Figure 6, even though it writes in figure -- or the inventor writes that the input to SW2 is IN1 bar and the input to SW3 is IN1 bar, you --

Q. You are referring to Figure 4, or --

A. No, 6. But, it leads back to Figure 4.

The thing is, you know, the input to SW2 and the input to SW3 are not the same signal because there is, you know, different circuit components between them, I mean to be the same signal, you know, they have to be connected.

So, I'm just pointing that out that when you go back to Figure 4 and you see IN1 bar and IN1 bar, in the mind of the inventor, they are not necessarily the same signal because they aren't in Figure 6.

I mean, they are not the same in the

sense that they are not connected directly.

Q. Yes. They are not connected directly. And in the text, it is not saying that they are different?

A. Well, I'm just going by the circuit diagram.

Q. I'm sorry --

A. You know, just in a very literal sense of the circuit diagram itself.

I mean, he drew two for a reason. Is this search -- it is not that long so I can read it. I'm wondering if it is the loads he is considering.

He doesn't say -- he doesn't specify the load. It is just inductive.

And so it may mean that the application he had in mind was for high speed operation. And so he felt the second inverter was required for his invention to work.

Q. And that is something that is not mentioned -- that is a possibility for one scenario and not something that is in the text.

Or is there text that you are thinking of?

A. Just inasmuch as he only describes the Load L as being inductive. And so it could, it could be a high speed load that he is contemplating.

MR. DEUTSCH: All right. Let's turn to the Izumi reference which is Exhibit 1005.

(Whereupon, previously marked Exhibit 1005, first referral.)

THE WITNESS: Okay.

BY MR. DEUTSCH:

Q. And I just had a couple of quick questions about Izumi. And this is -- I'm looking at Paragraph 63 of Izumi.

A. Okay.

Q. And that paragraph begins, "Although each of the ON-time and the OFF-time of the voltage is controlled in order to form the intended current waveform in this embodiment, in the actual real-time control, it can be difficult

to perform complicated control at every half-cycle or one cycle of the moving Element 1 due to a constraint of the control device such as CPU speed, ROM capacity, et cetera.

"So, the controller may control a ratio of the ON-time (T1) to the OFF-time (T2), namely a duty ratio (T1/T2), while keeping the sum of the ON-time and the OFF-time (T3=T1+T2) constant.

"That is, the controller may use a so-called PWM control method. In this case the Controller 6 can form and intended current waveform without using a complex control system."

A. Correct.

Q. And so when it talks about a PWM control method, is it your understanding that that can be performed by both an entirely analog circuit or performed in conjunction with a processor?

A. Yes. My interpretation of what he is saying here is that he is teaching away from using a processor.

Q. I think my question was a little bit different.

The -- I guess I was asking just specifically about the, when it talks about PWM control method, are you saying that can only be carried out using an entirely analog circuit?

A. That is what he is indicating. That within his intended invention, he intends it to be analog.

Q. And, when you say "it," I guess I'm not sure what you are referring to.

A. The controller. Or, how, how the signal was produced, the PWM signal.

He is saying -- he has these requirements on speed that he doesn't think a CPU can satisfy.

And so, he is saying what he needs to be done without using a complex control system, meaning without a CPU.

Q. So, the complex control system is referring to something different than CPU, I think, right? Or is there text that is equating

complex control system with CPU?

A. Well, I mean, he refers to, he equates CPU with complicated control. And so I equated that with complex control.

So, I guess, the two words, "complicated" and "complex" are not exactly the same. But, that was how I read the paragraph.

Q. So, then the sentence that begins "So."

"So the controller may control a ratio of the ON-time," et cetera.

And the next sentence, "That is, the controller may use a so-called PWM control method."

A. Yes.

Q. That PWM control method is something that can be carried out on a processor, right? PWM control, you are not saying PWM control is only able to be carried out by analog circuitry, correct?

A. No, I'm saying that within the context of his invention, he is pointing the

reader to using an analog system.

Q. But the PWM control method can be carried out by a processor, correct?

A. The -- just generally and not taking into account this invention, I would say perhaps. I mean -- I haven't performed that analysis.

Q. So, you are not sure if PWM control can be carried out with a processor?

A. Well, it would depend on the application.

He is indicating that for his application -- he is indicating in this paragraph, at least the way I read it, that he needs an analog technique.

Q. Is there an analog -- I'm not seeing analog in Paragraph 63.

Is there --

A. Well, not CPU.

Q. I'm not seeing "not CPU," either.

Is that somewhere -- am I missing that?

A. Well, again, I'm saying, he is

1 saying what he needs to do is difficult to
2 perform using a CPU, using complicated control.
3 And so he says at the bottom without
4 using complex control, which I interpret it
5 without using a CPU. Sort of equating the words,
6 complex and complicated.
7 Q. The -- right. Well, and it seems
8 like it is giving an option of it can be
9 difficult to perform complicated control at every
10 half-cycle or one cycle of a moving element.
11 And then the next sentence begins
12 "so," and gives another option, specifically that
13 the controller may control a ratio of the ON-time
14 to the OFF-time.
15 And then in the last sentence -- or
16 in the second to the last sentence, that is the
17 controller may use the so-called PWM control
18 method.
19 And so, is it, is the -- is it your
20 understanding that the so-called PWM control
21 method is what is being described up above that,
22 control at every half-cycle or one cycle of the

element.

Or is the PWM control method something different than the first sentence that says complicated control at every half-cycle or one cycle?

A. Well, I, I mean, the analysis is simpler than that.

He is saying in this case, meaning the case of his invention, he doesn't need a processor. And in fact, sort of indicates that they should be avoided.

Q. I don't see -- you said in this case. Is that a different paragraph?

A. No, it is the last sentence. In this case. That is what he says.

Q. Right, where the controller may use a so-called PWM control method.

A. Yes. Well, which is his invention. He is teaching his invention. He is teaching PWM control.

And he is saying in this case, meaning the case of using that within the context

of its invention, he does not use a complex control system which I equated with not using a CPU.

Q. And so by not using a complex control system, that could be carried out digitally with a processor or using an entirely analog circuit; is that correct?

A. Well, that is how I read this, that he is pointing -- he is saying to use an analog system, not a CPU.

Q. Why would this not be carried out using a CPU?

A. Well, I am not saying why or why not. I'm saying this is what he is teaching to do, not use a CPU.

Q. But you don't know why?

A. Well, he says why. Because of, you know, the constraints of the CPU speed and memory capacity, et cetera.

Q. So, you are saying the PWM control method wouldn't work on a CPU because of constraints of CPU speed?

A. Well, he is saying it. And, evidently within the context of his invention.

Q. Do you -- but I think the sentence is saying the Controller 6 can form an intended waveform without using a complex control system?

A. Yes, without using a CPU.

Q. So, you are equating complex control system with CPU. Not, not the --

A. Well, that is the --

Q. Not the control method or logic?

A. That is what he is saying. He is saying it is difficult to perform complicated control which he equates with a CPU in that statement.

And so, I am equating that with complex control, yes. I am equating that with CPU.

And he is teaching that he is concerned about CPU speeds to perform what he needs for his invention.

Q. The -- right. And so, maybe the disconnect is, I'm not understanding how you are

interpreting the complicated control at every half-cycle or one cycle of the moving Element 1.

And so I understand that -- let me rephrase that.

Do you understand the next sentence beginning, "So" as an alternative to that difficult -- or, excuse me, that complicated control at every half-cycle or one cycle?

Or is the complicated control at every half-cycle or one cycle what you are saying is being performed by the analog circuit?

A. Well, I mean, what I am saying is he is teaching that what he needs in his PWM control method cannot be done or is difficult to be done with a CPU.

And so he then teaches, you know, doing it without using a complex control system, which I interpret it, based upon what else was in the paragraph, as not using a CPU.

Q. There is nothing specific --

A. I mean, it is a fair -- I'm sorry.

Q. Go ahead.

A. It is a fair concern, right. I mean, you know, if you can do what he needs in an analog circuit, I mean, that will be the fastest, you know, way.

So, he is teaching to use an analog circuit.

Q. And that is the key criteria, the fastest way?

A. Well, that is what his concern is, is the speed of the CPU in order to perform what he needs.

Q. I just wanted to make sure I understood something you said earlier. And this goes again back to what Izumi refers to as a so-called PWM control method.

There is nothing about pulse-width modulation that is limiting to analog circuitry, correct?

A. Generally, not taking into consideration what the inventor is saying or what the inventor's requirements are, no.

Q. So, PWM control method does not

prohibit the use of CPU, generally speaking?

A. Well, I mean you can, you can write a program to do anything.

So, you know, I don't know. I actually haven't performed that analysis. The analysis I performed was that it could be done with analog methods.

And, in fact, the first implementation of PWM had to have been done with analog circuits back in the '40s.

Q. Got it.

If we go to your declaration briefly.

A. I'm sorry?

Q. I'm sorry. One moment. Just turning to Paragraph 92 of your declaration. The first sentence begins, "For example, Ground 1a relies on a combination of Izumi with Cosper. Both in the petition and in the declaration of Dr. Hannaford, it relies upon the only citations to prior art for this limitation are citations to Izumi."

1 And then there is a Footnote 56 with
2 a citation to the petition and the Dr. Hannaford
3 declaration.
4 Were there any other portions of the
5 petition and declaration that you considered in
6 making that statement?
7 A. Dr. Hannaford's declaration?
8 Q. Just that, the -- your assertion
9 that the petition and in the declaration of
10 Dr. Hannaford it relies upon only the citations
11 to prior art for this limitation and citations to
12 Izumi. And there are a few paragraphs and a few
13 pages of the petition that are cited.
14 A. Yes.
15 Q. If those were the only portions that
16 you have looked at or if there is others that
17 aren't cited here?
18 A. Well, I evaluated all of
19 Dr. Hannaford's document. And my conclusion was
20 that those are the citations he relied upon.
21 MR. DEUTSCH: Okay. I have no
22 further questions at this time, Dr. Goossen.

THE WITNESS: Okay.

MR. DAVIS: All right. No redirect from Resonant, either.

(Whereupon, signature not having been waived, the deposition suspended at 12:38 p.m.)

* * *

CERTIFICATE OF NOTARY

I, LORI J. GOODIN, RPR, CRR, CA CSR # 13959 the Notary for this deposition, do hereby certify that the witness whose testimony appears in the foregoing deposition was sworn by me; that I am neither counsel for, related to, nor employed by any of the parties to the action in which this deposition was taken; and, further, that I am not a relative or employee of any attorney or counsel employed by the parties hereto, or financially or otherwise interested in the outcome of this action.

Lori J. Goodin

LORI J. GOODIN, RPR, CLR, CRR
Notary Public in and for:

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Notary Commission Number: GG987804
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STATE OF CALIFORNIA, CA CSR# 13959
My Commission expires: February 22, 2027
STATE OF MARYLAND, COUNTY OF ANNE ARUNDEL
My Commission expires: August 2, 2025
DISTRICT OF COLUMBIA, WASHINGTON DC
My Commission expires: June 1, 2026
STATE OF DELAWARE, COUNTY OF KENT
My Commission expires: September 9, 2025

Keith W. Goossen, Ph.D., c/o
RUSS AUGUST & KABAT
12424 Wilshire Boulevard, 12th Floor
Los Angeles, California 90025

Case: Apple Inc. v. Resonant Systems, Inc.
Date of deposition: May 7, 2025
Deponent: Keith W. Goossen, Ph.D.

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**A**

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