UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE, INC.,	:	
	:	Case No.
Petitioner,	:	IPR2024-00697
	:	U.S. Patent No. 8,093,767
vs.	:	
	:	Case No.
RESONANT SYSTEMS, INC.,	:	IPR2024-00698
	:	U.S. Patent No. 8,093,767
Patent Owner.	:	

DEPOSITION OF BLAKE HANNAFORD, Ph.D.

Via Zoom Videoconference

Monday, June 23, 2025

Stenographically Reported by:
JUSTYNE N. JOHNSON
RPR, CSR. No. 14301

Job No. 589690

Pages 1-43

The Deposition of BLAKE HANNAFORD, Ph.D. was taken on behalf of Patent Owner, all parties appearing remotely via Zoom videoconference, beginning at 9:36 a.m., Pacific time, on June 23, 2025, before JUSTYNE JOHNSON, RPR, Certified Shorthand Reporter No. 14301.

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EXHIBITS

(None)

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June 23, 2025 | 9:36 a.m.

THE STENOGRAPHER: Good morning. We are going on the record at 9:36 a.m. on Monday, June 23, 2025, in the matter of Apple, Inc., v. Resonant Systems, Inc., Case Numbers IPR2024-00697 and IPR2024-00698. Today's deposition is taking place remotely via Zoom videoconference.

My name is Justyne Johnson. I am a California certified shorthand reporter representing the firm Planet Depos, and my certification number is 14301. The deponent is Blake Hannaford, Ph.D., and is located in Seattle, Washington.

Counsel, can you please introduce yourselves.

MR. RUBIN: Good morning. This is Neil Rubin of Russ, August & Kabat representing the patent owner of Resonant Systems, Inc.

MR. DEUTSCH: And this is Craig Deutsch of Fish & Richardson representing Petitioner Apple, Inc.

THE STENOGRAPHER: Dr. Hannaford, can you raise your right hand, please?

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BLAKE HANNAFORD,

having first been sworn by the Certified Shorthand Reporter, was examined and testified as follows:

THE WITNESS: I do.

THE STENOGRAPHER: Go ahead, Counsel.

MR. RUBIN: Thank you.

EXAMINATION

BY MR. RUBIN:

Q Good morning, Dr. Hannaford.

A Good morning, Mr. Rubin.

Q So you've been deposed previously in these matters; correct?

A That's right.

Q And you're familiar with the deposition process, I take it?

A Yes.

Q So, I guess, to save us time, I won't go over the ground rules again unless you have any questions about the process.

A I don't have any questions.

Q Is there any reason today that you cannot give a full and complete -- or withdrawn. Let me start that over.

Is there any reason today you cannot give

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complete and accurate testimony?
A No.
Q Are you suffering from any illness or taking any medication that would affect your memory or ability to answer questions?
A I am not.
Q So today, we're here to address two IPRs concerning Apple's -- I'm sorry, two IPRs concerning Resonant Systems' '767 patent. You're aware of that?
A Yes.
Q And in those two IPRs, you've submitted supplemental declarations that were signed May 28th of this year; is that right?
A I don't -- my -- I have an unmarked copy with me, and I don't recall the exact date. But certainly that's about right.
Q Okay. Do the -- wait. You referred to it as an "unmarked copy." I take it you probably have copies of two different declarations with you?
A I have printouts of the '697 and also the '698, the declarations on the '767 patent.
Q Okay. And do those declarations each bear the title "Supplemental Declaration of Blake Hannaford, Ph.D."?
A Yes.

Q And do those have exhibit numbers stamped at the bottom of the first page saying "Apple" --
A Not my copy, no.
Q Okay. And on the last page of each of those declarations, is there the date 28 May 2025?
A No.
Q Okay.
A These are copies without the signature or date.
Q Okay. So, I guess, before I go into further detail on the printed copies that you have, what the declarations are, are there any other printed materials that you have with you --
A No.
Q -- made for the deposition?
And are there any electronic copies of documents that you have with you for use in the deposition today?
A No.
Q For the declaration in the IPR with number ending in '697, what's the page number on the last page of the copy you have?
A Twenty-eight.
Q And is there any text on page 28?
A Only a signature line with my name under it and a date field, which are not signed.
Q I see. And then same question for the

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declaration in the IPR ending in '698.

A The last page I have is 31.

Q And I take it that there is a blank line meant to indicate the date and a blank signature line with your name printed underneath it?

A That is correct.

Q But the printed copies that you have in front of you, you understand those to be identical to the co- -- the versions that you signed and that were submitted in the --

A Yes. To the best of my knowledge, those are identical.

MR. RUBIN: So I'm going to upload, using the Zoom chat function, electronic copies that I have of the declarations as they were filed at the PTAB. And in case there's any issue as to what the final declaration as filed contained, you can feel free to consult those electronic copies.

BY MR. RUBIN:

Q Are you able to download those in Zoom?

A I see '698 right now. Yes. I can download those to my desktop. Or actually, I'll pull them in my downloads folder. That's where I'm going to do that.

So '698 is here, but I do not see '697.

Q Hm. That's interesting. I --

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MR. RUBIN: Mr. Deutsch, do you see two different documents in the chat window there?

MR. DEUTSCH: I do. Looks like '697 came in first and then '698.

THE WITNESS: Oh, I see. Sorry. There was a pop-up that was just blocking the first one. And now I get '697. That was -- that's a little bug in Zoom. I have them both. Thank you.

MR. RUBIN: And then while we're downloading things, I will also share with the chat function two documents that Apple submitted as Exhibit 1051 and Exhibit 1052 in each of the two IPRs.

THE STENOGRAPHER: Counsel, I need to go off the record.

MR. RUBIN: All right.

THE STENOGRAPHER: Off the record at 9:45.

(Off the record.)

THE STENOGRAPHER: Back on the record at 9:48 a.m.

Go ahead, Counsel.

MR. RUBIN: Yeah, sorry.

Can we go off the record for just a minute?

THE STENOGRAPHER: Off the record at 9:48 a.m.

(Off the record.)

THE STENOGRAPHER: Back on the record at

9:48 a.m.

Go ahead, Counsel.

BY MR. RUBIN:

Q So, Dr. Hannaford, were you able to download the Exhibit 1051 and Exhibit 1052 that I have uploaded in the chat?

A Yes. I have a total of four now.

Q So Exhibit 151 [sic] and Exhibit 152 [sic] were each filed by Apple in each of the two IPRs concerning the '767 patent. The copies that I uploaded are the copies filed in the '897 IPR. But should be the same as what was filed in the 89- -- I'm sorry, the '698 IPR.

So if I can have you turn to page 7 of your declaration in the '697 IPR.

Are you there?

A Okay.

Q And starting at paragraph 8, you -- well, I guess, starting in paragraph 7, you offer some opinions about whether Shahoian and Cosper are analogous are -- you see that?

A Yes.

Q And in particular, you offer some opinions about what the field of endeavor is for the '767 patent.

Do you recall that?

A Yes.

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Q In paragraph 9, you quote from the '767 patent its description of its, quote, "technical field."

Do you see that?

A I see paragraph 9, yes.

Q Is it your opinion that that quoted language from the '767 patent identifies the patent's field of endeavor?

MR. DEUTSCH: Objection. Form.

THE WITNESS: Well, it's certainly clear that it describes the technical field. And I don't know if there's a legal difference between "field of endeavor" and "technical field." But in my opinion, they are the same thing.

BY MR. RUBIN:

Q In the first sentence of paragraph 10, you say, "Shahoian and Cosper each fall within this field of endeavor."

Do you see that?

A I see that sentence.

Q And when you refer to, quote, "this field of endeavor," are you referring to the language you quoted from the '767 patent in paragraph 9?

A Yes.

Q So would you agree that your opinion that Shahoian and Cosper fall within the field of endeavor of the '767 patent is based on your determination that those

references fall within the field described in the language you quote in paragraph 9?

MR. DEUTSCH: Objection. Form and scope.

THE WITNESS: I -- my opinion, I think, is stated clearly in paragraph 9. And in particular, they -- the references belong to a wide variety of different types of electromechanical devices and systems and produce vibrations.

BY MR. RUBIN:

Q As you understand the technical field of the '767 patent, would it include technology for measuring the response of the ground or a structure to an earthquake?

MR. DEUTSCH: Objection. Scope.

THE WITNESS: That's not stated in my paragraph 9, if that's what you mean -- if that's what your question means.

BY MR. RUBIN:

Q Would the field of endeavor in the up -- I'm sorry. Withdrawn.

In your opinion, does the field of endeavor of the '767 patent include civil engineering?

MR. DEUTSCH: Objection. Scope.

THE WITNESS: I have no opinion about civil engineering in the report -- in the declaration -- in the -- I'll -- to be most precise, in the supplemental

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declaration.

MR. RUBIN: I'll share my screen, Exhibit 1051, which I previously shared a copy of with you.

(Exhibit 1051, page 1, was displayed.)

BY MR. RUBIN:

Q Do you recall citing from this dictionary in your declaration?

A Yes.

Q And you'd agree, from the title page, that this Exhibit 1051 is excerpts from The New Penguin Dictionary of Civil Engineering?

A I agree with that. Yes.

(Exhibit 1051, page 3, was displayed.)

BY MR. RUBIN:

Q Turning to the last page of the exhibit, do you recall citing to this dictionary -- its definition of "accelerometer"?

A I do.

Q Now, is this a dictionary that you, personally, have a copy of?

A I do not.

Q Is it a dictionary that you have ever consulted in your professional work?

A Not that I recall.

Q Looking at the first sentence of the definition

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of "accelerometer," it reads, quote, "A sensor for measuring acceleration used, e.g., to measure the response of the ground or a structure to an earthquake."

Do you see that?

A I see that. Yes.

Q You would agree that sensors used to measure the response of the ground or a structure to an earthquake are not within the technical field of the '767 patent; correct?

MR. DEUTSCH: Objection. Scope.

THE WITNESS: I believe accelerometers are within the technical field of the '767 patent. And I interpret the sentence you just highlighted or pointed -- pointed me to, I interpreted that sentence as defining "accelerometer" as a sensor for measuring acceleration. And then followed in that same sentence by an example given in this dictionary.

But acceleration is a fundamental physical quantity that accelerometers measure, as the roots of the word "accelerometer" suggest. And it's understandable that a civil engineering dictionary would choose an example pertinent to civil engineering. But accelero- -- acceleration is fundamental to all movement, all vibration of any type.

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BY MR. RUBIN:

Q Are you familiar with the concept of "proper acceleration"?

A I'm sorry. Which kind of acceleration?

Q Proper acceleration.

A Proper?

MR. DEUTSCH: Objection. Scope.

THE WITNESS: I am not familiar with the concept of "proper acceleration."

MR. RUBIN: Okay.

BY MR. RUBIN:

Q So if I were to tell you that by "proper acceleration," I meant acceleration of an object relative to an observer in an inertial frame of reference, would you understand what that means?

MR. DEUTSCH: Objection. Form.

THE WITNESS: I would understand that, I think.

BY MR. RUBIN:

Q Or put another way, if I said that by "proper acceleration," I meant acceleration of an object relative to an observer that's in free fall, would you understand what I mean?

MR. DEUTSCH: Objection. Form and scope.

THE WITNESS: I have to think about it and make sure I agree with those two -- that those -- I assume

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you're implying that those are two ways of saying the same def- -- the same thing, not two contrasting definitions of proper. Is that correct?

BY MR. RUBIN:

Q I think they're two different ways of saying the same thing but --

A I hope so.

Q You -- you may or may not agree.

A But I know what is meant by an observer -- relative to an observer in free fall.

Q So relative to an observer in free fall, you, sitting in your chair in your office there, are accelerating at what in physics is usually denoted with a "g" approximately 9.8 meters per second squared; is that right?

A Don't quote me on the second digit of G, but I agree with that in principle, yes.

Q Now, the petitioner here, Apple, sells, among other things, the iPhone; correct?

A I have heard of that product, yes.

Q Okay. And do you own an iPhone?

A I do not own an iPhone.

Q Do you know whether iPhones or competing smartphone devices have accelerometers in them?

MR. DEUTSCH: Objection. Scope.

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THE WITNESS: As far as I know, every phone that's commonly called a smartphone does contain an accelerometer.

BY MR. RUBIN:

Q And is one of the things that accelerometer is used for determining the orientation of the device?

A That is a common --

MR. DEUTSCH: Objection. Form and scope.

MR. RUBIN: I'm sorry. Your answer, I think, was cut off. What was the answer?

THE WITNESS: Maybe just repeat the question to be sure.

BY MR. RUBIN:

Q The question was: Is one of the things that accelerometer is used for determining the orientation of the device?

MR. DEUTSCH: Same objections.

THE WITNESS: Yes.

BY MR. RUBIN:

Q And imagine that a smartphone with an accelerometer like we've been discussing is sitting on the desk in front of you.

A And one is actually -- yes.

Q Okay. So the accelerometer -- even though the phone is sitting on the desk and at rest relative to the

desk, the accelerometer inside of it is measuring an acceleration because of the gravitational force that it's experiencing; correct?

MR. DEUTSCH: Objection. Form and scope. Incomplete hypothetical.

THE WITNESS: That is my understanding, yes.

BY MR. RUBIN:

Q So at least for the accelerometer in the smartphone on the desk in front of you, it's measuring acceleration not relative to the desk that it's sitting on top of, but relative to an observer that was in free fall?

MR. DEUTSCH: Objection. Form. Objection. Scope.

THE WITNESS: I think that's a correct statement.

(A document was displayed.)

MR. RUBIN: So you should see on the screen now Exhibit 1052, which I also uploaded in the chat.

(Exhibit 1052, page 1, was displayed.)

BY MR. RUBIN:

Q Do you see that?

A I see it. Yes. I see the number on the tab -- oh, I see the number at the bottom of the page too.

Q Great. And so the first page here is the title page of Collins Dictionary of Electronics: Definitions for the Digital Age. Would you agree?

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A I see that.

(Exhibit 1052, page 2 and 3, was displayed.)

BY MR. RUBIN:

Q On the last page at the top of the page, there's a definition of "accelerometer." Do you recall citing this definition in your declarations?

(Stenographer clarification.)

BY MR. RUBIN:

Q On the top of the last page of this exhibit, there's a definition of accelerometer. Do you recall citing this definition in your declarations?

A Yes.

Q I'll read that definition. Quote, "A device that senses or measures the acceleration applied to it usually with an electrical output."

Do you see that?

A Yes.

Q So you would agree that, at least according to this definition, an accelerometer is something that senses an acceleration applied to the accelerometer itself; correct?

MR. DEUTSCH: Objection. Form.

THE WITNESS: I see that -- I see "acceleration applied to it" as written in the declara- -- the definition, yes.

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BY MR. RUBIN:

Q So would you agree that the smartphone on your desk that we were talking about and the accelerometer inside it, that accelerometer is measuring the accelero- -- acceleration applied to the accelerometer itself?

MR. DEUTSCH: Objection. Scope and form.

THE WITNESS: It's measuring the acceleration of gravity and gravity certainly applies to the phone.

BY MR. RUBIN:

Q Now, if I wanted to measure an acceleration of an object, are there ways that I can measure the acceleration of that object without using a sensor that is, itself, experiencing that same acceleration?

MR. DEUTSCH: Objection. Form and scope.

THE WITNESS: I think I would have to think about that, actually.

BY MR. RUBIN:

Q Why do you say you'd have to think about it?

A Did you say why did I say I'd have to think about it? Sorry. I'm --

Q Yeah. That's --

A -- just trying to --

Q -- my question. And I'm sorry if maybe -- sounds like there's some difficulty understanding my audio. Let

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me adjust.

A No. I just wanted to confirm it.

I would have to think about it because you asked me if there's any way to sense acceleration that -- any device which can sense acceleration without accelerating itself. And I said I'd have to think about that because that encompasses any possible sensor, and I'd have to analyze different sensors to see if, A, they could measure acceleration; and, B, if they would, in fact, be accelerated themselves.

So, for example, is it possible to measure the acceleration of an object by bouncing a beam of light off of it? And that sensor would not be located on the object itself. But I don't have an opinion if that's possible or not because it requires some analysis.

Q So now you'd agree that you could measure the velocity of an object by bouncing light off the object; right?

MR. DEUTSCH: Objection. Form and scope.

THE WITNESS: There is a phenomenon called the Doppler shift, which could be exploited to do that.

BY MR. RUBIN:

Q And so using the phenomenon of Doppler shift, you could measure how the wavelength of light reflected off the object differed from the wavelength of light that

was -- before it reflected off the object, and based on that difference, you could figure out the relative velocity of the object; correct?

MR. DEUTSCH: Objection. Form. Incomplete hypothetical.

THE WITNESS: Again, I don't want to sit here and form an opinion that requires analysis right now in the -- during the deposition. But on a casual basis, I would agree with you.

BY MR. RUBIN:

Q And if you imagined that you measured the change in that wavelength shift as a function of time, would that tell you how the object was accelerating?

MR. DEUTSCH: Objection. Form and scope.

THE WITNESS: Again, without taking the time to form a formal opinion, the change in velocity can give you the acceleration if you -- if -- in conjunction with the time interval over which that change occurs.

MR. RUBIN: I'm going to upload another exhibit. This is Exhibit 1009 in the IPR ending in '697.

THE WITNESS: I have pulled it up.

MR. RUBIN: All right. And then you should also see it on the screen.

(Exhibit 1009, page 1, was displayed.)

///

BY MR. RUBIN:

Q This is a --

A I see it on the screen as well.

Q Okay. So this is the Cosper patent -- or I should say the Cosper patent application. I'm sure you recall offering opinions about this exhibit?

A I do.

(Exhibit 1009, page 26, was displayed.)

BY MR. RUBIN:

Q So turning to paragraph 9 of Cosper, which you should see on the screen, the last sentence of that paragraph reads, quote, in one system, the systems -- I'm sorry. Let me start over.

The last sentence of paragraph 3 reads, quote, "In one example, the systems are described for use with elimination systems including a" oscillating resonant assisted -- "oscillating resonant engine."

Do you see that?

A I do.

Q You would agree that there's no example in Cosper of applying its teachings to a system other than an elimination system?

A Well, I guess I would have --

MR. DEUTSCH: Objection. Form.

THE WITNESS: Sorry. I'll start over.

I guess I would have to check that -- all the examples in Cosper. I don't remember. I looked at it with respect to systems and methods for control of mass and bias subassembly, including oscillating mechanical systems. So as described in that same paragraph, that's what I was looking for.

We could go through the figures. I just don't recall either way if there were other examples given.

Q Okay. How about we go through the figures? And you can go through your local copy, I guess.

A Yeah. I'm scanning them right now.

(Exhibit 1009, page 2, was displayed.)

THE WITNESS: There's several figures which don't show optical elements like 14A and B and C, which shows springs and masses but don't show optical elements at all and, you know, really talk about resonating spring mass and damping systems or describe and -- with an actuator. So I -- you know, those are examples.

(Exhibit 1009, page 16, was displayed.)

MR. RUBIN: Figure 12, figure 11.

(Exhibit 1009, page 14, was displayed.)

BY MR. RUBIN:

Q Are you able to see my screen shared right now or has that gone away?

A Not right now.

Q All right.

A But I do have that referenced up on my -- on another window right now. It was up -- your screen was shared just up to a moment ago.

Q Thank you.

So staying at Exhibit 1009, the Cosper reference, you see paragraph 3, which we were just talking about, refers to systems, quote, "that operate in an oscillatory mode at or near their mechanical resonant frequency."

Do you see that?

A I do see that.

Q And lower on the -- that same page, paragraph 7, the first sentence reads, quote, "Driving a mechanical resonant system for low loss and a high Q at or near its resonant frequency using an external frequency" -- references -- "may require a highly stable frequency source."

Do you see that?

A I see that.

Q Turning to the next paragraph, the first sentence reads, "Accordingly, it may be desirable to incorporate feedback into such systems to eliminate the need for a secondary external frequency source such that the natural frequency of the mechanical resonant system becomes the frequency reference."

Do you see that?

A I see that.

Q And the next sentence reads, quote, "Any variation in the mechanical resonant system that affects its resonant frequency is sensed and tracked by a controller so that the mechanical resonant system is driven and continues to oscillate at the near resonant frequency."

Do you see that?

A I do.

Q So in paragraph 7, Cosper specifically refers to driving a mechanical resonant system with a, quote, "high Q" -- sorry. Paragraph 7 of Cosper recor- -- refers to driving a mechanical resonant system with a, quote, "high Q."

You would agree?

A Yes, I see that.

Q And it talks about when the system has a high Q, the importance of driving the system at a frequency that is close to the resonant frequency; correct?

MR. DEUTSCH: Objection. Form.

THE WITNESS: Sorry. Could you restate the question? I just want to answer it accurately.

BY MR. RUBIN:

Q So you would agree that Cosper talks about the

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importance of driving a system at a frequency that is close to its resonant system when that system has a high Q?

MR. DEUTSCH: Objection. Form.

THE WITNESS: Yeah. I mean, I don't see the word "importance." You may be referring to the last sentence where it -- you know, it's a significant change if there's a difference between the two frequencies.

BY MR. RUBIN:

Q So that last sentence refers to relatively small variations in frequency causing the amplitude to decrease significantly. That's something that's true if the system has a high Q value; correct?

MR. DEUTSCH: Objection. Form and scope.

THE WITNESS: But yeah. That is correct.

BY MR. RUBIN:

Q And in a system that has a low Q value, relatively small variations in frequency will not cause a significant decrease in amplitude; correct?

MR. DEUTSCH: Objection. Form and scope.

THE WITNESS: I would say it will change and reduce the amplitude of oscillations.

BY MR. RUBIN:

Q When will --

A I (indiscernible) --

Q -- (indiscernible) reduce?
A I misstated my answer. I'm sorry.
With a low Q, the change in amplitude will be smaller. Instead of decrease significantly, it will change less. I guess -- I don't want to say, though, that the decrease -- well, significance depends on -- on your application. But it will decrease less if the Q is less. That is true.
Q And would you agree that there's an inverse relationship between the Q of a mechanical system and its bandwidth?
MR. DEUTSCH: Objection. Form and scope.
THE WITNESS: I would slightly amend that and then agree that there's an inverse relationship between the Q of a resonant mechanical system and the bandwidth of that same resonant mechanical system. There could be a mechanical system that has other components that form its total bandwidth. But for a system composed of a spring mass and damper, I would agree to your statement.
BY MR. RUBIN:
Q And so for a mechanical resonant system -- saying that it has a high Q is equivalent to saying that it has a low bandwidth, and vice versa, saying it has a low Q is saying it has a high bandwidth?
MR. DEUTSCH: Objection. Form and scope.

THE WITNESS: Yes.

MR. RUBIN: I've just uploaded another exhibit in the chat function. This is Exhibit 1004 from the IPR ending in '697.

BY MR. RUBIN:

Q Are you able to download that?

A Yes, I have that. I have it open.

Q Very good.

You should see Exhibit 1004 shared on my screen.

(Exhibit 1004, page 1, was displayed.)

THE WITNESS: I see that.

BY MR. RUBIN:

Q And so this is the '696 patent to Shahoian.

(Exhibit 1004, page 10, was displayed.)

BY MR. RUBIN:

Q So here on page 10 of the exhibit in column 4... sorry. Give me a second.

(Exhibit 1004, page 9, was displayed.)

BY MR. RUBIN:

Q All right. So on top of column 2, the first paragraph, second sentence reads, quote, "The present invention provides actuators that output high-magnitude, high-bandwidth vibrations for more compelling force effects."

Do you see that?

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A I see that.

Q And then starting at line 61 in column 2, "Both the frequency and amplitude of the vibrations can be controlled using bi-directional control, and features such as the elastic material and flexures contribute to a high quality and high bandwidth vibration force output."

Do you see that?

A Yes.

Q So for the mechanical features such as the "elastic material and flexures to contribute to a high bandwidth vibration force output," would you agree that they would need to be contributing to a low Q value?

MR. DEUTSCH: Objection. Form and scope.

THE WITNESS: To the extent that bandwidth -- that a high bandwidth corresponds to a low Q and to the extent that that high bandwidth is -- well, the issue is high compared to what. But it's still -- it's a physical fact that when they say "high bandwidth," they could also say, "low Q."

BY MR. RUBIN:

Q And in your declarations in the executaries, you don't point to anything in the Shahoian reference suggesting that it's teaching use with a high Q resonant system; correct?

MR. DEUTSCH: Objection. Form.

THE WITNESS: I think the essence of my opinion is that Shahoian and Cosper are in the same field of endeavor and their analogous art to '767.

BY MR. RUBIN:

Q But in offering that opinion, you don't offer any evidence from Cosper suggesting that it's meant to be used with systems with a low Q, and you don't cite to any evidence from Shahoian suggesting it's meant to be used with systems with a high Q; correct?

MR. DEUTSCH: Objection. Form.

THE WITNESS: Well, I mean, I guess I'd have to -- I'd have to read, you know, everything here to be sure of that answer. Sorry. Say the -- say the two parts of that question again so I have it clear.

BY MR. RUBIN:

Q So in offering the opinions that you offer in your declarations that Shahoian and Cosper are in the same field of endeavor and, therefore, analogous art to the '767 patent, you don't present any evidence from Cosper suggesting it's meant to be used in systems with a low Q, and you don't cite to any evidence from Shahoian suggesting it's meant to be used with systems with a high Q; correct?

MR. DEUTSCH: Objection. Form.

THE WITNESS: I -- it's my opinion that

systems -- both systems with a high Q and a low Q are vibration-generating devices that can be incorporated into different types of electromechanical devices to provide -- you know, to produce vibrations of selected amplitude and frequency as in the '767 patent. And I don't see that -- I didn't see -- I did not compare the Q values between those different types of electromechanical devices that produce vibrations.

MR. RUBIN: How about we take a break?

THE STENOGRAPHER: Off the record at 10:46 a.m.

(Off the record.)

THE STENOGRAPHER: We are back on the record at 11:00 a.m.

BY MR. RUBIN:

Q All right. I'd like to turn to your discussions of culminations including the Rossi reference. So if you could please take a look at your declaration from the -- that is your supplemental declaration from the '897 IPR.

A I think you mean '697, but yeah.

Q I do mean '697. Thank you.

A I've been -- I've tried to compile a spreadsheet of all these numbers. It's -- working on all of them simultaneously, there are a lot to keep track of, and it's hard.

Q I don't want to sound flippant, but I feel your

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pain. I'll say I actually have a set of cases right now with 17 patents involved and IPRs coming in on most of them. And it's a lot to keep track of.

A Yeah. That must be worse. Okay.

Q All right. So are you there on page 15 of the supplemental declaration and the IPR with number ending in 697?

A Yes. I'm pretty sure I am. Let me look at the front page first. Yes, I am there.

And sorry. Page 15 you wanted?

Q Yeah. That's right.

A Okay. There we go.

Q And you should see this on your screen now that I'm sharing it.

So here -- and I'll point you to the second to last sentence in paragraph 19, where you say, quote, "Contrary to the patent owner's assertions, however, the Shahoian-Cosper-Rossi combinations as set forth in the petition is not limited to utilizing two separate inverter components."

And then you quote -- or you cite to pages 31 through 35 of the petition.

Do you see that?

A I am almost there. Let's see. Oh, so right. The bottom of paragraph 19 is the contrary -- okay.

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However -- I see that. Yeah.

Q And then there's a similar statement in your supplemental declaration in the IPR ending in '698 -- this is second to the last sentence of paragraph 26 (indicating) where you say, quote, "Contrary to the patent owners' assertions, however, the Azumi-Cosper-Rossi combinations as set forth in the petition is not limited to utilizing two separate inverter components."

A Okay.

Q Now, when you say that the petition -- the "combinations as set forth in the petitions are not limited to utilizing two separate inverter components," does the -- do the petitions actually describe doing anything other than using two separate inverters?

MR. DEUTSCH: Objection. Form.

THE WITNESS: I would have to repre- -- refresh my memory on the petition to answer that.

MR. RUBIN: Fair enough. Well, let me share copies of these two petitions with you.

BY MR. RUBIN:

Q So you should have, available in the chat function now, paper 2 from IPR2024-00697, which is the petition in that IPR.

A Yeah. I've got those now.

Q And then paper 3 from the IPR2024-00698.

A That one says "updated" in the name, and the '697 does not, but yeah, I have those.

Q All right.

A Sorry. Is there an active question right now?

Q Not right at this moment.

A Okay.

Q So, first, I'd like to point you to a discussion in a petition from the IPR with number ending in 697.

A Okay.

Q So there's a paragraph that begins at the bottom of page 33 of the petition. And the second sentence of that -- well, the first sentence of that paragraph says, quote --

A Oh, sorry. I'm on the wrong document. I'm sorry. '697 petition. All right. Page 33.

Q Yeah. Bottom of the page. Should see it --

A Yeah. (Indiscernible) --

Q -- share from my screen. I'll --

A -- page number things. I'll be right there.

Okay. Bottom of 33.

Q Right. So the first sentence of the paragraph starting at the bottom of 33 says, quote, "First a POSITA would have predictably looked for other references, such as Rossi for implementation details of an H-bridge switch, to further Shahoian's stated objectives."

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Do you see that?

A Yes.

Q And the next sentence describes implementation details. It says, quote, "Rossi plainly demonstrates a well-known H-bridge that receives as input a drive signal ("IN1"), which is then split and one branch inverted to generate complimentary internal signals."

Do you see that?

A Yes.

Q So as -- withdrawn.

So in the description of Rossi's H-Bridge switch implementation here in the petition, Rossi has described as splitting IN1, and then after that signal's been split, invert it; correct?

A "Which is then split" I think agrees with your statement. Or I should say "then split and one branch inverted." You -- yeah. I think that's what you said.

Q And so that's describing the Rossi implementation that uses two separate inverter components; correct?

A I do not see that here. I see one branch is inverted.

Q Now, right after the sentence that refers to the IN1 signal being split and one branch inserted -- inverted, there's a citation to figures 4 and 6 of Rossi.

You see that?

A I see that, yes, on the top of the next page.
Q I suppose I should share a copy of Rossi with you. You should see in the chat a copy of Apple Exhibit 1020, which is the same in both of the IPRs. It's the Rossi patent 4,879,641.
A I just loaded it -- just downloaded it.
Q So, I guess, focusing on the petition from the '697 IPR, you would agree that the pages that you cite from that petition, pages 31 through 35, do not mention Rossi figure 1; correct?
MR. DEUTSCH: Objection. Form.
THE WITNESS: I'm not seeing pages 30 -- sorry. The citations on page 33 and 34; is that what you mean? Which citations are you talking about that do not mention one of the figures?
MR. RUBIN: Fair enough.
BY MR. RUBIN:
Q So earlier we were looking at your supplemental declaration.
A Yeah.
Q Page 15 which says, quote, "Contrary to patent owners' assertions, however, the Shahoian-Cosper-Rossi" -- a "combination as set forth" in -- "the petition is not limited to utilizing two separate inverter components. See petition pages 31 through 35."

A I see. Okay.

Q Okay. And so my question is whether pages 31 through 35 of the petition mention Rossi figure 1?

A No. I clearly don't remember that for sure. So I would have to read it to give you a definitive answer. 35, 31 -- that's four pages of reading, if you want -- five pages of reading, if you want me to do that. But yeah.

Q Yeah. Sure. Please. Take a look at those pages.

A All right.

Well, now I have to look at these references. I mean, at the bottom of 31, right there at the beginning, it says, "The driving signal IN1 is split and a portion passed through an inverter I to generate an internal driving signal IN1. And an inverted signal thereof IN1 bar."

And there's cites to that. So they don't -- it doesn't say "more than one inverter" there. It says "an inverter."

I will also add that a POSITA would, in about one second, understand the equivalence of an inverter -- of a single inverter being used to create a single inverted signal at the equivalence of a single-inverter circuit to the circuit in figure 6, which you are apparently

referring to -- figure 6 of Rossi.

MR. RUBIN: Dr. Hannaford, I have no further questions for you today. I'll pass the witness.

MR. DEUTSCH: Let's take a five-minute break, if we could.

MR. RUBIN: Sure.

THE STENOGRAPHER: Off the record at 11:22 a.m.

(Off the record.)

THE STENOGRAPHER: Back on the record at 11:29 a.m.

MR. DEUTSCH: Dr. Hannaford, I have no further questions. Thank you for your time today.

THE WITNESS: Thank you all.

MR. RUBIN: Thank you.

THE WITNESS: Bye.

THE STENOGRAPHER: Off the record at 11:29 a.m.

(Time noted 11:29 a.m.)

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STATE OF CALIFORNIA)

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CERTIFICATE OF REPORTER

I, JUSTYNE N. JOHNSON do hereby certify:

That Dr. Blake Hannaford, 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 both parties were represented by counsel at the deposition.

I further certify that the deposition of Dr. Blake Hannaford, occurred remotely on June 23, 2025, commencing at 9:36 a.m. to 11:29 a.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.

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IN WITNESS WHEREOF, I have hereunto set my hand this 23rd day of June, 2025.

Justyne Johnson
_____

JUSTYNE N. JOHNSON, CSR NO. 14301

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