

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,

PETITIONER,

V.

RESONANT SYSTEMS, INC.,

PATENT OWNER.

CASE NO. IPR2024-00697

U.S. PATENT NO. 8,093,767

DEPONENT: BLAKE HANNAFORD, PH.D.

TAKEN: JANUARY 27, 2025

REPORTER: DANNIELLE COPELAND
REGISTERED DIPLOMATE REPORTER
CERTIFIED REALTIME REPORTER
CALIFORNIA CSR 14444

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JOB NUMBER 108120

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1 THE DEPOSITION OF BLAKE HANNAFORD, PH.D., TAKEN
2 PURSUANT TO NOTICE HERETOFORE FILED, VIA ZOOM
3 VIDEOCONFERENCE, ON JANUARY 27, 2025, AT APPROXIMATELY
4 9:02 A.M., PACIFIC TIME, UPON ORAL EXAMINATION, AND TO
5 BE USED IN ACCORDANCE WITH THE CALIFORNIA CODE OF CIVIL
6 PROCEDURE.

7
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1 BLAKE HANNAFORD, PH.D., AFTER BEING FIRST
2 DULY SWORN, WAS EXAMINED AND DEPOSED AS FOLLOWS:

3

4 EXAMINATION

5

6 BY ATTORNEY RUBIN:

7 Q. Good morning, Dr. Hannaford.

8 A. **Good morning.**

9 Q. So I don't believe we've met before, but I
10 am an attorney representing patent owner --

11 A. **Mr. Rubin, you're very -- your voice is**
12 **very quiet for hearing it, and my -- we're pretty sure**
13 **that my computer's turned up to the max on my volume.**

14 Q. All right. Sorry. I --

15 A. **This is much better. This is much better.**

16 Q. You know, I thought I turned up my mic
17 earlier, but I had instead turned up my --

18 A. **No, you fixed it.**

19 Q. -- speaker. Sorry.

20 So you can hear me just fine now; is that right?

21 A. **Yes.**

22 Q. All right. Well, let's go on.

23 Have you been deposed before?

24 A. **Yes.**

25 Q. How many times?

1 A. About seven.

2 Q. Okay. And were those all cases where you
3 were an expert witness?

4 A. Yes.

5 Q. How many of those were IPR cases?

6 A. I've never been deposed for an IPR before.

7 Q. Were the other cases --

8 A. I've contributed to them, but they were
9 patent litigation in, like, International Trade
10 Commission or federal court. One case was a -- a
11 copyright infringement, but mostly they're patent
12 infringement cases.

13 Q. And were you offering expert opinions on
14 behalf of Apple in any of those other cases?

15 A. I have.

16 Q. Which cases were those?

17 A. I'd have to go look at -- you know, it's
18 several years ago, and I would have to go back and look
19 at my list to -- to give you the details.

20 Q. Okay. Would all those be listed in the CV
21 that's -- I believe is attached to your declarations in
22 these cases?

23 A. It's usually not in my CV. I have a
24 special document that lists -- it's like a spreadsheet
25 of my previous expert witness engagements, and I know I

1 supplied that at some point. I don't know if you've
2 been provided with that or not.

3 Q. We'll come back to that in a minute -- in a
4 few minutes. Let me just finish with the
5 preliminaries.

6 You understand today that you're under oath just
7 as if you were testifying in a court of law?

8 A. Yes, I do.

9 Q. Okay. And the purpose of today's
10 deposition -- or at least one of the purposes is to get
11 a -- a clear record of your testimony. We have a court
12 reporter here today, and she's taking a record of
13 everything that's said here. Particularly since we
14 don't have a video recording, though, it is important
15 that all your testimony be in the form of words as
16 opposed to non-word utterances or -- or gestures.

17 Do you understand?

18 A. Understood.

19 Q. And also, it's important so that our court
20 reporter can -- can do a good job that we not talk over
21 one another. So I ask that you please make sure you
22 give me a chance to finish my answer -- or my question,
23 rather, before you start answering, and I'll try my
24 very best not to talk over your answers.

25 Is that fair?

1 **A. Sounds good.**

2 Q. And if at any point you don't hear or don't
3 understand a question, please let me know and we'll try
4 to make sure that you clearly understand the question.
5 Is that fair?

6 **A. I will do that.**

7 Q. And do you agree that if you do answer a
8 question, it's fair for us to assume that you've --
9 that you've heard the question and understand it?

10 **A. I will certainly try to make sure I**
11 **understand the question before I give you an answer.**

12 Q. Okay. So we'll generally be taking a break
13 for a few minutes at the end of every hour, hour and a
14 half of testimony. If you do need a break before that,
15 please let me know. I will ask, though, that if
16 there's a question pending, you answer the question
17 before we take the break.

18 Is that fair?

19 **A. Understood.**

20 Q. Is there any reason you cannot give
21 complete and accurate testimony here today?

22 **A. No.**

23 Q. Okay. Are you sick today?

24 **A. I am not.**

25 Q. Are you on any medication today that would

1 affect your memory or your ability to testify?

2 A. No, I am not.

3 Q. And at some points during today's
4 deposition Apple's attorneys may object to some of my
5 questions, but you still have to answer the question in
6 spite of the objection, unless you're specifically
7 instructed not to answer.

8 Do you understand?

9 A. That is my understanding.

10 Q. All right. So today we're here in this
11 deposition to address declarations that you submitted
12 on behalf of Apple in support of two IPR petitions,
13 both challenging the same patent, the 8,093,767 patent.

14 Do you understand that?

15 A. That's correct, in my understanding.

16 Q. All right. And just to make sure it's in
17 the record, the -- the two IPRs that Apple has filed
18 challenging that patent are IPR 2024-00697 and
19 IPR 2024-00698.

20 Do you have any pertinent materials with you
21 today?

22 A. I have physical copies of my -- the two
23 declarations freshly printed out and given to me by
24 counsel this morning.

25 Q. Do you have copies of any other exhibits

1 from these two IPRs, such as patents or other prior
2 art?

3 A. This laptop has a folder that contains
4 those.

5 Q. Are there any other materials on that
6 laptop that -- well, withdrawn.

7 Who owns the laptop that you just referred to, if
8 you know?

9 A. Counsel, their firm. Fish & Richardson.

10 Q. All right. So the materials from these
11 IPRs, were those loaded onto the laptop by somebody
12 working at Fish & Richardson?

13 A. That's my understanding, yes.

14 Q. Are there any materials that you have
15 access to on that laptop other than documents that have
16 been filed in these two IPRs?

17 A. Not that I'm aware of. I certainly have
18 not done some kind of search of this laptop, but I have
19 one specific folder that I've opened, and that one
20 contains only those materials.

21 Q. Okay. How many files are there in that
22 folder?

23 A. A lot. I don't know the number, but it's
24 dozens.

25 Q. Well, during the course of today's

1 deposition I'll be asking you to look at certain
2 exhibits. I'm -- well, I guess withdrawn.

3 Do you know whether -- withdrawn.

4 The documents in those -- in that folder you
5 referred to, are those all PDF files?

6 A. I -- I -- again, that's not a thing I
7 systematically checked, but I think the predominance of
8 them are -- at least the predominance are PDFs. I did
9 not -- I don't recall seeing any other types in there.

10 ATTORNEY RUBIN: Well, let me ask counsel.

11 Is the witness right that the files in that
12 folder were loaded by counsel at -- or staff at
13 Fish & Richardson?

14 THE WITNESS: That was a question for you,
15 I think.

16 ATTORNEY DEUTSCH: Counsel, can you repeat
17 that?

18 ATTORNEY RUBIN: Yeah. So I -- you know,
19 I -- I just want to make sure that I understand what
20 the documents are that the witness has been provided
21 and will be accessing during today's deposition, but
22 I -- I don't want to spend too much time on this if we
23 don't have to.

24 So the witness's understanding is that
25 there's a folder on the laptop that's in front of him

1 that was prepared by counsel or staff at
2 Fish & Richardson.

3 Is -- is that correct?

4 ATTORNEY DEUTSCH: Yeah. Counsel, the --
5 there's just a file -- clean file from the record that
6 was made available to the extent you request that he
7 pulls anything up.

8 ATTORNEY RUBIN: Okay. So that was the
9 main question that I had for you.

10 The folder just contains documents as filed
11 in the -- in the PTAB docket in these two IPRs without
12 any modifications to them?

13 ATTORNEY DEUTSCH: That's correct.

14 ATTORNEY RUBIN: Okay. Very good.

15 ATTORNEY DEUTSCH: That was our
16 understanding from the -- the arrangements I made.

17 ATTORNEY RUBIN: Okay.

18 BY ATTORNEY RUBIN:

19 Q. So during today's deposition,
20 Dr. Hannaford, I'll be asking you to -- asking you
21 questions about specific documents or directing you to
22 look at specific documents.

23 If at any point you look at a document on that
24 computer other than a document that I've directed you
25 to or asked you about, could you please let me know

1 what it is you're looking at?

2 A. Yes, I will do that.

3 Q. Thank you.

4 THE WITNESS: I just realized I can't mouse
5 this -- either the Zoom or the folder onto the other
6 screen, so I'm effectively on this -- sorry. This is
7 just an IT thing. I'm effectively on just one screen,
8 which -- which I can make it work, but -- yeah. Maybe
9 the IT can come in during a break and enable that.
10 It's no big deal.

11 ATTORNEY RUBIN: All right. Well, do let
12 me know if there are any technical issues that are --

13 THE WITNESS: I will.

14 ATTORNEY RUBIN: -- interfering with your
15 ability to answer questions.

16 THE WITNESS: I will do that.

17 ATTORNEY RUBIN: All right.

18 BY ATTORNEY RUBIN:

19 Q. So -- so you submitted two declarations in
20 these two IPRs that are both dated April 12th, 2024; is
21 that right?

22 A. That's correct. That's my signature date,
23 anyway, yeah.

24 Q. Okay. And are you able to -- well, I guess
25 I would like to be able to refer to the two

1 declarations by the IPR case number that they were
2 filed in, so I would like to be able to refer to them
3 as the -- as your '697 declaration and your '698
4 declaration.

5 Do you have a way of telling which one was filed
6 in which of the IPRs?

7 **A. Actually, on my copy they both are labeled**
8 **12/782,697, if that's what you're referring to. I**
9 **don't have a '698.**

10 Q. All right. So the -- I think the number
11 that you just read off was the number listed under
12 application serial number, which is the -- a number
13 that identifies the patent application that ultimately
14 resulted in the '767 patent.

15 **A. I did read it from the application serial**
16 **number. I'm sorry if that was just like a coincidental**
17 **match of '697 or something.**

18 Q. No.

19 **A. I don't have those numbers on my copy.**

20 Q. Yeah, it is a coincidence, but you're
21 right. Those three digits are matching.

22 **A. Okay.**

23 Q. So both of your declarations list the -- on
24 the first page list the application serial number.
25 They're both -- they're both declarations. That

1 application serial number is the same because it's the
2 same patent.

3 So I think, though, probably the way to
4 distinguish the two declarations in your printed copies
5 would be from the attorney docket number, which is sort
6 of near the upper right-hand corner of each
7 declaration.

8 A. Yes. Those are different numbers.

9 Q. Yeah.

10 So the -- so one of the attorney docket numbers
11 ends in the characters P1, and the other one ends in
12 the characters P2?

13 A. That is right.

14 Q. All right. And the -- withdrawn.

15 So the other attorney docket numbers, as I
16 understand it, correspond to internal numbers assigned
17 at Fish & Richardson for each of these IPRs, and I
18 assume the documents -- the declarations that you have
19 in front of you don't list the actual IPR number
20 because that -- those numbers hadn't actually been
21 assigned when this was being prepared before they were
22 filed.

23 So I think it's going to give us a cleaner record
24 if I can refer to the declaration that has a P1 in it
25 as the '697 declaration and the one that has a P2 in it

1 as the '698 declaration.

2 A. Honestly, my -- my impression is that's
3 clearer for you and more confusing for me, but I can
4 try to work with it if you need that.

5 Q. So I'll try to refer to them as both, as
6 '697, the one with the P1 in it, so that -- so when
7 reading the transcript we can tell which we're talking
8 about, but also it's clear to you.

9 In any event, if at any point you're confused
10 about which declaration I'm asking about, which
11 hopefully that won't happen, but if that does, please
12 let me know and --

13 A. Yes. And I appreciate your help orienting
14 me on the right declaration.

15 Q. Yeah. Yeah.

16 And so the -- the declaration with the P1 in the
17 attorney docket number relies on a number of prior art
18 references, including a Shahoian.

19 I don't know if you know how --

20 A. We kind of call it Shahoian, but I
21 understood what you said.

22 Q. All right. Shahoian.

23 And then the declaration with the P2 and the
24 docket number relies on a number of references,
25 including one to Izumi?

1 A. That's correct.

2 Q. All right. And you know it may be that
3 it's -- Shahoian, is that how you pronounce it?

4 A. That's understandable to me. I don't know
5 the correct pronunciation.

6 Q. You know what actually might make it easier
7 is if I just refer to the declarations by their
8 principal reference, Shahoian versus Izumi. So
9 hopefully if I refer to them, that way you'll know what
10 I'm saying. And hopefully, however I refer to them,
11 we'll at least be talking about the same thing at the
12 end of the day. Okay?

13 A. Yes. That sounds okay to me too.

14 Q. All right. So referring to the two
15 declarations you submit concerning IPRs of the '767
16 patent, the Shahoian declaration and the Izumi
17 declaration, are you aware of any errors or things that
18 you wish to correct sitting here today?

19 A. There actually is one. I -- I -- there's
20 one little sentence that I think is now -- you know,
21 during review I released was incorrect. It's not
22 critical to the argument. It would take me a while to
23 find it right now, sitting here. So I could correct it
24 if we get to it, or I could look for it.

25 Q. Do you remember which declaration that

1 sentence is in?

2 A. No, and it could be both.

3 Q. Do you remember anything about what the
4 error was?

5 A. Yes. I -- I think I could find it. It's
6 related to the summarization of the Rossi reference, I
7 believe, if I'm not mistaken.

8 Q. So would that be the -- when you say "the
9 summarization of the Rossi reference," that would be in
10 the section overview of Rossi?

11 A. Well, let's look at the Shahoian version
12 overview of Rossi, and I think that's where it is. And
13 it won't take me long if I find it. And it's -- again,
14 it -- it was peripheral to the argument anyway.

15 Actually, let's look at the argument where we
16 apply Rossi to it, and the -- it's probably under the
17 analysis of Izumi, Cosper, and Rossi. So that would be
18 starting at 82.

19 I'm sorry. I'm not finding it. It's possible I
20 recalled that in one of my other declarations that
21 involved Rossi or -- yeah.

22 Q. Okay. Do you recall --

23 A. But I -- if we get there in answering
24 another question, I will -- I will call it out.

25 Q. Is there anything that you remember about

1 what the nature there was, related to Rossi?

2 A. Yes.

3 It -- it was a statement -- it was -- it was a
4 paragraph concerning advantages that a POSITA would
5 recognize for incorporating Rossi's design, and the
6 topic was the use of diodes across the switches which
7 was featured in Rossi.

8 And there were advantages listed for the diodes,
9 and one of the advantages that I listed was that it
10 would prevent a current surge if accidentally two
11 switches on the same side of the H-bridge were turned
12 on simultaneously.

13 And there were other advantages of the diodes, but
14 that particular sentence -- it's just one sentence that
15 states this advantage of protecting the devices from
16 multiple devices turning on in a way that
17 short-circuits the power supply.

18 That -- on -- on further thought about that
19 schematic diagram, I realized the diodes do not protect
20 the devices that way. But it was just one sentence,
21 and it was -- and I now think that that was incorrect.

22 And I -- I could -- I'm sorry I couldn't find it.
23 Again, it might be in another declaration. But if we
24 get there, I will point it out.

25 Q. Okay. I appreciate that.

1 So you have -- you have copies of both of these
2 declarations, right, so you can look at both of them
3 simultaneously?

4 **A. I can.**

5 Q. So I want to ask you to turn to the first
6 page of the table of contents in each of your '767
7 patent declarations.

8 **A. Okay. I've turned to those.**

9 Q. All right. So in each of these tables of
10 contents, under Section 7, "Overview of the Cited
11 References," there are Sections F and G titled,
12 "Overview of Motohashi" and "Overview of Amaya."

13 Do you see those?

14 **A. Yes, I see those.**

15 Q. All right. So at least when I looked
16 through the declarations, I don't recall seeing any
17 mention of Motohashi or Amaya in the declarations
18 outside of that overview section.

19 In particular, I don't think that either of those
20 two references is part of one of the invalidity grounds
21 that -- the vague and obviousness combinations that you
22 discuss in the declarations.

23 Does that sound right?

24 ATTORNEY DEUTSCH: Objection, form.

25 **THE WITNESS: I do not see those as -- as**

1 listed combinations in our grounds.

2 BY ATTORNEY RUBIN:

3 Q. Do you recall why those references are
4 discussed in the overview of cited references sections
5 of your declarations?

6 A. I'm sorry. There was a little bit of
7 garble at the beginning of the question, if you could
8 repeat it.

9 Q. Yeah.

10 So do you recall why you discussed -- why you
11 provided an overview for each of those two references
12 in your declarations?

13 A. My recollection is they're just
14 corroboration of the -- oh, I'm sorry. I'm going to
15 turn my phone completely off because it was making
16 little noises. Okay.

17 So my -- my recollection is that those were
18 corroboration of what a POSITA would know, just
19 additional references for -- for the same ideas that we
20 expect of a POSITA.

21 Q. Do you recall whether in either of your
22 declarations in the sections where you discuss the
23 specific grounds of obviousness you ever mention the
24 Motohashi prior art reference?

25 ATTORNEY DEUTSCH: Objection, form.

1 **THE WITNESS:** That's not something I recall
2 sitting here right now.

3 BY ATTORNEY RUBIN:

4 Q. And do you know whether in either of your
5 declarations in the sections where you're discussing
6 the specific grounds of obviousness you ever mentioned
7 the Amaya reference?

8 ATTORNEY DEUTSCH: Objection, form.

9 **THE WITNESS:** Sitting here now, I don't
10 recall that.

11 BY ATTORNEY RUBIN:

12 Q. So if I could ask you to open up the
13 Shahoian reference, which I believe is Exhibit 1004 in
14 each of the IPRs.

15 A. Sorry. What did you ask me about 1004?

16 Q. I just wanted you to open it up.

17 A. Got it.

18 Okay. I have that exhibit.

19 Q. So this is a reference that you discuss as
20 part of an obviousness -- as part of a number of
21 obviousness combinations that you offer opinions on for
22 the '767 patent; is that right?

23 A. Well, I guess focusing us back on this
24 Shahoian declaration, I certainly rely on this
25 reference.

1 (TECHNICAL INTERRUPTION.)

2 (A DISCUSSION WAS HELD OFF THE RECORD.)

3 BY ATTORNEY RUBIN:

4 Q. So do you agree that in the Shahoian
5 reference the haptic feedback actuator that's described
6 is capable of operating at multiple different
7 frequencies?

8 ATTORNEY DEUTSCH: Objection, form.

9 THE WITNESS: I guess I would want to take
10 a look at that. Is there a, like, specific claim in
11 '767 or a claim limitation that you're interested in
12 here?

13 BY ATTORNEY RUBIN:

14 Q. Well, there are some claim limitations that
15 mention frequency, as I recall, but I -- my questions
16 were about the -- or my question was about the Shahoian
17 reference.

18 Maybe if I could direct your attention to Column 7
19 of Exhibit 1004, and I'll ask you about the sentence
20 that starts on line 41.

21 A. All right. I'm there.

22 Q. All right. So starting on line 41, it
23 says, "The controller can also adjust the frequency of
24 the drive waveform independently of the amplitude to
25 adjust the frequency of vibration. This allows

1 different frequency vibrations to be output
2 independently of the magnitude of those vibrations."

3 Do you see that?

4 **A. I see that.**

5 Q. Do you have an understanding in the system
6 described in Shahoian why it would be desirable to be
7 able to output different frequency vibrations?

8 ATTORNEY DEUTSCH: Objection, form.

9 **THE WITNESS: I would have to think about**
10 **that. I'm not sure I actually have an opinion on that**
11 **question.**

12 BY ATTORNEY RUBIN:

13 Q. So if I could turn your direct -- or turn
14 your attention to -- withdrawn.

15 If I could direct you to Column 5 of this
16 reference, starting on line 50.

17 Let me know when you're there.

18 **A. I see line 50 on Column 5.**

19 Q. So it says, "Manipulandum 34 can be a
20 joystick, mouse, trackball, stylus, (e.g. at the end of
21 a linkage), steering wheel, sphere, medical instrument,
22 pool cue, hand grip, knob, button, or other object."

23 Do you see that?

24 **A. I see those -- yes, I see that language.**

25 Q. I'll have to admit, "manipulandum" is not a

1 word that I was familiar with before this -- before
2 reading this reference.

3 Do you know what it means?

4 ATTORNEY DEUTSCH: Objection, scope.

5 THE WITNESS: Well, defin- -- defining that
6 term was not something I was asked to give an opinion
7 on.

8 There's more -- in this column just above
9 the -- like between 40 and 50, there's more explanation
10 of it. It was a term commonly used in the art.

11 BY ATTORNEY RUBIN:

12 Q. So do you think that a person skilled in
13 the art reading the Shahoian reference and its
14 discussion of providing haptic feedback to devices like
15 the ones that I -- the ones in the sentence that I read
16 would find it desirable to be able to provide haptic
17 feedback at more than one frequency at different times?

18 ATTORNEY DEUTSCH: Objection, form and
19 scope.

20 THE WITNESS: Sorry. Could you -- could
21 you repeat that question again?

22 BY ATTORNEY RUBIN:

23 Q. So a person skilled in the art reading the
24 Shahoian reference, would that person believe that in
25 providing haptic feedback to devices such as a

1 joystick, mouse, trackball, stylus, sphere, medical
2 instrument, pool cue, hand grip, knob, button, or other
3 object would find it desirable to be able to provide
4 haptic responses at more than one frequency at
5 different points in time?

6 ATTORNEY DEUTSCH: Objection to the form
7 and the scope.

8 THE WITNESS: I don't think that was an
9 opinion I was asked to form, and I don't think that's
10 addressed in my report, if I recall it correctly.

11 BY ATTORNEY RUBIN:

12 Q. If we could turn back to Column 7, starting
13 at line 56. So I believe you quote from this sentence
14 in your declaration.

15 It says, quote, This gain at higher frequencies is
16 due primarily to the vibration occurring at the
17 resonance frequency of the mechanical system, including
18 actuator, foam, housing, etc., and, if desired, can be
19 compensated for in other embodiments to obtain a more
20 flat response by providing compensating frequencies
21 that will provide the desired response (e.g., from a
22 look-up table or firmware)."

23 Do you see that?

24 A. Yes, I see that text.

25 Q. So what does the sentence mean when it

1 refers to a, quote, flat -- or a more flat response?

2 ATTORNEY DEUTSCH: Objection, form.

3 THE WITNESS: Again, I -- I didn't -- I
4 wasn't asked to offer an opinion on this, and I
5 would -- if I were, I would want to take the time to
6 read the whole specification again, if not including
7 the claims as well, and then be able to give an opinion
8 on that question.

9 BY ATTORNEY RUBIN:

10 Q. You do cite to this paragraph, the
11 paragraph that I was reading from in your declaration
12 concerning the Shahoian reference, right?

13 A. Would you help me out by pointing me to the
14 citation in the -- in the -- in the declaration?

15 Q. Sure.

16 So in the declaration where you address the
17 Shahoian reference, on page 53, near the middle of
18 paragraph 108, you say, "Shahoian also describes the
19 advantages of operating the linear actuator at
20 resonance," and then you cite to this paragraph from
21 the reference and explain what you believe it
22 describes.

23 Do you see that?

24 A. Yes.

25 Q. So in offering that opinion about what this

1 paragraph describes, I take it that you -- you did read
2 and try to understand the -- the full paragraph that
3 you cite to; is that right?

4 A. Yeah. Let me just re-read this paragraph
5 quickly in its entirety.

6 Okay. I've done that, and yeah, I think this does
7 represent my opinion involving that statement in the
8 patent.

9 Q. And so when the paragraph that you cite to
10 refers to, quote, a "more flat response," what does
11 that mean?

12 ATTORNEY DEUTSCH: Objection, form.

13 THE WITNESS: As I interpret it, it says
14 optionally, that's the language, if desired -- first --
15 the first part of that sentence is describing
16 advantages of operating at resonance, greater
17 magnitude. And then it says if desired, maybe you
18 don't want it to be acting as a resonance.

19 So a resonance -- you know, if any
20 vibrational system is known to a POSITA or just known
21 to have a frequency response which has a peak at a
22 certain frequency that we call a resonant frequency. A
23 flat response has a negligible peak, a small or
24 nonexistent peak at any one frequency but instead would
25 have a maximum value over a range of frequencies and

1 not exhibit a clear peak.

2 So that's an optional way that Shahoian is
3 describing their invention to be used.

4 BY ATTORNEY RUBIN:

5 Q. And Shahoian talks about obtaining a more
6 flat response by, quote, compensating for the gain due
7 to resonance, right?

8 ATTORNEY DEUTSCH: Objection, form.

9 THE WITNESS: I see language "by providing
10 compensating frequencies that will provide." That's
11 the language I see on line 61.

12 BY ATTORNEY RUBIN:

13 Q. And earlier in the sentence it says, quote,
14 This gain at higher frequencies is due primarily to the
15 vibration occurring at the resonance frequency of the
16 mechanical system, including actuator, foam, housing,
17 etc., and, if desired, can be compensated for," and
18 then the sentence continues.

19 You would agree that there it's talking about --
20 that is the Shahoian reference, is talking about
21 compensating for the gain that require -- or that
22 occurs at the resonance frequency, right?

23 ATTORNEY DEUTSCH: Objection, form.

24 THE WITNESS: I -- I think I've already
25 answered that as well. I mean, I -- it's -- it's an

1 optional way to control the actuator, is to drive it to
2 make a flat response. The word "compensation" is
3 widely used for any means of changing frequencies or
4 changing frequency response.

5 For example, in control systems there's a
6 compensator -- lead -- lead compensator, lag
7 compensator, other compensators. It's a widely used
8 term to describe changing a frequency response, and if
9 desired in Shahoian's specification, the engineer can
10 use those techniques to obtain a more flat frequency
11 response.

12 BY ATTORNEY RUBIN:

13 Q. In your opinion, in a haptic feedback
14 system, is a greater magnitude of vibrations always
15 more desirable than a lesser magnitude of vibrations?

16 ATTORNEY DEUTSCH: Objection to form and
17 scope.

18 THE WITNESS: I -- I don't think I offer an
19 opinion on that in my declaration, if I recall, but
20 there's -- I would not make an absolute statement that
21 greater magnitude is better than smaller magnitude in
22 all situations.

23 BY ATTORNEY RUBIN:

24 Q. So focusing on this same paragraph that you
25 cite from Shahoian, the first sentence of that

1 paragraph reads, quote, The linear actuator 100
2 provides a greater magnitude of vibrations at higher
3 frequencies (assuming the waveform magnitude is held
4 constant)."

5 Do you see that?

6 **A. Yes, I see that.**

7 Q. So I think we can agree that that sentence
8 states that for a given waveform magnitude, the
9 magnitude of vibrations will be greater at higher
10 frequencies, which the paragraph goes on to explain is
11 when you're closer to resonance.

12 Is there anything in that sentence, however,
13 that -- that says that in the view of the Shahoian
14 inventors that's a desirable effect?

15 ATTORNEY DEUTSCH: Objection, form.

16 **THE WITNESS: First of all, I was confused**
17 **about which sentence you were referring to.**

18 BY ATTORNEY RUBIN:

19 Q. All right. Paragraph -- let's talk about
20 the -- the paragraph as a whole. That is Column 7,
21 lines 54 through 62, which you cite.

22 So my first question concerning that paragraph is:
23 You would agree that that paragraph says that for a
24 given waveform magnitude, the magnitude of vibrations
25 will be greater at higher frequencies because the

1 actuator is operating closer to resonance; is that
2 right?

3 ATTORNEY DEUTSCH: Objection, form.

4 THE WITNESS: The gain -- you know, I'm
5 just seeing it there. This gain at higher frequencies
6 is due primarily to the vibration occurring at the
7 resonance frequency of the mechanical system.

8 BY ATTORNEY RUBIN:

9 Q. Is there anything in that paragraph --
10 Column 7, lines 54 through 62 of Shahoian -- which says
11 that the greater gain at higher frequencies is a
12 desirable phenomenon?

13 ATTORNEY DEUTSCH: Objection, form.

14 THE WITNESS: I think this paragraph is
15 simply laying out properties -- actually well-known
16 ones to a POSITA -- of resonance, and if resonant
17 behavior was not desired, then it offers a way to
18 change that; but implicitly, if resonance is desired,
19 it talks about that mode as well.

20 ATTORNEY RUBIN: So I would like to go off
21 the record briefly, if that's all right.

22 (RECESS TAKEN.)

23 ATTORNEY RUBIN: If I could ask you to pull
24 up Exhibit 1009, the Cosper prior art reference.

25 And I'll also upload that to the chat for

1 anyone who needs a copy.

2 BY ATTORNEY RUBIN:

3 Q. Do you have that open, sir?

4 A. Oh, sorry. Yes, I do have it open.

5 Q. All right.

6 A. Cosper, '532.

7 Q. So if you look at the first page of Cosper,
8 the 1009 -- well, and just for -- well, never mind.
9 Withdrawn.

10 If you look at the first page of the Cosper
11 reference, Exhibit 1009, you'll see that it lists two
12 inventors, James Cosper and Enrique Gutierrez.

13 Do you see that?

14 A. I see that.

15 Q. Now, sometimes a patent will list an
16 assignee, an entity that -- that owns the patent.

17 This doesn't appear to list an assignee on the
18 face of the patent, would you agree -- or I should say
19 on the face of the patent publication, would you agree?

20 ATTORNEY DEUTSCH: Objection, form.

21 THE WITNESS: I don't see an assignee here.

22 BY ATTORNEY RUBIN:

23 Q. Do you happen to know who this patent was
24 filed by?

25 ATTORNEY DEUTSCH: Objection, scope.

1 **THE WITNESS: No.**

2 BY ATTORNEY RUBIN:

3 Q. So you don't know who, if anyone,
4 Mr. Cospers and Mr. Gutierrez worked for when they
5 developed what's described in this patent?

6 ATTORNEY DEUTSCH: Objection, form.

7 **THE WITNESS: Not that I can recall sitting**
8 **here.**

9 BY ATTORNEY RUBIN:

10 Q. So I'll represent to you that there are
11 records at the patent office indicating that this
12 was -- this patent application was assigned to an
13 Omnilux, Inc.

14 Have you ever heard of them?

15 A. **I don't recall hearing of Omnilux.**

16 Q. So if you could turn to paragraph 3 of the
17 Cospers reference.

18 Let me know when you're there.

19 A. **Okay.**

20 Q. So the last sentence of that paragraph
21 reads, quote, In one example the systems are described
22 for use with illumination systems, including an
23 oscillating resonant engine."

24 Do you see that?

25 A. **I see it.**

1 Q. Do you have any understanding of what the
2 use would be of a -- of mechanical oscillation in an
3 illumination system?

4 ATTORNEY DEUTSCH: Objection, form.

5 THE WITNESS: That's definitely not a
6 question I was asked to give an opinion about.

7 BY ATTORNEY RUBIN:

8 Q. So do you have any understanding of what
9 type of product the invention that's described in the
10 Cosper patent application would have been used in?

11 ATTORNEY DEUTSCH: Objection to form.

12 THE WITNESS: I take that whole paragraph 3
13 as answering that. Any product with mass and bias
14 elements that oscillate at resonance. And in one
15 example the systems are described for use with
16 illumination systems, including oscillating resonant
17 engines. So I think that explains it.

18 BY ATTORNEY RUBIN:

19 Q. So would you agree that Cosper describes
20 the use of a parabolic reflector in at least some of
21 the embodiments of its invention?

22 ATTORNEY DEUTSCH: Objection, form.

23 THE WITNESS: Well, I wasn't asked to give
24 an opinion on that. I recall something that looks like
25 a parabola in some of the figures.

1 BY ATTORNEY RUBIN:

2 Q. If you could look, please, at Figure 7 of
3 Cospir.

4 Would you agree that that figure shows a parabolic
5 reflector at least partially surrounding what's labeled
6 as a bulb?

7 A. Yes, I see those things in Figure 7.

8 Q. And would you agree that the control system
9 described in Cospir is specifically designed to drive
10 the mechanical system at resonance?

11 ATTORNEY DEUTSCH: Objection, form.

12 THE WITNESS: I -- I would have to form a
13 new opinion, I think, on that if -- because of your
14 wording, "specifically designed." I don't have an
15 opinion on "specifically designed."

16 BY ATTORNEY RUBIN:

17 Q. Okay. So if I could ask you to turn to
18 page 58 of your declaration where you address -- of the
19 declaration in which you address the Shahoian
20 reference.

21 A. Are you referring to addressing the
22 Shahoian and Cospir combination?

23 Q. So let me -- let me restate it. Thanks.

24 So I want to refer you to a -- to one of your two
25 declarations.

1 A. **Okay.**

2 Q. And the declaration I want you to look at
3 is the one that talks about Shahoian.

4 A. **Okay.**

5 Q. All right. And then within that
6 declaration I would like you to please turn to page 58.

7 A. **Okay. I'm there.**

8 Q. And page 58 contains, at the beginning of
9 the page, part of paragraph 115.

10 Do you see that?

11 A. **Well, I see that 115 starts on 57 with a**
12 **couple of lines, and most of it is on page 58, yeah.**

13 Q. Okay. So the second-to-last sentence of
14 page -- of paragraph 115 reads, quote, For example,
15 Cosper's sensors and control system is specifically
16 designed for use in resonant systems that involve a
17 linearly moving mass, including reciprocal
18 electromagnetic drivers, like that of Shahoian."

19 Do you see that?

20 A. **I see that.**

21 Q. So you -- in the sentence that I read from,
22 you use the phrase "specifically designed."

23 And would you agree that the sensors and control
24 system in Cosper are specifically designed to drive the
25 resonant systems at their resonant frequency?

1 ATTORNEY DEUTSCH: Objection to form.

2 THE WITNESS: I think -- I think -- first
3 of all, it's -- it's designed -- you know, the Cosper
4 reference is very clear that it applies to any resonant
5 system, and it gives ways to drive it involving the
6 resonance, but if the frequency happens to be off of
7 resonance, it is still covered by -- by -- it's still
8 disclosed in Shahoian.

9 BY ATTORNEY RUBIN:

10 Q. Well, turning to -- I'm sorry.

11 You said it's still disclosed in Shahoian. My
12 question was about Cosper.

13 A. I meant -- I'm sorry. I meant Cosper.
14 Yeah. Thanks for that clarification.

15 Q. So turning back to paragraph 3 of Cosper,
16 the first sentence reads, "This application generally
17 relates to systems and methods for control of a mass
18 and bias (e.g., 'elastomeric members') subassembly
19 including oscillating mechanical systems that operate
20 in an oscillatory mode at or near their mechanical
21 resonant frequency."

22 Do you see that?

23 A. I see it.

24 Q. So would you agree that the systems
25 described in Cosper are designed to operate at or near

1 their mechanical resonant frequency?

2 ATTORNEY DEUTSCH: Objection, form and
3 scope.

4 THE WITNESS: Yeah, I think I -- I think I
5 would want to form an opinion more carefully, and that
6 would require some study on this one. You know, I
7 don't think my opinion answers that question.

8 BY ATTORNEY RUBIN:

9 Q. So sitting here today, is there anything
10 that you can point to in Cosper that describes driving
11 a system at a frequency that is other than, at, or near
12 the resonant frequency?

13 ATTORNEY DEUTSCH: Objection, form.

14 THE WITNESS: Yeah, again, that would
15 require me to study Cosper again with that question in
16 mind.

17 BY ATTORNEY RUBIN:

18 Q. So in that same declaration we've been
19 looking at, the declaration that addresses combinations
20 involving Shahoian, could you please turn to page 68?

21 A. Okay. I'm there.

22 Q. And this -- the text on page 68
23 specifically is within your section addressing blame --
24 I'm sorry, addressing ground 1A.

25 A. I'll just refer to the table of contents to

1 refresh my memory of that, but -- yes. That's -- that
2 appears to be right.

3 Q. So I'll read you the sentence that begins
4 at the bottom of page 68. Quote, To be clear, the
5 control component of the combined system includes a
6 control program that receives the value of an output
7 signal, compares that value to a different value, and
8 adjusts one or more operational control outputs based
9 on that comparison, in accordance with Cosper's
10 description of maintaining oscillation at a resonant
11 frequency."

12 Do you see that?

13 A. Yes, I see that.

14 Q. So you would agree that in the specific
15 combination of Shahoian and Cosper that you provide
16 your obviousness opinions based upon, in that
17 combination oscillation is maintained at a resonant
18 frequency?

19 ATTORNEY DEUTSCH: Objection, form.

20 THE WITNESS: I -- I would -- I think this
21 opinion says that the adjustment of control is in
22 accordance with Cosper's description of maintaining an
23 oscillation at a resonance frequency, which may or may
24 not be the same as your statement. I'm not sure. But
25 that's my precise opinion.

1 BY ATTORNEY RUBIN:

2 Q. So if we could turn back to the Shahoian
3 reference, Exhibit 1004, and specifically turn to
4 Figure 1.

5 Are you there?

6 A. I'm almost there.

7 Okay. Figure 1.

8 Q. So toward the middle on the right-hand side
9 of this figure, there's a box, 28, that's labeled
10 "sensors."

11 Do you see that?

12 A. I see that.

13 Q. And I think in your declaration you mention
14 at some point the fact that Shahoian describes sensors.
15 Do you recall that?

16 A. I -- I -- I guess I would have to look, but
17 sitting here right now I think I recall that.

18 Q. Yeah.

19 So for example, on -- in paragraph 75 on page 35
20 of your declaration addressing the Shahoian grounds,
21 you at least mention the fact that Shahoian has one or
22 more sensors 28.

23 Do you see that?

24 A. Yeah, I see that on page 35. Uh-huh.

25 Q. So if you could please turn to page 74 of

1 your declaration.

2 Let me know when you're there.

3 **A. I'm on 74.**

4 Q. So there in bold, italic text, you included
5 the text of Element 1.6 of the '767 patent claims.

6 Do you see that?

7 **A. Yes, I see that.**

8 Q. And this element begins, quote, the control
9 component receiving output signals from sensors, close
10 quote.

11 Do you see that?

12 **A. I see it without your quotes, but I -- I**
13 **get your point. Yeah.**

14 Q. Yeah.

15 And it ends -- basically the last three lines as
16 you've produced them here, I'll quote, in order that
17 subsequent operation of linear resonant vibration
18 module produces desired outputs from the one or more
19 sensors corresponding to one or more operational
20 control parameters."

21 Do you see that?

22 **A. I'm sorry. That's in the 1.6 limitation**
23 **bolded and italicized; is that where you're pointing**
24 **me?**

25 Q. That's right.

1 A. Yeah, I see it.

2 Q. And would you agree that this is describing
3 some sort of feedback mechanism where the control
4 component is adjusting outputs such that the outputs
5 from the one or more sensors have desired values?

6 ATTORNEY DEUTSCH: Objection, form.

7 THE WITNESS: I think I addressed that on
8 the very next page near the top, "The microprocessor
9 adjusts one or more operational control outputs, such
10 as then H-bridge transistor control signals," et
11 cetera.

12 According to the received sensor, output
13 signals from the sensors in particular -- you know,
14 dot, dot, dot -- adjust control outputs in order to do
15 the subsequent operation produces desired outputs from
16 the sensor.

17 So I think that's where I would say the
18 answer to your question is.

19 BY ATTORNEY RUBIN:

20 Q. All right. And then on page 75, starting
21 at -- well, on page 75, the sixth line from the bottom,
22 you refer to this in your words as, quote, a -- I'm
23 sorry, as a, quote, feedback system.

24 Would you agree?

25 A. I'm just taking a look at that in context.

1 I use the term "feedback system" to describe what
2 is -- what is performing the seeking. Yeah.

3 Q. Now, the sensors that are involved in this
4 feedback system are something that you identify in the
5 prior art in the Cosper reference, correct?

6 ATTORNEY DEUTSCH: Objection, form.

7 THE WITNESS: I would just want to -- I
8 certainly talk about sensors in the -- with regards to
9 the Cosper reference, but I'm not going to say that's
10 the only place.

11 BY ATTORNEY RUBIN:

12 Q. Okay. You don't offer any opinion that the
13 sensors in the Shahoian reference satisfy the
14 requirements of Limitation 1.6 that the, quote,
15 Subsequent operation of linear resonant vibration
16 modules produces desired outputs from the one or more
17 sensors," correct?

18 ATTORNEY DEUTSCH: Objection, form.

19 THE WITNESS: I'm just -- I want to just
20 review this a little bit before I answer your question.

21 I don't see right now that I invoke
22 Shahoian's reference in this argument, again, that the
23 1.6 limitation is anticipated.

24 BY ATTORNEY RUBIN:

25 Q. Would you agree that the sensors in the

1 Shahoian reference function to receive user input
2 rather than to measure the operation of the linear
3 resonant vibration module?

4 A. I guess I would want to refresh my memory
5 by pulling it -- pulling it up, if that -- if that's
6 okay with you.

7 Q. Sure. So I think at least some relevant
8 description in Exhibit 1004 would be the paragraph
9 on -- in Column 4, starting at line --

10 A. Sorry. Did you say -- I heard "7," but I
11 didn't hear the previous digit in -- that you were
12 directing me.

13 Q. Sorry. Column 4, starting at line 56.

14 A. 56. Okay.

15 What I'm seeing there is sensors 28 sense the
16 position, motion, and/or other characteristics of user
17 manipulandum 34 of the interface device along one or
18 more degrees of freedom to provide signals.

19 That's what I'm seeing there. And they're not
20 specific to user inputs.

21 Q. So in the sentence that starts at the
22 bottom of Column 4, Shahoian says, quote, For example,
23 these sensor signals can be used by the host computer
24 to influence the host application program (e.g., to
25 steer a race car in a game or move a cursor across the

1 screen, close quote.

2 Do you see that?

3 A. I see it.

4 Q. So at least in that sentence it's talking
5 about using sensor signals to detect user input; would
6 you agree?

7 A. That example, "e.g., detects user inputs,"
8 yes.

9 Q. So turning back to your declaration, if we
10 look at the section of your declaration addressing
11 Limitation 1.6 and the combination of Shahoian with
12 Cosper -- so that's paragraphs 136 and 137 -- you don't
13 cite to anything in those paragraphs from Shahoian as
14 satisfying this limitation, 1.6; do you agree?

15 A. From looking here right now, I don't --

16 ATTORNEY DEUTSCH: Objection, form.

17 THE WITNESS: Looking here right now, I
18 don't see such a citation.

19 BY ATTORNEY RUBIN:

20 Q. And in particular, you don't offer an
21 opinion in -- in those paragraphs, 136 and -- 130 -- or
22 137, that the sensors in Shahoian would satisfy
23 Limitation 1.6, correct?

24 A. These paragraphs address the combination of
25 Shahoian with Cosper, and I -- and I think that is

1 correct in -- in these paragraphs, that they do not
2 offer an opinion about Shahoian by itself.

3 Q. If you could turn, please, to page 76 of
4 the same declaration.

5 A. Okay. I'm on 76.

6 Q. And I'm going to read to you the last two
7 sentences of paragraph 137. Quoting, it says,
8 "Additionally, the term 'the one or more sensors' lacks
9 antecedent basis. For my analysis here, I have
10 attempted to interpret the claim to the best of my
11 ability, although I believe the lack of antecedent
12 basis renders the meaning of the claim term
13 indefinite."

14 Do you see that?

15 A. I see that.

16 Q. So I understand that you believe that
17 there's a lack of antecedent basis, but you do say that
18 you've attempted to interpret the claim to the best of
19 your ability, and so as you attempted to apply
20 Limitation 1.6 to the prior art, you've offered
21 opinions on, how you interpreted the phrase, quote, the
22 one or more sensors, close quote?

23 ATTORNEY DEUTSCH: Objection, form.

24 THE WITNESS: First of all, I didn't apply
25 1.6 to the prior art. I applied the prior art to 1.6,

1 if that makes a difference. Okay?

2 And I'm applying -- I guess to the best of
3 my ability I'm looking for -- there's -- your -- your
4 two terms which you -- you read out when you were
5 reading me -- you even pointed out the first and last
6 sentence of -- or -- or lines of 1.6.

7 The beginning, the term used is "sensors,"
8 and near the end it's "the one or more sensors." And
9 so that's the issue, is the difference between those
10 two, and not -- and using "the" implies that there's a
11 prior mention of it.

12 So there's some confusion there. I looked
13 for I would say the biggest interpretation there, "one
14 or more."

15 BY ATTORNEY RUBIN:

16 Q. So as you've interpreted Limitation 1.6 in
17 offering your opinions about the combinations of the
18 prior art, did you assume that, quote, the one or more
19 sensors, close quote, referred to the same thing as,
20 quote, sensors, close quote, near the beginning of
21 Limitation 1.6?

22 ATTORNEY DEUTSCH: Objection, form and
23 scope.

24 THE WITNESS: I think that characterizes my
25 assumption, yes, with -- subject to the ambiguity that

1 they aren't written the same. So that's why I --
2 that's why I believe that the meaning is indefinite.

3 ATTORNEY RUBIN: So if you have the '767
4 patent open or if you can open that.

5 And I'll upload that for the court
6 reporter's benefit.

7 THE WITNESS: I'm just -- actually, I have
8 a hardcopy of that patent right here.

9 ATTORNEY RUBIN: Okay.

10 THE WITNESS: So I'm going to just use
11 that.

12 BY ATTORNEY RUBIN:

13 Q. So just to be clear, it sounds like you
14 have hardcopies of the two declarations. You have a
15 hardcopy of the '767 patent.

16 Are there any other documents you have hardcopies
17 of with you today?

18 A. No.

19 Q. Just those three?

20 A. But I have two copies of the '767 -- or
21 maybe that's Craig's copy. But in terms of unique
22 documents, I have a hardcopy of '767, and I have the P1
23 and P2 doc- -- declarations that we talked about,
24 177P1 -- IP1, 177IP2, and that's it.

25 Q. Do you have any notes with you here today?

1 A. **No, I don't.**

2 Q. Well, I won't -- I won't ask you to tell me
3 anything about counsel's copy of the '767 patent, but
4 yeah, I understand you've got your copy of the '767
5 patent in front of you. And if you could turn to the
6 last page, Column 11.

7 A. **Okay.**

8 Q. So starting at the end of line 25 is the
9 word "sensors."
10 Do you see that?

11 A. **Yes.**

12 Q. And that's also -- line 25 is also where
13 Limitation 1.6 starts; would you agree?

14 A. **Yes.**

15 **I think just checking the first few words and the**
16 **last few words, line 25 to I guess 30-some -- 31, '2,**
17 **'3, are the same as the highlighted text in bold on**
18 **page 74 of my declaration.**

19 Q. Okay. So that Limitation 1.6 which appears
20 in the '767 patent, Column 11, lines 25 through 33,
21 actually contains the word "sensors" three times. I'll
22 point you to the three times that it appears.

23 So there's once starting at the end of line 25.

24 Do you see that?

25 A. **Yes. It's hyphenated into the next line.**

1 **Yeah.**

2 Q. And then the lines -- I'm sorry.

3 Withdrawn.

4 Line 30 contains the phrase, quote, these sensors.

5 Do you see that?

6 **A. I see that too.**

7 Q. And then line 32 contains the phrase,

8 quote, the one or more sensors, close quote.

9 Do you see that?

10 **A. Yes, I see that.**

11 Q. So understanding that it's your opinion

12 this limitation is actually indefinite, as you've

13 interpreted the claim to the best of your ability in

14 offering your opinions, have you interpreted

15 Limitation 1.6 such that "sensors" starting at the end

16 of line 25, "the sensors" on line 30, and "the one or

17 more sensors" on line 32 are all referring to the same

18 thing?

19 ATTORNEY DEUTSCH: Objection, form.

20 **THE WITNESS: I would just say I -- I --**

21 **this is why I believe the meaning of that term is**

22 **indefinite, because I can't answer that question from**

23 **what I read in the claim element.**

24 BY ATTORNEY RUBIN:

25 Q. Well, I take it from your declaration that

1 there is some interpretation of Limitation 1.6 that you
2 applied in an offering opinion that the combinations of
3 the prior art you discussed in your declaration
4 satisfied that limitation.

5 Is that right, that there's some interpretation of
6 Limitation 1.6 that you applied?

7 ATTORNEY DEUTSCH: Objection, form.

8 **THE WITNESS: I struggle to know the**
9 **definite meaning of the claim term, but under many --**
10 **or a lot of possible interpretations, I think Cosper**
11 **covers them.**

12 BY ATTORNEY RUBIN:

13 Q. So is one of the interpretations that you
14 just referred to the interpretation where "sensors" on
15 lines 25 to 26, "the sensors" on line 30, and "the one
16 or more sensors" on line 32 all refer to the same
17 things?

18 ATTORNEY DEUTSCH: Objection, form.

19 **THE WITNESS: I -- I didn't, you know, form**
20 **an opinion on whether they're -- those things are the**
21 **same. That's -- a lot of this is legal knowledge**
22 **beyond my expertise, so however that's resolved,**
23 **sensors maps to it and applies to it, but I don't have**
24 **an opinion on whether -- you know, whether or not it**
25 **has antecedent basis and they're the same.**

1 BY ATTORNEY RUBIN:

2 Q. Well, let's imagine that under the correct
3 interpretation of Limitation 1.6, quote, the one or
4 more sensors, close quote, on line 32, have to be
5 different sensors from, quote, sensors on lines 25
6 through 26 or, quote, the sensors on line 30.

7 That's not an interpretation that you've shown
8 that Cosper satisfies in your declaration; would you
9 agree?

10 ATTORNEY DEUTSCH: Objection, form and
11 mischaracterizes.

12 THE WITNESS: I feel that pulls me pretty
13 far from my opinion and my way of thinking about it, so
14 I would not agree.

15 BY ATTORNEY RUBIN:

16 Q. All right. Point to me where you've
17 offered such an opinion.

18 A. My point was I have not offered that
19 opinion. I have not offered an opinion that the --
20 those two versions are the same.

21 Q. Sorry. When you refer to "those two
22 versions," two versions of what?

23 A. I think you used the word "versions."
24 Correct me if I'm wrong.

25 But the claim term is ambiguous and it's -- you

1 know, you -- you described "sensors" and contrasted
2 that with "one or more sensors," and I have not offered
3 an opinion that those things are the same, if I
4 understood your question correctly.

5 Q. So my question was about what you've
6 pointed to in the prior art combination that you
7 propose based upon Shahoian and Cosper.

8 You understand that in order to demonstrate
9 obviousness you need to show that that combination
10 would have satisfied each element of the claims,
11 including each element of what you've called Limitation
12 1.6, correct?

13 A. Sorry. I -- I lost the beginning of the
14 question.

15 Q. All right. So I think earlier today in
16 answering one of my questions you pointed out that the
17 analysis that you did was applying the combination of
18 the prior art to the -- the claims that Apple contends
19 are invalid.

20 Would you agree that that's at least one of the
21 things you did in your declarations?

22 A. Yes.

23 Q. All right. So would you agree that in
24 order to show a claim is obvious based upon the
25 combination of Shahoian with Cosper, you need to show

1 that that combination satisfies each element of that
2 claim and, thus, for Claim 1, among the things you'd
3 need to show is that that combination satisfies each
4 element of Limitation 1.6?

5 **A. Is that a question or...**

6 Q. Yeah.

7 You would agree that that's something you need to
8 show?

9 **A. I agree I need to show the combination**
10 **describes all the pieces of the claim.**

11 Q. So among the things you need to show is
12 that the combination of Shahoian and Cosper satisfies
13 the limitation "sensors" from lines 25 to 26, right?

14 **A. Yes.**

15 Q. And you also need to show that the
16 combination of Shahoian with Cosper satisfies "the
17 sensors" from line 30, right?

18 **A. Yes.**

19 Q. And you also need to show that the
20 combination of Shahoian with Cosper satisfies "the one
21 or more sensors" from line 32, correct?

22 **A. Yes.**

23 Q. All right. So in the combination of Cosper
24 with Shahoian as you apply it to Claim 1, are you
25 pointing to the same thing in that combination for each

1 of those three elements?

2 ATTORNEY DEUTSCH: Objection, form.

3 THE WITNESS: Well, as I said, I tried to
4 resolve the potential ambiguity to the best of my
5 ability.

6 And the way I read it and the way I think a
7 POSITA would read Cosper is that "sensors," the word
8 "sensors," would -- would apply to "sensors" -- I'm
9 sorry, I was doing air quotes, but I -- I know that
10 doesn't count, but I think my answer still holds -- and
11 also the word "sensors" -- the description of sensors
12 in Cosper also applies to one or more sensors, and I
13 don't have an opinion if those are the same thing or
14 different things.

15 BY ATTORNEY RUBIN:

16 Q. So if I understand that last sentence there
17 correctly, are you saying that you don't have an
18 opinion whether the sensors in Cosper that satisfy the
19 limitation "sensors" from Column 11, line 25 of the
20 '767 patent are the same as the sensors in Cosper that
21 satisfy "the one or more sensors" from Column 11,
22 line 32 of the '767 patent?

23 A. I don't think that characterizes my answer
24 correctly.

25 I'm saying the sensors of Cosper describe sensors

1 on line 50, or approximately, the sensors, and they
2 also apply to the one or more sensors. If those are
3 different things, if those are the same things, it
4 still applies. They -- the -- they still apply to all
5 of them.

6 Q. All right. Staying in the same
7 declaration, could you please turn to page 85?

8 A. Okay. I'm on 85.

9 Q. So here you're discussing the combination
10 of prior art references Shahoian plus Cosper plus
11 Rossi.

12 Do you see that?

13 A. Yes, in regards to Claims 1 through 4.

14 Q. And here you reproduce a claim limitation
15 that you label 2.3 which reads, I'll quote, a
16 directional-signal splitter/inverter that generates two
17 complementary internal signals, d and d bar,
18 corresponding to directional-signal d; and, close
19 quote.

20 Do you see that?

21 A. I see it.

22 Q. Now turning to the next page, you reproduce
23 the limitation that you labeled 2.4. And I'll quote
24 from the -- I'll quote the first two lines as you've
25 reproduced them. "Two pairs of solid-state switches, a

1 first switch of each pair controlled by internal signal
2 d and a second switch of the pair controlled by
3 internal signal d bar."

4 Do you see that?

5 **A. Yes.**

6 Q. So would you agree that the internal signal
7 d bar referred to in Limitation 2.4 is the same as the
8 internal signal d bar generated by the
9 splitter/inverter in Limitation 2.3?

10 ATTORNEY DEUTSCH: Objection, form.

11 **THE WITNESS: Sitting here right now, I**
12 **would say yes.**

13 BY ATTORNEY RUBIN:

14 Q. Now, at the top of page 86 you've
15 reproduced and annotated a portion of Rossi Figure 6.

16 Do you see that?

17 **A. I see it at the top of the page.**

18 Q. Would you agree that Rossi Figure 6
19 contains two inverters, one that's close to the
20 transistor SW2 and another one that's close to the
21 transistor SW3?

22 **A. Yes, I see that.**

23 Q. So would you agree that in Rossi --
24 withdrawn.

25 Would you agree that in the portion of Rossi that

1 you cite there is no inverter that generates a signal
2 that's used by both of the switch pairs?

3 ATTORNEY DEUTSCH: Objection, form.

4 THE WITNESS: What I'm -- what I -- what my
5 opinion is saying is that -- let me get to where I've
6 got that.

7 Yeah, I -- you know, the switch includes a
8 directional signal splitter and inverter I that
9 generates two complementary internal signals, d and d
10 bar, or given their names in Rossi, IN1 and IN1 bar.

11 So it contains the exact structure or --
12 you know, and function that's -- I don't want to use
13 those -- I know those words have significance, but it
14 contains the exact things that are described in
15 Limitation 2.3, and that's my understanding of
16 anticipation.

17 BY ATTORNEY RUBIN:

18 Q. You just referred to anticipation.

19 Your opinions in your declaration are that the
20 claims are obvious, not that they're anticipated; is
21 that right?

22 A. Well, that's -- that's fair, but in
23 addition -- it certainly makes it obvious as well.

24 Q. So as you apply the combination of Shahoian
25 and Cosper and Rospi -- Rossi -- withdrawn.

1 As you apply the combination of Shahoian, Cosper
2 and Rossi to Claim 2, would you agree that -- that the
3 two pairs of solid-state switches you point to are a
4 first pair, SW1 and SW3; and a second pair, SW2 and
5 SW4?

6 ATTORNEY DEUTSCH: Objection, form.

7 THE WITNESS: Let's see. Can we get back
8 to the -- the claim limitation that we're talking about
9 here?

10 I'm sorry. Could you clarify that claim
11 limitation for me?

12 BY ATTORNEY RUBIN:

13 Q. Sure.

14 So I'll read you the beginning of claim
15 Limitation 2.4. From the beginning to the first comma
16 reads, quote, two pairs of solid-state switches, close
17 quote.

18 A. Oh, sorry. Okay. My -- my pages got a
19 little mixed up. "First pair controlled by internal
20 signal d and a second switch of the pair controlled by
21 d bar."

22 Okay. I'm there.

23 Q. All right. Right now I'm just asking about
24 the first six words, quote, two pairs of solid-state
25 switches."

1 Do you see that?

2 A. Okay.

3 Q. All right. And so I think you identify
4 what those two pairs are at the beginning of your
5 paragraph 153.

6 Do you see paragraph --

7 A. Yes.

8 Q. -- 153?

9 So you would agree that the two pairs that you
10 identify in the prior art are the first pair, Rossi's
11 switches S1 -- SW1 and SW3; and the second pair,
12 Rossi's switches SW2 and SW4?

13 ATTORNEY DEUTSCH: Objection, form.

14 THE WITNESS: I think that's -- that is
15 what it says in that first sentence, right? So yes, I
16 agree with that.

17 BY ATTORNEY RUBIN:

18 Q. Now, as we saw on page 85, Limitation 2.3
19 requires a splitter/inverter, and on page 86 you
20 actually label some components with an annotation and
21 arrows that say -- that says "splitter/inverter."

22 Do you see that?

23 A. Yes, I see the figure with annotations on
24 page 86.

25 Q. All right. And that -- what you've

1 annotated as being a splitter/inverter includes a
2 circuit schematic signal -- symbol, a circuit schematic
3 symbol for an inverter labeled I to the left of
4 transistor labeled SW3, correct?

5 ATTORNEY DEUTSCH: Objection, form.

6 THE WITNESS: Yes. That is the very
7 well-known standard schematic symbol for an inverter.
8 It's a triangle with a little circle at the tip.

9 BY ATTORNEY RUBIN:

10 Q. And the output of that inverter controls
11 the switch SW3, correct?

12 A. Yes.

13 Q. Now, the output of that inverter, which
14 you've -- which is part of what you've annotated as
15 splitter/inverter, does not control the transistor SW2,
16 correct; there's a different inverter that controls
17 SW2?

18 ATTORNEY DEUTSCH: Objection, form.

19 THE WITNESS: The way I interpreted 2.4 is
20 that the first switch is controlled by internal signal
21 d. It does not say that it's controlled by a specific
22 component. And in fact, the IN1 bar signal in Rossi
23 corresponds exactly to the signal d bar, and both --
24 and SW2 and SW3 in Rossi's figure are both controlled
25 by the same signal just the way it describes in

1 **Limitation 2.4.**

2 And I would also add that there are many
3 ways to supply the correct switch signals known to
4 persons of ordinary skill in the art at the time, in
5 fact way before the time of this invention, and this is
6 one way you can do it. There's a very specific mapping
7 between the signals labeled in Rossi on those switches
8 and this claim limitation signals.

9 BY ATTORNEY RUBIN:

10 Q. So as you've applied -- withdrawn.

11 As you've interpreted Limitation 2.4 in your
12 analysis applying the combination of the prior art to
13 Claim 2, have you interpreted Limitation 2.4 to require
14 that at least one switch in each pair be controlled by
15 the same signal d bar?

16 ATTORNEY DEUTSCH: Objection, form.

17 **THE WITNESS:** It says a second switch of
18 the pair controlled by internal signal d bar, and I --
19 I didn't think that requires interpretation. It's --
20 it would be clear to any POSITA what that requires.

21 BY ATTORNEY RUBIN:

22 Q. So you would agree that the one switch in
23 each pair has to be controlled by d bar, correct?

24 ATTORNEY DEUTSCH: Objection, form.

25 **THE WITNESS:** The second switch of each

1 pair, yeah. That's the one I -- that's what I agree
2 with.

3 BY ATTORNEY RUBIN:

4 Q. All right.

5 A. That's what's there.

6 Q. But as you've interpreted Claim 2, that
7 signal d bar controlling each of those two switches
8 does not need to come from the -- as an output from the
9 same inverter; is that right?

10 ATTORNEY DEUTSCH: Objection, form,
11 mischaracterizes.

12 THE WITNESS: The -- the -- as I read that,
13 the limitation, 2.4, requires that the switch is
14 controlled by a certain signal. It doesn't specify or
15 require how that signal is generated.

16 BY ATTORNEY RUBIN:

17 Q. And your answer right now was about
18 Limitation 2.4.

19 If you take all of the limitations of Claim 2
20 together, does Claim 2 require that both of the second
21 switches be controlled by a signal generated by the
22 same inverter?

23 ATTORNEY DEUTSCH: Objection, form and
24 scope.

25 THE WITNESS: I -- I've -- in forming my

1 opinion, I've taken each limitation on its own and
2 looked for support in the prior art that in
3 combination, you know, makes the whole claim invalid.

4 BY ATTORNEY RUBIN:

5 Q. So in doing that did you believe that
6 Claim 2 requires that both of the second switches be
7 controlled by a signal generated by the same inverter,
8 or did you think the claim could be satisfied by second
9 switches controlled by internal signals d bar that were
10 generated by two different inverters?

11 ATTORNEY DEUTSCH: Objection, scope.

12 THE WITNESS: I -- I -- I didn't -- I don't
13 think it's required to have an opinion about how the
14 signals d bar and d are generated. It's -- it's clear
15 that Rossi labels the two inputs to those two switches
16 IN1 bar.

17 And so those two signals have the same
18 name, and a POSITA would know that no matter how it's
19 generated -- first of all, having the same name means
20 they're the same signal in -- in schematic diagrams.

21 Secondly, the logic that's shown with Rossi
22 shows two inverters, and a POSITA would know that the
23 two outputs of the two inverters, because their inputs
24 are the same, the two outputs would be identical and
25 would know that it's not a mistake, those two are

1 labeled with the same label, IN1 bar, because they're
2 the same, and they're the same signal, the same
3 internal signal corresponding exactly to d bar and d.

4 BY ATTORNEY RUBIN:

5 Q. All right. I would like to ask you to turn
6 in the same declaration to page 90, please.

7 A. Okay. I'm on 90.

8 Q. So towards the bottom of page 90 is the
9 start of paragraph 158. And I'll read the portion of
10 the first sentence up to the first comma. Quote, The
11 Shahoian-Cosper-Rossi linear resonant vibration module
12 includes an accelerometer, close quote.

13 A. I see it.

14 Q. All right. So I don't see any citations in
15 that paragraph to any of the prior art references. I
16 do see a citation at the very end the '767 patent.

17 But would you agree that you don't cite in this
18 paragraph to any of the prior art references?

19 ATTORNEY DEUTSCH: Objection, form.

20 THE WITNESS: I do not see a citation
21 there.

22 ATTORNEY DEUTSCH: Neil, I wonder if we are
23 due for a break.

24 ATTORNEY RUBIN: Sure. Yeah. How about
25 I'll just --

1 ATTORNEY DEUTSCH: Don't mean to interrupt.

2 ATTORNEY RUBIN: -- wrap up this line of
3 questions, and then we can take a break.

4 THE WITNESS: That's okay with me.

5 ATTORNEY RUBIN: Yeah.

6 BY ATTORNEY RUBIN:

7 Q. So when you say that the
8 Shahoian-Cosper-Rossi linear resonant vibration module
9 includes an accelerometer and then in the next sentence
10 you say the acceleration -- or I'm sorry, in the next
11 sentence you say the accelerometer is a vibration
12 sensor, do you believe that a particular one of those
13 three references -- Shahoian, Cosper, and Rossi --
14 includes an accelerometer that is a vibration sensor?

15 A. I just have to review and look for it. But
16 I recall it, but I don't recall which particular one.

17 ATTORNEY RUBIN: Well, let's take a break.

18 THE WITNESS: Okay.

19 (RECESS TAKEN.)

20 BY ATTORNEY RUBIN:

21 Q. So just before the break I asked you some
22 questions about what you were pointing to as an
23 accelerometer in the Shahoian-Cosper-Rossi combination,
24 and you answered that you would have to review and look
25 for it and didn't recall which particular reference

1 included an accelerometer.

2 In the -- over the break did you have a chance to
3 look or think about it some more, or is it the same
4 answer as we sit here right now?

5 A. No, I didn't do anything over the break. I
6 took a break.

7 Q. Perfectly fine.

8 So if you could turn in the declaration that
9 addresses the Shahoian combinations to page 91.

10 Are you there?

11 A. Yeah. I am on 91, and I am just
12 referencing the TOC so that I know where I am.

13 Okay.

14 Q. All right.

15 A. And yeah, just for the record, this is the
16 attorney docket 0177IP1.

17 Q. Very good.

18 So right above paragraph 159 on this page you
19 reproduce what you call Limitation 3.2, which begins,
20 I'll quote, wherein the control program continuously
21 monitors output from the vibration sensor, close quote.

22 Do you see that?

23 A. I see that.

24 Q. All right. Do you cite to anything in the
25 prior art that shows that monitoring is done, quote,

1 continuously?

2 ATTORNEY DEUTSCH: Objection, form.

3 THE WITNESS: It's my opinion that the
4 combination discloses a control program which
5 continuously monitor -- monitors that output.

6 BY ATTORNEY RUBIN:

7 Q. So what would be the evidence that supports
8 your opinion that the monitoring is -- is done
9 continuously?

10 A. Well, like I say below, I know the
11 combination is like the examples recited by '767, which
12 recites that the control loop uses continuous feedback
13 control. So there's a control loop in the combination,
14 and so it maps pretty well, in my opinion.

15 Q. So the evidence that the prior art
16 combination monitors continuously is this quote that
17 you have from the '767 patent specification saying that
18 its control loop uses continuous feedback?

19 ATTORNEY DEUTSCH: Objection to form.

20 THE WITNESS: No, I would not use -- I'm
21 sorry if I misspoke to that degree. I would not use a
22 patent itself to disqualify it or to call it prior art.

23 BY ATTORNEY RUBIN:

24 Q. So what is your basis for having the
25 opinion that the monitoring in the combination of prior

1 art references would be continuous monitoring?

2 A. A control program of this combination --
3 and, you know, I could start looking more at those
4 references to find specifics, but certainly I would
5 have used, at a minimum, a -- the disclosures that
6 there's a control process which reads sensors and
7 adjusts the outputs to achieve a goal to optimize
8 performance and that that is widely, widely known to be
9 implemented with a control loop.

10 So if there's -- and -- and the -- you know,
11 the -- the -- if there's a specific thing, I would need
12 to look for it more, like a mention in a specific
13 citation of control loop, but we could start -- we
14 can -- I can't recall specifically where that is, but
15 that's what I'm talking about.

16 Q. Turning to page 108 of the declaration
17 we're talking about with attorney docket number ending
18 in P1.

19 Let me know when you're there.

20 A. Okay. I am there.

21 Q. So there's a Section B titled, Analysis of
22 Shahoian, Copper -- Cosper, Ramsey, and Aldrich with
23 respect to Claims 1 through 5.

24 Would you agree that for that specific combination
25 of those four references, you only offer an obviousness

1 opinion addressing Claim 1?

2 ATTORNEY DEUTSCH: Objection, form.

3 THE WITNESS: Well, I would have to look
4 through it.

5 BY ATTORNEY RUBIN:

6 Q. Well, let's --

7 A. I don't know until I -- you know -- you
8 mean Section B refers only to Claim 1?
9 Please clarify.

10 Q. Well, I think Section B is the section
11 where you're analyzing that combination of four
12 references with respect to any of the claims of the
13 '767 patent.

14 Now, for Ground 2B in Section 12 starting on
15 page 130, do you address a combination of Shahoian,
16 Cosper, Ramsey, Aldrich, and Rossi, so adding Rossi as
17 a fifth reference, but with respect to the four
18 references, Shahoian, Cosper, Ramsey, and Aldrich, I
19 believe the only claim analysis you provide is for
20 Claim 1.

21 Would you agree?

22 A. I guess, you know, really I -- I want to
23 review it to be careful because some of these analyses
24 of the -- of sublimitations -- or limitations of
25 Claim 1, you know, they go on kind of long, so I -- I

1 want to see for sure where we cite claim limitations.

2 1.5. 1.3. 1.6.

3 Right now, looking at these roughly 22 pages, I
4 see only the claim limitations as -- that are part of
5 Claim 1.

6 Q. All right. Can I have you turn to
7 Exhibit 1005, which is Izumi.

8 ATTORNEY RUBIN: And I'll put that in the
9 chat.

10 THE WITNESS: Okay. I have Izumi ending in
11 '294 up on the screen.

12 BY ATTORNEY RUBIN:

13 Q. All right. So this is a -- a reference
14 that you include in obviousness combinations that you
15 analyze in the second declaration we're here to address
16 today, the one with the docket number ending in P2.

17 Is that right?

18 A. Yes, that agrees with my -- my copy. And
19 yeah, that is correct.

20 Q. Would you agree that the Izumi patent
21 application describes using its invention as an
22 actuator in an electric shaver?

23 ATTORNEY DEUTSCH: Objection, form.

24 THE WITNESS: Predominantly, yes.

25 BY ATTORNEY RUBIN:

1 Q. Do you recall Izumi mentioning any
2 applications of its invention that did not involve an
3 electric shaver?

4 A. Well, I -- you know, the technical field,
5 paragraph 1, says, "The present invention relates to"
6 driving -- "a driving unit and a method for driving a
7 resonance system comprising an elastic body and a
8 moving element supported by the elastic body."

9 So it doesn't even mention shavers. It mentions
10 resonant systems. But I agree that predominantly this
11 describes examples in electric shavers.

12 Q. Would you agree that there's nothing in
13 Izumi that mentions haptic feedback?

14 A. I don't recall --

15 ATTORNEY DEUTSCH: Objection, form.

16 Sorry.

17 THE WITNESS: I don't recall a mention of
18 haptic feedback in Izumi right sitting here now.

19 BY ATTORNEY RUBIN:

20 Q. Could you turn to page 5 of the
21 specification, and in particular the last paragraph on
22 that page, paragraph 63.

23 A. Okay. I have paragraph 63.

24 Q. So the first sentence of paragraph 63 of
25 Izumi I'll read. Quote, Although each of the on time

1 and the off time of the voltage is controlled in order
2 to form the intended current waveform in this
3 embodiment, in the actual realtime control it can be
4 difficult to perform complicated control at every half
5 cycle or one cycle of the moving element 1 due to a
6 constraint of the control device such as CPU speed, ROM
7 capacity, etc."

8 Do you see that?

9 A. I see the -- yeah, I see that sentence.

10 Q. So would you agree that that sentence is
11 referring to using a control device that includes a CPU
12 and memory in order to perform what it refers to as,
13 quote, complicated control?

14 ATTORNEY DEUTSCH: Objection, form.

15 THE WITNESS: I -- I'm not sure I really
16 understand that question.

17 This is making a statement -- this is not
18 making a statement about what's being used.

19 BY ATTORNEY RUBIN:

20 Q. Okay. Can you help me understand what you
21 mean by -- by that?

22 ATTORNEY DEUTSCH: Objection, form, scope.

23 THE WITNESS: In order to form the intended
24 current waveform in the actual realtime control, it can
25 be difficult to perform complicated control at every

1 half cycle or cycle due to constraints from CPU speed.

2 So I mean it -- it doesn't say that it's
3 performing the complicated control. It says it can be
4 difficult, perhaps it's not even possible because of
5 their constraints from the CPU speed. That's how I
6 read that sentence.

7 BY ATTORNEY RUBIN:

8 Q. So I won't read the second sentence, but
9 you can see what it is. I will read the third
10 sentence. Quote, that is, the controller may use a
11 so-called PWM control method, close quote.

12 Do you see that?

13 A. Yes, I see that.

14 Q. Do you know what "PWM" stands for there?

15 A. PWM is a very, very widely used term in the
16 art known to every POSITA, which means pulse-width
17 modulation.

18 Q. And what is pulse-width modulation?

19 A. Modulation refers to the ability to vary
20 something, adjust it, and pulse width is the length of
21 time the pulse is turned on. So modulating the pulse
22 width is pulse-width modulation.

23 Q. The next sentence says, "In this case the
24 controller 6 can form an intended waveform without
25 using a complex control system."

1 Do you see that?

2 A. I see that.

3 Q. Do pulse-width modulation systems sometimes
4 utilize purely analog control methods?

5 ATTORNEY DEUTSCH: Objection, form and
6 scope.

7 THE WITNESS: Yeah, I -- I -- in the -- in
8 the abstract that -- you know, unrelated to this case,
9 PWM can perhaps be generated by an analog system.

10 BY ATTORNEY RUBIN:

11 Q. Are you familiar with the designs of switch
12 mode power supplies?

13 A. Only a little bit. It's not what I
14 consider my expertise.

15 Q. What's your understanding of what a switch
16 mode power supply is?

17 ATTORNEY DEUTSCH: Objection, scope.

18 THE WITNESS: My understanding is it
19 converts power from, for example, one voltage to
20 another by a circuit that switches it on and off and
21 filters the resulting power as needed for the user,
22 quote/unquote, or the person that used the output of
23 the switch mode power supply.

24 BY ATTORNEY RUBIN:

25 Q. And -- withdrawn.

1 Would that switching on and off be considered by
2 those in the art to be an example of pulse-width
3 modulation?

4 ATTORNEY DEUTSCH: Objection, scope.

5 THE WITNESS: Well, again, I haven't
6 offered any opinions about switch mode power supplies
7 that I can recall. And also, it's a field of its own
8 that I'm not an expert in.

9 But given those -- those qualifications,
10 no, I think there's other ways to control the switching
11 that are not PWM. Maybe some switch mode power
12 supplies use it, but maybe they use other switching
13 methods.

14 BY ATTORNEY RUBIN:

15 Q. So you should have in front of you your
16 declaration in the IPR that includes grounds based on
17 Izumi. So that's the declaration with the docket --
18 the attorney docket number ending in P2.

19 Do you have that?

20 A. Yes, I -- yes. I have that in front of me.

21 Q. Could you turn to page 72, please.

22 A. Okay. I'm at page 72.

23 Q. So right above paragraph 134 you quote the
24 claim limitation 1.5.3, which I'll read. Quote, A
25 switch that receives a directional signal d from the

1 processor and that selects a corresponding direction of
2 the two opposite directions in which the driving
3 component drives the movable component."

4 So the switch in that claim limitation -- you
5 point to a Figure 22A from Izumi.

6 In your opinion, does that figure depict a switch
7 that satisfies Limitation 1.5.3?

8 ATTORNEY DEUTSCH: Objection, form.

9 THE WITNESS: I think that figure satisfies
10 1.5.3.

11 BY ATTORNEY RUBIN:

12 Q. And what is the switch in that figure that
13 satisfies 1.5.3?

14 A. The figure clearly shows an H-bridge
15 circuit which is composed of four switches.

16 Q. Well, you're sort of getting at my
17 question, my real question.

18 Is there one switch in Figure 12 point -- I'm
19 sorry, Figure 22A that is made up of the four
20 transistors, or are there four switches, each one being
21 one of the transistors?

22 ATTORNEY DEUTSCH: Objection, form and
23 scope.

24 THE WITNESS: I think this combination
25 includes a switch, and it's described as H-bridge -- as

1 Izumi's H-bridge switch circuit. So a lot of times an
2 H-bridge is described as a switch.

3 BY ATTORNEY RUBIN:

4 Q. So I -- I think it's a reasonable question.

5 As you're applying Izumi -- combinations of Izumi
6 with other art to Limitation 1.5.3, what is it in this
7 figure that you're identifying as, quote, a switch?

8 ATTORNEY DEUTSCH: Objection, form.

9 THE WITNESS: I'm identifying the H-bridge
10 switch, composed of individual switches, but I'm -- I'm
11 looking for -- or I'm matching it based on an H-bridge
12 switch circuit.

13 BY ATTORNEY RUBIN:

14 Q. So the four transistors -- withdrawn.

15 So the circuit containing the four transistors is
16 the switch of Limitation 1.5.3; is that right?

17 ATTORNEY DEUTSCH: Objection, form.

18 THE WITNESS: It's the H-bridge switch
19 circuit, and yes, that contains four transistors acting
20 as switches.

21 BY ATTORNEY RUBIN:

22 Q. Let me see if I understand the points that
23 you're making here.

24 I think you've said more than once that each of
25 the transistors is a switch -- just taking that term in

1 isolation for the moment, each of the transistors is a
2 switch; is that right?

3 A. Transistors can operate in other ways as
4 well, but in H-bridge switches, by far the most common
5 understanding of how they operate is in switch mode.
6 So transistors have switch modes and they have other
7 modes for, like, amplifying audio, which is not a
8 switch. So in H-bridge switches, transistors are
9 almost -- to my knowledge, exclusively operated in a
10 switch mode.

11 Q. Okay. So the transistors that make up the
12 Izumi H-bridge are each a switch --

13 ATTORNEY DEUTSCH: Objection.

14 BY ATTORNEY RUBIN:

15 Q. -- as that circuit is meant to operate; is
16 that right?

17 ATTORNEY DEUTSCH: Objection, form.

18 BY ATTORNEY RUBIN:

19 Q. I mean, I think that's a point that you've
20 affirmative -- that you've volunteered a few times.
21 I'm not trying to trip you up here, but, I mean --

22 A. And I've answered it.

23 Q. Okay. So -- yeah.

24 So you don't disagree that each individual
25 transistor is operating as a switch in the Izumi

1 circuit -- in the Izumi H-bridge circuit?

2 ATTORNEY DEUTSCH: Objection, form.

3 THE WITNESS: I will say that I -- I
4 wasn't -- I didn't need to talk about the transistors
5 as switches in my opinion. I wasn't asked for an
6 opinion of that.

7 This is a circuit commonly -- very, very
8 commonly called an H-bridge switch, and the transistors
9 in H-bridge switches, which there seems to be always
10 four, they are very, very uniformly driven in switching
11 mode.

12 BY ATTORNEY RUBIN:

13 Q. Okay.

14 A. So you can call them switches, and you can
15 call the whole thing a switch.

16 Q. And as you're applying Izumi's circuits to
17 Limitation 1.5.3, it's the whole H-bridge that
18 you're --

19 A. The -- the --

20 Q. -- saying is the claim switch?

21 A. I'm sorry to interrupt you.

22 ATTORNEY DEUTSCH: Objection, form.

23 THE WITNESS: The limitation simply asks
24 for a switch.

25 BY ATTORNEY RUBIN:

1 Q. Well, let's try to -- I mean, I'll disagree
2 a little bit.

3 I think it says a switch that receives a signal
4 and that selects a corresponding direction, so it has
5 to be a switch that does certain things.

6 A. Okay.

7 Q. So I guess my -- my question for you is:
8 You've identified, I take it, a switch in Izumi that
9 you think does the things that the claim requires the
10 switch do, and am I correct in understanding that the
11 switch you've identified that you believe does those
12 things required by the claim is the H-bridge switch
13 which contains, at the very least, four transistors?

14 A. I didn't make an opinion on the difference
15 between those or which one is required. I think both
16 actually read directly onto the claim limitation.

17 Q. So one of the things that the claim
18 limitation requires the switch do is, quote, selects a
19 corresponding direction of the two opposite directions
20 in which the driving component drives the movable
21 component."

22 So let's pick one of the transistors, Q1.

23 Is it your opinion that Q1 selects a direction in
24 which the driving component drives the movable
25 component?

1 A. Well --

2 ATTORNEY DEUTSCH: Objection, form.

3 THE WITNESS: First of all, that's not an
4 opinion I was asked to render, and, you know -- but if
5 the Q1 is on, then it can move current from left to
6 right in the coil depicted in Figure 22A, and if it's
7 off, it cannot.

8 And, you know, to go any farther than that
9 I feel like I need to form a new opinion with, you
10 know, research, thinking about this more.

11 BY ATTORNEY RUBIN:

12 Q. Now, Limitation 1.5.3 requires the switch
13 receives, quote, a directional signal d.

14 Do you see that?

15 A. Yes.

16 Q. So what is the directional signal d in
17 Izumi?

18 A. I think I have some actual language on
19 that.

20 Paragraphs 137 and 138 talk about how the
21 direction is switched by the devices and the
22 transistors, and the -- 138 talks about how the signals
23 S1 through 4 change the direction.

24 Q. So in the opinions you're presenting in
25 your declaration, are you saying that, to take an

1 example, signal S1 satisfies the claim requirement of,
2 quote, a directional signal d?

3 A. I think what I mean by paragraph 138 is the
4 signals S1 through S4, the -- the -- collectively are a
5 directional signal. And there's lots of examples in --
6 of signals comprised of more than one -- let's say
7 wire, for example. For example, a digital video signal
8 might have eight wires sending the video signal.

9 Q. So would you agree that if you know --
10 withdrawn.

11 Would you agree that if the only information you
12 have about the control signals at a particular point in
13 time is that the control signal S1 has a value such
14 that transistor Q1 is off, you don't know whether the
15 driving component is driving the movable component at
16 that moment in time?

17 A. What my opinion says is that the four
18 signals collectively are a direction signal, S1 through
19 S4.

20 Q. So you're not offering the opinion that S1
21 by itself would satisfy the -- the claim limitation of
22 a directional signal?

23 ATTORNEY DEUTSCH: Objection, form and
24 scope.

25 THE WITNESS: Sitting here now, I don't

1 think that my opinion equates one signal, S1, with the
2 direction signal, but it's a part of the direction
3 signal.

4 BY ATTORNEY RUBIN:

5 Q. Could you please turn to page 92.

6 Are you there?

7 A. Not quite, but --

8 Q. Okay.

9 A. But now I'm on 92.

10 Q. So right above paragraph 162 you reproduce
11 Limitation 3.1, which requires, quote, a vibration
12 sensor.

13 Do you see that?

14 A. Yes.

15 Q. And then in the first sentence of
16 paragraph 162, you say, and I'll quote, "The
17 Izumi-Cosper-Rossi linear resonant vibration module
18 includes a vibration sensor (accelerometer) in
19 accordance with Cosper, in addition to the sensors
20 associated with 'position' and 'velocity' that are used
21 as part of the feedback control."

22 Do you see that?

23 A. Yes.

24 Q. And so much like the corresponding
25 paragraph in the other declaration I asked you about

1 this morning, I -- I don't see a citation here to any
2 evidence of an accelerometer in any of these prior art
3 references.

4 Do you know which reference has an accelerometer?

5 ATTORNEY DEUTSCH: Objection, form.

6 **THE WITNESS: I think this is what we meant**
7 **to -- what I meant to say or we meant to say in**
8 **accordance -- by in accordance with Cosper, Cosper's**
9 **accelerometer, and to the extent that that clarifies my**
10 **earlier answer also.**

11 BY ATTORNEY RUBIN:

12 Q. If we could turn to page 102 of your
13 declaration with the docket number ending in P2.

14 A. **Okay. I'm at page 102.**

15 Q. So in paragraph 178 you have some
16 discussion of a prior art reference called Ibuki, which
17 is cited as Exhibit Apple 138.

18 Can you see that?

19 A. **Apple 1038, but yeah.**

20 Q. I stand corrected. Yes.

21 So just -- just below the halfway point of page
22 102, you quote from Ibuki, quote, at least one of a
23 driving frequency, the number of revolutions per unit
24 time, and an amplitude of the blade in the cleaning
25 drive mode is differentiated from a corresponding one

1 in the normal drive mode."

2 Do you see that?

3 A. Yes, I do.

4 Q. And then in your sentence following that,
5 you say, and I'll quote, "For example, the frequency is
6 higher in the 'normal drive mode' than in the 'cleaning
7 drive mode.'"

8 Do you see that?

9 A. Yes.

10 Q. Now, would you agree that Ibuki doesn't
11 talk about any of the frequencies it utilizes being
12 resonant frequencies?

13 ATTORNEY DEUTSCH: Objection, form and
14 scope.

15 THE WITNESS: I would want to check Ibuki a
16 little bit on that. I can't recall right now, sitting
17 here.

18 BY ATTORNEY RUBIN:

19 Q. So taking as -- well, withdrawn.

20 Taking the example that you give in the sentence I
21 just quoted where the normal drive mode frequency is
22 higher than the cleaning drive mode frequency, do you
23 have an opinion as to which if either of those
24 frequencies would be at resonance?

25 ATTORNEY DEUTSCH: Objection, form.

1 THE WITNESS: No, I don't have that -- an
2 opinion either way on that. I wasn't asked to opine on
3 that, at least the best -- at least to my best
4 recollection.

5 BY ATTORNEY RUBIN:

6 Q. If you could just turn to page 126, please,
7 of this declaration.

8 A. Okay. I'm on 126.

9 Q. So in paragraph 219, the sentence that
10 starts at the bottom of the page reads, and I'll quote,
11 "As I discussed, Shahoian's H-bridge switch circuit
12 provides a switch as recited by Element 1.5.3."

13 Now, this is in the context of a discussion of the
14 Izumi-Cosper-Ibuki-Aldrich combination, so I'm going to
15 guess that citing to Shahoian in this paragraph was not
16 what was intended?

17 A. Yeah. I think that was a typo we
18 identified.

19 That's certainly not intended to be Shahoian's
20 H-bridge, but rather Ibuki's H-bridge or, let's see --
21 yeah, and we are not relying on Rossi there, so that
22 would be Ibuki's -- sorry, Izumi's H-bridge.

23 So yeah, sorry about that typo on the last line of
24 126, page 126.

25 Q. So way back at the beginning of the

1 deposition I had asked you whether there were any
2 errors that you were aware of, and you referred to
3 something which I don't think is this issue, and I'll
4 forgive you for not necessarily knowing about every
5 typo that might have been in here, but the -- the error
6 that you did remember you hadn't been able to find in
7 the declaration.

8 With more time to think about things or as we've
9 been going through your declarations today, do you --
10 do you have any better recollection of where that error
11 was?

12 A. Not at this time. I was -- you know, there
13 are several declarations, and some of them use Rossi,
14 and it did relate to Rossi's H-bridge.

15 So I -- I don't remember if it's in this one or
16 not, and since this morning I have not seen it. And I
17 would have called it out to you if I had seen it.

18 And I -- and I -- I'm sorry I didn't include that
19 one Shahoian typo I forgot about this morning. I --
20 you know, I do recall it. We ran into it in -- in depo
21 prep.

22 Q. Okay. Are there any other typos or
23 corrections that you can think of now that you didn't
24 remember earlier?

25 A. Not at this time in my head, no.

1 Q. Okay.

2 ATTORNEY RUBIN: Well, I'll pass the
3 witness as to these two IPR declarations.

4 ATTORNEY DEUTSCH: Thanks. Let's take a
5 short break.

6 (RECESS TAKEN.)

7

8 EXAMINATION

9

10 BY ATTORNEY DEUTSCH:

11 Q. Thank you again, Dr. Hannaford, for your
12 time today. I just have a couple follow-up questions.

13 Do you recall discussing the directional signal d
14 a few moments ago in the context of the Izumi-Cosper
15 combination?

16 A. Yes.

17 Q. And we were discussing Element 1.5.3
18 beginning at page 72 of the IP2 declaration.

19 A. Yeah, I am there.

20 Q. So I see at page 72 the claim language is
21 reproduced in the heading at 1.5.3.

22 Do you see that?

23 A. Yes, I see the -- the reproduced 1.5.3
24 claim limitation.

25 Q. And then there are several paragraphs of

1 analysis after that, which I understand are examples of
2 how the Izumi-Cosper combination addresses
3 Element 1.5.3.

4 ATTORNEY RUBIN: Objection, leading.

5 BY ATTORNEY DEUTSCH:

6 Q. Is that correct?

7 ATTORNEY RUBIN: Same objection.

8 BY ATTORNEY DEUTSCH:

9 Q. I can rephrase the question.

10 If we turn to the top of page 73, Figure 22A of
11 Izumi is shown.

12 Do you see that?

13 A. Yes. I've turned to that figure on that
14 page.

15 Q. And there are four annotated control
16 signals identified by red arrows; is that correct?

17 A. Yes.

18 Q. And then if we turn just immediately below
19 that, paragraph 135 discusses the control signal input
20 to each transistor.

21 And so my understanding is one way that the
22 directional signal d is satisfied is by each control
23 signal input to each transistor.

24 Is that right?

25 ATTORNEY RUBIN: Objection, leading.

1 BY ATTORNEY DEUTSCH:

2 Q. I can rephrase that.

3 So the paragraph 135, can you read that paragraph?

4 A. Yeah.

5 "Each control signal input to each transistor
6 (e.g., control signals S1 through 4) provides a
7 direction signal d that controls the on/off state of
8 each of the switches Q1 through 4. In the combined
9 system each switch receives the transistor control
10 signal from the microprocessor and Izumi explicitly" --
11 "explicitly describes that the controller provides the
12 control signals that drive the electromagnet and moving
13 element."

14 Q. And so this paragraph is explaining that
15 each of those four control signals input to each
16 transistor each provides a direction signal d --

17 ATTORNEY RUBIN: Objection.

18 (A DISCUSSION WAS HELD OFF THE RECORD.)

19 BY ATTORNEY DEUTSCH:

20 Q. I understand from paragraph 135 that one
21 way that the directional signal d is provided in the
22 Izumi-Cosper combination is based on each control
23 signal input to each transistor, and, more
24 specifically, that each control signal input to each
25 transistor provides a direction signal d that controls

1 the on/off state of each of the switches Q1 through Q4;
2 is that correct?

3 ATTORNEY RUBIN: Objection, leading.

4 THE WITNESS: I believe that correctly
5 summarizes that -- that -- my opinion there, yeah.

6 ATTORNEY DEUTSCH: Okay.

7 Thank you. No further questions.

8 ATTORNEY RUBIN: All right. I'll have some
9 recross.

10

11 EXAMINATION

12

13 BY ATTORNEY RUBIN:

14 Q. So with the testimony that you just gave in
15 response to Apple's counsel's questioning, I want to
16 understand where your opinions stand right now
17 concerning the directional signal d and Izumi.

18 So am I correct in understanding that you're
19 presenting two alternative opinions for what in Izumi
20 satisfies the directional signal d, that it could
21 either be a collection of the four signals S1 through
22 S4 or it could be any one of those signals taken
23 individually?

24 A. I think it's what my opinion is written
25 here, that each control signal input to each transistor

1 (e.g., the control signals S1 through S4) provides a
2 direction signal. So they're all direction signals.
3 The bridge needs all the direction signals to set the
4 direction.

5 Q. Okay. So in the text that counsel asked
6 you about in the first sentence of paragraph 135, you
7 say -- and I'll read it again, quote, Each control
8 signal input to each transistor (e.g., control signals
9 S1 through S4) provides the direction signal d" -- and
10 I'll end the quote there.

11 So here you are -- you do offer the opinion that
12 each of the control signals, S1 through S4, taken
13 individually, provides a direction signal d.

14 Would you agree?

15 A. They are all direction signals, but the --
16 the bridge requires all the direction signals to
17 function properly. So I gave that example before with
18 the Q1.

19 Q. Okay. So I think that earlier today you
20 gave some testimony about those in the art
21 understanding that a signal could be carried on
22 multiple conductors in parallel.

23 Are you still offering the opinion that the three
24 signals, S1 -- I'm sorry, the four signals, S1 through
25 S4, collectively satisfy the limitation directional

1 signal d?

2 ATTORNEY DEUTSCH: Objection, form.

3 THE WITNESS: Yeah, I don't -- you know --
4 well, each -- each one carries directional information
5 and is a direction signal, and collectively they
6 operate the switch.

7 BY ATTORNEY RUBIN:

8 Q. Collectively, are they --

9 A. I'll be clearer.

10 Collectively they operate the H-bridge.

11 Q. Sorry for talking over you there.

12 Collectively, are they the claimed direction
13 signal d?

14 ATTORNEY DEUTSCH: Objection, form.

15 THE WITNESS: They are directional signals,
16 and they -- they are required to -- but all of them are
17 required to fully function the H-bridge -- to make the
18 H-bridge fully function, is probably a more accurate
19 answer.

20 BY ATTORNEY RUBIN:

21 Q. So in Izumi could you please turn to
22 Figure 23A?

23 A. You mean --

24 ATTORNEY DEUTSCH: Objection, scope.

25 THE WITNESS: You mean Apple 1005?

1 BY ATTORNEY RUBIN:

2 Q. Yeah, that's right.

3 A. Okay. And tell me the figure again.

4 Q. 23A.

5 A. All right.

6 Okay. 23A.

7 Q. So would you agree that looking at the
8 voltage of signal S1, if all that I know is that S1 has
9 a low voltage at a particular moment in time, I don't
10 know whether the actuator is being driven at that
11 moment in time?

12 ATTORNEY DEUTSCH: Objection, form.
13 Objection, outside the scope of redirect.

14 THE WITNESS: Yeah, I -- it's -- I think
15 it's stretching pretty far from my opinion, but this
16 shows how, collectively, the direction signals change
17 the direction of the current.

18 BY ATTORNEY RUBIN:

19 Q. So if S1 -- if I know that S1 has a low
20 voltage, I'd need to know what the voltages are of at
21 least one of the other signals, S2 through S4, to know
22 whether -- or in which direction the actuator was being
23 driven, correct?

24 A. I -- I would have to think about that a
25 little bit in terms of the circuit analysis. Sitting

1 here right now, maybe that's correct. It
2 might -- that's correct, I still stick with my answer
3 that collectively all four signals are required to
4 drive the H-bridge are the -- part of my answer.

5 ATTORNEY RUBIN: Pass the witness.

6 ATTORNEY DEUTSCH: I just have a few
7 follow-up questions.

8 THE WITNESS: Okay.

9

10 EXAMINATION

11

12 BY ATTORNEY DEUTSCH:

13 Q. So I would like to turn back to
14 paragraph 137 of the IP2 declaration.

15 ATTORNEY RUBIN: I'll just say I think the
16 rules provide for cross, redirect, and recross. I
17 don't think they provide for re-redirect, but -- so
18 I'll object on that basis, but you can go ahead and
19 answer that question subject -- or ask the question
20 subject to that objection.

21 ATTORNEY DEUTSCH: Yeah, thanks for --
22 thanks for adding that, Neil, and I think the -- it's
23 beyond the scope.

24 ATTORNEY RUBIN: Yeah, I disagree that
25 there's a scope issue. I think the witness actually

1 offered a different opinion on redirect than he had on
2 cross, and I think it was reasonable for me to explore
3 that. But let's proceed.

4 ATTORNEY DEUTSCH: Sure. At any rate, just
5 a few questions.

6 BY ATTORNEY DEUTSCH:

7 Q. Turning to paragraph 137, I think you had
8 discussed that paragraph previously, and in
9 paragraph 137 it gives an example, looking partway down
10 the paragraph, "For example, when switching elements Q1
11 and Q3 are open and switching elements Q2 and Q4 are
12 closed, the current flows through the cord on the first
13 direction through switching elements Q2 and Q4."

14 And so in that example if -- if Q2 were switched,
15 for example, due to the signal coming into -- to S2,
16 then the state of the H-bridge would -- would change;
17 is that correct?

18 ATTORNEY RUBIN: Objection, leading, and
19 objection, scope.

20 THE WITNESS: I -- I'm not sure I
21 understood that. Just repeat the switches open and
22 close state and what you're asking.

23 BY ATTORNEY DEUTSCH:

24 Q. Sure.

25 And more generally for a given -- given state of

1 the respective switching elements, the signal coming
2 into Q2, for example, is -- would control the --
3 whether that corresponding switching element Q2 was
4 open or closed, correct?

5 A. Yes.

6 ATTORNEY RUBIN: Same objections.

7 ATTORNEY DEUTSCH: Okay.

8 ATTORNEY RUBIN: And just -- all right. No
9 questions from me.

10 (CONCLUDED AT 2:07 P.M.)

11

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25

1 REPORTER'S CERTIFICATE

2 I, DANNIELLE COPELAND, RDR, CRR, DO HEREBY CERTIFY
3 THAT THE FOREGOING DEPOSITION OF BLAKE HANNAFORD, PH.D.
4 WAS TAKEN ON 1/27/25 VIA ZOOM BEFORE ME AT 9:02 A.M. FOR
5 THE PURPOSE IN THE CAPTION STATED; THAT THE WITNESS WAS
6 FIRST DULY SWORN TO TELL THE TRUTH, THE WHOLE TRUTH,
7 AND NOTHING BUT THE TRUTH; THAT THE DEPOSITION WAS
8 TAKEN BEFORE ME STENOGRAPHICALLY AND AFTERWARDS
9 TRANSCRIBED UNDER MY DIRECTION; THAT THE FOREGOING IS A
10 FULL, TRUE, AND CORRECT TRANSCRIPT OF THE SAID DEPOSITION
11 SO GIVEN; THAT COUNSEL FOR ALL PARTIES WERE PRESENT AT
12 THE TIME OF THE DEPOSITION; THAT THERE WAS A REQUEST THAT
13 THE WITNESS READ AND SIGN THE TRANSCRIPT.

14 I FURTHER CERTIFY THAT I AM NEITHER OF COUNSEL NOR
15 OF KIN TO ANY OF THE PARTIES TO THIS ACTION, AND AM IN
16 NO WAY INTERESTED IN THE OUTCOME OF SAID ACTION.

17
18 WITNESS MY SIGNATURE ON JANUARY 30, 2025.

19
20
21 *Dannielle Copeland*

22 _____
23 DANNIELLE COPELAND, RDR, CRR
24 CALIFORNIA CSR 14444
25 TENNESSEE LICENSE 807
WASHINGTON CSR 22000824

25

1 Errata Sheet

2

3 NAME OF CASE: APPLE INC. V. RESONANT SYSTEMS, INC.

4 DATE OF DEPOSITION: 01/27/2025

5 NAME OF WITNESS: BLAKE HANNAFORD, PH.D.

6 Reason Codes:

7 1. To clarify the record.

8 2. To conform to the facts.

9 3. To correct transcription errors.

10 Page _____ Line _____ Reason _____

11 From _____ to _____

12 Page _____ Line _____ Reason _____

13 From _____ to _____

14 Page _____ Line _____ Reason _____

15 From _____ to _____

16 Page _____ Line _____ Reason _____

17 From _____ to _____

18 Page _____ Line _____ Reason _____

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