

1 UNITED STATES PATENT AND TRADEMARK OFFICE
2 BEFORE THE PATENT TRIAL AND APPEAL BOARD
3

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5 _____
6 SONY CORPORATION,
7 Petitioner

8 v.

9 COLLABO INNOVATIONS, INC.
10 Patent Owner
11 _____

12 Case No. IPR2016-00941

13 Patent No. 5,952,714
14 _____
15

16 ORAL AND VIDEOTAPED DEPOSITION OF
17 MARTIN AFROMOWITZ, Ph.D.

18 Dallas, Texas

19 April 6, 2017
20
21

22 Reported By:

23 Janice K. McMoran, CSR, RDR, CRR, TCRR

24 Texas CSR No. 1959

25 Job No. 10031200

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April 6, 2017

12:13 p.m.

Oral and Videotaped Deposition of MARTIN
AFROMOWITZ, Ph.D., taken on behalf of Petitioner, at
the offices of Bragalone Conroy PC, 2200 Ross Avenue,
Suite 4500W, Dallas, Texas, beginning at 12:13 p.m.
and ending at 4:14 p.m., on April 6, 2017, before
Janice K. McMoran, RDR, CRR, TCRR, and Certified
Shorthand Reporter in and for the State of Texas.

A P P E A R A N C E S

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ALSO PRESENT:

Joe Cerda - Videographer

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I N D E X

PAGE

WITNESS: MARTIN AFROMOWITZ, Ph.D.

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(No exhibits marked in this proceeding)

1 P R O C E E D I N G S

2 THE VIDEOGRAPHER: We are now on the
3 record. Today's date is April 6, 2017. The time is
4 12:13 p.m. This is the video deposition of Dr. Martin
5 Afromowitz being taken in the matter of Sony
6 Corporation versus Collabo Innovations, Inc., pending
7 in the United States Patent and Trademark Office,
8 Case No. IPR2016-00941, Patent No. 5,952,714.

9 We are at Bragalone Conroy, 2200 Ross
10 Avenue, Suite 4500, Dallas, Texas 75201. My name is
11 Joe Cerda of Aptus Court Reporting, located at 600
12 West Broadway, Suite 300, San Diego, California 92101.

13 Will counsel please identify yourselves
14 and state whom you represent?

15 MR. ZWEIG: Jacob Zweig for petitioner,
16 Sony Corporation.

17 MR. SMITH: Matthew Smith, Turner Boyd,
18 LLP, for the petitioner, Sony Corporation.

19 MR. KLIEWER: Nick Kliewer with
20 Bragalone Conroy representing Collabo Innovations.

21 THE VIDEOGRAPHER: The court reporter
22 today is Janice McMoran, and she may now swear in the
23 witness.

24 MARTIN AFROMOWITZ, Ph.D.,
25 having been first duly sworn, testified as follows:

1 EXAMINATION

2 BY MR. ZWEIG:

3 Q. All right. Before we continue, I just
4 wanted to mention that this deposition is taking place
5 after a deposition we had earlier today in IPR21 --
6 2016-00940 and a deposition that took place yesterday
7 in IPR2016-00938 and IPR2016-00939.

8 So good afternoon, Dr. Afromowitz.

9 A. Good afternoon.

10 Q. You understand that as I ask you questions,
11 we may take breaks and that during the breaks you're
12 not allowed to talk with anybody about the substance
13 of the deposition, right?

14 A. Yes, I understand that.

15 Q. And if you'd like to take a break at any
16 point, please just let me know. Is there any reason
17 that you cannot testify accurately today?

18 A. No, there is not.

19 Q. You don't have any medical or other issues
20 that would interfere with your testimony today,
21 correct?

22 A. That's correct.

23 Q. Did you prepare for today's deposition?

24 A. Yes, I did.

25 Q. And what did you do to prepare?

1 A. I read over my declaration. I read over the
2 patent. I looked at some of the prior art. Those are
3 the most recent things that I did.

4 **Q. Did you review the Patent Trial and Appeal**
5 **Board's institution decision in this case in preparing**
6 **for this deposition?**

7 A. I didn't review that most recently. I did
8 review that a previous time.

9 **Q. Okay. So I'm going to hand you a copy of**
10 **your deposition -- I'm sorry, your declaration. This**
11 **is Exhibit 2001. Can you confirm, please, that this**
12 **is a declaration signed by you?**

13 A. Yes, it is.

14 **Q. And when you signed this declaration, did**
15 **you understand that you were signing it under oath?**

16 A. Yes, I did.

17 **Q. Did you write this declaration?**

18 A. Yes. I wrote the greatest majority of this
19 declaration myself.

20 **Q. Which parts did you not write yourself?**

21 A. The only parts that I did not write had to
22 do with the sections describing the legal standards.

23 **Q. Did you check this declaration for accuracy**
24 **before signing it?**

25 A. I did. And I later saw some typographical

1 problems that -- that I had not seen before,
2 particularly at the very end of my declaration, in
3 paragraphs 99 and 100. Both paragraphs refer to the
4 claims of the '493 patent or the ordinary skill in the
5 art of the '493 patent, and those are typographical
6 errors. What was meant there in both cases was to
7 refer to the '714 patent.

8 In addition, at the very end of my
9 declaration, there is a partial sentence that starts
10 "Thus, it is my opinion." That partial sentence
11 should be stricken. It was inadvertently placed there
12 by our --

13 Q. So this declaration is about U.S. Patent
14 Number 5,952,714, correct?

15 A. That's correct.

16 Q. I'm going to hand you a copy of that.
17 That's Exhibit 1001 in this proceeding. And if I
18 refer to that as the '714 patent, you will understand
19 what I am talking about, yes?

20 A. Yes, I will.

21 Q. Okay. So are you an expert in the field of
22 the '714 patent?

23 A. Yes, I am.

24 Q. There is a CV at the end of your declaration
25 starting on page, I think, 51, which is Appendix A.

1 Would you mind turning to that?

2 In your CV, you say you taught at the
3 Department of Electrical Engineering at the University
4 of Washington from 1974 to 2015; is that correct?

5 A. That's correct.

6 Q. And were you a professor this whole time?

7 A. No. I started out as a research fellow for
8 the first year or two, and then I was appointed
9 research assistant professor for a few years, and then
10 a research associate professor. And after that, I was
11 awarded tenure as an associate professor. And then I
12 became a full professor in the department.

13 Q. Okay. And prior to that you worked at Bell
14 Telephone Laboratories, correct?

15 A. That's correct.

16 Q. And at Bell Telephone Laboratories you
17 worked in the group that developed the first visible
18 light red and green LEDs; is that correct?

19 A. Yes, in part, that's -- I worked on those,
20 yes.

21 Q. In your work there at the Bell Telephone
22 Laboratories, were you responsible for the design of
23 any packages for integrated circuits?

24 A. I did not work on packaging of integrated
25 circuits at Bell Labs.

1 Q. In your work at Bell Labs, were you
2 responsible for the fabrication of any packages for
3 integrated circuits?

4 A. I was involved in the design of packaging
5 for semiconductor lasers at that time.

6 Q. Can you tell me a little bit about what
7 those packages were?

8 A. Sure. Semiconductor laser during that
9 period of time required fairly hefty currents in order
10 to cause the device to operate. And those large
11 currents produced a lot of heat in the -- in the
12 semiconductor laser, and that heat had to be removed
13 through an appropriate heat sync. And I did some
14 calculations and assessment of the heat syncing
15 capabilities of different designs that we were
16 contemplating at the time.

17 Q. And you would characterize that as a
18 contribution to the design of the packaging?

19 A. Yes, I would.

20 MR. KLIEWER: Objection, form.

21 Q. (By Mr. Zweig) Were you responsible for any
22 step of the fabrication of the package that we just
23 discussed?

24 A. No. I was more involved in an analysis of
25 the heat flow in the package, and other engineers were

1 responsible for actually implementing the design.

2 Q. In your work at Bell Telephone Laboratories,
3 were you responsible for designing any image sensors?

4 A. No. At that time I did not work on image
5 sensors.

6 Q. So at that time at Bell Telephone
7 Laboratories, were you -- you also were not
8 responsible for fabricating any image sensors,
9 correct?

10 A. I did not fabricate any image sensors at
11 Bell Telephone Laboratories.

12 Q. Have you taught any classes on the design of
13 packages for integrated circuits?

14 A. Packaging of integrated circuits was not one
15 of the topics in my class, no.

16 Q. So neither design nor fabrication of
17 integrated circuits was covered in any class --

18 MR. KLIEWER: Objection.

19 Q. -- that you taught?

20 MR. KLIEWER: Sorry. Objection, form.

21 A. Did you mean design or implementation of the
22 packages of integrated circuits?

23 Q. (By Mr. Zweig) Let me withdraw the question.

24 Have you taught any classes on the
25 fabrication of packages for integrated circuits?

1 A. I have not taught any classes on the
2 fabrication of packages of integrated circuits.

3 Q. And has any of your research while you were
4 employed at the University of Washington focused on
5 the design of packages for integrated circuits?

6 MR. KLIEWER: Objection, form.

7 A. I have not done research on the packaging of
8 integrated circuits, although I have packaged devices
9 myself. In the following way I have used wire bonding
10 tools in the laboratories at the University of
11 Washington. I have used adhesives to attach
12 semiconductor dies to substrates.

13 And so to -- so my answer to your question
14 is that I have not done research on those topics, but
15 I have used the technology involved in packaging.

16 Q. (By Mr. Zweig) So is it fair to say when you
17 say you've used wire bonds and adhesives to attach
18 semiconductor dies to substrates that you were -- your
19 research was focused on something else, but you were
20 using essentially off-the-shelf components to package
21 a semiconductor die?

22 MR. KLIEWER: Objection, form.
23 Objection, foundation.

24 A. I wouldn't describe wire bonding as an
25 off-the-shelf component. It's a -- it's a process

1 that utilizes a wire-bonding machine. I have designed
2 the substrates that I was wire-bonding chips to. In
3 fact, I -- I built those substrates myself in the
4 laboratory by evaporating metal films on -- on
5 insulating wafers such as alumina, and wire-bonded
6 chips to those substrates and gluing the chips down to
7 the substrates prior to wire bonding.

8 So -- so these were activities that utilized
9 the same fabrication processes as are described in
10 this patent.

11 Q. (By Mr. Zweig) Okay. But these -- is it
12 fair to say these fabrication processes were not
13 themselves the subject of your research?

14 A. Well, no, they weren't the subject of the
15 research. They were used in order to facilitate my
16 research.

17 Q. Have you ever authored any papers on
18 packaging for integrated circuits?

19 MR. KLIEWER: Objection, form.

20 A. One of the patents which I wrote and which
21 was issued in May of 2006 has the title "Fabrication
22 of Molds and Mold Components Using a Photolithographic
23 Technique and Structures Made Therefrom," and this is
24 peripherally related to molding of resins that are
25 part of the technology described in patent '714.

1 In addition, several papers in the mid '90s
2 had to do with the properties of epoxy as it is cured,
3 and in particular, papers with the title "Fiberoptic
4 Epoxy Cure Sensor."

5 And during the course of my research on a
6 fiberoptic epoxy cure sensor, I became very familiar
7 with the characteristics of epoxy resins, which are a
8 thermoset adhesive.

9 So -- so that research also has helped me in
10 the understanding of the issues involved in the '714
11 patent and has given me a good degree of expertise in
12 the area.

13 **Q. (By Mr. Zweig) You mentioned your research**
14 **on fiberoptic sensors for monitoring epoxy cure. Is**
15 **that research related to any of the patents on this**
16 **list attached to your CV?**

17 MR. KLIEWER: Objection, form.

18 A. Well, as you can see in my list of patents,
19 one of my patents is titled "Method for Fabricating
20 3-D Structures with Smoothly Varying Topographic
21 Features in Photo-Sensitized Epoxy Resists." And the
22 research that I did in the mid '90s on the changes
23 that occur in epoxies during cure and relating those
24 changes to methods for monitoring the cure of epoxies
25 became important in my work on the research that

1 resulted in this patent that was issued in October of
2 2003.

3 So, yes, that earlier work was related to
4 this later patent.

5 Q. (By Mr. Zweig) When you say that earlier
6 work, you're referring to work you did in the mid
7 '90s?

8 A. That's correct.

9 Q. Okay. All right. Are any other of these
10 patents relevant to the subject matter of the '714
11 patent?

12 MR. KLIEWER: Objection, form.

13 A. I think that covers it.

14 Q. (By Mr. Zweig) Let me ask about, in your CV,
15 you say that you worked on optical fiber sensors --
16 oh, I'm sorry. You developed an optical fiber sensor
17 for monitoring the cure of thermoset resins. Is this
18 related to your patents for "Method of Monitoring
19 Solidification of a Liquid Composition," that's U.S.
20 Patent Number 4,904,080, and the next one down on the
21 list, Patent Number 5,009,102?

22 MR. KLIEWER: Objection, form.

23 A. Yes, it is, actually.

24 Q. (By Mr. Zweig) So are those patents also
25 relevant to the subject matter of the '714 patent?

1 A. I -- I believe it would be relevant. I
2 haven't looked at those patents in quite a while,
3 but -- but as I recall, it would be relevant.

4 Q. Let me back up a moment. So after joining
5 the faculty of the University of Washington, did you
6 do any work within the semiconductor industry not
7 including any consulting work as a legal expert?

8 MR. KLIEWER: Objection, form.

9 A. Yes. As a consultant I did work on
10 semiconductors, in a technical capacity.

11 Q. (By Mr. Zweig) Did that work include any
12 consulting on the subject of semiconductor packaging?

13 A. Not that I recall.

14 Q. Okay. And your CV says that you were on the
15 board of directors of a company called Enertechnix,
16 Incorporated for three years. Did your position on
17 the board there include any work in which you were
18 responsible for the design of packages for integrated
19 circuits?

20 MR. KLIEWER: Objection, form.

21 A. My work with Enertechnix did result in my
22 being a coinventor on a publication -- pardon me, on a
23 patent. The patent is 7,437,025, entitled "Sensing
24 System for Detection and Control of Deposition on
25 Pendant Tubes in Recovery and Power Boilers."

1 Also, I -- as a result of my work with
2 Enertechnix, I was a coinventor on patent 7,956,326,
3 the patent entitled "Infrared Imaging Sensor." But
4 neither of these patents nor the experimental work
5 with which I was involved had to do specifically with
6 packaging of integrated circuits.

7 **Q. (By Mr. Zweig) And do you have a degree in**
8 **chemistry?**

9 A. No, I do not.

10 **Q. Do you have a degree in materials science?**

11 A. I do not have a degree in materials science,
12 but throughout my professional career, I dealt with
13 the science of materials and their properties,
14 specifically semiconductor materials, the optical
15 properties of semiconductors, dielectric materials and
16 the optical properties of dielectrics, metals, the
17 thermal conductivity of metals, properties of
18 semiconductor alloys. So a great deal of my work over
19 the years has been in evaluating the properties of
20 materials of various kinds.

21 **Q. Let me ask you about one more of the patents**
22 **on your list. It's the first patent on the list in --**
23 **on -- attached to Appendix A of your declaration, "Ion**
24 **Sensitive Electrode and Processes for Making the**
25 **Same." Is this a patent that has to do with the**

1 **fabrication of semiconductors?**

2 MR. KLIEWER: Objection, form.

3 A. This -- this patent does not have anything
4 to do with the fabrication of semiconductors, but it
5 uses processes that are common in the fabrication of
6 certain kinds of semiconductor packages and applying
7 those techniques to another problem.

8 In particular, this -- this patent taught
9 how to use a silk screening-type process. Didn't use
10 silk, but it was a screening process similar to silk
11 screening for making electrodes that were sensitive to
12 the pH of a solution. And so that thin film screening
13 process is often used to make wiring and insulating
14 regions on -- on substrates on which semiconductor
15 devices are attached and packaged.

16 Q. (By Mr. Zweig) So in the sense you just
17 described, would you say it's relevant to the subject
18 matter of the '714 patent at all?

19 A. Well, directly relevant, I would not -- I
20 wouldn't -- I wouldn't characterize it that way, but
21 as background information and experience, I think it's
22 relevant, in the sense that they became familiar with
23 technology that was applicable to the -- generally to
24 the packaging of integrated circuits.

25 Q. Okay. What is the relevant time frame for

1 the '714 patent?

2 A. '714 patent has a priority date through
3 foreign application of August 2nd, 1995.

4 Q. But what is the relevant time frame?

5 A. So the relevant time frame --

6 MR. KLIEWER: Objection, form.

7 Objection, calls for a --

8 THE WITNESS: Pardon.

9 MR. KLIEWER: -- legal conclusion.
10 Objection, foundation.

11 A. As I understand it, relevant time frame is
12 the period of time up to the earliest priority date of
13 the patent, and that is August 2nd, 1995.

14 Q. (By Mr. Zweig) How long a period of time up
15 until that date would you consider the relevant time
16 frame?

17 A. Well, my understanding --

18 MR. KLIEWER: Same objection.

19 A. My understanding of the term "relevant time
20 frame" would include any art that would have been
21 known to a person of ordinary skill up to that
22 priority date, that earliest priority date. And so
23 given the fact that semiconductors and packaging of
24 semiconductors is a fairly recent art, one would not
25 have to go too far back to get a start date. But --

1 but we clearly know the end date, which is the
2 priority date that I mentioned.

3 Q. (By Mr. Zweig) Okay. If I refer to this
4 time period ending with the priority date that the
5 '714 patent is the relevant time frame for the
6 purposes of our discussion today, is that all right?
7 Will you understand what I'm referring to?

8 A. Yes, I would.

9 Q. Thank you. So I'd like to ask you to turn
10 back to your declaration to Appendix B. That's on the
11 last page. At the top it says "Information
12 Considered." Is this a complete list of documents
13 that you considered?

14 A. I believe it is.

15 Q. Take a look at Exhibit 2002 entitled
16 "Optoelectronics & Photonics: Principles & Practices,
17 2nd Edition, 2013."

18 Why do you think this reference is relevant?

19 MR. KLIEWER: Objection, form.
20 Objection, foundation.

21 A. Well, that was a textbook that I used in one
22 of my classes on optical properties of semiconductors
23 and optical devices. And although I note that the
24 publication date is 2013, which is later than the --
25 the relevant time period that we have just been

1 discussing, I used that text principally to copy an
2 image of an image sensor, and I do not believe I used
3 it for any technical description other than that.

4 There also may have been an earlier edition
5 of the book that included essentially the same
6 content, but this was the copy that I had available to
7 me at the time.

8 **Q. (By Mr. Zweig) So you did not consult with**
9 **an earlier edition of this book, did you?**

10 A. I did not have an opportunity to do that,
11 no.

12 **Q. Okay. Do you recall when was the first time**
13 **you heard about the '714 patent?**

14 A. No, I really don't recall when I was first
15 introduced to that patent.

16 **Q. In your opinion, is there anything**
17 **surprising about the '714 patent?**

18 MR. KLIEWER: Objection, form.

19 A. Well, I'm not sure what you mean by
20 "surprising."

21 **Q. (By Mr. Zweig) Anything unexpected?**

22 MR. KLIEWER: Same objection.

23 A. No, I don't -- I'm not sure I know how to
24 answer your question because I don't know what -- what
25 you would expect me to be surprised about, so...

1 Q. (By Mr. Zweig) What were people able to do
2 after the '714 patent that they couldn't do before?

3 MR. KLIEWER: Objection, form.

4 A. Well, one of the novel teachings of the '714
5 patent was related to a way of positioning the image
6 sensor chip inside a package using an optical
7 positioning criteria before the chip itself was glued
8 into firm position in the package. And I thought that
9 was a novel and very useful teaching.

10 Q. (By Mr. Zweig) I'd like to ask you about
11 something in your declaration, on paragraph 24. I
12 believe that's on page 12. In this paragraph you
13 state: One novel aspect of the package is the way the
14 image sensor device is precisely positioned into the
15 package via ball bumps to inner leads of the package,
16 the image device is then fixed into place by glue.
17 Then a sealant used to fill up the package [sic],
18 i.e., wider opening.

19 Isn't it true that this sealant used to fill
20 up the inlet is not disclosed in the '714 patent?

21 MR. KLIEWER: Objection, form.

22 A. Well, I flipped through the patent, and I do
23 not find a section that -- that confirms what I have
24 written here.

25 Q. (By Mr. Zweig) So would you care to change

1 your testimony in this point?

2 A. I think it would be accurate to delete this
3 last sentence, yes.

4 Q. Okay. I'd like to ask you a few questions
5 about packages. If a package has a glass lid, is the
6 lid considered part of the package?

7 A. I would consider the lid to be part of the
8 package.

9 Q. Do you believe a person of ordinary skill in
10 the relevant time frame would have felt the same way?

11 A. Well, you know, in any situation like this
12 where you ask me about a particular item or object or
13 structure that's mentioned in the patent, it's --
14 it's -- it's important that we be careful about using
15 common descriptions without first analyzing whether
16 the common description comports with the teachings of
17 the patent.

18 So if we're going to be talking in general
19 without reference to the '714 patent, that would be
20 one thing. But if we become more specific about a
21 cover glass in a package that is described in the '714
22 patent, then I must be much more careful about the
23 construction of that term. And since I did not
24 analyze the construction of a term such as glass lid
25 or package, for that matter, I would not want to opine

1 on it.

2 Q. What if a package uses a resin to
3 encapsulate the chip? Would the resin be considered
4 part of the package?

5 MR. KLIEWER: Objection, form.

6 A. Well, how do you mean "encapsulate"?

7 Q. (By Mr. Zweig) I just mean that if the chip
8 was sealed in resin, would that be part of the
9 package?

10 A. Well, it really depends. I mean, if you're
11 talking about an image sensor chip, I would be
12 hard-pressed to understand why I would want to seal
13 the entire chip in a resin because you're trying to
14 get light to the optically active surface of the image
15 sensor.

16 So, again, your question is very vague, and
17 I -- I would prefer not to answer it.

18 Q. Well, if it's an image sensor chip, if the
19 back side of the chip was sealed in resin, would that
20 resin be considered part of the package so that the
21 front side was still able to receive light?

22 A. And does your question regard any structure
23 pertinent to the '714 patent, or are we talking about
24 an image sensor in general?

25 Q. Well, the '714 patent doesn't disclose a

1 sealant like that. So in general.

2 MR. KLIEWER: Objection, form.

3 Objection, counsel testifying.

4 A. Well, as you have pointed out, it is true
5 that -- that a -- that the '714 patent does not use a
6 sealant to fill up the inlet or wider opening, but
7 there are other prior art devices in which materials
8 are used to seal and fill up the back side of the
9 image sensor. So I would be hesitant to characterize,
10 in a general way, your -- the device that you describe
11 without more specific information.

12 Q. (By Mr. Zweig) Suppose you're talking about
13 a package with a lead frame. Is the lead frame
14 considered part of the package?

15 MR. KLIEWER: Objection, form.

16 A. If the lead frame is molded into the package
17 as it is in the '714 patent, I would be satisfied
18 to -- to agree that the lead frame is part of that
19 package.

20 Q. (By Mr. Zweig) What is a lead frame?

21 A. A lead frame is generally -- generally
22 understood to be a metal structure that is typically
23 stamped out of a thin foil of conducting material and
24 provides points of access to electrical connections to
25 the chip and -- and structures that can then be

1 connected to circuitry beyond the chip on a -- on a
2 carrier of some form.

3 **Q. Can you describe the leads of the lead frame**
4 **a little bit more specifically?**

5 MR. KLIEWER: Objection, form.
6 Objection, foundation.

7 A. The '714 patent describes a lead frame that
8 uses in its packaging process. For example, in column
9 1, starting approximately at line 54, the '714 patent
10 reads, "A lead frame 11 comprising an inner lead 9 and
11 an outer lead 10 is inmolded in a plastic package 12."

12 **Q. (By Mr. Zweig) Does this mean that the lead**
13 **frame contains only one inner lead and only one outer**
14 **lead?**

15 A. That's not the way I would interpret that
16 sentence.

17 **Q. How would you interpret it?**

18 A. I would interpret it to mean that -- that in
19 most cases there would be multiple inner and outer
20 leads. And these leads are shown in several of the
21 figures, but particularly Figure 10 of the patent, it
22 shows two structures in a prior art package labeled 9
23 and 10, which comprise the lead frame that is
24 described in the paragraph that I -- or the sentence
25 that I just read to you.

1 Q. So this shows two inner leads and two outer
2 leads; is that correct?

3 MR. KLIEWER: Objection, form.

4 A. Well, that's what is shown in this
5 cross-sectional view.

6 Q. (By Mr. Zweig) Does Figure 1 of the patent
7 show the lead frame?

8 MR. KLIEWER: Objection, form.
9 Objection, foundation.

10 A. Yes, it does.

11 Q. (By Mr. Zweig) Can you tell me which
12 numerals in Figure 1 represent the lead frame?

13 A. Yes. I'm quoting now from column 4 of the
14 patent, approximately line 52, where a preferred
15 embodiment is described, and it says, "A lead frame 24
16 comprising an inner lead 22 and outer lead 23 is
17 inmolded in a package 21."

18 This refers to Figure 1. And Figure 1 shows
19 a multiple of similar structures 23, 22, and 24
20 surrounding the chip.

21 Q. So would you agree that a lead frame then,
22 the leads themselves are typically these thin
23 structures with space between them, as shown in Figure
24 1?

25 MR. KLIEWER: Objection, form.

1 A. Yes. I would -- I would agree that those
2 structures are associated with the lead frame.

3 **Q. (By Mr. Zweig) And what are bonding pads?**

4 MR. KLIEWER: Objection, form.
5 Objection, foundation.

6 A. In general, bonding pads are metal or
7 conducting areas that can accept a bond wire. The
8 patent itself mentions electrode pad 47. I'm finding
9 this in column 8 down around line 60. And such a
10 structure is shown in, for example, Figure 6. And
11 there are similar structures in other -- in other
12 figures.

13 **Q. (By Mr. Zweig) What does it mean to say that**
14 **the bonding pads of a chip have a certain pitch?**

15 A. The pitch --

16 MR. KLIEWER: Objection, form.
17 Objection, foundation.

18 A. The pitch refers to the spacing of bonding
19 pads, the number of bonding pads one would find, for
20 example, per millimeter of linear dimension along the
21 edge of the chip, for example.

22 **Q. (By Mr. Zweig) Okay. So when the leads of**
23 **the lead frame are bonded to the chip's pads, these**
24 **bonds would then have space between them, correct?**

25 MR. KLIEWER: Objection, form.

1 Objection, foundation. Objection, counsel testifying.

2 A. The -- the reference I made to electrode
3 pads -- and they've been labeled 47 -- were not pads
4 to which the lead frame was attached. They were pads
5 on which wire bonds were placed. But if you have been
6 able to find any reference in the patent that refers
7 to bonding pads attached to a lead frame, I'd be happy
8 to take a look at that.

9 Q. **(By Mr. Zweig) Please take a look at Figure**
10 **2 of the '714 patent.**

11 A. Yes.

12 Q. **Does numeral 28 of Figure 2 represent a**
13 **bonding pad?**

14 A. Numeral 28 --

15 Q. **Or, rather, an electrode pad --**

16 MR. KLIEWER: Objection, form.

17 Q. **-- to use the terminology of the '714**
18 **patent.**

19 A. Yes. Numeral 28 refers to an electrode pad.

20 Q. **And what is this electrode pad bonded to?**

21 MR. KLIEWER: Objection, form.

22 Objection, foundation.

23 A. This electrode pad makes electrical contact
24 to the inner portion of a lead frame electrode.

25 Q. **(By Mr. Zweig) Okay. And is it your opinion**

1 that Figure 1 and Figure 2 represent, respectively,
2 plan and cross-section views of the same embodiment of
3 the '714 patent?

4 MR. KLIEWER: Objection, form.

5 A. Column 4 of the '714 patent, at
6 approximately the bottom of the column there, states
7 that Figure 2 is cross-sectioned of the solid-state
8 image sensing apparatus according to the first
9 exemplary embodiment, and an exemplary embodiment is
10 shown in Figure 1, which is a cutaway perspective
11 view.

12 So I am satisfied that those two figures
13 represent the same structure in different ways.

14 Q. (By Mr. Zweig) So would you agree that
15 Figure 1 shows the inner leads of the lead frame
16 connected to electrode pads 28 with some space between
17 each one?

18 MR. KLIEWER: Objection, form.

19 A. Well, in a general way, yes, I would agree
20 with that. There's electrode pads 28, and then
21 there's this bump 29 --

22 Q. (By Mr. Zweig) Right.

23 A. -- associated with the electrode pad.
24 But -- but in general, I would agree with your
25 statement.

1 Q. Yeah, let's move on from the lead frame.

2 What factors might guide a person of
3 ordinary skill in deciding what shape to make a
4 package for an image sensor chip?

5 MR. KLIEWER: Objection, form.

6 A. Well, an image sensor chip package needs to
7 fit on the substrate and within the structure of
8 whatever product is being designed. So it's difficult
9 for me to -- to tell you all the factors that go into
10 the design of the shape of -- of a package. There
11 are -- there are requirements involving what kind of
12 contacts need to be made to the chip, what kind of
13 pins to use. There are certain standard pin layouts
14 that need to be taken into account for -- perhaps it's
15 a changeability of devices, et cetera. So there are
16 many, many factors that go into that decision.

17 Q. (By Mr. Zweig) Would the shape of the image
18 sensor chip itself be one of those factors?

19 A. Oh, I would imagine that the size of the
20 image sensor chip and its shape would play a role,
21 yes.

22 Q. Supposing the image sensor chip was a
23 square. How do you think this would impact one of
24 ordinary skill's decisions about what chip to make the
25 package?

1 MR. KLIEWER: Objection, form.

2 A. Actually, it is unusual for an image sensor
3 to be square. But were an image sensor to be square,
4 it would -- it would impact the shape of the -- at
5 least the shape of the opening through which light
6 came into the image sensor, the opening itself, which
7 is generally covered with a covered glass of some
8 kind, transparent -- a transparent window, would be
9 designed so that a light could come to all parts of
10 the image sensor sensitive area.

11 Q. (By Mr. Zweig) Do you believe a person of
12 ordinary skill would design a package that was much
13 larger than the chip it contained?

14 MR. KLIEWER: Objection, form.

15 A. Well, it's possible that if an image sensor
16 were very small, that -- that the tools that were used
17 to build the product in which this image sensor was
18 used might require that the package be larger or
19 considerably larger than the image sensor just so that
20 it could be handled by automated equipment.

21 Q. (By Mr. Zweig) So it depends on the
22 application?

23 A. Well --

24 MR. KLIEWER: Objection, form.

25 A. -- it certainly would depend on the

1 application, the size of the image sensor itself, the
2 manner in which the -- the device was built.

3 **Q. (By Mr. Zweig) Thank you.**

4 MR. ZWEIG: So I'm going to -- I'm
5 about to take the questioning in a slightly different
6 direction. If you guys would like to take a break,
7 this would be a good time. I'm happy to continue as
8 well.

9 THE VIDEOGRAPHER: We're now going off
10 the video record. The time is 1:24.

11 (Recess taken 1:24 p.m. - 1:34 p.m.)

12 THE VIDEOGRAPHER: We're now going back
13 on the video record. The time is 1:34.

14 **Q. (By Mr. Zweig) So I have to ask: During the**
15 **break, did you discuss the substance of this**
16 **deposition with anybody?**

17 A. No.

18 **Q. Thank you.**

19 **So in your declaration, you mentioned a**
20 **process called injection molding. Injection molding**
21 **uses a closed mold; is that correct?**

22 MR. KLIEWER: Objection, form.

23 A. That is correct. There are only a few open
24 places, and that's where the resin is pressed under
25 pressure to flow into the mold.

1 Q. (By Mr. Zweig) So with injection molding,
2 the mold needs to completely enclose the item being
3 molded; is that right?

4 MR. KLIEWER: Objection, form.

5 A. Well, it doesn't have to completely enclose
6 the -- how shall I say it? Parts of the item being
7 molded may stick out from the mold itself, but the
8 volume in which the resin is meant to be contained is
9 totally enclosed, yeah.

10 Q. (By Mr. Zweig) When you say "the volume in
11 which the resin is meant to be contained," you mean
12 the resin that's being introduced in this injection
13 molding process to form a new molded part that must be
14 completely enclosed?

15 A. Yes.

16 MR. KLIEWER: Objection, form.
17 Objection, mischaracterizes.

18 Q. (By Mr. Zweig) The molding material used in
19 injection molding is always a resin, correct?

20 MR. KLIEWER: Objection, form.

21 A. Well, I would say that materials used in
22 injection molding are either thermoplastic materials
23 or thermoset materials, generally.

24 Q. (By Mr. Zweig) Always or generally?

25 MR. KLIEWER: Objection, form.

1 A. Well, in the fabrication of packaging for
2 integrated circuits, that would be true. I don't know
3 of any cases when thermoset or thermoplastic materials
4 were not used in an injection molding apparatus.

5 **Q. (By Mr. Zweig) And that involves the resin**
6 **being heated, correct?**

7 MR. KLIEWER: Objection, form.

8 A. So a thermoset material hardens or cures
9 typically with the application of heat. It's not
10 always necessary, but it does accelerate the curing of
11 the material.

12 In a thermoplastic material, one needs to
13 heat the plastic up so that it becomes more fluid and
14 can be forced into the mold. And then when the
15 material has filled the mold adequately, then the
16 temperature is reduced so that the thermoplastic
17 material hardens up.

18 **Q. (By Mr. Zweig) Can you please generally**
19 **describe the injection molding process?**

20 MR. KLIEWER: Objection, form.

21 Objection, relevance. Objection, outside the scope of
22 the declaration.

23 A. I am only familiar with the basic processes
24 involved in injection molding. I have never operated
25 an injection molding machine myself, nor have I

1 studied the -- the different kinds of injection
2 molding machines.

3 So I would hesitate to give a full and
4 complete answer to that question.

5 Q. So leaving aside for a moment the specific
6 context of injection molding, you were talking about
7 thermoset materials that harden when heat is
8 introduced. Do these materials begin as a liquid and
9 then cure upon the introduction of heat?

10 MR. KLIEWER: Objection, form.
11 Objection, relevance. Objection, outside the scope of
12 the declaration. Objection, foundation.

13 A. Well, as I said before, thermoset materials
14 may be heated in order to accelerate the reaction, but
15 we all are familiar with, for example, epoxy, which is
16 a two-part resin that will cure at substantially room
17 temperature without application of heat.

18 So in general, I can't -- I can't agree with
19 your characterization.

20 Q. (By Mr. Zweig) Okay. So if you had a liquid
21 resin that cured with or without heat, would you agree
22 that a force-like gravity could potentially affect the
23 shape that the resin takes when it's cured?

24 MR. KLIEWER: Objection, form.
25 Objection, relevance. Objection, outside the scope.

1 A. Well, we were talking about injection
2 molding a moment ago, and I'm wondering if we're still
3 talking about injection molding or just thermoset
4 materials in general.

5 Q. **(By Mr. Zweig) Let's start with just**
6 **thermoset materials in general and we'll get back to**
7 **injection molding in a moment.**

8 MR. KLIEWER: Same objections.

9 A. And your question again, then, with regard
10 to thermoset materials in general is what?

11 Q. **(By Mr. Zweig) Let me rephrase it in the**
12 **form of an example. So if you filled a cavity with a**
13 **resin that is liquid, a liquid resin, and it would**
14 **cure on its own or with heat, would -- and gravity**
15 **caused that resin to pool at the bottom of the cavity,**
16 **it would retain the shape of that cavity when it**
17 **cured, right?**

18 MR. KLIEWER: Same objections.

19 A. Did you say you were filling the cavity?

20 Q. **(By Mr. Zweig) Yes.**

21 A. Well, if you --

22 MR. KLIEWER: Same objection.

23 A. If you filled the cavity, then -- then the
24 material would not be subjected to a gravitational
25 modification of its shape because it's filled the

1 cavity.

2 Q. (By Mr. Zweig) So the cavity itself would
3 function as a mold?

4 MR. KLIEWER: Objection, form.

5 A. Well, I'm envisioning a -- a closed cavity
6 except for a place where this thermoset material may
7 be poured in. If that's what you had in mind, then if
8 this thermoset material filled this cavity except for
9 the access hole, then the material would assume the
10 shape of this filled cavity as it set.

11 Q. (By Mr. Zweig) This would be true -- would
12 this be true of an open cavity as well?

13 A. Of what?

14 Q. I'm sorry. This would be true of an open
15 cavity as well, correct?

16 MR. KLIEWER: Objection, form.

17 A. I -- I would like you to describe the open
18 cavity in a little more detail. What I have in my
19 mind may not be what you have in your mind, and -- and
20 then my question -- my answers might be misleading to
21 you.

22 So can you describe the situation that
23 you're proposing to me a little bit more carefully?

24 Q. (By Mr. Zweig) Sure. I'm going to describe
25 it in very general terms first. If you had a bowl and

1 poured liquid resin in that bowl, would you agree that
2 the bowl would represent an open cavity?

3 A. Yeah.

4 MR. KLIEWER: Objection, form.
5 Objection, relevance. Objection, outside the scope.

6 Q. (By Mr. Zweig) And the liquid resin would
7 pool at the bottom of that cavity and retain the shape
8 of that cavity when it cured, correct?

9 MR. KLIEWER: Same objections.

10 A. In that situation, if we were not in a zero
11 gravity situation, I would agree that that would be
12 expected, yeah.

13 Q. (By Mr. Zweig) Similarly, could a force-like
14 surface tension affect the shape that a liquid resin
15 takes after it cures?

16 MR. KLIEWER: Same objections.

17 A. Well, it might affect the shape while it's
18 curing, in the liquid form. It wouldn't change the
19 shape after it cured.

20 Q. (By Mr. Zweig) Right. So while it's curing,
21 surface tension might affect the shape, and then it
22 would finish curing and the shape would not change
23 after that point?

24 MR. KLIEWER: Objection, form.
25 Objection, counsel testifying.

1 Q. (By Mr. Zweig) I'll withdraw the question.
2 I think you answered it.

3 Let's move on to reaction injection
4 molding. Does reaction injection molding use a closed
5 mold?

6 A. I have not studied reaction --

7 MR. KLIEWER: Objection, form.
8 Objection, foundation. Objection, outside the scope.

9 A. I have not studied the reaction injection
10 molding process in detail.

11 Q. (By Mr. Zweig) Does reaction injection
12 molding also use thermoset and thermoplastic resins?

13 MR. KLIEWER: Objection, form.
14 Objection, foundation. Objection, outside the scope.
15 Objection, relevance.

16 A. I am not familiar with the apparatus that is
17 used in reaction injection molding.

18 Q. (By Mr. Zweig) So can you say if reaction
19 injection molding involves the heating of resin at
20 all?

21 MR. KLIEWER: Same objections.

22 A. Thermoset compounds are exothermic. And an
23 example of that is epoxy resins. If you were to
24 measure the temperature of an epoxy resin as it cured,
25 you would see a substantial rise in temperature

1 generated by the exothermic reaction that takes place
2 in the resin itself that comes about from the mixing
3 of the curing agent and the other components of the
4 resin.

5 So -- but as I said before, all of these
6 reactions involving thermoset compounds are
7 accelerated by the application of heat. And they can
8 be greatly accelerated by the application of heat.

9 So depending on the -- the manner in which
10 the thermoset resin is expected to be molded, there
11 may or may not be heat applied, and the internal heat
12 generated by the exothermic reaction may be sufficient
13 for -- for the operation.

14 **Q. (By Mr. Zweig) Let me ask you about**
15 **compression molding. This is another form of molding**
16 **you referred to in your declaration. Compression**
17 **molding uses an open mold; is that correct?**

18 MR. KLIEWER: Objection, form.

19 A. Well, there -- there is a mold part and then
20 there is a compressing part, a piston of some sort.
21 And so in the end, the resin is held in a closed space
22 as it is formed.

23 **Q. (By Mr. Zweig) The molding material used in**
24 **compression molding is always a resin; is that**
25 **correct?**

1 MR. KLIEWER: Objection, form.

2 A. I couldn't say categorically that that
3 statement is true, as I have not studied that process
4 in detail.

5 Q. (By Mr. Zweig) Is it true that it at least
6 sometimes uses a resin?

7 MR. KLIEWER: Objection, form.

8 A. I believe that that is true.

9 Q. (By Mr. Zweig) Would compression molding use
10 a thermoset resin?

11 A. I'm --

12 MR. KLIEWER: Objection, form.

13 A. I'm unable to answer that question, as I
14 have not studied that process in detail.

15 Q. (By Mr. Zweig) Would compression molding use
16 a thermoplastic resin?

17 MR. KLIEWER: Objection, form.

18 Objection, relevance. Objection, outside the scope.

19 A. Again, I have not studied that process in
20 detail.

21 Q. (By Mr. Zweig) And last question on
22 compression molding. Does compression molding involve
23 the resin being heated or giving off heat? Let me
24 withdraw the question.

25 Does compression molding involve the resin

1 being heated?

2 MR. KLIEWER: Objection, form.

3 A. I'm not familiar with the details of
4 compression molding to that extent.

5 Q. (By Mr. Zweig) Let me ask you about the
6 transfer molding, another molding process you describe
7 in your declaration. Transfer molding uses an open
8 mold; is that correct?

9 MR. KLIEWER: Objection, form.
10 Objection, foundation.

11 A. Well, to my knowledge, all molding
12 operations have a similarity in that the object that
13 is molded is surrounded by a structure that -- to
14 which the resin conforms its shape.

15 Q. (By Mr. Zweig) Can you describe the transfer
16 molding process?

17 A. No, I cannot describe the transfer molding
18 process in detail.

19 Q. Do you know if it involves heating of the
20 resin?

21 A. If --

22 MR. KLIEWER: Objection, form.

23 A. If the resin is a thermoplastic material,
24 then the resin would have to be heated before it is
25 transferred to the mold region.

1 Q. (By Mr. Zweig) So transfer molding might use
2 a thermoplastic resin, correct?

3 MR. KLIEWER: Objection, form.
4 Objection, relevance.

5 A. That is my understanding.

6 Q. (By Mr. Zweig) Could transfer molding use a
7 thermosetting resin as well?

8 MR. KLIEWER: Objection, form.
9 Objection, relevance.

10 A. I have not studied that process to the
11 degree that would allow me to answer that question.

12 Q. (By Mr. Zweig) Are these four molding
13 processes we just discussed the only molding processes
14 that were used in fabrication of packages for
15 integrated circuits in the relevant time frame?

16 MR. KLIEWER: Objection, form.

17 A. I'm not aware of other processes being used
18 for molding packages in the relevant time frame.

19 Q. (By Mr. Zweig) Can you be certain that there
20 weren't other processes used in the relevant time
21 frame?

22 A. And this is specifically for making plastic
23 packages; is that correct?

24 Q. Not necessarily. I am simply referring to
25 fabrication of packages for integrated circuits in

1 **general.**

2 A. Oh. Integrated circuits have been packaged
3 in a wide variety of materials and package designs.
4 Some of them are ceramic, some of them are metal. So
5 consequently, I would have to say that the molding
6 processes that you have been discussing are only used
7 for plastic-based packaging and not for any other
8 materials.

9 Q. So if we're talking about plastic-based
10 packaging, can you say with certainty that these are
11 the only four molding processes that were used in the
12 relevant time frame?

13 MR. KLIEWER: Objection, form.

14 A. They're the only ones that I am aware of.

15 Q. (By Mr. Zweig) Could a mold be used at least
16 partly for aesthetic reasons?

17 MR. KLIEWER: Objection, form.

18 Objection, relevance. Objection, foundation.

19 Objection, outside the scope.

20 A. Well, I'm not sure what type of structure
21 we're discussing. Are we building integrated circuit
22 packages or iPhone packaging or what?

23 Q. (By Mr. Zweig) Let me rephrase the question
24 more specifically. Could a mold be used in integrated
25 circuits packaging at least partly for aesthetic

1 reasons, in other words, to affect the appearance of
2 the package?

3 MR. KLIEWER: Objection, form. Same
4 objections as to form.

5 A. Well, I find that an odd question because
6 integrated circuits and their packages are generally
7 not seen by the consumer, and a manufacturer that
8 purchases an integrated circuit inside of an
9 integrated circuit package would likely be much more
10 interested in the cost of that item. And if it costs
11 more to have a pretty -- pretty picture on it or -- or
12 some other -- some other structure which is not
13 functional, then it would be unlikely that a
14 manufacturer would -- would use that kind of a
15 package.

16 Q. (By Mr. Zweig) I'd like to ask a few more
17 questions about resins. So you mentioned
18 thermoplastic resins. These were used in integrated
19 circuit packaging during the relevant time frame,
20 correct?

21 A. Yes, I did say that.

22 Q. And thermosetting resins as well were used
23 in integrated circuit packaging in the relevant time
24 frame?

25 A. Yes, I did say that.

1 Q. Thermosetting resins were also well-known
2 and widely used as structural adhesives in the
3 relevant time frame; is that correct?

4 MR. KLIEWER: Objection, form.
5 Objection, foundation.

6 A. Well, there are several kinds of
7 thermosetting adhesives that have been used in
8 integrated circuits. Some of them are used to
9 establish thermal contact of a chip with a substrate.
10 Some of them are used to establish electrical
11 connection between electrical features on a chip
12 and -- and conducting regions on a substrate. And
13 some materials are UV cured, that is, ultraviolet
14 cured.

15 So there are a very large range of resins
16 that have been used in integrated circuit packaging.

17 Q. (By Mr. Zweig) But focusing specifically on
18 thermosetting resins, isn't it true that those were
19 well-known as structural adhesives in the relevant
20 time frame?

21 MR. KLIEWER: Objection, form.

22 A. Yes, I believe thermosetting adhesives have
23 been used in integrated circuits packaging during the
24 relevant time frame.

25 Q. (By Mr. Zweig) I'm sorry, but I asked about

1 thermosetting resins. Is it your position that
2 thermosetting resins are thermosetting adhesives?

3 MR. KLIEWER: Objection, form.

4 A. No, I misspoke.

5 Q. (By Mr. Zweig) Okay. So you would agree,
6 then, that thermosetting resins were known as
7 structural adhesives in the relevant time frame?

8 A. Correct.

9 MR. KLIEWER: Objection, form.
10 Objection, asked and answered.

11 Q. (By Mr. Zweig) Okay. Epoxy resins were used
12 in integrated circuit packaging in the relevant time
13 frame, correct?

14 MR. KLIEWER: Objection, form.
15 Objection, outside the scope. Objection, foundation.

16 A. Epoxy resins were used in integrated circuit
17 packaging in the relevant time frame.

18 Q. (By Mr. Zweig) Are you aware of any other
19 types of resins in particular that were used in
20 integrated circuit packaging in the relevant time
21 frame?

22 MR. KLIEWER: Objection, form.

23 A. Well, I would not be able to give you a
24 chemical name for other types of resins. It's not my
25 area of expertise.

1 Q. (By Mr. Zweig) Are you familiar with a
2 polyimide resin?

3 A. I have heard of polyimide resins, yes.

4 MR. KLIEWER: Objection, form.

5 Q. (By Mr. Zweig) Can that type of resin be
6 used as an adhesive?

7 MR. KLIEWER: Objection, form.

8 Objection, outside the scope.

9 A. As I said, I've heard of polyimide, but I am
10 not familiar with its properties.

11 Q. (By Mr. Zweig) Can an epoxy resin be used as
12 an adhesive?

13 MR. KLIEWER: Objection, form.

14 A. Yes, epoxy resins can be used as an
15 adhesive.

16 Q. (By Mr. Zweig) I'm going to ask you about a
17 couple of particular epoxies, and you'll have to
18 forgive me for the pronunciation here. But an epoxy
19 made from epichlorohydrin and BPA could be used as an
20 adhesive, correct?

21 MR. KLIEWER: Objection, form.

22 Objection, relevance.

23 A. I'm not familiar with the properties of that
24 compound.

25 Q. (By Mr. Zweig) Could an epoxy made from

1 polyolefins oxidized with acidic acid be used as an
2 adhesive?

3 MR. KLIEWER: Objection, form.
4 Objection, relevance.

5 A. I'm not familiar with the properties of that
6 compound.

7 Q. You could use a resin as a matrix for a
8 composite material in integrated circuit packaging,
9 true? Right?

10 MR. KLIEWER: Objection, form.
11 Objection, foundation.

12 A. Yes, I believe that is true.

13 Q. (By Mr. Zweig) For example, you could use a
14 thermosetting resin as a matrix for a composite
15 material in integrated circuit packaging, right?

16 MR. KLIEWER: Objection, form.
17 Objection, outside the scope.

18 A. I'm not familiar with the process by which
19 one would incorporate particles in a thermoplastic
20 matrix for use in integrated circuit packaging
21 produced by an injection molding system. But -- but
22 that is not my field of expertise.

23 Q. (By Mr. Zweig) But you did opine just a
24 moment ago that speaking generally, at least, you
25 could use a resin as a matrix for a composite material

1 in integrated circuit packaging. As far as your
2 understanding goes, this involves using the resin as a
3 matrix and adding some type of filler to form a
4 composite material; is that right?

5 MR. KLIEWER: Objection, form.
6 Objection, misstates testimony.

7 A. Well, I agree that resins could be used in
8 integrated circuit packaging, but I declined to opine
9 on a process by which thermoplastic resins would
10 incorporate particles in a composite.

11 Q. (By Mr. Zweig) Leaving aside the setting --
12 the question of thermoplastic resins for a moment and
13 going back to discussing resins generally, I believe
14 you testified that resins generally could be used as a
15 matrix for a composite material. Is that -- is that
16 correct?

17 MR. KLIEWER: Objection, form.

18 Q. (By Mr. Zweig) You can answer.

19 A. Well, I believe I did say that resins can be
20 used in composite materials.

21 Q. And this involves using the resin as a
22 matrix and adding another substance to form a
23 composite material, correct?

24 MR. KLIEWER: Objection, form.

25 A. Yes, that's correct.

1 Q. (By Mr. Zweig) So what is the function of
2 the resin in this composite material?

3 MR. KLIEWER: Objection, form.
4 Objection, relevance. Objection, outside the scope.

5 A. Well, for example, if a composite material
6 is composed of a resin binder and a -- in particles
7 of, let's say, ceramic or metal or something of that
8 nature, the particles do not adhere to one another.
9 They're more or less a powder. And the resin matrix
10 is what holds these particles in suspension in the
11 material and provides the form in which these
12 particles are dispersed.

13 Q. (By Mr. Zweig) Are you aware of an
14 application for a resin referred to as preform resin?

15 MR. KLIEWER: Objection, relevance.
16 Objection, outside the scope.

17 A. When I was working with the curing of
18 epoxies, I did come across preformed sheets of epoxy
19 that were called B-staged, where the layers of epoxy
20 were partially cured but were not fully cured.

21 Q. (By Mr. Zweig) And are you aware that they
22 might be used in integrated circuits packaging,
23 preformed resin generally, not specifically the sheets
24 you referred to just now?

25 MR. KLIEWER: Objection, form.

1 A. I have not come across that application in
2 my studies, no.

3 Q. (By Mr. Zweig) Okay. Are you aware that
4 releasing agents are sometimes used when using a resin
5 in a mold?

6 MR. KLIEWER: Objection, foundation.
7 Objection, counsel testifying.

8 A. I have used releasing agents myself in
9 molding operations, yes.

10 Q. (By Mr. Zweig) Why would you need to use a
11 releasing agent?

12 MR. KLIEWER: Objection, form.

13 A. Well, a typical releasing agent inhibits the
14 adhesion of a cured resin to the mold body and allows
15 you to separate the molded part from the mold itself.

16 Q. (By Mr. Zweig) Okay. Let me ask you a few
17 more questions about the '714 patent.

18 So the '714 patent discloses a solid-state
19 image sensing device. How would you define that term?

20 MR. KLIEWER: Objection, form.

21 A. As used in the '714 patent, the solid-state
22 image sensing apparatus, which is in the title of
23 this -- of this patent, refers to a device that can be
24 employed in a video camera to record the
25 characteristics of images that are focused on the

1 surface of the image sensor.

2 Q. (By Mr. Zweig) Let me ask it a little bit
3 more specifically. So the '714 patent in column 1,
4 lines 6 to 7, refers to a solid-state image sensing
5 apparatus using a solid-state image sensing device.

6 The second part of that refers to a
7 solid-state image sensing device. How would you
8 define that term specifically?

9 MR. KLIEWER: Objection, form.

10 A. Typically, solid-state in this context
11 refers to the use of a semiconductor, and the -- the
12 phrase that you quoted goes on to call it a CCD chip.

13 MR. KLIEWER: If you're going to go on
14 much longer, can we go ahead and take a break?

15 MR. ZWEIG: This would be a good place
16 to take a break, actually.

17 MR. KLIEWER: Okay. Good deal.

18 MR. ZWEIG: Okay.

19 THE VIDEOGRAPHER: Going off the video
20 record. The time is 2:17.

21 (Recess taken 2:17 p.m - 2:26 p.m.)

22 THE VIDEOGRAPHER: We're now going back
23 on the video record. The time is 2:26.

24 Q. (By Mr. Zweig) Dr. Afromowitz, once again,
25 we just came from break. Can you please confirm that

1 during the break you didn't speak with anybody about
2 the substance of this deposition?

3 A. That's true, I did not.

4 Q. Thank you.

5 So I was asking you about image sensing
6 devices. Isn't image sensing device generally a
7 device that detects light from a scene?

8 A. Light from a scene, did you say?

9 Q. Yes.

10 A. Well, in a very broad sense it detects light
11 from a scene, yes.

12 Q. And then it converts that light into an
13 electrical signal? I am speaking broadly.

14 A. Speaking very broadly, if I were to describe
15 an image sensor in particular as opposed to a photo
16 sensor, I would -- I would tend to want to include the
17 idea that an image -- or something about the image was
18 being -- was being detected. And presumably, that
19 means being able to tell one image from another image.

20 If you're just detecting light, you can do
21 that with -- with a photo cell, and you wouldn't get
22 any information about an image.

23 Q. So an image sensing device, then, is,
24 generally speaking, a device that detects light,
25 converts that light into an electrical signal that can

1 be used to create an image of that scene?

2 MR. KLIEWER: Objection, form.

3 A. Generally, yes. There needs to be some way
4 to utilize the signal that is acquired by the device
5 so that an image can be recorded, yeah.

6 Q. (By Mr. Zweig) Is there anything else you
7 could do with the electrical signal?

8 MR. KLIEWER: Objection, form.
9 Objection, foundation.

10 A. Well, once the image information is acquired
11 by the image sensor, you can use it for a number of
12 things. You could display the image on a display
13 apparatus. You could use it to print the image on a
14 printer of some kind. So, yeah, there are lots of
15 things you could do with it.

16 Q. (By Mr. Zweig) Could you use it, for
17 example, to determine the brightness of a scene so
18 your camera could automatically set aperture or other
19 exposure factors?

20 MR. KLIEWER: Objection, form.

21 A. Well, if all you're measuring is the
22 brightness of a scene, then you're not acquiring an
23 image. But if you are acquiring an image, you can use
24 an average light level of the image to set apertures
25 and things of that nature.

1 Q. (By Mr. Zweig) So a person of ordinary skill
2 in the relevant time frame would know that a image
3 sensor chip could be circular, correct?

4 MR. KLIEWER: Objection, form.

5 A. Image sensors have imaging areas which are
6 of certain standard shapes and sizes. And I have
7 never seen a standard shape or size that would be
8 described as circular.

9 Q. (By Mr. Zweig) What shapes do they come in?

10 MR. KLIEWER: Objection to form.

11 A. Image sensors generally are rectangular.
12 I've never seen an image sensor chip which didn't have
13 square corners.

14 Q. (By Mr. Zweig) So always rectangular?

15 A. In a broad sense, rectangular, yes.

16 MR. KLIEWER: Objection, form.

17 Q. (By Mr. Zweig) What do you mean, "in a broad
18 sense"?

19 MR. KLIEWER: Objection, form.

20 A. Well, there are line-scanning image sensors
21 which are long and thin rectangles, and most of the
22 image sensors that are used in portable cameras and --
23 and smartphones are rectangular with a 3:4 or 4:3,
24 perhaps, aspect ratio that comports with the screen
25 dimensions on televisions and display devices. And

1 there are other rectangular shapes that are commonly
2 used, but those are the most common one.

3 Q. (By Mr. Zweig) Image sensors have what's
4 referred to as peripheral circuits, correct?

5 A. Image sensor systems generally have circuits
6 that generate timing signals that acquire the data
7 from the optically sensitive part of the image sensor
8 and do data analysis and image reconstruction. There
9 are many -- there are many functions, electrical
10 functions that need to be associated with an imaging
11 device in order to make the whole system work.

12 Q. And these circuits are referred to as
13 peripheral circuits, correct?

14 A. Yeah, sometimes you could collectively refer
15 to those as peripheral circuits.

16 Q. Isn't it true that one of skill in the
17 relevant time frame would have known that these
18 peripheral circuits are on a separate peripheral
19 circuit chip?

20 A. Well, that's not necessarily the case. With
21 regard to CCD-type image sensors, it was often true
22 that peripheral circuit functions were done off chip.
23 But other types of image sensors, solid-state image
24 sensors, were referred to as camera on the chip. And
25 that meant that all of the peripheral functions could

1 be implemented on the same chip as the image sensing
2 elements itself.

3 Q. But one of skill would be motivated to move
4 them onto a peripheral chip, wouldn't they?

5 A. Could you repeat that, please?

6 Q. But one of skill would be motivated to move
7 the peripheral circuits or to locate the peripheral
8 circuits on a peripheral circuit chip, a separate
9 chip, correct?

10 MR. KLIEWER: Objection, form.

11 A. No, I think the opposite is true. I think
12 that there was motivation to place peripheral
13 circuitry on the same chip. It reduces cost and --
14 and it makes for a better image sensing system.

15 Q. (By Mr. Zweig) I'd like to ask you a few
16 more questions about the '714 patent. Could you
17 please take a look at claim 13 of the '714 patent?
18 I'll give you a moment to read it, and let me know
19 when you're done.

20 A. Yes, sir.

21 Q. So I'm going to read the preamble. It says,
22 "A manufacturing method of a solid-state image sensing
23 apparatus comprising a package having a through hole
24 therein, a lead frame comprising inner leads and outer
25 leads, said lead frame being sealed in said package,

1 and said solid-state image sensing device being
2 mounted in said package."

3 So this device -- sorry, this method begins
4 with inserting said solid-state image sensing device
5 into said through hole. Can you explain how that
6 would be done?

7 MR. KLIEWER: Objection, form.

8 A. Well, the claim goes on to tell you how it
9 was done. It was done by inserting said solid-state
10 image sensing device into said through hole and
11 connecting an electrode pad of the solid-state image
12 sensing device inserted in the through hole to the
13 inner lead via a bump or an anisotropic conductor
14 having only vertical conductivity while simultaneously
15 adjusting the optical positioning of said solid-state
16 image sensing device and then securing the device with
17 an adhesive.

18 So I believe that describes the method.

19 Q. (By Mr. Zweig) But how does the inserting
20 step actually physically take place?

21 MR. KLIEWER: Objection, form.

22 A. Well, the -- the patent doesn't describe the
23 process of insertion. One of ordinary skill who has
24 been in industry would have some ideas about the types
25 of tooling that would be used to pick up a chip and

1 place it in a package. But that's -- that's not part
2 of this claim.

3 Q. (By Mr. Zweig) Can you describe some of
4 those types of toolings that might theoretically be
5 used to carry out this step?

6 MR. KLIEWER: Objection, form.

7 A. Well, I'm familiar with vacuum pick types of
8 tooling where semiconductor devices are picked up by a
9 probe which has a tube in which a vacuum is pulled
10 with a little air pump, and -- and these kinds of
11 vacuum devices are used typically because they don't
12 cause damage to the chip, and they're easily attached
13 to little robotic arms and can be used in any number
14 of ways to -- to place integrated circuits in
15 packages.

16 But other than that, I wouldn't be able to
17 describe the manufacturing method that -- beyond --
18 beyond what claim 13 says.

19 Q. (By Mr. Zweig) Let's move on to the next
20 step, which is connecting an electrode pad of the
21 solid-state image sensing device inserted in the
22 through hole to the inner lead via a bump or an
23 anisotropic conductor having only vertical
24 conductivity while simultaneously adjusting the
25 optical positioning of said solid-state image sensing

1 device.

2 Let's focus on the connecting part first.

3 How are the electrode pads connected to the inner lead
4 here?

5 MR. KLIEWER: Objection, form.

6 A. I'm sorry, I didn't hear. How are the
7 electrode pads connected to the...

8 Q. (By Mr. Zweig) The inner lead.

9 A. Inner lead.

10 MR. KLIEWER: Same objection.

11 A. So as we saw in the earlier images that we
12 discussed, the electrode pad has little bumps on it.
13 And the specification of the patent talks about
14 pressing the substrate with the electrode pads up
15 against the inner leads so that the bumps make contact
16 with the inner leads. And that would accomplish a
17 connection, electrical connection.

18 Q. (By Mr. Zweig) The connection made by these
19 bumps to the inner leads would be quite mechanically
20 stable, in other words, difficult to break; is that
21 right?

22 MR. KLIEWER: Objection, form.

23 A. Well, the insertion tool presses the chip so
24 that the bumps or anisotropic conductors would pick
25 contact with the inner leads. But as to the rigidity

1 of that contact, I don't see that that is discussed.

2 Q. (By Mr. Zweig) If it was -- if the bonding
3 process was made via an anisotropic conductor rather
4 than bumps, what would this process entail?

5 MR. KLIEWER: Objection, form.

6 A. Well, an anisotropic conductor is generally
7 a paste or tape that contains particles of metal or
8 other conductors in a fairly sparse concentration, and
9 the sparseness of the concentration of these
10 conducting particles prohibits, in general, electrical
11 contact between individual particles.

12 But if the paste or tape is pressed against
13 a surface or between two surfaces, that squeezes the
14 matrix away from that region and then the particles
15 can touch each other. And that's what provides for
16 electrical contact in the direction at which the
17 squeezing is occurring. And that gives an ability for
18 the paste to provide an anisotropic-conducting medium.
19 It only provides that -- that effect when it is
20 pressed together, that is, when this medium is
21 compressed in one direction.

22 Q. (By Mr. Zweig) And the connection made by
23 that anisotropic conductor would be mechanically
24 stable, in other words, difficult to break, correct?

25 A. Well, as long as --

1 MR. KLIEWER: Objection, form.

2 Objection, foundation.

3 A. As long as pressure --

4 MR. KLIEWER: Objection, relevance.

5 THE WITNESS: Sorry.

6 MR. KLIEWER: Objection, outside the
7 scope.

8 A. As long as pressure is applied, the
9 electrical connection would be maintained.

10 Q. (By Mr. Zweig) How does the optical
11 positioning step of this method work?

12 MR. KLIEWER: Objection, form.

13 A. The patent states in, for example, column 5,
14 near line 12 and following, that during the press-fit
15 operation, which is what I referred to before as
16 causing electrical contact to be established. It
17 says, "A position signal is feedbacked from an optical
18 position adjusting device disposed in front of the CCD
19 chip to the mounting jig, thereby finely adjusting an
20 orientation of the CCD chip and disposing the CCD chip
21 on the back side of the step of the package."

22 And then once that is accomplished,
23 ultraviolet hardening adhesive is injected in a
24 specified quantity from a dispenser and -- and the
25 device -- the chip is glued on four sides to the

1 package.

2 Q. (By Mr. Zweig) Can you explain what the
3 mounting jig referred to here is?

4 MR. KLIEWER: Objection, form.
5 Objection, relevance. Objection, outside the scope.

6 A. Well, I have a picture in my mind of what
7 this probably looks like, but the structure of the
8 mounting jig is not described, basically. A mounting
9 jig would be a tool that can accept a signal from the
10 optical positioning device and adjust the position of
11 the chip in the package so that it meets the
12 requirements of -- of the manufacturer. Other than
13 that, I can't describe it.

14 Q. (By Mr. Zweig) So the final step of claim 13
15 is securing said solid-state imaging device -- I'm
16 sorry, said solid-state image sensing device to the
17 package with an adhesive.

18 Can you describe how this process would
19 work?

20 MR. KLIEWER: Objection, form.

21 A. Well, I think I did read part of the answer
22 to that question previously, the same section that I
23 was quoting. It says, "At the same time, ultraviolet
24 hardening adhesive, item 30, is injected in a
25 specified quantity from a dispenser which is situated

1 beside a press-fit jig to glue four sides of the CCD
2 chip to the package, and finally, the CCD chip is
3 accurately mounted to the package."

4 **Q. (By Mr. Zweig) Isn't it true that the image**
5 **sensor would move due to the pressure of the adhesive**
6 **being applied from the applicator?**

7 MR. KLIEWER: Objection, form.
8 Objection, foundation.

9 A. I have no reason to think that the -- the
10 mounting jig would allow the chip to move during this
11 operation. That would be detrimental to the whole
12 operation.

13 **Q. (By Mr. Zweig) And isn't it true that there**
14 **would be no way to make sure that the adhesive was**
15 **evenly applied?**

16 MR. KLIEWER: Objection, form.

17 A. Well, it says that the ultraviolet hardening
18 adhesive is injected in a specified quantity from a
19 dispenser.

20 Typically, these dispensers are similar to
21 hypodermic syringes, and I have used hand-held epoxy
22 or ultraviolet dispensing syringes that allow very
23 precise amounts of material to be dispensed. And
24 especially if it's attached to a small robotic arm, it
25 can be preprogrammed to move around the chip in a very

1 precise manner while dispensing very precise amounts
2 of material. If I were the manufacturer, that's the
3 way I would configure this system.

4 But, again, it's merely an image I have in
5 my mind of what this patent is -- is describing.

6 **Q. (By Mr. Zweig) What is a glue?**

7 MR. KLIEWER: Objection, form.

8 A. Well, a glue is commonly understood to be an
9 adhesive substance.

10 **Q. (By Mr. Zweig) And a person of ordinary**
11 **skill in the relevant time frame would have understood**
12 **that to be true, correct?**

13 A. That would be my opinion, that a person of
14 ordinary skill in the time frame at issue here would
15 understand the glue to be an adhesive material.

16 **Q. Does glue have a specific chemical**
17 **composition?**

18 A. Each glue has its own specific chemical
19 composition, but there's hardly any generalized
20 statement one could make about all glues.

21 **Q. Does gluing mean that you couldn't have a**
22 **separate curing step?**

23 MR. KLIEWER: Objection, form.

24 A. No. The particular adhesive that is
25 described in this patent application refers to a UV

1 curing adhesive. So a liquid UV-sensitive resin is
2 dispensed around the chip, and then UV light is shined
3 on the -- on this resin, and it hardens very quickly.
4 It's very similar to a material that might be used at
5 your dentist's office to attach a crown or something
6 of that nature.

7 Q. (By Mr. Zweig) Does gluing mean that you
8 can't use anything to shape the adhesive once it's
9 been applied?

10 MR. KLIEWER: Objection, form.

11 A. Well, in this patent, a distinction is made
12 between molded resins and adhesives that glue an
13 object. So it's my opinion that by maintaining that
14 distinction, a glue -- a gluing operation is one in
15 which a molding process is not used, but it's more
16 free form, and the glue flows under the action of
17 gravity, geometry, surface tension, et cetera.

18 Q. (By Mr. Zweig) That's not exactly the
19 question I asked. Does gluing mean that you can't use
20 anything at all to shape the adhesive once it's been
21 applied?

22 MR. KLIEWER: Objection, form.

23 Objection, asked and answered.

24 A. My opinion is that a gluing operation does
25 not use a forming structure, and that a person of

1 ordinary skill in the art would understand that to be
2 the case.

3 Q. (By Mr. Zweig) If a process used an adhesive
4 applied to a chip's four corners to mount the chip in
5 the package but then applied more adhesive to fully
6 seal the chip in the package, in your opinion would
7 this meet the requirements of the '714 patent?

8 MR. KLIEWER: Objection, form.

9 A. So as I understand it, you're asking if the
10 first operation, which is -- sounds to me like a
11 gluing operation that secures the chip to a package is
12 then followed up by a sealing operation? Is that what
13 you're saying?

14 Q. (By Mr. Zweig) Yes.

15 A. And your question refers to the sealing
16 operation?

17 Q. If the sealing operation involved applying
18 more adhesive to fully seal the chip into the package,
19 would this still meet the requirements of the '714
20 patent?

21 A. Well, as you pointed out to me, the sealing
22 operation that you described goes beyond what is in
23 the '714 patent, as there is no sealing operation
24 described in the '714 patent, which was an error that
25 I apparently made in my declaration.

1 Q. Is it your understanding that the method --
2 the methods described in the '714 patent can only
3 include the steps listed in the '714 patent?

4 A. Well, that is the extent of the invention.
5 I don't know what else to say. I mean, I can
6 certainly take an invention and modify it. But -- but
7 that would not be the -- the essence of the patent
8 itself.

9 Q. All right. I'd like to ask you a few
10 questions about the Yoshino reference. This is
11 Exhibit 1003. I have copies here. I'm going to hand
12 one to you.

13 MR. ZWEIG: And I believe, Nick, you
14 said you wanted one as well.

15 MR. KLIEWER: Thanks.

16 Q. (By Mr. Zweig) So on page 003 of this
17 exhibit -- that's the page numbers on the bottom -- on
18 the top right of the page, Yoshino talks about how the
19 image sensor 25 is supported in the package via a
20 molded resin 28. Let me know when you're -- you've
21 read this passage.

22 A. Yes, I see it.

23 Q. Okay. And then on -- in the same section,
24 on page 3, it says, "The bonding pads 26 and the
25 electrode leads 21 aligned therewith are connected via

1 a conductive bonding material 27, for example,
2 indium."

3 Do you see that as well?

4 A. I haven't found it. Where is that again?

5 Q. Let's see. That is the top right.

6 A. In the first paragraph?

7 Q. First line, it begins with, "The electrode
8 leads 21 and the bonding pads 26 and the electrode
9 leads 21 aligned therewith are connected via a
10 conductive bonding material 27."

11 A. Yes, I see that. And thus the space can be
12 reduced to make -- and you mentioned indium? I don't
13 see that.

14 Q. So it's the rightmost column at the very
15 top. The sentence actually continues --

16 A. Oh.

17 Q. -- from the bottom of the first column.

18 A. Oh, I see. Way up there.

19 Q. I'll give you a moment to read that passage
20 if you would like to. Let me know when you're ready.

21 A. Okay. I think I've read that area.

22 Q. Okay. So my question was about how the
23 bonding pads 26 and the electrode leads 21 aligned
24 therewith are connected via conductive bonding
25 material 27, for example, indium.

1 The connection here referred to in this
2 passage would be strong enough so that it would not be
3 disturbed when the molded resin 28 was then applied,
4 correct?

5 MR. KLIEWER: Objection, counsel
6 testifying. Objection, form.

7 A. So this is a statement that you're making
8 which is not found in the patent; is that correct?

9 Q. (By Mr. Zweig) Let me withdraw the question
10 and ask you in a better way.

11 How strong would that bond referred to in
12 Yoshino when it says, "The bonding pads 26 and the
13 electrode leads 21 aligned therewith are connected via
14 conductive bonding material 27"? How strong would
15 that bond be?

16 MR. KLIEWER: Objection, form.

17 A. Well, I have used indium as a solder-type
18 material. Pure indium is extraordinarily soft. I
19 would not be able to characterize, in any technical
20 sense, the strength of the bond. One thing I know for
21 sure is that resins, when they are -- when they are
22 curing, shrink in volume.

23 For example, the epoxy resins that I used
24 in -- in my study of optical sensor for evaluating the
25 curing or -- the curing of epoxy resins, that study

1 that I did that resulted in some papers and patent,
2 what I did there was that I put a small amount of
3 epoxy on a glass slide with a cover slip over the
4 epoxy. So there was a very thin layer of epoxy resin,
5 and I let that cure.

6 The next day, after the epoxy had fully
7 cured, the glass slide had shattered, which surprised
8 me no end. But it shows the effect that I was just
9 referring to, and that is that epoxy, as it cures,
10 shrinks. It shrinks by over 1 percent, depending upon
11 the kind of epoxy and whether it's filled with a
12 filler to make a composite material. Composite filler
13 tends to reduce the amount of shrinkage.

14 But the forces can be extraordinarily high
15 in a curing resin. And to compare that with the
16 strength of an indium bond, I wouldn't -- I wouldn't
17 know how to quantify it, but I would -- I would be
18 hesitant to say that the indium were strong enough to
19 withstand the shrinkage forces of a thermoset resin as
20 it cures.

21 **Q. (By Mr. Zweig) So is it your opinion that**
22 **Yoshino then teaches a nonfunctional device?**

23 MR. KLIEWER: Objection, form.

24 A. Well, no, not necessarily. The effect of --
25 the effect of shrinkage of a molded resin such as

1 described here might shift the position of the chip
2 slightly. It wouldn't necessarily destroy the
3 functionality of the device.

4 But -- but that would be an issue that a
5 packaging engineer would have to study and -- and try
6 to mitigate that problem in some way.

7 Q. (By Mr. Zweig) Can you quantify how much
8 shrinkage might be required to move the device?

9 A. To move it, did you say?

10 Q. Yes, sir.

11 MR. KLIEWER: Objection, form.

12 A. All I know is that the epoxy shrinks about
13 1 percent and -- upon cure. So -- so it's a potential
14 packaging problem. But I wouldn't be able to
15 characterize it in any other way. It would certainly
16 depend upon how much epoxy was used or how much
17 bonding -- pardon me, how much molded resin was used
18 in the package.

19 Q. (By Mr. Zweig) I'd like to ask you to take a
20 look at Figure 1 of Yoshino. It's on page 4. Do you
21 see that Figure 1 shows resin 28?

22 A. Yes.

23 Q. Would a person of ordinary skill in the art
24 think that resin 28, as shown in Figure 1, would be
25 loose?

1 A. Loose?

2 Q. Loose. Could it fall out of the bottom of
3 the package?

4 MR. KLIEWER: Objection, form.

5 A. I think the description of the manufacturing
6 technology used here would indicate that material 28
7 was molded into that shape in the package, and
8 presumably that means it's solidified and unable to
9 move.

10 MR. SMITH: Jacob, do you think we
11 could take a short break?

12 MR. KLIEWER: Sure.

13 MR. ZWEIG: Yes. Let's take a short
14 break.

15 THE VIDEOGRAPHER: We're going off the
16 video record. The time is 3:15.

17 (Recess taken 3:15 p.m. - 3:22 p.m.)

18 THE VIDEOGRAPHER: Going back on the
19 record. The time is 3:22.

20 Q. (By Mr. Zweig) So, once again, you didn't
21 discuss the substance of this deposition with anybody
22 during the break?

23 A. Correct. No, I did not.

24 Q. Thank you.

25 So before we broke we were discussing a

1 problem with shrinkage of curing epoxies. This
2 problem wouldn't be an issue for the Yoshino
3 reference, right?

4 MR. KLIEWER: Objection, form.

5 A. Well, it's hard for me to tell. I --
6 there's not really enough information for me to
7 evaluate that. And I haven't evaluated that. All I
8 was attempting to do is to relay some information that
9 I know about the curing of thermoset materials and
10 suggesting that the packaging engineers who were
11 working on this device probably had to contend with
12 issues like that.

13 Q. (By Mr. Zweig) Okay. So another question
14 about the Yoshino reference relating to Figure 1,
15 Figure 1 shows only two leads 21 connected to the
16 image sensor chip via bumps of conducting bonding
17 material 27.

18 Does this mean that Yoshino's device has
19 only those two leads?

20 MR. KLIEWER: Objection, form.

21 Objection, counsel testifying.

22 A. No. I think a person of ordinary skill in
23 the art would understand that this is a
24 cross-sectional view of the device and would expect
25 that a full view of the device would show plurality of

1 electrode leads.

2 Q. (By Mr. Zweig) What prevents resin 28 from
3 flowing between the spaces between these individual
4 bonds and onto the upper surface of the image sensor?

5 MR. KLIEWER: Objection, form.

6 Objection, foundation.

7 A. Well, the patent is silent on that issue. I
8 think it's an interesting question. Since it's a
9 molded resin, it's potentially possible that some kind
10 of a dam were placed around the top part of the chip.
11 After all, 28 is described as a molded resin. So it's
12 just a supposition on my part, but -- but, in fact,
13 the patent is silent on that issue.

14 Q. (By Mr. Zweig) Do you agree that there must
15 be something there preventing the resin from flowing
16 onto the upper surface of the image sensor?

17 MR. KLIEWER: Objection, form.

18 A. I wouldn't be able to say. It would be a
19 total supposition on my part.

20 Q. (By Mr. Zweig) In your opinion, is the resin
21 shown in Yoshino's Figure 1 a liquid when it is
22 introduced?

23 MR. KLIEWER: Objection, form.

24 Objection, foundation.

25 A. Well, we don't know. There's very little

1 information about this molded resin 28. In fact, it
2 just says molded resin 28. And that's all we know
3 about it. So I can't answer that question.

4 Q. (By Mr. Zweig) I'd like to ask you about the
5 Fuji reference. And I have copies here. That's
6 Exhibit 1024. I'd like to hand a copy to you,
7 Dr. Afromowitz.

8 MR. ZWEIG: And one for you, Nick.

9 Q. (By Mr. Zweig) Could you please take a look
10 at paragraph 16? That's on page 4. Let me know when
11 you have read it, please.

12 MR. KLIEWER: I'm showing paragraph 6
13 on page 2. Am I looking at the wrong reference?

14 MR. ZWEIG: I was referring to
15 paragraph 16.

16 A. Well, I have read it briefly.

17 Q. (By Mr. Zweig) Okay. This paragraph says,
18 beginning midway through the second sentence, "The
19 light-shielding plate can be installed with high
20 precision by using the upper face of the base as a
21 reference because the light-shielding plate is
22 installed on the supports erected on the base.
23 Moreover, integrally forming the light-shielding plate
24 and the supports can simplify the installation of the
25 light-shielding plate as well as allowing the space

1 between the solid-state image sensor and the
2 light-shielding plate to be accurately set."

3 What do you understand this passage to mean?

4 MR. KLIEWER: Objection, form.
5 Objection, counsel testifying. Objection,
6 mischaracterizes the reference.

7 A. Well, the structure of the light-shielding
8 plate are shown at Figure 3 of this patent. It shows
9 it has a plate with feet tabs, two on the left, two on
10 the right, and a rectangular opening in the center of
11 the sheet material. And specification talks about the
12 need to install this light-shielding plate with high
13 precision.

14 Furthermore, the specification says that
15 this can be accomplished because there are supports
16 that are erected on the base to which this
17 light-shielding plate is attached, and presumably if
18 it is properly attached to those supports, the plate
19 can be installed with the precision necessary for this
20 application. That's what I understand this to mean.

21 Q. (By Mr. Zweig) Would a person of ordinary
22 skill in the art in the relevant time frame understood
23 what this means?

24 MR. KLIEWER: Objection, form.

25 A. I don't see why not.

1 MR. ZWEIG: All right. I have no more
2 questions for you.

3 MR. KLIEWER: Why don't we take a
4 break, then, and I'll look things over.

5 THE VIDEOGRAPHER: We are going off the
6 video record. The time is 3:34.

7 (Recess taken 3:34 p.m. - 4:06 p.m.)

8 THE VIDEOGRAPHER: We're now going back
9 on the record. The time is 4:06.

10 EXAMINATION

11 BY MR. KLIEWER:

12 Q. Dr. Afromowitz, can you look over your
13 declaration in paragraph 24?

14 A. Yes, sir.

15 Q. And can you turn to the '714 patent?

16 A. Uh-huh.

17 Q. And look at the first sentence of the
18 abstract.

19 A. All right.

20 Q. And the first sentence beginning column 3,
21 line 30.

22 A. I see that.

23 Q. Can you tell me how, if at all, those
24 sentences informed your understanding under the '714
25 patent?

1 A. There's an interesting construction in this
2 abstract in column 3, sentence beginning around line
3 30 of the abstract states, "Lead frame 24 comprising
4 an inner lead 22 and outer lead 23 sealingly filled
5 from a through hole into a package 21."

6 And the part that you referred me to on
7 column 3 of the patent states, "Still another
8 manufacturing method according to the present
9 invention relates to the solid-state image sensing
10 apparatus which has the package comprising the through
11 hole therein, and the lead frame comprising the inner
12 lead and the outer lead sealingly filled therein."

13 And I may have gotten the impression from
14 those passages that there was a sealant that filled in
15 around the lead frame. It says the outer lead and the
16 inner lead sealingly filled from a through hole into a
17 package 21.

18 But I must admit that reading those sections
19 right now, those sections don't convince me entirely
20 that the statement that I made in paragraph 24 -- at
21 the end of paragraph 24 that says that a sealant used
22 to fill up the inlet referred to the same -- referred
23 to the same process. It may. It's difficult for me
24 to tell right now.

25 There is material, apparently, according to

1 the abstract and to this column 3, that sealingly
2 fills a space from a through hole into the package.
3 Then again, none of the figures call out a -- a
4 sealant-filled space.

5 Looking at the Figure 1, for example, label
6 26 just shows an open area, and that it's -- that
7 continues the same way in Figures 2 and 3, and it's
8 shown in Figure 6 and Figure 7, and it's identified
9 not as a sealant-filled space but as an inlet area.

10 So, frankly, I at this point cannot tell if
11 my statement in paragraph 24 is correct or not. And I
12 guess I have to leave it at that.

13 MR. KLIEWER: No further questions.

14 MR. ZWEIG: I have nothing on redirect.

15 THE VIDEOGRAPHER: We are now ending
16 this deposition. The time is 4:14.

17 (Deposition concluded at 4:14 p.m.)
18
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25

1 UNITED STATES PATENT AND TRADEMARK OFFICE
2 BEFORE THE PATENT TRIAL AND APPEAL BOARD
3

4
5 _____
6 SONY CORPORATION,
7 Petitioner

8 v.

9 COLLABO INNOVATIONS, INC.,
10 Patent Owner
11 _____

12 Case No. IPR2016-00941

13 Patent No. 5,952,714
14 _____
15

16 REPORTER'S CERTIFICATION

17 MARTIN AFROMOWITZ, Ph.D.

18 APRIL 6, 2017
19
20

21 I, JANICE K. McMORAN, RDR, CRR, TCRR, and
22 Certified Shorthand Reporter in and for the State of
23 Texas, do hereby certify that the witness whose
24 deposition is hereinbefore set forth was duly sworn,
25 and that such deposition is a true correct, and full

1 record of the testimony given.

2 I further certify that I am not related to
3 any of the parties to this action by blood or by
4 marriage, and that I am in no way interested in the
5 outcome of this matter.

6 IN WITNESS WHEREOF, I have hereunto set my
7 hand this 13th day of April, 2017.

8 
9

10 JANICE K. McMORAN, RDR, CRR, TCRR
11 Texas CSR #1959
12 Expiration Date: 12/31/18
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DECLARATION UNDER PENALTY OF PERJURY

Case Name: Sony Corp. vs. Collabo Innovations, Inc.

Date of Deposition: 04/06/2017

Job No.: 10031200

I, MARTIN AFROMOWITZ, PH.D., hereby certify
under penalty of perjury under the laws of the State of
_____ that the foregoing is true and correct.

Executed this _____ day of
_____, 2017, at _____.

MARTIN AFROMOWITZ, PH.D.

NOTARIZATION (If Required)

State of _____

County of _____

Subscribed and sworn to (or affirmed) before me on
this _____ day of _____, 20____,
by _____, proved to me on the
basis of satisfactory evidence to be the person
who appeared before me.

Signature: _____ (Seal)

1	DEPOSITION ERRATA SHEET		
2	Case Name: Sony Corp. vs. Collabo Innovations, Inc.		
3	Name of Witness: Martin Afromowitz, Ph.D.		
4	Date of Deposition: 04/06/2017		
5	Job No.: 10031200		
6	Reason Codes: 1. To clarify the record.		
7	2. To conform to the facts.		
8	3. To correct transcription errors.		
9	Page	Line	Reason
10	From	to	
11	Page	Line	Reason
12	From	to	
13	Page	Line	Reason
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21	Page	Line	Reason
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23	Page	Line	Reason
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25	Page	Line	Reason
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1 DEPOSITION ERRATA SHEET

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21 From _____ to _____

22 _____ Subject to the above changes, I certify that the
transcript is true and correct

23 _____ No changes have been made. I certify that the
transcript is true and correct.

24

25 _____
MARTIN AFROMOWITZ, PH.D.

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