UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HTC Corporation,

HTC America, Inc.,

LG Electronics, Inc.,

Samsung Electronics Co., Ltd., and

Samsung Electronics America, Inc.,

Petitioners

v.

Parthenon Unified Memory Architecture LLC,

Patent Owner

Case No. IPR2015-01500 (Patent 7,321,368 B2)

Case No. IPR2015-01501 (Patent 7,777,753 B2)

Case No. IPR2015-01502 (Patent 7,542,045 B2)

DEPOSITION OF HAROLD S. STONE, Ph.D.

Washington, D.C.

March 17, 2016

Reported by: Mary Ann Payonk

Job No. 105102

March 17, 2016
9:00 a.m.

Deposition of HAROLD S. STONE, Ph.D., held at the law offices of Paul Hastings LLP, 875 15th Street, N.W., Washington, D.C., pursuant to Notice before Mary Ann Payonk, Nationally Certified Realtime Reporter and Notary Public of the District of Columbia, Commonwealth of Virginia, States of Maryland and New York.

APPEARANCES:

ON BEHALF OF PETITIONER and THE WITNESS:
ALLAN SOOBERT, ESQUIRE
PAUL HASTINGS
875 15th Street, NW
Washington, DC 20005
- and -
JOSEPH RUMPLER, ESQUIRE
1117 South California Avenue
Palo Alto, California 94304

ON BEHALF OF PATENT OWNER:
MICHAEL McBRIDE, ESQUIRE
AHMAD, ZAVITSANOS, ANAIPAKOS,
ALAVI & MENSING
1221 McKinney Street
Houston, Texas 77010

ON BEHALF OF HTC:
JOSEPH MICALLEF, ESQUIRE
SIDLEY AUSTIN
1501 K Street, NW
Washington, DC 20005

Appearances (Cont'd):

ON BEHALF OF LG:
AIDAN SKOYLES, ESQUIRE
FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER
901 New York Avenue, NW
Washington, DC 20001

H. Stone

THE REPORTER: Appearances for the record?

MR. McBRIDE: Michael McBride from AZA on behalf of Parthenon Unified Memory Architecture LLC.

MR. SOOBERT: Good morning. Allan Soobert from Paul Hastings LLP on behalf of the petitioner generally and the Samsung entities more specifically, and the witness. Along with me from Paul Hastings is Joe Rumpler.

MR. MICALLEF: Joe Micallef, Sidley Austin, for HTC.

MR. SKOYLES: Aidan Skoyles from Finnegan Henderson for LG.

HAROLD S. STONE,
called as a witness, having been duly sworn, was examined and testified as follows:

EXAMINATION

BY MR. McBRIDE:

Q. Good morning, Dr. Stone. How are you doing this morning?
A. Good morning. I'm fine.

H. Stone

MR. SOOBERT: I just want to note an objection for the record. We weren't served -- petitioner was not served with a deposition notice pursuant to the Patent Office rules. We object to that and reserve any relief as appropriate under the rules.

MR. McBRIDE: Okay, I'll follow up with my office. I'm not sure what happened. Are we able to proceed, though?

MR. SOOBERT: Sure.

BY MR. McBRIDE:

Q. So I guess I'll dive into the most important issue. Are you aware of today's date?

A. Yes, I am.

Q. And you're aware it's St. Patrick's Day?

A. Yes, I am.

Q. Are you wearing green, sir?

A. No, but my wife's maiden name is Murphy.

Q. Okay. Well, I'll leave the

H. Stone

sanctioning to your counsel to enforce during the next break. That's all right. I'm not either, so --

So I'd like to -- to begin just sort of talking about -- a little bit about your background. Do you mind sort of telling me -- let's start with your education, where you went to school.

A. Sure. I was an undergraduate at Princeton University with a degree in electrical engineering in 1960. I graduated summa cum laude.

I received a master's and Ph.D. from the University of California at Berkeley, both in electrical engineering, the master's in 1961 and the doctorate in 1963.

Q. Any postdoctorate education, any other degrees?

A. No -- no degrees after that.

Q. Let's move on to your sort of work history. Following your Ph.D. in 1963, what did you do next?

A. Well, my first position was a brief one at Boeing. I decided not to stay in the

H. Stone

aerospace industry and I went to research. That was Stanford Research Institute.

Q. How long were you at Boeing?

A. Oh, just a few months. I -- it was not a good match. I really was a researcher.

Q. Okay. And -- and so after Boeing, you said you went where?

A. Stanford Research Institute. They're in Menlo Park, California.

Q. And what did you do while you were at Stanford Research Institute?

A. I did research in computers of various kinds and published papers and worked on grants.

Q. You said "computers of various kinds." What -- what do you mean by that? What -- what kind of computers?

A. I was looking into parallel computers, computers with -- today, we would call it intelligent memory where the logic was built into the -- into the memory. Those are the two that come to mind.

Q. Any others come to mind?

A. Any other computers?

H. Stone

Q. Or, yeah, any other --

A. Any other research?

Q. Yeah. Let's start with that. Well, let's start with computers. Any other computers that come to mind?

A. Those were the two main things.

Q. And then any other sort of fields of research that come to mind?

A. I was working in what was called cellular logic, and that was a forerunner of integrated circuits.

The -- the work went along a line that is very much like PL -- programmable logic arrays today. So I would say it's a forerunner of programmable logic arrays.

Q. Just curious. How -- how did they differ? What was the -- what separates a programmable logic array from the cellular logic?

A. Well, our -- our cellular logic was basically our -- our vision of what became programmable logic arrays. It -- it had a layout, a rectangular layout as they do.

Perhaps the -- the interconnection

H. Stone

structure that we used and the means of programming is -- is different from what evolved. We had to visualize what the future technology was like. And I don't know that we got it right or wrong; we just had something that's different from what evolved.

Q. Okay. So I have parallel computing, intelligent memory, cellular logic. Anything else? I guess we can keep this while you were at Stanford Research Institute.

A. That's right, right. I did work in design automation.

Q. And what is design automation?

A. Software for the development of computers. My design automation software did layouts for automatic wiring machines. Of course, that's -- that's now obsolete, but it's not -- not terribly different from the layout that goes on at -- at some level of integrated circuit manufacture today when you -- when you lay out the wiring between transistors on a -- on a mask. So I was doing work that's related to things that -- that happen today.

Q. Okay. Anything else you can think

H. Stone

of, or does that pretty much sum up in your mind the -- the research projects, or at least the main research projects at Stanford Research Institute?

A. Those -- those are the ones that come to mind now. There may be others. I don't -- don't mean to leave anything out, but those are the ones that I can recall right now.

Q. Okay. And just -- just to fill in a gap, at least in my notes, what years were you at Stanford Research Institute?

A. 1963 to 1968.

Q. You mentioned that you published papers. Do you recall, first off, how many papers?

A. It would be in my vitae. I -- I believe -- I can't count right now. Let's say on the order of half a dozen. But don't hold me to that number, please.

Q. I -- I won't.

Generally speaking, do you recall the subject matter of those papers?

A. I do. One was on cellular logic. One was called "A Logic-in-Memory Computer."

H. Stone

That was on logic and memory. One was on software for a parallel computer. Those are three that come to mind.

Q. Would it be accurate to say that your papers mirror the research that you were doing at the time?

A. It would be accurate. There may be some -- some research that was not covered by papers published in that time.

Q. Okay. Other than computer research and publishing papers, I mean, would you say that there was any other kind of different category of thing you did at Stanford Research Institute?

A. I wrote grant proposals.

Q. And what does that involve?

A. I responded to requests for quote where typically a government agency was looking for work to be done in particular areas, and I was part of a team, usually the -- one or two or three people would get together and write up a response and bid for the work.

Q. Okay. So what -- what sort of work were you bidding for?

H. Stone

A. I remember one grant request was from NASA.

Q. The National?

A. National Aeronautics and Space Administration.

Q. Okay, the NASA. As opposed to Nassau in the Bahamas.

A. NASA instead of Nassau.

Q. What was -- just really quickly, what was that -- do you recall the subject matter of that work?

A. That subject matter had to do with some high-level changeable software that they -- they were interested in software for spacecraft, but being able to modify it after launch. I think that's -- that's what comes to mind. I may not have that exactly accurate.

Q. Okay. Do you recall any other sort of grant proposal work that you did?

A. I know there were several. I don't recall offhand what they were.

Q. So at the time of Stanford Research Institute between year 1963 and 1968, did any of your work involve video decoding?

H. Stone

A. Indirectly, it did.
Q. How did it involve it indirectly?
A. I was working on something called the fast Fourier transform.
Q. Would you mind taking a couple minutes to describe fast Fourier transform?
A. Well, surely. Let's consider a picture, an image, and when you represent that image, you represent it as a set of numbers, as an array of numbers. Each number represents a color value. And for sake of argument, let's suppose our image is 8 by 8, so there are 64 numbers.
It's well known in mathematics that you don't need to use numbers for pixels to represent that image. You can use frequencies. So I'll explain it briefly, but if I can transform those -- those numbers, those integers of pixels into frequencies, I will get exactly the same number of numbers. I will have an array of 8 by 8, 64 numbers, each representing a frequency.
Now let me explain what's happening. Focus on someplace on the wall behind me, for

H. Stone

example, and you see a region. Think of that as your 8 by 8 region with 64 numbers representing those. Now erase that and look again and look at the edges in this room. You see there are edges along the walls, there are edges along shadows and things like that. If instead of looking at the pixels, the numbers of the colors, I told you where the edges were and told you where they were spaced, I could reconstruct that whole picture --
Q. Okay.
A. -- just by the edges. By knowing where the edges are and the relative spacing, I'm telling you the frequencies that are involved in that representation. So that's what the -- Fourier -- fast Fourier transform is a way of representing data, and I'm going to use this term "edges" loosely. That's just at a high level for you and me. It's more accurate to say frequencies. But instead of looking at the pixels themselves, I'm going to tell you where the edges are and then you'll be able to reconstruct the image. Okay?
So that's -- I was working on the

H. Stone

fast Fourier transform. And you're probably wondering what that has to do with video decoding, or I'm not sure if you want --
Q. I guess -- you're talking about like video image. I -- I -- what was the -- what was the project? Was it -- when you say you were working on fast Fourier transform, would you mind like kind of elaborating on what you meant by that?
A. Yeah. The fast Fourier transform has long been used in signal processing and image processing. One of the important algorithms that are widely used. I was working in parallel processing. I wanted to build machines or design or know how to build machines that could do large amounts of numerical computation.
The fast Fourier transform was an obvious candidate to consider for such a machine. So there were various algorithms to do this and I was looking at algorithms and -- and machines that were particularly well-suited to those algorithms to do things efficiently.
Q. Okay.

H. Stone

A. I'm not sure if I answered your question about how this relates to image processing.
Q. I think -- I think I -- I think it does. I mean, I don't think I need to ask a question on that. If you'd like to add anything, feel free to.
A. I do.
Q. All right, go ahead.
A. An important aspect of image processing today is compression, data compression. And I've told you that if you represent a number by pixels -- I mean an image by pixels, you can also represent it by an equal number of frequencies.
So by going into frequencies, you're not changing the number of numbers you have, but there's an important observation. If you look around the room and look at adjacent areas, they're all the same color more or less. There are actually very few edges in an image relative to the other pixels.
When you go into the frequency domain where you use frequencies instead of pixels,

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.

WHAT WILL YOU BUILD? | **sales@docketalarm.com** | **1-866-77-FASTCASE**

fastcase® Smarter legal research.