UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FORD MOTOR COMPANY,

Petitioner,

-vs-

PAICE, LLC & ABELL FOUNDATION, INC.,

Patent Owner.

U.S. Patent No. 7,237,634 to Severinsky, et al.

IPR Case No: IPR2014-01416

DEPOSITION OF GREGORY W. DAVIS, Ph.D.

Taken at 1000 Town Center, 21st Floor, Southfield, Michigan, Commencing at 9:05 a.m., Wednesday, June 3, 2015

Reported by:

Laura J. Steenbergh

Job no: 14291A



	Page 2		Page 4
1	APPEARANCES:	1	Southfield, Michigan
2	AFFEARANCES.	2	Wednesday, June 3, 2015
3	MR. JOHN RONDINI, ESQ.	3	About 9:05 a.m. 09:05:47AM
4	BROOKS KUSHMAN, P.C.	4	MR. LIVEDALEN: Good morning. 09:06:36AM
5	1000 Town Center, 22nd Floor	5	THE WITNESS: Good morning. 09:06:38AM
6	Southfield, Michigan 48075	6	GREGORY DAVIS, PhD, 09:06:38AM
7	(248) 358-4400	7	having first been duly sworn, was examined and testified 09:06:38AM
8	jrondini@brookskushman.com	8	on his oath as follows: 09:06:38AM
9	Appearing on behalf of the Petitioner.	9	EXAMINATION BY MR. LIVEDALEN: 09:06:38AM
10		10	Q. Can you please state your name for the record? 09:06:40AM
11	MR. BRIAN LIVEDALEN, ESQ.	11	A. Sure. Dr. Gregory W. Davis. 09:06:42AM
12	FISH & RICHARDSON	12	Q. And you understand you've taken an oath this morning? 09:06:44AM
13	1425 K Street NW, 11th Floor	13	A. Yes. 09:06:48AM
14	Washington, DC 20005	14	Q. And I think by now you're familiar with all the 09:06:48AM
15	(202) 783-5050	15	deposition rules. Do you want me to go over any of 09:06:51AM
16	livedalen@fr.com	16	those again? 09:06:54AM
17	Appearing on behalf of the Patent Owner.	17	A. No. I think I'm in pretty good shape on those. 09:06:54AM
18		18	Q. Okay. Great. 09:06:57AM
19	* * * *	19	All right. I'm going to hand you what we'll 09:06:58AM
20		20	mark as Exhibit 1. 09:07:08AM
21		21	DAVIS EXHIBIT 1 09:07:18AM
22		22	U.S. Patent 5,842,534 09:07:18AM
23		23	WAS MARKED BY THE REPORTER 09:07:18AM
24		24	FOR IDENTIFICATION 09:07:18AM
25		25	09:07:18AM
	Page 3		Page 5
1	TABLE OF CONTENTS	1	BY MR. LIVEDALEN: 09:07:18AM
2		2	Q. Can you please identify for the record what I've handed 09:07:22AM
3	Witness Page	3	you as Exhibit 1? 09:07:36AM
4	GREGORY DAVIS, PhD	4	A. Yes. It's a U.S. Patent 5,842,534, to Andy Frank. 09:07:37AM
5	EXAMINATION BY MR. LIVEDALEN: 4	5	Q. So you'd be okay if we called this the Frank reference? 09:07:45AM
6	EXAMINATION BY MR. RONDINI: 55	6	A. That would be fine. 09:07:48AM
7	RE-EXAMINATION BY MR. LIVEDALEN: 59	7	Q. Or Frank for short. 09:07:49AM
8		8	Dr. Davis, why do you cite to this reference 09:07:52AM
9		9	or let me strike that. 09:07:57AM
10	INDEX TO EXHIBITS	10	Do you cite to this reference in your 09:07:58AM
11	(Exhibits attached to transcript)	11	declaration for this matter? 09:08:01AM
12	-	12	A. Yes, I believe I do. 09:08:02AM
13	Exhibit Page	13	Q. And why did you do that? 09:08:04AM
14	DAVIS EXHIBIT 1 U.S. Patent 5,842,534 4	14	A. Well, I think if you refer to my report you'll see that 09:08:35AM
15	DAVIS EVIDITE O Declaration of Conserve Davis	15	I talk about that in several spots. And I was using the 09:08:41AM
	DAVIS EXHIBIT 2 Declaration of Gregory Davis 6	3 ~	
16	DAVIS EXHIBIT 2 Declaration of Gregory Davis DAVIS EXHIBIT 3 Patent Trial Board Opinion 51	16	Andy Frank reference as a teaching that discloses using 09:08:47AM
16 17	5 •	17	a setpoint to switch when to turn on or off the engine, 09:08:54AM
16 17 18	5 •	17 18	a setpoint to switch when to turn on or off the engine, and using a time delay in order to prevent unwanted 09:08:59AM
16 17 18 19	5 •	17 18 19	a setpoint to switch when to turn on or off the engine, 09:08:54AM and using a time delay in order to prevent unwanted 09:08:59AM engine starts. 09:09:06AM
16 17 18 19 20	5 •	17 18 19 20	a setpoint to switch when to turn on or off the engine, and using a time delay in order to prevent unwanted o9:08:59AM engine starts. 09:09:06AM Q. So it's your testimony that Frank teaches using a time 09:09:06AM
16 17 18 19 20 21	5 •	17 18 19 20 21	a setpoint to switch when to turn on or off the engine, and using a time delay in order to prevent unwanted engine starts. Q. So it's your testimony that Frank teaches using a time delay? 09:08:59AM 09:09:06AM 09:09:06AM
16 17 18 19 20 21 22	5 •	17 18 19 20 21 22	a setpoint to switch when to turn on or off the engine, and using a time delay in order to prevent unwanted engine starts. Q. So it's your testimony that Frank teaches using a time delay? O9:09:13AM A. Yes, it is. 09:09:13AM
16 17 18 19 20 21 22 23	5 •	17 18 19 20 21 22 23	a setpoint to switch when to turn on or off the engine, and using a time delay in order to prevent unwanted engine starts. Q. So it's your testimony that Frank teaches using a time delay? O9:09:06AM O9:09:06AM O9:09:13AM O9:09:13AM O9:09:13AM O9:09:13AM O9:09:13AM
16 17 18 19 20 21 22	5 •	17 18 19 20 21 22	a setpoint to switch when to turn on or off the engine, and using a time delay in order to prevent unwanted engine starts. Q. So it's your testimony that Frank teaches using a time delay? O9:09:13AM A. Yes, it is. 09:09:13AM

2 (Pages 2 to 5)



	Page 6		Page 8
1	making a determination about, in this case, deciding 09:09:31AM	1	and the off threshold curve prevents undesirable or 09:13:38AM
2	whether to turn on or turn off the engine. 09:09:34AM	2	excessive cycling of the ICE due to fluctuations in 09:13:42AM
3	Q. And is that what type of setpoint is that? 09:09:36AM	3	sense, speed and depth of discharge. And that's what 09:13:48AM
4	MR. RONDINI: Objection, vague. 09:09:42AM	4	he's disclosing in Figure 4. 09:13:51AM
5	THE WITNESS: I'm not sure I can answer, or 09:09:46AM	5	But then he goes on to say, As an alternative 09:13:53AM
6	BY MR. LIVEDALEN: 09:09:49AM	6	to separate on and off thresholds a single threshold 09:13:57AM
7	Q. Is it a torque value, is it a speed value? 09:09:49AM	7	could be used in combination with a time delay between 09:14:00AM
8	A. Are you talking about Andy Frank's or the Frank 09:09:53AM	8	the on and off modes to prevent frequent cycling. 09:14:03AM
9	reference? 09:09:57AM	9	So he showed a band type of hysteresis in 09:14:06AM
10	Q. Yeah. 09:09:58AM	10	Figure 4, but he also contemplates the idea that you 09:14:11AM
11	A. He's using kind of a speed and depth of discharge. 09:09:59AM	11	could do the same thing without a band and use a time 09:14:14AM
12	Q. So the setpoint you're referring to is it's part 09:10:05AM	12	delay. 09:14:18AM
13	speed and part depth of discharge, is that right? 09:10:12AM	13	Q. Okay. Let's look back at Figure 4 here. And so do you 09:14:19AM
14	A. Yeah. I think we could get probably a better idea of 09:10:15AM	14	see the section of Figure 4, it says between 0 percent 09:14:23AM
15	that if we look at, for example, paragraph 368 of my 09:10:18AM	15	and 50 percent battery depth of discharge? 09:14:28AM
16		16	A. Yes, I do. 09:14:32AM
17	report. 09:10:21AM Q. Let me before you go, why don't we just mark that as 09:10:23AM	17	Q. And in that area what is Frank using as the threshold 09:14:33AM
18	an exhibit since you're referring to that. 09:10:27AM	18	•
19	A. Okay. 09:10:30AM	19	for determining when to turn on the engine? 09:14:41AM
20	DAVIS EXHIBIT 2 09:10:31AM	20	A. He's using a series of speeds in that particular region 09:14:46AM from 0 to 50 percent depth of discharge. He appears to 09:14:52AM
21		21	
22		22	be turning on the engine at 113 kilometers per hour. 09:14:56AM But then he goes on in the other depth of discharge to 09:15:00AM
23	WAS MARKED BY THE REPORTER 09:10:31AM	23	1
	FOR IDENTIFICATION 09:10:31AM		change the setpoints progressively going down as we go 09:15:07AM
24	BY MR. LIVEDALEN: 09:10:31AM	24	to the right, let's say going down lower. So he drops 09:15:12AM
25	Q. And, Dr. Davis, could you please identify Exhibit 2 for 09:10:50AM	25	down, for example, from 113 kilometers per hour at 50 09:15:16AM
	Page 7		Page 9
1	the record? 09:10:55AM	1	percent, to well, kind of eyeballing it, at 75 09:15:20AM
2	the record? 09:10:55AM A. Exhibit 2 appears to be a copy of the my declaration 09:10:55AM	2	percent, to well, kind of eyeballing it, at 75 09:15:20AM percent depth of discharge. It appears to be, I don't 09:15:29AM
2	the record? 09:10:55AM A. Exhibit 2 appears to be a copy of the my declaration 09:10:55AM in support of the IPR review. 09:11:33AM		percent, to well, kind of eyeballing it, at 75 09:15:20AM percent depth of discharge. It appears to be, I don't 09:15:29AM know, on the order of about 60 kilometers per hour. 09:15:32AM
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2 3 4 5 6 7 8 9 10	the record? A. Exhibit 2 appears to be a copy of the my declaration 09:10:55AM in support of the IPR review. 09:11:33AM Q. Could you read the number? 09:11:38AM A. Yeah, I was going to say, a Ford designation of 1107 if 09:11:41AM you want, or if want the IPR case number is 09:11:45AM IPR2014-01416. 09:11:53AM Q. Yeah, that's great. Thanks. 09:11:54AM All right. So let's go back to Exhibit 1, 09:12:04AM Frank. And if you want to go to Figure 4. Does Figure 09:12:13AM 4 show the speed and battery depth of discharge 09:12:26AM	2 3 4 5 6 7 8 9 10	percent, to well, kind of eyeballing it, at 75
2 3 4 5 6 7 8 9 10 11	the record? A. Exhibit 2 appears to be a copy of the my declaration 09:10:55AM in support of the IPR review. 09:11:33AM Q. Could you read the number? 09:11:38AM A. Yeah, I was going to say, a Ford designation of 1107 if 09:11:41AM you want, or if want the IPR case number is 09:11:45AM IPR2014-01416. 09:11:53AM Q. Yeah, that's great. Thanks. 09:11:54AM All right. So let's go back to Exhibit 1, 09:12:04AM Frank. And if you want to go to Figure 4. Does Figure 09:12:13AM 4 show the speed and battery depth of discharge 09:12:26AM thresholds that you're referring to? 09:12:33AM	2 3 4 5 6 7 8 9 10 11	percent, to well, kind of eyeballing it, at 75
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	Page 10		Page 12
1	discharge of the batteries. And then the other way is 09:17:22AM	1	bands, an on band or series of setpoints, and then an 09:19:58AM
2	instead of using a hysteresis band he disclosed the idea 09:17:27AM	2	off band or series of setpoints. But, you know, later 09:20:02AM
3	of using time delays. 09:17:31AM	3	on, as I've already read in Column 7, he discloses that 09:20:06AM
4	Q. Let's not worry about the hysteresis aspect right now. 09:17:32AM	4	instead of using these hysteresis bands you could just 09:20:11AM
5	Fundamentally I want to understand your opinion as far 09:17:37AM	5	use a time delay. 09:20:15AM
6	how Frank decides to turn the engine on and off. 09:17:39AM	6	Q. Okay. But are there any other factors that Frank 09:20:16AM
7	And so my question is, is the sentence I just 09:17:42AM	7	discloses for determining when to turn the engine on and 09:20:27AM
8	read, and I'll read it again for you, Column 3, line 3, 09:17:45AM	8	off other than vehicle speed and battery depth of 09:20:31AM
9	At speeds greater than approximately 113 kilometers per 09:17:48AM	9	discharge? 09:20:37AM
10	hour the vehicle operates in an HEV mode where the ICE 09:17:52AM	10	MR. RONDINI: Objection, asked and answered. 09:20:37AM
11	is used as a primary source of power. 09:17:55AM	11	THE WITNESS: At least in this operation he's, 09:20:38AM
12	Do you see that there? 09:17:59AM	12	again, he's showing that he's using a combination of 09:20:47AM
13	A. Yes, I do. 09:18:00AM	13	speed setpoints that vary with the depth of discharge. 09:20:52AM
14	Q. Does that indicate to you that, at least in certain 09:18:00AM	14	In general everything that he discloses, I think I'd 09:20:58AM
15	regions, Frank turns the engine on and off purely based 09:18:04AM	15	have to go back and refresh myself to see if there's 09:21:02AM
16	on speed? 09:18:09AM	16	other modes of operation. 09:21:05AM
17	A. No. Because, again, when you look at Figure 4 you see 09:18:10AM	17	BY MR. LIVEDALEN: 09:21:09AM
18	it's more than just speed disclosed, it's speed and 09:18:14AM	18	Q. Sitting here today, do you know of any other modes of 09:21:09AM
19	depth of discharge. In that particular region the 09:18:17AM	19	operation that use any other control metric besides 09:21:11AM
20	design he made the design decision to cycle the 09:18:22AM	20	vehicle speed and battery depth of discharge? 09:21:16AM
21	engine based on constant values for the speed, but as he 09:18:26AM	21	MR. RONDINI: Objection, vague. 09:21:19AM
22	clearly discloses in other regions, he's varying the 09:18:34AM	22	THE WITNESS: Again, Andy Frank is using 09:21:20AM
23	setpoint values for speed based on the depth of 09:18:37AM	23	speeds in the form of these hysteresis bands for on and 09:21:30AM
24	discharge. 09:18:40AM	24	off where the speed setpoints can vary as a function of 09:21:34AM
25	Q. Understood. But my question was, and I think you 09:18:41AM	25	the depth of discharge, as disclosed in Figure 4. But 09:21:38AM
	Page 11		Page 13
1	answered it for me, but for some regions, right, so you 09:18:45AM	1	then he goes on to disclose that he could use a single 09:21:42AM
2	just identified two regions, right, one region where the 09:18:48AM	2	threshold or set setpoints that would vary that would 09:21:51AM
3	speed is held constant, one region where the speed is a 09:18:51AM	3	be used, but then he would use that in addition to a 09:21:57AM
4	function of the battery depth of discharge, is that 09:18:55AM	4	time delay. So he's using a time delay as well. 09:22:00AM
5	right? 09:18:57AM	5	BY MR. LIVEDALEN: 09:22:03AM
6	MR. RONDINI: Objection, asked and answered. 09:18:57AM	6	Q. Okay. So time, vehicle speed, and battery depth of 09:22:04AM
7	THE WITNESS: Again, it's kind of the same 09:19:00AM	7	discharge. Any others? 09:22:08AM
8	answer. You can't 09:19:02AM	8	A. In Frank? I'd say I think I'd have to I would have 09:22:09AM
9	BY MR. LIVEDALEN: 09:19:03AM	9	to study this some more. Because I don't I do know 09:22:22AM
10	Q. I'm asking about the two regions, I'm not asking about 09:19:04AM	10	that he disclosed some information about, you know, if 09:22:32AM
11	turning on and off. I just want to understand. Are 09:19:09AM	11	the batteries become completely depleted turning on the 09:22:37AM
12 13	there two regions in Figure 4? 09:19:11AM A. Wall actually there's three regions if you want to try 09:19:12AM	12 13	IC engine. For example, I think in Column 3, if we go 09:22:45AM down to around line 39, for example, if the batteries 09:22:56AM
14	A. Well, actually there's three regions if you want to try 09:19:12AM and separate it. I don't think one of ordinary skill 09:19:15AM	14	were completely depleted and the IC engine was running 09:22:002AM
15	would separate that into all those spots, but I think, 09:19:17AM	15	the batteries could be slightly charged by the IC 09:23:05AM
16	again, you can't divorce the idea of his hysteresis 09:19:21AM	16	engine, only to provide additional performance to get 09:23:11AM
17	bands' speed from a depth of discharge. Because you'd 09:19:26AM	17	home or to a charging station. 09:23:13AM
18	first have to know where the depth of discharge is 09:19:30AM	18	So, you know, he obviously has probably some 09:23:22AM
19	located in order to determine the setpoint value for the 09:19:33AM	19	other operations where he's turning on and off the IC 09:23:25AM
20	speed. 09:19:37AM	20	engine as well. 09:23:32AM
21	Q. Okay. So in your opinion then Frank turns the engine on 09:19:38AM	21	Q. That is also based on the battery though, right? 09:23:33AM
22	and off based on speed and based on the depth of 09:19:45AM	22	A. Well, in that particular one it was if the batteries 09:23:36AM
23	discharge of the battery? 09:19:48AM	23	were completely depleted, yes. 09:23:39AM
24	A. Again, but he does it in, you know, different ways. I 09:19:50AM	24	Q. Okay. Are you relying on Frank to teach load response 09:23:42AM
25	mean, in Figure 4 he's disclosing the idea of hysteresis 09:19:54AM	25	of hysteresis? 09:24:01AM
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	Page 14	Page 16
1	A. Now, as I point out in my report, I'm using the idea 09:24:01AM	1 Q. Okay. Did you look at Frank during that meeting? 09:26:46AM
2	disclosing in Frank about, you know, he discloses a 09:24:07AM	2 A. I don't recall. I don't believe so, but I really don't 09:26:48AM
3	couple of ways of putting a hysteresis in to prevent 09:24:10AM	3 recall. 09:26:56AM
4	unwanted engine starts or cycling the engine. One way 09:24:14AM	4 Q. Have you ever read Frank in its entirety? 09:26:56AM
5	was using hysteresis bands, and the other way was using 09:24:17AM	5 A. Yes, I'm sure I have when I was preparing this report. 09:26:59AM
6	time delays. So I'm using the ideas of Frank in terms 09:24:22AM	6 Q. Okay. That's fine. 09:27:02AM
7	of in particular the idea of using a time delay to 09:24:24AM	7 And you keep referring to Frank as Andy Frank. 09:27:07AM
8	prevent unwanted engine starts. 09:24:27AM	8 Do you know Andy Frank? 09:27:10AM
9	Q. Okay. And let's go to paragraph 368 of your report. It 09:24:29AM	9 A. Yes, I do. 09:27:10AM
10	says, For example, Frank discloses using a hysteresis 09:24:36AM	10 Q. Who is he? 09:27:11AM
11	time delay switching between engine and motor modes in 09:24:39AM	11 A. He was, when I was developing my own hybrid electric 09:27:12AM
12	order to prevent unnecessary engine stops and restarts 09:24:43AM	vehicles for the hybrid electric vehicle challenge and 09:27:18AM
13	when the torque required to propel the vehicle was near 09:24:47AM	13 also for the future car challenge, Andy Frank was the 09:27:22AM
14	the setpoint. 09:24:51AM	14 faculty advisor I was the faculty advisor first at 09:27:26AM
15	So are you saying that the torque required to 09:24:53AM	15 the United States Naval Academy, and then the faculty 09:27:31AM
16	propel the vehicle, that's not found in Frank, right? 09:24:56AM	advisor at Lawrence Technological University, and he was 09:27:34AM
17	A. Yeah. What I'm saying is, I'm using the idea from Frank 09:25:00AM	the faculty advisor for UC Davis. 09:27:37AM
18	is the hysteresis time delay. 09:25:03AM	18 Q. And what year was that? 09:27:41AM
19	Q. Okay. So Frank does not teach using the torque required 09:25:07AM	19 A. It was over a number of years. I don't know when I 09:27:42AM
20	to propel the vehicle? 09:25:10AM	20 first met Andy, but I think it was probably in the 09:27:52AM
21	A. He's using, again, as we've looked at, he's using the 09:25:11AM	21 1992-1993 time frame through, I believe, into the 1997 09:27:59AM
22	idea of setting his thresholds based on the speed and 09:25:17AM	time frame. So over a number of years. 09:28:04AM
23	the depth of discharge in order those would be the 09:25:24AM	23 Q. And during that time he was at UC Davis you said? 09:28:06AM
24	setpoints that he was using in this instance. 09:25:30AM	24 A. Yes, he was. 09:28:08AM
25	Q. And those setpoints are not torque setpoints, right? 09:25:32AM	25 Q. Would he have been at UC Davis when he filed for this 09:28:09AM
	Page 15	Page 17
1	A. Well, they're certainly related to the torque, 09:25:36AM	
	A. Wen, they be certainly related to the torque, 09.23.30Alvi	1 patent? 09:28:14AM
2	obviously. I mean, I think he recognized the idea that 09:25:41AM	1 patent? 09:28:14AM 2 MR. RONDINI: Objection, vague. 09:28:15AM
		1
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2 3 4 5	obviously. I mean, I think he recognized the idea that 09:25:41AM generally as the vehicle's going faster the 09:25:44AM instantaneous torque required for propulsion would be at 09:25:46AM a higher level. 09:25:50AM	2 MR. RONDINI: Objection, vague. 09:28:15AM 3 THE WITNESS: I believe so, but I don't know 09:28:16AM 4 for sure. But I do believe so. 09:28:23AM 5 BY MR. LIVEDALEN: 09:28:30AM
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