UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

_____

ADC SOLUTIONS AUTO LLC

Petitioner

v.

THE NOCO COMPANY

Patent Owner

_____

IPR2024-00577 (Patent 11,447,023)

IPR2024-00671 (Patent 11,584,243)

_____

DEPOSITION OF DR. C. ARTHUR MacCARLEY

TAKEN ON BEHALF OF THE PATENT OWNER

OCTOBER 29, 2024

I N D E X

WITNESSES

ALL WITNESSES PAGE
For Patent Owner
DR. C. ARTHUR MacCARLEY
Examination by Mr. Sauer 6

EXHIBITS

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(Exhibits retained by counsel.)

STENOGRAPHER'S NOTE: All quotations from exhibits are reflected in the manner in which they were read into the record and do not necessarily denote an exact quote from the document.

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DEPOSITION OF WITNESS, DR. C. ARTHUR MacCARLEY, produced, sworn and examined on the 29th day of October, 2024, at the offices of Husch Blackwell, 8001 Forsyth Boulevard, St. Louis, Missouri, before Tara Schwake, a Registered Professional Reporter, Certified Realtime Reporter, Certified Shorthand Reporter (IL), Certified Court Reporter (MO), and Notary Public within and for the State of Missouri.

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IT IS HEREBY STIPULATED AND AGREED by and between Counsel for Petitioner and Counsel for Patent Owner that this deposition may be taken by Tara Schwake, Notary Public and Certified Realtime Reporter, thereafter transcribed into typewriting, with the signature of the witness being expressly reserved.

DR. C. ARTHUR MacCARLEY,

Of lawful age, having been produced, sworn, and examined on the part of Patent Owner, testified as follows:

* * * * *

(Deposition commenced at 8:58 AM.)

EXAMINATION

QUESTIONS BY MR. SAUER:

Q Sir, can you state your name for the record, please?

A Carl Arthur MacCarley. I go by Art.

Q Do you understand that the testimony you're providing today is under oath?

A Yes.

Q Is there anything that would prevent you from giving truthful and accurate testimony today such as medications you might be taking or anything else?

A Nope.

Q So it's important that we don't talk over each other so the court reporter can accurately report what you're saying. So if you would, please let me finish my questions, and before you answer, and then I'll try and make sure that I don't speak over you. Is that fair?

A Understood.

Q Today we're discussing Inter Partes Review Proceedings for US Patent Numbers 11,447,023 and 11,584,243. Is that your understanding?

A Yes.

Q Is it okay if we refer to these patents as the '023 and the '243 patents?

A No problem.

Q ADC's counsel has agreed that this deposition will cover your testimony in both IPR proceedings. Is that your understanding?

A I understand. I'll speak louder.

Q Sir, what did you do to prepare for your deposition today?

A Well, I reviewed my Declarations for both the patents. I reviewed my existing knowledge of the USB specifications. I reviewed the exhibits that I cited in the Declarations. And I reviewed

both of the original NOCO patents.

Q Did you speak with anybody in preparation for your deposition?

A Well, yes. I spoke quite a bit with Paul Smelcer, the lead attorney on the case.

Q Anybody else?

A Briefly I spoke with Daisy Manning, another attorney on the case who briefly joined us in a summary meeting yesterday.

Q Did you have discussions with -- in preparation for your deposition with anybody who was not a lawyer?

A No.

Q Okay. If you could, I handed you earlier your Declaration from IPR2024-00577 which is marked as Exhibit 1003. Could you pull that out, please? This is the one from your '023 patent first.

For the record, the exhibit numbers are going to be the same here for both IPRs for most everything except his Declarations, which are different. So if I'm referring to his Declarations and I don't say which one I'm referring to, please let me know.

We're talking about the '023

Declaration now.

A I understand.

Q And do you recognize this as the Declaration you submitted in IPR2024-00577 on the '023 patent?

A Yes.

Q And we can refer to this as your '023 Declaration; is that okay?

A I prefer that.

Q Can you look at page 104, last page?

A Okay.

Q Is that your signature, sir?

A Yes, it is.

Q Did you write this Declaration?

A Not entirely, but most of it.

Q Who else wrote it?

A Much of the legal input, which is outside of my area of expertise but was necessary, was provided by Mr. Smelcer.

Q Which parts did you write?

A All of the technical content I can take first person authorship for. There is quite a bit of legal content, especially from the prosecution history, that was originally authored by Mr. Smelcer and I imported. I can assure you

that I take full responsibility for everything in the Declaration.

Q You say "imported," what do you mean by "imported"?

MR. SMELCER: Object as -- on the basis of work product and privilege.

Q (BY MR. SAUER) I just wanted to understand what you meant by the word "imported."

A The -- the original written content was provided by Mr. Smelcer.

Q Oh, imported into your Declaration?

A And I put it in the Declaration. Or sometimes, since this was a collaborative effort, he might have inserted it at the appropriate position.

Q Understood. Understood. About how much time did you spend preparing your Declaration?

A Going back to the original work on it, you know, it's been a while.

Q Approximately.

A I think maybe about three, four days were dedicated to my work on this. But it wasn't necessarily contiguous. This is a little back and forth.

Q Sure.

A But I think that's a fair assessment of the original work I did on it.
Q Are there any changes you'd like to make at this time?
A Not that I can think of at the moment, but I would like to reserve the opportunity to, if I see something in the course of your questioning that I have second thoughts about, I will certainly let you know.
Q Sure. There's no mistakes you're aware of at this point?
A No.
Q Okay. If you can pull from the pile the other Declaration, the one for the '243 patent?
A Mm-hmm.
Q And this is Exhibit 1003 in IPR2024-00671.
A Yes.
Q Do you recognize this as the Declaration you submitted in IPR2024-00671?
A Yes.
Q And we can refer to this one as your '243 Declaration?
A That'd be fine.
Q And if you look on page 91 in the

back? Is that your signature, sir?
A Yes.
Q And did you also write this Declaration?
A This is a photocopy. It's not the original.
Q Understood.
A Go ahead.
Q You wrote this Declaration in the same way you wrote the '023?
A That's a fair statement, yeah.
Q Was there any differences in how you prepared this one than the '023 patent?
A Not really. In fact, you'll find a great deal of overlap between them because the patents are very similar.
Q But as far as the procedure.
A No. This is formulaic. There is -- I have some experience with Declarations and there's usually sort of a sequential pattern you can follow, and I follow that.
Q And how much time did you spend preparing this Declaration?
A Probably about the same time.
Q Any changes you want to make in this

one?

A Same response as before.

Q Which is none that you're aware of?

A None that I'm aware of, but if in the course of going through it I find something that I would like to amend in some way, I will certainly let you know.

Q Understood. Okay. If you can pull out your CV, please? And this is Exhibit Number 1004 in both IPRs. Do you recognize this as a copy of your CV, sir?

A I do.

Q And at the bottom of page 1 here it says "Curriculum Vitae, C. A. MacCarley (Updated June 2023)."

A That's correct.

Q Does this mean that the CV is up to date as of June of 2023?

A Yes.

Q Is there anything since June 2023 that you'd want to add?

A Yes, I've been engaged on at least two cases since then. Would you like to know more about them?

Q Are you able to?

A I think it's a matter of public record. One was for Tesla, Tesla IPR against Graphite Charging, which is actually an NPE. Non-participating entity. And another IPR involving NOCO, this time they had asserted against Deltran, or Deltronics, and I am serving as their expert also.

Q In the Tesla IPR, did you submit a Declaration?

A I have, yes.

Q At the top of page 1 of your CV you list your specializations as "Automotive electronics and control systems, electric and alternative fuel vehicles." Correct?

A That's correct.

Q Would you consider yourself to be an expert in these areas, sir?

A I think most people would consider me to be an expert.

Q And then starting on page 5 of your CV, going through for the next several pages, you list multiple publications that relate generally to automotive technology. Is that correct? Starts at the bottom of page 5.

A Page 5 of 12 of the exhibit is what

I'm on.

Q I take that back. I think your publications start at the top of page 5; correct?

A Yes. These are publications over the course of my academic and research career.

Q And mostly relating to automotive technology?

A Mostly.

Q Is there anything in here that specifically relates to jump starter technology?

A Jump starter. Nothing directly, but indirectly quite a few of them because --

Q How so?

A Power control technology, say, on electronic vehicles and automobiles in general, has a lot of -- a lot of the same electronics involved, power conversion, power transfer. As I'm sure you're aware, electric cars and even combustion engine vehicles now carry enough electronics to probably cover all electronics that were available 30 years ago.

Q Sure. Well, is there anything in here, in these publications, that relates to vehicle emission systems?

A Yes.

Q Could you -- could you point them out? I'm trying to reduce what I have to read.

A Sure. If you could give me a moment. Well, starting with the first one, which was my first professional publication in 1976, "Sodium Borohydride Hydrogen Fuel Storage," the whole objective of that is to produce vehicles that have no regulated emissions.

Hydrogen can do that. The problem with hydrogen is it's difficult to store on board and this was -- I would -- I would say most people consider it now a significant milestone publication in that area.

Q Let me make my question more specific. Anything in here that you would find relevant to vehicle emission systems for combustion engine vehicles?

A Sure. Well, that is for combustion engine vehicles.

Q Oh, sorry.

A Yeah. You're probably thinking of fuel cell hydrogen vehicles now, and you can use hydrogen for that, but in this time frame, although hydrogen fuel cells were available, and actually part of this paper does talk about I developed a

hydrogen from sodium borohydride base fuel cell at the time.

But moving forward to most directly answer your question, electronic fuel injection techniques for hydrogen powered internal combustion engines, IC engines, that was on point.

I'll -- Alternative Automotive Fuels Handbook, I was not the sole author on this, I was contributor to it, by the National Science Foundation, had to do with the use of alternative fuels as a way of reducing emissions and improving efficiency.

Moving down to "An Indirect Sensing Technique for Closed-Loop Diesel Fuel Quantity Control," this was -- it dealt with reducing the emissions of diesel engines. I should point out, although the titles for maybe the next five or six or seven don't speak directly to automotive, they're all funded by the California Department of Transportation, which part of their mandate has to do with reducing emissions as well as maintaining flow of traffic.

That is, in the chronology for this CV, that's the end of the journal papers. Now I go into the conference papers for which there are

quite a few more. I should add to this list, though, I have just published a book which covers many of these same topics.

Q What's the name of it?

A It's called The New Age of Non-petroleum Transportation. It's very heavily involved in the control systems of vehicles that run on something other than gasoline or diesel fuel, as well as the whole field of electric vehicles.

Q There's a lot of papers here, so maybe let me ask a more specific question. Are there any of your conference papers or other publications, journal publications, books, that relate to jump starter technology?

A No. Not specifically, no.

Q What about USB technology?

A No.

Q Consumer electronics in any way?

A Yes, you'll find a number of these that involve video assessment sensing technologies, all in the automotive space. You probably have noticed from my case list later, beyond the publications, that I've done a number of expert witness cases related to -- in a similar area that

are all automotive.

I guess the closest I can claim to it is in the vicinity of 2,000, I've published a few papers related to alternatives to vehicle battery charging, but this was devoted to electric vehicles, not jump starting internal combustion engine vehicles.

One of my prior expert witness cases, since I guess you can say that Declarations that I have written do -- they're actually published. I don't list them and stuff, but they are public record.

One is for AM General and it dealt with charging dead batteries basically in military vehicles usually. They were the primary contractor for the Humvee. The standard vehicle used in the Gulf wars.

Q AM General, is that listed on here, that case?

A I'll have to jump forward to --

Q I'll look for it at the same time.

A If you do a search for. It's the third from the bottom on page 10 of the CV, UUSI LLC versus AM General LLC.

Q And you say you submitted a

Declaration in this case?

A Yes. And we prevailed.

Q Any others?

A Oh, gosh. You'll find that, you know, I've -- I just jump to my legal experience. I didn't complete answering your question for the publications. Do you want me to go back?

Q Sure. Either legal experience or publications, let's make it a broader question, related to jump starter technology.

A Well, again, I have no publications directly related to jump start technology. As I mentioned before, I am doing an almost identical current case in support of Deltran against your client.

Well, going to the end of the conference publication list and reports, I've done a fair amount of research and have developed expertise in the electric vehicle area. One paper I list called "Electric Vehicle Safety," which is actually online tutorial.

Q Okay.

A This is November of 2011, dealt with charging batteries. Maybe almost half the publication is related to that because they're

enormous hazards when you're dealing with extremely high powered batteries found in electric vehicles. And this is for the benefit of, first of all, all my students.

I was the founder of the Electric Vehicle Engineering Club at Cal Poly. We built several vehicles, competed in some, and I was very concerned about students so I produced this publication, put it out there for general use, and over the years, even though it's out of date now because this was mainly talking about lead acid battery technology, which is the same thing for current IC engine vehicles for their SLI batteries, starting, lighting, and ignition, it does not discuss lithium batteries but it was very much centered around handling batteries, charging them, appropriate safe wiring procedures when building prototype electric vehicles, of which we and the students and projects and classes or in the context of the club that I founded did do. With some -- a fairly high level of success also I should say.

Q Is that it?

A Now we'll jump to the legal cases. There's quite a few cases here that dealt with almost identical technology in the power

electronics. In fact, the core issues that I'm sure you will be addressing later, for instance, Continental Automotive GmbH versus Atmel, I was representing Atmel. Had to do with an airbag control module and the electronics at issue was a bidirectional buck-boost converter. Buck, as in buck-boost, and then converter. Sorry. So there was a lot of commonality in that technology.

Also a class action suit in which I represented the class against Toyota later. Okay. It's, at about the 60 percent point down on page 11, it's Remy McCarthy, et al., which was a class, versus Toyota, and it had to do with, it says, a "Product defect, hybrid drive power electronics." Which is exactly the same voltage increase or decrease technology that is one of -- one of the points I'm sure you'll be discussing later.

Q Okay. I asked this for your publications. I don't think I did for your experience. Any of your expert witness experience relate to USB technology?

A Some in -- I would say quite a few involved at some point equipment that had USB connections, but none was specifically related to intellectual property of USB or USB applications.

Q As an expert in the field of automotive electronics, are you familiar with the operation of an automobile ignition system?

A Yes.

Q And are you familiar with the operation of portable jump starters?

A Yes.

Q So for a typical midsized automobile in average weather conditions, do you know, what's the typical peak current that a jump starter would need in order to start the engine?

A Well, it is -- it is strongly dependent upon the displacement of the engine, as it's almost linear proportional because that's the opposing torque from the engine. I'll say about 500 amps. A typical starting, lighting, and ignition battery that you would use to start a car is in the range of capability between 450 and 1,000 peak amps.

You'll see a rating on the side of a battery. Usually they will say CCA, cold cranking amps, which under cold weather conditions, I think that's zero Centigrade; although, I'm not sure on that point, that's how much current it can provide.

And under hot normal room temperature

cranking conditions, 1,000 amps is within the realm of, say, a group 27 automotive battery, which you would find in maybe the most common type of vehicles now which are SUVs.

Q So a common automotive battery can provide a peak amp rating of 1,000 amps?

A Yes. And I speak from my own actual personal experience on that.

Q Yeah.

A The actually rating, the name plate rating, again, would say, typically, we'll say between 650 and 850 CCA, cold cranking amps. You can find that on the name plate of the battery. And that would be more than adequate to start a car for which you would actually require at least 500 amps to rotate the starter under those same conditions.

Q Is the peak current that's required to start a battery higher than the cold cranking amps?

A Yes. Batteries perform -- at least lead acid batteries perform better when they are at room temperature. All batteries tend to degrade their potential power output as they get cold.

Q The average peak current for a

standard automobile that's required to start the battery would be you said 500 amps?

A Yes.

Q What about the cold cranking amps?

A Well, this is why they list CCA on batteries because what matters to the owner is I want to be able to start my car in the morning and it's cold in the morning, so the ability of the battery to provide a certain current flow under those conditions sets the minimum required for that battery. This is why you'll find different size batteries in different cars.

Q Let me ask it this way. Does the temperature affect the peak current that's required to start a car?

A Oh, absolutely, yes.

Q How so?

A Well, when it is cold, with the exception of a few exotic battery chemistries, all batteries are limited to lower current outputs when it is cold. I'm sure you've observed that if you come from a cold climate and you find your car doesn't crank over very well when it's 20 below zero.

Q Is that why a typical battery would

have a peak current rating of 1,000 amps so it can start in unfavorable conditions?

A Well, the thousand amps was at normal temperature or maybe about 20 C, 20 degrees Centigrade. Under cold conditions, I don't believe that same battery that I'm thinking of could provide that much current.

Q Under winter conditions, do you know what the typical peak amperage would be that's required to start a midsized automobile?

A Well, the actual requirement from the engine, which is the way you asked the question, is actually -- is higher while concurrently the battery amp capability is lower.

So I mean, this is the problem with starting cars under cold conditions. It's why -- I used to live in Minnesota for a while and a lot of people have battery heaters if their car is in an unheated garage or outdoors.

Q You said the peak amp requirement's higher. Do you know average, what amount?

A If it required 500 under normal conditions, it might require 600 or so. Maybe slightly more. Concurrently, the battery's capability to provide that current is also reduced.

Cold weather is hard on starting cars.

Q And if you're using a jump starter instead of the vehicle battery to jump start the car, that jump starter would be required to provide that peak amp current; right?

A Yes. Although one of the advantages of using a portable jump starter is that it is usually warm. It has been in the interior of the car or you keep it in your house or in the garage, so it is not as cold as the battery that is sitting in the car.

Q You mean the device is warm.

A Yes. The batteries in the jump starter are warmer.

Q But if a jump starter were being used to start a car that's in cold conditions, it would need to provide a higher peak current than in the car were in --

A Yes.

Q -- warm conditions?

A Further to your question, if you left your jump starter outdoors, left it on the roof of your car when it hit 20 below, it would be subject to the same limitations as any other batteries.

In fact, lithium batteries may even

be a bit worse. This is one of the big issues in the design of lithium batteries for electric vehicles.

Q Are you aware that many commercially available jump starters have peak current rating of over 1,000 amps?

A I don't believe that's a number I've seen published for them.

Q What number have you seen published?

A I have not seen published numbers for them. I can infer that from the size and the number of batteries on the side. And for brief periods, compact jump starters of the type that are produced by your client, I suppose. They certainly can provide more than 500 amps.

Q And is that so that they can -- would you infer that that's so that they can start cars in favorable conditions as well?

A I would assume so. At some point it could be too cold for even them to work, but I believe one of the times that you would probably end up using a jump starter is if you have a weak battery in the car and it's really cold and it doesn't quite have enough juice to crank the engine. Juice being energy storage capacity.

Q What about vehicles with larger engines, would they require a higher peak current to start?

A Yes.

Q Pickup trucks?

A I wouldn't say -- pickup trucks are in the class of light trucks. They generally have the same types of engines as the SUVs that completely dominate the US market right now. But generally the larger the engine, the more power is necessary to crank it. Under any conditions.

Q What about a tractor-trailer?

A That would be a fairly large diesel engine and most definitely it would require more power.

Q Do you know roundabout the peak current that would be required to start a tractor-trailer in average weather conditions?

A I -- I don't -- I don't -- I don't know exactly. I was speaking from personal experience before. I'm sure this is something I could look up for you if you needed or if I ever needed it, I would, but I have never had the need to have that number.

Q Certainly higher than the 500 amps

that you say for a typical automobile?

A Yes.

Q Would you think it would be twice as much? In the neighborhood of twice as much?

A Well, general diesel engines require more power to start.

Q Sure.

A It is because they are higher compression ratio engines. So it's a -- call it a higher pressure compressor and it requires more power to drive that compressor. That's probably the biggest factor even more so than the increase in the displacement.

Truck engines are -- a ten liter tractor-trailer engine might be typical; whereas, a typical for car might be a five liter engine.

Q So you really couldn't put a number on peak current off the top of your head?

A No. I would look it up.

Q And you said that largely because it's a diesel engine. Is the same true for diesel automobiles? Do they require a higher current to start?

A Yes. I own a diesel light pickup truck and I'm not sure -- in fact, I'm sure that

all of them don't, but mine has dual batteries specifically for that purpose and they are kept in parallel.

Q Parallel?

A Yes. Simply to provide higher power. Higher current. Two batteries in parallel can provide twice the current of one battery.

Q Do you know what size batteries?

A I think they're group 24s.

Q Does the peak current rating factor into the battery capacity that's needed to -- in a jump starter?

A I'm just a bit confused by your question because -- could you separate that into what is the requirement of the jump starter versus the --

Q In order -- let me ask it this way. In order to provide a higher peak current to start a vehicle, does that also mean you need to have a higher capacity battery? Are the two related?

A Higher capacity jump starter?

Q Jump starter or battery.

A Or another vehicle to connect jumper cables to, jump start, yes, that's true.

Q There's a relationship between the

amount of current that a battery can provide and its capacity?

A Yes. Now, I should, as a subtlety here, in lead acid batteries alone there are considered three main classes. In vehicles they're called SLI, starting, lighting, and ignition batteries, and they are designed specifically to provide high current at the expense of not very much energy storage capacity. They can provide that, you know, that thousand amps, if necessary, for a brief period of time, but you can't go cranking for a long, long time.

The other extreme are batteries called deep cycle batteries which are the type you would use in a lead acid power battery for an electric vehicle like a golf cart. Those are all deep cycle batteries. Or for lead acid battery equipped solar, home solar systems, the standard used to be large banks of deep cycle batteries.

Then there is an intermediate class called marine deep cycle batteries, which are kind of halfway between, because in a marine application you need a decent amount of energy but you also need to be able to start the engine, which is usually a diesel engine, in a boat.

Q We're going to move on to another topic. Whenever you want to take a break, just let me know. Otherwise, I lose track of time.

A We can go at least an hour.

Q As long as I'm not in the middle of a question.

A Okay. I appreciate the offer.

Q Okay. If you can pull out the Richardson reference. And this is Exhibit 1005 and that's the same exhibit number for both IPRs. Turning first to your '023 Declaration for Richardson, if you can flip to page 28, please?

A I am there.

Q Starting on page 28 of your '023 Declaration and continuing through page 71, you address Ground 1, which alleges that (quote as read):

> Claims 1, 32, 38, 39, 47, 52, and 54 are unpatentable over Richardson in view of Zhao, Z-h-a-o.
>
> Is that correct?

A That's correct.

Q And if you can pull out your '243 Declaration? On page 28?

A I'm there.
Q Similarly, starting on page 28 of your '243 Declaration, you address Ground 1 that alleges that (quote as read):
Claims 1 and 2 are unpatentable over Richardson in view of Zhao.
Correct?
A Correct.
Q Now if you can turn to Richardson, please, Exhibit 1005?
A In '023 or --
Q No, the reference exhibit. Exhibit 1005 is a copy of US Patent Application Number 2013/0154543 to Richardson. Correct?
A That's correct.
Q Do you recognize this as the same Richardson reference that you've addressed in your Declarations?
A Yes.
Q Did you review Richardson during the preparation of your Declarations?
A Yes.
Q How much time did you spend reviewing this reference?
A I used it as needed rather than do a

block read through. So certain parts were applicable to certain things. I can say I feel more than adequately familiar with the Richardson patent.

Q Okay. Then if you could turn to Page 5 of Richardson?

A I'm there.

Q I'm sorry, page 18. It says 5 at the top, but page 18 of 20 at the bottom. That's the problem with renumbering things that already have numbers.

A I'm there.

Q Refer to paragraph 55, 0055?

A Okay.

Q Can you read this paragraph to yourself, let me know when you're done?

A It references Figure 2, but there is actually a Figure 2A, 2B, and 2C, and it appears to be referring to Figure 2C, just for your...

I've read it.

Q What's Richardson describing in paragraph 55?

A He's pointing out an advantage OF their approach whereby if the jump starter, as he envisioned it, is left connected after the vehicle

does start, then the charging system of the vehicle, which generally produces 60 to 80 amps, always sets the rating of the alternator, will actually back charge the batteries in the jump starter.

Because you're talking about very high current available, either directly from the now charged battery or from the charging system, the alternator, generator of the vehicle. It can, therefore, charge the jump starter batteries quite quickly.

They cite one to five minutes as opposed to a longer period of time if it was slow charged from a lower current source. And they point out that (quote as read):

> This is very useful -- I'm quoting -- This is very useful when starting fleets of vehicles with dead batteries.

This would be where you would use your jump starter to start one vehicle and then immediately use it or within one to five minutes use it to start another vehicle.

Q You said one to five minutes because Richardson states that the goal was to be able to

do this in about one to five minutes; right?

A He cites it as, as he says, (quote as read):

> This is very useful when starting fleets of vehicles.
>
> This is a rare situation, I should point out, but most compact jump starters are designed with the consumer in mind who is not going to be starting one vehicle after another vehicle. They're going to start their vehicle with the dead battery and then go to work or leave for the grocery store.

Q But Richardson's device is designed with that in mind you're saying?

A It has that additional capability beyond capabilities of any other way in which the jump starter batteries can be charged.

Q And at the beginning of this paragraph Richardson refers to Figures 1 and 2?

A Correct.

Q And you were saying that's 2C; correct?

A Yes. This really refers to Figures 2C.

Q And says specifically, (quote as

read):

Referring to Figures 1 and 2, a diode 35 may be connected across the contact 34 to charge the capacitors 21 and jump starter batteries 22 from the vehicle charging system 28.

Right?

A I didn't read along with you but that sounds correct.

Q Let's look at Figure 1 then on page --

A Did you mean Figure 2C?

Q Let's start with Figure 1.

A Okay. Figure 1 is a higher level diagram. So you can see towards the bottom of Figure 1, jump starter batteries 22. You see that? Bottom left.

A Yes.

Q And these are the same jump starter batteries 22 that Richardson is referring to in paragraph 55. Right?

A Yes. And as you can see from the schematic, they are in parallel with the optional capacitors.

Q Capacitors 21, they are also shown on Figure 1. Right?

A Correct.

Q And diode 35 that's refers to in paragraph 55, is also shown here in Figure 1. Right? On the right.

A Sorry, I -- what I heard was 55. This is 35.

Q I'm sorry, I have 35. I may have misspoke.

A I see it, yes. I see diode 35.

Q That's the diode that's referred to in paragraph 55?

A Yes.

Q And it's connected across the contact relay 34. Right?

A Yes. The power contacts of the relay, yes.

Q And then there's box 41 that's also connected to the contact relay. Do you see that?

A Yes.

Q And that's a thermal switch. Correct? It's referred to in paragraph 18, if you'd like to go there.

A It does not appear in Figures --

Q Thermal switch is box 41?
A Yes. I see that. I'm trying to match it to the diagram as we did previously, and I'm not finding it on the diagram. I'm referring to the schematic diagram.
Q Let's look at Figure 1 for now. We'll get to Figure 2.
A Yes, I definitely see it in Figure 1.
Q It's connected to the contact relay 34.
A Yes.
Q And do you recognize that as a thermal switch? Let me help you. Look at paragraph 18 on page 15. See the first sentence of paragraph 18 says (quote as read):

> The temperature of a 00 AWG shunt cable 37 may also be monitored by a temperature sensor or thermal switch 41.

You see that?
A Yes.
Q Then referring back to Figure 1?
A Yes.
Q 41 is a thermal switch. Correct?
A Correct. Which I would -- there's

multiple embodiments of thermal switches, but yes, I see it there.

Q Sure. And then that's connected, the thermal switch directly to the vehicle charging system 28 through jumper cables which are labeled 60 in Figure 1. Correct?

A Yes. It is in series with those.

Q So looking at this circuit in Figure 1, so long as this thermal switch 41 is closed, the vehicle charging system 28 is connected directly to the jump starter batteries 22 through the diode 35. Right?

A Correct. I'm sure you included the caveat that the diode flows current only in the charge direction, that is, the external battery of the vehicle or its charge system is now pushing current in the reverse direction of charging it to recharge the battery in the jump starter.

Q And that direct connection through that diode allows the charging system 28 inside the vehicle to directly charge the jump starter batteries 22 after the vehicle's been started. Right?

A I'm not sure about the first thing you said. The diode bypasses the contact relays.

So even when the contacts of the -- it's labeled contact relay, element 34, even when they are open, it still allows current to flow in the reverse direction in which it would be used as a jump starter.

Q Yes. So I guess let me rephrase the question. The connection from the vehicle 28 --

A Yes.

Q -- to the jump starter batteries 22 --

A Yes.

Q -- through that diode 35 --

A Yes.

Q -- is what enables the vehicle charging system to recharge the --

A Or the battery on board the vehicle, if it is adequately charged to be able to provide current back to the jump starter, yes.

Q To directly charge the jump starter batteries?

A Yes, that is the obvious purpose of that diode 35.

Q Then this same circuit is shown in Figures 2A and 2C of Richardson; correct?

A The diode is not shown in 2A. It is

shown in 2C.

Q Let's look at 2A first, they connect. So Figure 2A on page 3, you can see here are the batteries and they are inside that dark box labeled 22; right?

A That's correct.

Q And they go out to nodes C and D; correct?

A Yes.

Q And then now if you flip to Figure 2C on page 5, here again you have those nodes C and D; right?

A Yes.

Q And here you have the diode 35 connected to the vehicle 28?

A Yes.

Q So it's the same circuit?

MR. SMELCER: Objection, form.

A Please give me a moment, I've just noticed something in the diagram. Okay. I think the answer to your question is yes, but maybe you should repeat the question.

Q (BY MR. SAUER) I just wanted to confirm that the circuit showing a diode directly connecting the vehicle charging system 28 to the

batteries 22 is shown in both Figures 1 and is shown in the same way in Figures 2A and 2C. Is that correct? The same circuit is shown in both?

A The circuit, but 2A does not show the diode.

Q 2C shows the diode?

A That's correct.

Q But the circuit is shown in both. Correct? Same circuit? Is there a difference --

A Well, as you noticed in my Declaration, I just connected all these parts together. When they say A, B, C, D, these are page connectors. They're not specifically terminals they identify in the circuit. It's standard practice when you're writing out schematics that cover more than one page.

So, but the point being, the schematic of 2C would normally be placed to the right of the schematic in Figure 2A.

Q Let's just follow it through to make sure we're all on the same page. If you look at Figure 2C, you have a box labeled "Vehicle" that's reference 28?

A Yes.

Q And that's the same as the box in

Figure 1 that's labeled "Vehicle to Be Started" 28. Right?

A If I might just be more specific in answering, the connection shown as 28 going to "Vehicle to Be Started" is the red and the black thick jumper cables we'll call them, large clamps that normally you hook onto the terminals of the battery in the vehicle that you wish to jump start.

So it provides, as -- as you --

Q So if you can turn to page 15, please? Let me know when you're there.

A I'm there.

Q And let's say paragraph 16.

A Okay.

Q In the second sentence in paragraph 16 refers to 28 and it refers to it as (quote as read):

...the vehicle's electrical system 28.

Do you see that?

A Yes, are connected to the vehicle's electrical system in 28, yes.

Q And then on Figure 1, you can see there's reference 60. You see that?

A Yes. That's -- you've identified

that connection to -- when they say vehicle electrical system, in practice, the large jumper clamps are always connected to the terminals, usually the top and the side terminals of the battery in the vehicle. And then it does become part of the vehicle's electrical system.

So we can refer to it as the vehicle's electrical system or the terminals of the battery in the vehicle. They are the same.

Q Okay. And 60 on Figure 11 is referring to the jumper cables that are used to connect to that system; correct?

A Yes.

Q So back on page 5, Figure 2C, you can see there's the vehicle's electrical system 28 that we were just referring to?

A Yes.

Q And there are the clamps 60 that we were just referring to; correct?

A Yes.

Q And then from the red clamp, you can see there's a connection to box 41.

Do you see that? Do you see box 41?

A I'm searching for it. It's the positive terminal of the battery is connected to --

yes. It goes into something identified as box 41.

Q We identified -- we've already established that box 41 is the thermal switch; correct? Which is also shown --

A Yes.

Q -- also shown in Figure 1?

A Yes.

Q And then from that thermal switch 41, there's a connection to diode 35. Correct?

A It connects to one of the power contacts, the relay and the anode of diode 35.

Q And is that the same connection that's shown in Figure 1 between the thermal switch 41 and diode 35?

A Yes.

Q And then back to Figure 2C from the other terminal of diode 35, there's a connection to 36. Which is shown as a resistive device?

A Correct.

Q And if you look on Figure 1, you can see 36 is the 00 AWG cable; correct?

A Yes. American wire gauge.

Q So those are the same connections in Figure 1 and Figure 2. Correct?

A Yes.

Q And then back on Figure 2C, it goes from 36 to node C. Correct?

A Yes.

Q So if we can turn to Figure 2A on page 3, do you see node C?

A Yes, I do.

Q Node C is directly connected to battery 22, which is inside the dotted box on this page. Correct?

A Yes.

Q And referring to Figure 1 again, that's the same connection shown here between cable 36 and jump starter batteries 22. Correct?

A Yes.

Q So the circuit between the vehicle to be started 28 and the jump starter batteries 22 through diode 35 is the same circuit in Figure 1 and Figures 2A and 2C. Correct?

A It appears to be.

Q And in the circuits shown in Figure 1 and Figures 2 of Richardson, the connection between diode 35 from the vehicle charging system 28 to the jump starter batteries 22 is the only circuit that's shown for recharging jump starter batteries 22. Is that correct?

A It does identify a sensor connection labeled 26 intended to -- let me back up a minute. This is the problem with a block diagram. You're talking about circuits, you always have two conductors to pass power. It shows one as a signal path or a power flow path.

So 26 says sensor wiring harness and then it bifurcates into one leg going up to join what is identified as cable 36, which is the left side contactor of the relay. It also goes over to 60, which is the vehicle to be started battery.

I don't believe this is discussed in the text, but I can verify if you'd like me to be sure, but I believe that's simply an embodiment of saying it is a wiring harness and not a single conductor; therefore, there's actually two signals coming in on it for different purposes.

Q What different purposes?

A Well, one would be a fair measure of the voltage across the jump start batteries and the capacitors that are in parallel, and the other would be the voltage measured at the vehicle to be started.

The latter being critical for doing preliminary voltage measurements to assure that

you'd want to close the relay to charge that battery in the first place, Since the patent does identify the ability to detect a reverse connection or a -- not a -- a failure of the connection to the battery itself.

Q But as far as recharging the jump starter batteries 22, the only circuit that's shown is the connection through diode 35 from the vehicle battery. Correct?

A You're referring to Figure 1?

Q Yes, referring to Figure 1.

A That's correct. It only shows cable 36 going into it that carries power into the batteries and capacitors.

Q And the same is true for Figure 2; correct? 2A through 2C?

A Um, 80 percent, yes.

Q Let me help you.

A Let me qualify my answer.

Q Okay.

A Save you the trouble. There is nothing in Figures 2A or 2C you're referring to, these are the actual schematic diagrams, that preclude another contact being made to either draw power from the jump starter batteries or inject

power into it, current flowing into it.

But the primary path identified in both Figure 1 and Figure 2C where it shows the vehicle battery is indeed through the red and the black clamps.

Q You're saying there's nothing shown in these figures to preclude another contact to recharge the batteries, but there's no other contact shown to recharge the batteries other than from the vehicle battery system; correct?

A Well, it's possible that the reason that they broke out in the patent Figure 2C separately with connections C and D identified on them is, well, you may want to connect something else there.

But as shown here, Richardson is assuming in this embodiment that the power would be used to charge the jump start batteries would come in via cables labeled the red clamp and the black clamp connected to the vehicle battery.

Q And just to make it even more clear, let's look at page 16 of Richardson in paragraph 28. Why don't you go ahead and read paragraph 28 to yourself and let me know when you're done.

A Page 16, paragraph 28.

Q You see it?
A Yes. I'm reading.
Yes. And the final sentence of that does point out that you need not connect this to a vehicle battery or a vehicle charging system. You could connect it to any external source of power that could be used to recharge the jump start batteries, and they specifically mention a battery charger not shown has been connected to the batteries 22.
What they don't show, as you pointed out, is, well, where exactly would you connect that? And my statement before was allowing the fact there is actually several places shown in the schematic. They just haven't been identified by the words "connect battery charger here."
Q So you understand the words "not shown" in the last sentence of paragraph 28 --
A I do.
Q -- to mean that it's "not shown" in the drawings. Correct?
A The battery charger is not shown in the drawing. In fact, the battery charger and the connections are not shown in the drawing. But I'm sure that Richardson pointed it out because it's

just an obvious thing you could do and you may want to -- in fact, it's very likely you may want to recharge the batteries in the jump starter from an external battery charger, not shown, as opposed to hooking it up to a vehicle 12 volt battery.

Q But you can confirm that how you would connect that external battery charger is not shown in any of the figures for Richardson?

A It's not identified, but as far as shown, because there are conductors there that you could connect it to, I -- there are multiple possibilities shown. They are just not labeled as such in the diagram.

Q There's no charging circuitry shown to connect when an external battery is there?

A That's a much broader issue.

Q To connect to an external battery charger?

A I would prefer to leave the word "charging circuitry" to a follow-on question and discussion, but there is no specific point in that schematic diagram or in the block diagram, conceptual block diagram of Figure 1 in which they say "connect external battery charger here."

Q There's no circuitry shown to connect

to an external battery charger?

A No circuitry is necessary. All you need to do is connect the power source to the jump start batteries, and there's multiple places shown in the schematic where that's possible.

Q You want to take a break?

A Sure.

(Off the record.)

Q (BY MR. SAUER) Welcome back. Over the break did you and counsel talk about your testimony?

A No. Not at all.

Q Let's go now still with Richardson to paragraph 34, which is on page 16 of 20.

A I see it.

Q Can you read that paragraph to yourself, let me know when you're done?

A Okay.

Q So here, second sentence Richardson tells us that their jump starter can (quote as read):

...be configured for 12, 18, 24, 30, 36, 42, or 48 volts.

Correct?

A Yes.

MR. SMELCER: Objection, form.

Q (BY MR. SAUER) And this is done using jump selector 55 it tells us. Correct? Same sentence.

A Yeah. Got it. Referencing Figure 2A.

Q Yes. Let's look at Figure 2A since you're there, page 3. Figure 2A, the jump starter batteries are shown inside the dotted box labeled 22. Correct?

A That's correct.

Q And this includes two batteries labeled 23 and one battery labeled 25. Correct?

A Correct.

Q And the jump selector 55 here is shown with jumpers 27 and another one labeled 29. Correct?

A Correct.

Q And the jumpers are used to connect the batteries 23 or 25 in different configurations. Correct?

A Either in series or in parallel.

Q In series or in parallel?

A Series or in parallel. It's a classic series parallel switch.

Q How could you use these in connective parallel?

A Well, if you put the -- if 29 is -- well, let's start with the top. Normal operation -- if 27, if the jumper 27 is connected to the arrows to the left, the two arrows to the left, then you've placed these two batteries in series. If they are both 12 volt batteries, it would provide a 24 volt output, which would be maybe appropriate for a marine application or sometimes heavier duty engines.

Whereas, if the lower, 29, was connected to those, these two batteries would then be placed in parallel where you would be able to get double the current but at the 12 volt voltage.

Q Is it common to connect jump starter batteries in series?

A You could configure the battery pack and the jump starter to be probably whatever is the cheapest to the manufacturer battery, the best deal that they could come up with. You might want to -- electric vehicles batteries, for instance, are comprised of many cells. Series strings and then series strings are connected in parallel.

So both -- you see the same thing

going on here. And they're allowing the possibility that with just using jumper 27 or 29, that you could produce either 24 volts or 12 volts, assuming that each of the batteries labeled 23 are 12 volt nominal batteries.

Q To produce more current, you might put them in parallel?

A That's correct.

Q But to increase the voltage, you would want to put them in series?

A That's correct.

Q So, for example, if I wanted to -- let's say the batteries labeled 23 were both 12 volt batteries and I wanted to have a 24 volt output, I would then use the jumper cable to put them in series; correct?

A Yes.

Q And similarly, if I wanted to create a 48 volt battery, I would put some -- I would put batteries in series to do that?

A You said 12 volt?

Q Well, Richardson refers to --

A I think you meant -- the first question you asked placed them in series to create 28 volts.

Q 24, right.
A The second would create 12 volts by placing them in parallel.
Q Right. But to increase the voltage output of the batteries, you would place batteries in series?
A In series in general, yes. That's correct.
Q Most automobiles use 12 volts?
A Yes.
Q What kind of vehicles might need a battery larger than 12 volts?
A Some heavy duty engines that, say, might be found in a Class 6, 7, or 8 truck. There is, and has been for some years, a movement by auto manufacturers worldwide to transition to a 44 volt standard for automotive batteries so that they could use smaller conductors to carry the same power, and that hasn't gained much traction but I am aware that the high end of BMW and Mercedes product offerings, they do use 44 volt systems.
Q Is that why you want to configure potentially Richardson to output 48 volts?
A I'm not sure that the 40 volt standard was -- it was probably discussed in 2014

but I can't place the chronology. It's been kicking around a long time. But there's a lot of inertia in the automotive industry to change not just the batteries, but every electrical accessory, every -- the lights, the starting voltage.

So there's -- it's been a slow transition and some wonder whether it will ever occur.

Q Do you know of any vehicles that use a 48 volt battery?

A I can't say with certainty. I believe that some of the military vehicles use 48 volt systems. And 48 volts is actually the standard for small electric vehicles like golf carts. So if you were planning on quickly recharging the batteries in your golf cart, that would be a 48 volt connection.

Q Does the voltage of the vehicle battery have any relationship to the peak current that's necessary to start an engine?

A Yes, they are inversely related.

Q How so?

A Power is the product of the voltage times the current. So if you increase the voltage, say, going 12 to 48 by a factor of 4, you could

reduce the current by that same inverse factor.

Q But would a vehicle that -- maybe I have this backwards, but would a vehicle that operates with a higher voltage battery typically need a higher peak current?

A No, it would need a lower peak current because, as I was attempting to explain before, power is the product of the voltage times the current.

Q So you're not necessarily -- you're saying you're not necessarily using a larger, for example, 48 volt battery because it's a larger engine?

A That actually could be a motivation because the -- if you stuck with 12 volts and you have a cranking requirement, starting the motor requirement that, for 12 volts would be very, very large. High current. And a way of -- which would require very, very thick cables.

This is why, if you look at the cable that goes down to the starter in any car, it'll be pretty fat.

The way you can get away with reduced size of that cable, by reducing the current you have to push to the starter, you could increase the

starter's operating voltage. And it's an inverse relationship. The higher the voltage, the lower the current. To deliver the same power.

Q Now, if I'm putting batteries -- start over.

If I'm connecting batteries in series to achieve the output voltage that I want --

A The higher output voltage.

Q Yes, each one of those series connected batteries, since they're connected series, has to be capable of generating on its own the peak current. Correct?

A Yes, because they are in series and the current that is provided by each one of those batteries is the output current of the series connection.

Q So if Richardson is connecting -- has the capability of generating a 12 volt output and -- or connecting multiple of these 12 volt batteries in series to generate a higher output voltage, by connecting them in series, I would be necessarily increasing the capacity of the battery. Correct?

A Oh, no. No. Well, I'll allow that there may be multiple definitions of capacity of

the battery. You would be increasing the voltage capacity of the battery. But capacity usually refers to the energy that is stored in the combination of the batteries and that does not change whether it is connected in series or in parallel.

Q What I mean is since each battery has to be capable of generating the peak current because they're connected in series. Correct?

A Yes.

Q So let's say I have two batteries that each both -- each can generate a peak current of 500 amps. I connect those in series, since each individual battery still has to be able to generate 500 amp peak current, the voltage of them is the same, I'm doubling the battery capacity by connecting them in series; isn't that right?

A No. You're doubling the battery voltage.

Q But the current of each stays the same, so just times current is power, I'm doubling capacity. Right?

A Well, no, again, capacity, I will allow that by some other definition, maybe more of a layman's definition, capacity could mean a number

of things including the voltage capacity, the current capacity. But in automotive and electrical engineering, it's just assume, when you say the capacity of a battery, you are referring to its energy storage capacity usually measured in kilowatt hours.

And that does not change whether you hook the batteries up in series or parallel. You still have the same energy stored in each battery. It's just being delivered at a different current or voltage depending upon the series or parallel connection.

Q But I have one battery and now I have two connecting the series.

A Correct.

Q Each with the same capacity.

A Yes. So you have double the capacity.

Q So I've doubled the capacity. That's all I'm saying.

A Perhaps I misunderstood your question. You're really just asking, has nothing to do with series or parallel, has to do if I have two batteries, I have double the capacity of one, and that's correct.

Q But by connecting the series, I would have to have double the capacity. If I connected them in parallel, I could use smaller batteries because I don't need to generate the same peak current with each; right? You could cut that in half.

A No. I -- forgive me if I misinterpret. You're not getting any more power delivered to the starter regardless of whether they are hooked up in parallel or series. I'm emphasizing the word "power."

Q Mm-hmm.

A By hooking them in series, you're increasing the voltage but reducing -- retaining the current to the limits of each battery individually. So you said 500 amps. That 500 amps times now twice the voltage of one battery would give you a certain power measured in watts or kilowatts.

If you hook them in parallel, you still have the same energy storage capacity in the two batteries, but it's being delivered as twice the current but at the voltage of any -- of each of the individual batteries.

Q Okay. And in Richardson, if I were

trying to generate a 48 volt output, I would connect four 12 volt batteries in series. Correct?

A Yes. You could do it that way.

Q How else could you do it in Richardson?

A Well, "battery," by definition, means a connection of multiple cells, and by default it means an internal series connection of multiple cells. In a 12 volt battery there are six individual lead acid cells that are internally connected in series, and that's why it provides a 12 volt output. Did that answer your question?

Q That's why -- so you have a number of cells usually for inside the 12 volt battery, I understand that. But you want to create a 48 volt battery using Richardson's system now we can connect --

A You would take 12 volt batteries and took four of them in series.

Q Compared to a single 12 volt battery, it would be four times the battery capacity?

A Not capacity. You're not changing the capacity. Same amount of power can be delivered regardless of how you hook those up because it's based upon the energy storage capacity

of all of the batteries and all four, no matter how you hook them up, they will be -- they will be delivering that power in a different current or voltage, but it will be same power.

Q So you're saying if you were using a 12 volt output, you would still have the same four batteries, just connected differently?

A If you hook them in parallel to produce a 12 volt output, it would be at four times the current of any individual battery, and either way, 12 times 4 times the current is going to be the same power as 48 volt times 1 times the current.

Q I understand. So in that scenario the capacity would be the same four connected in parallel or four connected in series. But if instead the difference were one singular battery not connected to anything as an output, compared to four of the identical batteries connected to series --

A Series or parallel.

Q -- or parallel, you would --

A Doesn't matter.

Q -- you would have four times the capacity because you have four of the same

batteries?

A But at four times both the energy storage capacity and four times the power delivery capability, agnostic as to how they are connected.

Q Okay. Let's move on then to Yu. This is Exhibit 1008 in both IPRs. Exhibit 1008 is a copy of the translation of Chinese Utility Model Patent Number 203211234U, to inventor Yu Chunlan. Correct?

A Correct.

Q Do you recognize this as the same Yu reference you address in your Declarations?

A Yes.

Q Did you review Yu during the preparation of your Declarations?

A Yes.

Q About how much time?

A Gosh. I have to apologize, I don't do a very good accounting of my time. An adequate amount of time in order to understand it.

Q Would you consider yourself familiar with the technologies described in Yu?

A Yes.

Q Let's turn to page 5, please. Page 5, they're the same here. 5 of 5 and 5, so less

confusing.

A All right. You're talking about this page?

Q Page 5 of 12 at the bottom?

A It says yeah, 5, 5 of 12. Got it.

Q Here there's a paragraph 28. You see that?

A Got it.

Q Paragraph 28, it says, (quote as read):

> To allow the internal battery 1 to be charged, a charging input 10 interface is provided on the device.

Correct?

A That's what it says.

Q And then if you look on page 11, please?

A Mm-hmm.

Q That charging input 10 that you had described in paragraph 28 is shown in Figure 9. Correct?

A Charging input 10. The --

Q 10.

A Marked as 10 in Figure 9, it's a

female barrel connector.

Q That's what I was going to ask. It appears to be a barrel connector, a BC --

A It's kinda hard to tell. That actually could be a din connector or even a mini jack. What used to be called RCA jacks.

Q Okay.

A It's simply a way of connecting -- it's co-axial, to conductors, provides power.

Q Okay. Then on the same page you see Figure 7?

A I do.

Q And Figure 7 has two additional ports, one labeled 8 and one labeled 9?

A Correct.

Q Would you agree that port that's labeled 8 is a USB port?

A Yes, that's a USB-A port.

Q In paragraph 25, which is on page 4, turn to page 4?

A Okay.

Q 25 is at the bottom of page 4. Starting there and then it continues on the next page. And here it says, (quote as read):

For convenience of use, the

emergency automotive starting device in the present invention also includes a 5 volt output circuit and a 19 volt output circuit; the 5 volt output circuit is connected to the 5 volt output terminal 8.

Correct?

A Correct.

Q And it goes on. Correct?

A Correct.

Q So this is telling us that that USB port labeled 8 in Figure 7 is a 5 volt output terminal; right?

A According to this sentence, yes.

Q That's enough of Yu. If you could pull out your '023 Declaration again, please?

A Got it.

Q Turn to page 39.

A Okay. I'm on page 39.

Q Starting at the bottom of page 39, you're addressing what you call Limitation 1(f) of the '023 patent. Right?

A Yes.

Q And Limitation 1(f) requires (quote

as read):

A USB input circuit connected to the power supply, the USB input circuit configured for converting power from a USB power source to increase power voltage to the power supply.

Correct?

A Correct.

Q And here you're relying on the combination of Richardson and Zhao for this claim element. Correct?

A Yes.

Q Flip then to page 43.

A Go ahead.

Q Page 43 in paragraph 89, you're still referring to claim element 1(f). Correct?

A Let me double check that. Yes.

Q And in paragraph 89 you say, you support your proposed combination of Richardson and Zhao, you cite to USB-IF Battery Charging Specification, Revision 1, which is Exhibit 1025. Correct?

A Correct.

Q And quoting from the first sentence

in paragraph 89, you cite to this USB charging specification as showing (quote as read):

..the known benefits of utilizing USB technology to charge battery powered devices.

Correct?

A Yes.

Q As a person of skill in the art, if you were adding a USB input port to charge battery powered device in 2014, was this the USB specification that you would have relied on?

MR. SMELCER: Object to form.

A There were revisions to the revision. There was a 1.1, 1.2, I think there are -- they are mentioned in exhibit -- on the face of it, it says Exhibit D, so you would, at the very least, conform to a specification from 2007, seven years later, 2014. But there may be -- but the variations, improvements in the specification between then and 2014, would also be apropos.

Q (BY MR. SAUER) You didn't refer to any other USB specification in your Declaration, did you?

A No. Well, gosh. To save the time of me verifying by an extensive read, if you're aware

of a reference to it, let me know. Otherwise, I have no recollection of referring to a sub specification.

Q I'm not. And if you look on page 5 --

A Of my Declaration?

Q -- 5 through 7 of your Declaration, there is an exhibit list so you can refresh your recollection.

A You're referring me to the exhibit list.

Q Yes.

A And this is the exhibit referred to.

Q Right. And that's the only USB specification that's an exhibit.

A Right, but if you note inside this, there is mention of sub specifications.

Q The witness is looking at Exhibit --

A Exhibit 1025.

Q Okay.

A Um, I'm not seeing it in the Table of Contents for the exhibit, which is quite lengthy. But I can tell you with certainty that USB Battery Charging Specification 2 came out in 2012. So in 2014 it would definitely be appropriate.

Q That's not cited your Declaration, is it?

A Honestly, to save the time of exhaustively checking everything in a 100-page document I wrote eight months ago, I can tell you with certainty that charging standard one oh from 2007 would be applicable. There were revisions to the revision. I know specifically one came out in 2010, but the most relevant change, a very radical change, occurred in 2012 with revision 2.0 that then subsequently had its own sub revisions.

Q If they were applicable, is there a reason they're not in your Declaration?

A Well, that's assuming that I didn't. It's probably true that I didn't. I just didn't want to do an exhaustive check.

Q I'll proffer to you that you didn't cite any other USB specifications.

A I'll believe you and your question was is that the reason I didn't cite?

Q No. Is there a reason you didn't cite them?

A Is there a reason? No. Well, let me change that. It wasn't required that the capabilities, the power transfer standards that

were established in the rev 1 charging spec were adequate for -- for all of the discussions, and Nook doesn't cite them either.

Q That circles back to my first question then. Is this the USB standard that you would have relied on as showing the power requirements that were necessary to install a USB port into a jump starter in 2014?

A It would have been adequate because spec 1, I had actually allowed a change from the 5 volt input to as high as 20 volts, and that was greatly expanded when it came -- when two oh came around in 2012, that that was more than adequate, and although Nook -- neither of the patents talks about the capacity of the USB, it's -- I believe this was retained in 2007, it was certainly part of the original USB spec, that the maximum current expected was 100 milliamps. Which wasn't much when you consider it's either 5 or under the new power spec which allowed higher voltages, you could run it up as high as 20.

In fact, I think they even mentioned in spec 1 -- actually, I'm sure they did, that's from memory, that under that 2007 USB power spec 1, you could push it up to 500 milliamps if -- it says

if bus is not suspended and configured for 500 milliamps. So there has to be some special provision in the hardware for that.

Either way the output is fairly small. They allowed for the absolute maximum power transfer in the original spec, again from memory of I believe 100 watts.

Q Let's take a look at that. Let's start on page 6, and you are familiar with this document?

A Which document?

Q Exhibit 1025? The USB specification we've just been talking about?

A Yes.

Q So let's look at page 6. And on page 6, are you there?

A Not yet.

Q Take your time. At the bottom where it says page 6 of 30, this is another one that has multiple numbers.

A Okay.

Q And there should be section 1.2 on page 6. Do you see that?

A Yes. Background.

Q Yes. And it continues for a few

short paragraphs. Can you read -- go ahead and read section 1.2 to yourself. Just let me know when you're done.

A I've read it.

Q Okay. So second paragraph, section 1.2 starts with, (quote as read):

If a portable device is attached to a USB host or hub, then the USB 2.0 spec requires that: After connecting, a portable device must draw less than.

And then it lists some current requirements; right?

A Yes.

Q So am I correct that what this means is that if you were drawing power from a standard USB host or hub, you had to meet the listed current requirements from the USB 2.0 spec. Right?

A Yes.

Q And then the next paragraph starts -- it refers to different current requirements if attached to authenticated charger or a host or hub charger; right?

A Yes.

Q And specifically for a dedicated

charger, it says you're allowed to draw a current of, and it gives a defined term of IDEV_DCHGR; right?

A Yes.

Q And then for a host or hub charger, it says you're allowed to draw a current of either two more defined terms, first being IDEV_HCHGR_LFS, or IDEV_HCHGR_HS. Right?

A Yes.

Q So let's talk first about the standard USB host or hub. The second paragraph of section 1.2 tells us that after connecting a portable device to a USB host or hub, USB 2.0 requires that the maximum current that the portable device can draw from the USB connection is 500 milliamps; right?

A Yes. Subject to the requirement if a bus is not suspended and it is configured for 500 milliamps.

Q Right. So there were some situations where it can draw less than that, but the maximum it can draw --

A Normally it's 100 milliamps because -- except in specific cases of -- they refer to them as -- well. I'll simply refer to it as USB

connection specifically for charging that have slightly larger conductors and contacts. They would be -- that would constitute configuring them for 500 milliamps.

Q So normally it's 100 milliamps, but there's some situations where it could be up to 500 milliamps?

A Yes.

Q And if you add 500 milliamps, that's provided at 5 volts, right, USB?

A Well, under 2007 spec, the nominal voltage, the initial connect voltage is always 5 volts. But following the negotiation that occurs over the data lines, a different voltage could be called for, a different current limit could be called for. That's one of the advantages of USB for power transfer.

Q At 5 volts, the power would be, what, five times 500 milliamps, so 2.5 watts; right?

A I was referring to 100 milliamps. So at 500 milliamps, yes, it would be 2.5 watts, that's correct. At 5 volts.

Q If it was at -- then if you took and boosted that 5 volts to a higher voltage, you'd still have a maximum of 2.5 watts; correct?

A Yes.
Q 2.5 watts is the most I can pull?
A Second part of your statement, yes. First part, no. They -- I would like to review -- refresh my memory on how it handles power limits under the maximum condition. I believe under the -- I will say this from memory and then confirm in a moment.
I believe the current spec is independent of the voltage spec because under -- it's unlike the situation we were talking about before, you're not constrained to a specific power transfer rate. It is defined in this spec in terms of current and voltage.
Q I understand what you're saying. I'm not talking about using USB to configure a higher voltage. I understand that's allowed for in this, but set that aside. It's you're using USB to output 5 volts, in the maximum --
A Correct.
Q -- 500 milliamps.
A Unless negotiated otherwise.
Q Unless negotiated otherwise. But we've negotiated 5 volt output, 500 milliamps, so the maximum power is 2.5 watts.

A Okay. In that -- with configured for 500 milliamps, yes.

Q If I took that 5 volt output with external circuitry and I boosted it to a higher voltage, I couldn't pull -- I couldn't pull more than 2.5 watts from that USB, could I?

A That's what I was saying I'd like to verify, because I don't believe they, unlike the situation we were talking about before, my recollection is that you could still provide 500 -- 500 milliamps at -- under the spec, I'm not talking about how you would do it, but at that higher voltage, whatever it was supplied as.

Now, I'm going to -- what I think you're talking about is what you could do with that power after it is received by the device. Is that it?

Q Right. I'm trying to get my head around is it power limited, that USB port? I can only draw 2.5 watts from that?

A I don't believe that that is, you know, I'd like to review that, but from memory, no, I don't believe that it says that it is limited to 2.5 watts.

That's why you see it written out as

2.5 milliamps, 100 milliamps, or 500 milliamps, under various conditions, and then elsewhere it allows for the possibility that the voltage delivered could be something other than 5 volts, if negotiated.

I don't believe -- I don't recall it being limited at a higher voltage to the same power transfer. I believe the power transfer -- I think the power transfer would actually be higher. But this sounds like it's important to your argument, so may I take a look at -- read the document and verify this?

Q Let's make sure we have the same hypothetical in mind. You have a USB port that's outputting 5 volts.

A Okay.

Q And it's current limited under the USB specifications to --

A 500 milliamps at the extreme, which is delivering 2.5 watts.

Q And then external circuitry that receives that 5 volts and 500 milliamps, you have a boost converter that changes the voltage.

A Yes.

Q So the question is, does that

necessarily lower than the current since you're limited to 2.5 watts, or can you deliver more than 2.5 watts?

MR. SMELCER: Object to form.

Q (BY MR. SAUER) Does that make sense to you?

A Yes. That was what I was saying. I think you're talking about what happens after it gets into the device where it hits a DC to DC converter and it up converts the voltage. But this is something that happens inside your device as opposed to negotiated by the voltage supplied by the source.

Q Exactly.

A And the answer to that question is I don't think there could be a difference. 2.5 watts delivered to your device, if you up convert it to a higher voltage, you will compromise the current such that, at best, you could still provide 2.5 watts after the DC to DC converter. In fact, slightly less because of the second law of thermodynamics. Which means you always lose.

Q In fact, DC to DC converters are lossy devices; right?

A A high quality device is probably

about 80 percent efficient. It depends on the configuration of the DC to DC converter, also.

Q Let's say you boosted all the way to 48 volts. You'd still have to --

A If 2.5 watts was all that's coming into the device, you can't get energy out of nothing. You're still going to be limited to that 2.5 watts, which means at 48 volts, you're going to be proportionally decreasing the current.

Q 2.5 divided by 48, which is about 52 milliamps?

A Yes. Yeah, you have that configuration.

Q Let's look at the higher currents under this USB spec. Look at page 29. 29 of 30. Table 5 point -- 5-2?

A Mm-hmm.

Q Table 5-2, the specification lists the currents for power received from different types of chargers.

Do you see that?

A Yes.

Q And the highest current listed here is from the dedicated charger IDEV_DCHGR. Right?

A Yes. First line.

Q And that's at 1.8 amps. Right?
A I see 1.5. Oh, 1.8, third line down.
Q Yeah.
A "Device Current from Dedicated Charger." Yes. That's a maximum rating.
Q Maximum rating of 1.8 amps, but you make a good point. The dedicated charger output current is 1.5 max amps; right?
A Yes.
Q So why then is the device current from the dedicated charger, line 3, higher than the 1.5 max that the dedicated charger is able to put out, if you know?
A I could tell you if I had a little bit of time to go through this and -- more than a little bit of time. I cannot answer off the top of my head.
Q That's fair. Let's just assume 1.8 is the max then, if you're using a dedicated charger, but you'd still -- it's the same holds true; right? If your 5 volt output, then the maximum power that you could deliver would then be 1.8 times 5, 9 watts?
A My assumption, consistent with the data sheets, is when they list a max value, that

means do not ever exceed this or something's going to burn up.

Devices are never operated at the max. It just wouldn't be -- it would compromise your reliability a bit depending on who's designing the device, whatever their internal design margins were, it could be more or less hazardous.

And the criteria they use for determining the max, like, do I see smoke yet, or is it just above 100 Centigrade or something. So it can mean a lot of different things, but please don't assume that 1.8 amps is a normal way you would transfer power under this USB specification.

Q Same holds true as under the lower current for USB 2.0 if we boosted that voltage externally above 5 volts, we would lower the current that we could deliver because the wattage stays the same; correct?

A Yes, the power flow rate would be the same or even slightly less.

MR. SAUER: All right. Why don't we take a break. I might be done here.

(Off the record.)

MR. SAUER: Welcome back. I have no further questions.

MR. SMELCER: I have no questions at this time.

THE REPORTER: Signature?

MR. SMELCER: I will reserve the right to read and sign. Thank you.

(Wherein, the taking of the instant deposition ceased at 11:26 AM.)

(Deposition to be read and signed by the witness.)

CERTIFICATE OF REPORTER

I, TARA SCHWAKE, a Registered Professional Reporter and Notary Public within and for the State of Missouri, do hereby certify that the witness whose testimony appears in the foregoing deposition was duly sworn by me; that the testimony of said witness was taken by me to the best of my ability and thereafter reduced to typewriting under my direction; that I am neither counsel for, related to, nor employed by any of the parties to the action in which this deposition was taken, and further that I am not a relative or employee of any attorney or counsel employed by the parties thereto, nor financially or otherwise interested in the outcome of the action.

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November 5, 2024

To: Paul Smelcer, Esq.

Case Name: ADC Solutions Auto LLC v. The NOCO Company

Veritext Reference Number: 6947786

Witness: Dr. C. Arthur MacCarley Deposition Date: 10/29/2024

Dear Sir/Madam:

Enclosed please find a deposition transcript. Please have the witness review the transcript and note any changes or corrections on the included errata sheet, indicating the page, line number, change, and the reason for the change. Have the witness' signature notarized and forward the completed page(s) back to us at the Production address shown above, or email to production-midwest@veritext.com.

If the errata is not returned within thirty days of your receipt of this letter, the reading and signing will be deemed waived.

Sincerely,
Production Department

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DEPOSITION REVIEW
CERTIFICATION OF WITNESS

ASSIGNMENT REFERENCE NO: 6947786
CASE NAME: ADC Solutions Auto LLC v. The NOCO Company
DATE OF DEPOSITION: 10/29/2024
WITNESS' NAME: Dr. C. Arthur MacCarley

In accordance with the Rules of Civil Procedure, I have read the entire transcript of my testimony or it has been read to me.

I have made no changes to the testimony as transcribed by the court reporter.

_____ _____
Date Dr. C. Arthur MacCarley

Sworn to and subscribed before me, a Notary Public in and for the State and County, the referenced witness did personally appear and acknowledge that:

They have read the transcript;
They signed the foregoing Sworn Statement; and
Their execution of this Statement is of their free act and deed.

I have affixed my name and official seal

this _____ day of_____, 20____.

_____
Notary Public

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Commission Expiration Date

DEPOSITION REVIEW
CERTIFICATION OF WITNESS

ASSIGNMENT REFERENCE NO: 6947786
CASE NAME: ADC Solutions Auto LLC v. The NOCO Company
DATE OF DEPOSITION: 10/29/2024
WITNESS' NAME: Dr. C. Arthur MacCarley

In accordance with the Rules of Civil Procedure, I have read the entire transcript of my testimony or it has been read to me.

I have listed my changes on the attached Errata Sheet, listing page and line numbers as well as the reason(s) for the change(s).

I request that these changes be entered as part of the record of my testimony.

I have executed the Errata Sheet, as well as this Certificate, and request and authorize that both be appended to the transcript of my testimony and be incorporated therein.

Signed by: Art MacCarley 212681AE61344F7...

11/15/2024
_____ _____
Date Dr. C. Arthur MacCarley

Sworn to and subscribed before me, a Notary Public in and for the State and County, the referenced witness did personally appear and acknowledge that:

They have read the transcript;
They have listed all of their corrections in the appended Errata Sheet;
They signed the foregoing Sworn Statement; and
Their execution of this Statement is of their free act and deed.

I have affixed my name and official seal this _____ day of_____, 20____.

_____
Notary Public

_____
Commission Expiration Date

ERRATA SHEET 1 of 2

VERITEXT LEGAL SOLUTIONS MIDWEST

ASSIGNMENT NO: 6947786

PAGE/LINE(S) /	CHANGE	/REASON
7:19	"I'll speak louder" was my response to a request by the court reporter.	
16:25	Replace "talk about I developed" with "talk about, I developed"	/ grammar
27:17-18	Replace "than in the car were in" with "than if the car were in"	/ transcription error
28:12	Replace "side" with "site"	/ transcription error
31:2	Replace "kept" with "connected"	/ transcription error
36:3	Replace "always sets" with "according to"	/ transcription error
36:9	Replace "alternator, generator" with "alternator or generator"	/ transcription error
37:7	Replace "but" with "that"	/ transcription error
41:25	Replace "contact relays" with "relay contacts"	/ transcription error
46:4	Replace "top and the side terminals" with "top or side terminals"	/ transcription error
47:11	Replace "contacts, the relay" with "contacts of the relay"	/ transcription error
51:17	Replace "power would" with "power that would"	/ transcription error
52:14	Replace "is" with "are"	/ transcription error
53:10	Remove "because"	/ transcription error
57:25	Replace "28" with "24"	/ transcription error

15 November 2024 _____ Art MacCarley _____

Date Dr. C. Arthur MacCarley

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DAY OF _____, 20_____ .

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Notary Public

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ERRATA SHEET 2 of 2

VERITEXT LEGAL SOLUTIONS MIDWEST

ASSIGNMENT NO: 6947786

PAGE/LINE(S) /	CHANGE	/REASON
58:20	Replace "that the" with "that in the"	transcription error
58:24	Replace "40" with "44"	transcription error
59:3	Replace "change" with "changing"	transcription error
63:3	Replace "assume" with "assumed"	transcription error
65:19	Replace "took" with "put"	transcription error
69:9	Replace "to" with "two"	transcription error
72:18	Replace "variations" with "various"	transcription error
74:6	Remove "oh"	transcription error
75:12	Replace "two oh" with "two point zero"	transcription error
75:19	Replace "either 5 or" with "either 5 volts, or"	transcription error
76:6	Replace "memory of" with "memory, of"	grammar
81:21	Replace "that that" with "that it"	transcription error

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Federal Rules of Civil Procedure

Rule 30

(e) Review By the Witness; Changes.

(1) Review; Statement of Changes. On request by the deponent or a party before the deposition is completed, the deponent must be allowed 30 days after being notified by the officer that the transcript or recording is available in which:

(A) to review the transcript or recording; and

(B) if there are changes in form or substance, to sign a statement listing the changes and the reasons for making them.

(2) Changes Indicated in the Officer's Certificate. The officer must note in the certificate prescribed by Rule 30(f)(1) whether a review was requested and, if so, must attach any changes the deponent makes during the 30-day period.

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