

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ADC SOLUTIONS AUTO LLC
Petitioner

v.

THE NOCO COMPANY
Patent Owner

Patent No. 11,584,243
Issue Date: February 21, 2023

Title: JUMP STARTING DEVICE WITH USB

Inter Partes Review No. IPR2024-00671

**DECLARATION OF C. ARTHUR MACCARLEY, Ph.D., P.E.
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 11,584,243**

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I. INTRODUCTION

1. I, C. Arthur MacCarley, offer this declaration in support of the Petition for *Inter Partes* Review of U.S. Patent No. 11,584,243 (“the ’243 patent”). I am over the age of 18, competent to make this declaration, and have personal knowledge of the facts set forth below. If called to testify, I could and would testify honestly, under oath, to the matters set forth herein.

2. I am not an attorney. I have not been asked to offer any legal opinions. I have been informed and understand the law to be applied for determining invalidity, which I explain in places below. I have applied the law told to me in developing my technical opinions in this Declaration.

II. BACKGROUND AND QUALIFICATIONS

A. Education and Work Experience

3. I am a technical expert with over 40 years of experience in the field of electrical engineering and automotive systems, including DC power supplies and battery charging technology. This includes expertise in the areas of electronic circuits, control systems, power electronics, power conversion, safety systems, and battery charging systems.

4. I earned my Bachelor of Science in Engineering (Energy and Kinetics specialization) and a Master of Science (Electrical Engineering) from the University of California, Los Angeles, in 1976 and 1978, respectively. I was employed by Hughes Aircraft Corp between 1976 and 1979. Between 1979 and

1984, I was employed by the University of Denver Research Institute and the American Bosch Division of United Technologies. I then earned a Ph.D. in Electrical Engineering with a specialty in Computer-based Control Systems in 1987 from Purdue University. While at Purdue, I was the recipient of the David Ross Fellowship for doctoral study and focused my research on microprocessor-based control systems and advanced indirect sensing methods for automotive applications. My curriculum vitae contains a detailed description of my work history and education. EX1004.

5. My research and development work since the late 1970s has involved advanced control systems in automotive or transportation applications, including developing microprocessor-based control systems. As an academic, my teaching specialization is control systems and electronics applicable to automotive and similar applications utilizing power supplies. My university teaching and research specialties include digital control systems, microprocessor-embedded systems, automotive and transportation electronics, and advanced sensors, all with applications in the field of power supplies. Accordingly, I have conducted research and managed many projects that are highly relevant to the subject matter of the '243 patent, as further detailed below.

6. I am currently an Emeritus Professor of Electrical and Computer Engineering at the California Polytechnic State University, San Luis Obispo, CA

(Cal Poly), a leading public technical university in the United States. I served on the faculty of the California Polytechnic College of Engineering from 1988 to 2019 and have been tenured since 1994. Since 2019, I have been teaching part time at Cal Poly in addition to consulting in forensic automotive electronics. My academic and research specialties include digital control systems, advanced electronics, and electric and alternative energy vehicle engineering. Among other appointments, I served as the Chair of the Electrical and Computer Engineering Department (2007-2010), as the Director of the Computer Engineering Program (2000-2003), and as the Director of the Transportation Electronics Laboratory (1994-2013).

7. I also teach automotive engineering and electrical engineering as part of an international summer school program at the Munich University of Applied Sciences (Hochschule München, HM), every summer since 2014, and taught during the regular academic year in 2016.

8. I am a Senior Member of the Society of Automotive Engineers (SAE), the Institute of Electrical and Electronic Engineers (IEEE), and Sigma Xi (Scientific Research Honor Society). I have been a Registered Professional Engineer in good standing in the State of Colorado continuously since 1981.

9. I have published 89 technical papers and articles in journals and conference proceedings and as book chapters, in the field of automotive and

transportation electronics and control systems. Among my research activities have been funded research projects on electric vehicle battery systems and automated battery exchange, indirect sensing methods for engine control for the National Science Foundation, the US Department of Energy, the California Energy Commission, US Department of Commerce, and Isuzu Motor Company. I have served as an expert witness in 21 litigated cases since 1999.

10. Based upon on my education, my professional experience from 1978 through the present, and my scholarly publications, I am an expert in the relevant field of the '243 patent at issue here, and I have been an expert in this field since before the '243 patent was effectively filed with the United States Patent and Trademark Office ("USPTO"). I am intimately familiar with how a person of ordinary skill in the art (herein "PHOSITA") would have understood and used the terminology found in the '243 patent at the time of its claimed priority date.

B. Engagement

11. I have been retained as an independent expert consultant by ADC Solutions Auto LLC ("Petitioner") in connection with a petition for *inter partes* review of the '243 patent. EX1001.

12. Specifically, I was asked to investigate and opine on the technology claimed in, and the patentability or unpatentability of certain claims of the '243 Patent. Specifically, I was asked to opine on the validity of claims 1, 2, 15, 17, 18,

51, 54, and 57 (the “Challenged Claims”) of the ’243 Patent.

13. Although I am being compensated for my services in this matter at my standard consulting rate of \$300 per hour, my compensation is not contingent upon the opinions I render or the outcome of this proceeding. I have no financial interest in any of the parties, and I have no other interest in this proceeding.

14. This report is based on information currently available to me. I reserve the right to amend or supplement my analysis in this report and/or to respond to any additional submissions prepared by or on behalf of the Patent Owner. I also reserve the right to amend or supplement my opinions based on further discovery and information provided in the case.

15. I reserve the right to create any additional summaries, tutorials, demonstrations, charts, drawings, tables, and/or animations that may be appropriate to supplement and demonstrate my opinions as necessary.

16. All the opinions stated in this report are based on my own personal knowledge and professional judgment.

III. MATERIALS CONSIDERED

17. I have considered the following list of materials in formulating my opinions in this matter:

Ex #	Exhibit
1001	U.S. Patent No. 11,584,243 (“the ’243 patent”)

Ex #	Exhibit
1002	Prosecution History of the '243 patent
1005	U.S. Patent Publication No. 2013/0154543 A1 to Richardson et al. ("Richardson")
1006	U.S. Patent No. 9,391,467 B2 to Zhao et al. ("Zhao")
1007	Chinese Utility Model Patent No. CN 203211234 U to Yu ("Yu")
1008	Certified English Translation of Yu
1009	U.S. Patent No. 9,219,372 B2 to Paparrizos et al. ("Paparrizos")
1012	XR3403 Datasheet by XySemi Inc., Rev. 0.5
1013	U.S. Patent No. 9,007,015 to Nook et al. ("the '015 Patent")
1014	Final Written Decision in IPR2020-00944 (Paper 73) as to the '015 Patent, dated November 3, 2021
1016	U.S. Patent Publication No. 2013/0285596 A1 to Zhou et al. ("Zhou")
1017	U.S. Patent No. 9,035,599 B2 to Amemiya et al. ("Amemiya")
1018	Chinese Utility Model Patent No. CN 202512152 U
1019	Certified English Translation of CN 202512152 U
1020	Chinese Utility Model Patent Publication No. CN 201226449Y
1021	Certified English Translation of CN 201226449Y
1022	Chinese Utility Model Patent No. CN 203788026 U
1023	Certified English Translation of CN 203788026 U
1024	Declaration of Jeffrey L. Ravencraft of USB Implementers Forum, Inc., dated October 28, 2023 ("Ravencraft Decl.")
1025	Battery Charging Specification, Revision 1.0, Mar. 8, 2007 from the Universal Serial Bus Implementers Forum ("USB-IF"), Ex. D to Ravencraft Decl.
1026	Transcript of Deposition of Bryan A. Legates, dated September 25, 2023 ("Legates Dep. Tr.")
1027	Respondents' Subpoena Ad Testificandum to Bryan Legates, Ex. 2 to Legates Dep. Tr.
1029	Brents, Barry, "Automotive Electronics Drive The Need For Circuit Protection," Electronic Design (May 7, 2014), accessed via

Ex #	Exhibit
	https://www.electronicdesign.com/technologies/power/article/21799679/automotive-electronics-drive-the-need-for-circuit-protection
1030	Healey, James R., “Newest VW lacks USB, only iPhones welcome,” USA Today (July 8, 2014), accessed via https://www.usatoday.com/story/money/cars/2014/07/08/vw-gti-2015-usb-iphone/12378577/
1031	U.S. Publication No. 2013/0241488 A1 (“Dao”)
1032	U.S. Publication No. 2014/0139175 A1 to Gonzalez
1033	U.S. Publication No. 2007/0285049 A1 to Krieger et al.
1034	U.S. Publication No. 2010/0301800 to Innskeep
1035	International Publication No. WO 2008/106447 A2
1036	U.S. Publication No. 2002/0193015 A1 to Milan
1037	U.S. Publication No. 2005/0170699 A1 to Overtoom
1038	U.S. Patent No. 9,368,966 B2 to Green
1039	U.S. Publication No. 2013/0257346 A1 to Jakins et al.
1040	U.S. Patent No. 9,954,391 B2 to Lei
1041	U.S. Publication No. 2007/0108940 A1 to Sainomoto et al.
1042	U.S. Publication No. 2013/0241496 A1 to Kurayama
1043	International Publication No. WO 01/91208 A2

IV. OVERVIEW OF THE PATENT AT ISSUE

18. I have read and understand the ’243 patent, filed March 16, 2020 (EX1001), as well as its prosecution history (EX1002). I have been advised that the ’243 patent has a priority date of July 3, 2014.

19. The ’243 patent discloses a battery-powered emergency power source that can boost, charge, or “jump start” a vehicle that has a depleted or discharged

automotive battery. EX1001, Abstract, 1:5-7. The term “jump starter” refers to a portable device that electrically connects to the positive and negative terminals of an automotive SLI (starting lighting and ignition) battery, that can provide for a few seconds up to 400-700 Amps DC current, sufficient to activate the engine starter motor. This operation is called “jump starting”, a term that originally required the use of long heavy gauge “jumper cables” or “booster cables” connected between the discharged battery and a fully charged battery in another vehicle. Portable engine starting devices, aka “jump boxes” or “start boxes” date back to approximately the 1950s, originally used for off-road racing vehicles that carried only a small or no battery to save weight. Compact jump starters became much more popular for emergency starting of cars following the development in the late 1990’s of lithium-ion batteries that allowed them to be smaller and lighter than predecessor devices that usually contained either a lead-acid SLI battery or many standard size D flashlight batteries. Although other nomenclature is also common, I will refer to this type of device as a “jump starter” throughout my declaration.

20. The ’243 patent discloses a jump starter with an internal power supply which can be a rechargeable lithium ion battery pack of series-connected cells with a nominal voltage of 11.1V. EX1001, Abstract, Fig. 1, 3:20-22, 3:48-50.

21. The ’243 patent discloses jumper cables with cable clamps for

connecting the jump starter to the terminal of a vehicle battery. EX1001, Fig. 4, 3:51-55, 7:67-8:3.

22. The jump starter disclosed in the '243 patent also includes a microcontroller. EX1001, Abstract, Fig. 1. The '243 patent contemplates the use of a commercial off-the-shelf HT67F30 from Holtek Semiconductor Inc. for the microcontroller. EX1001, 4:27-36.

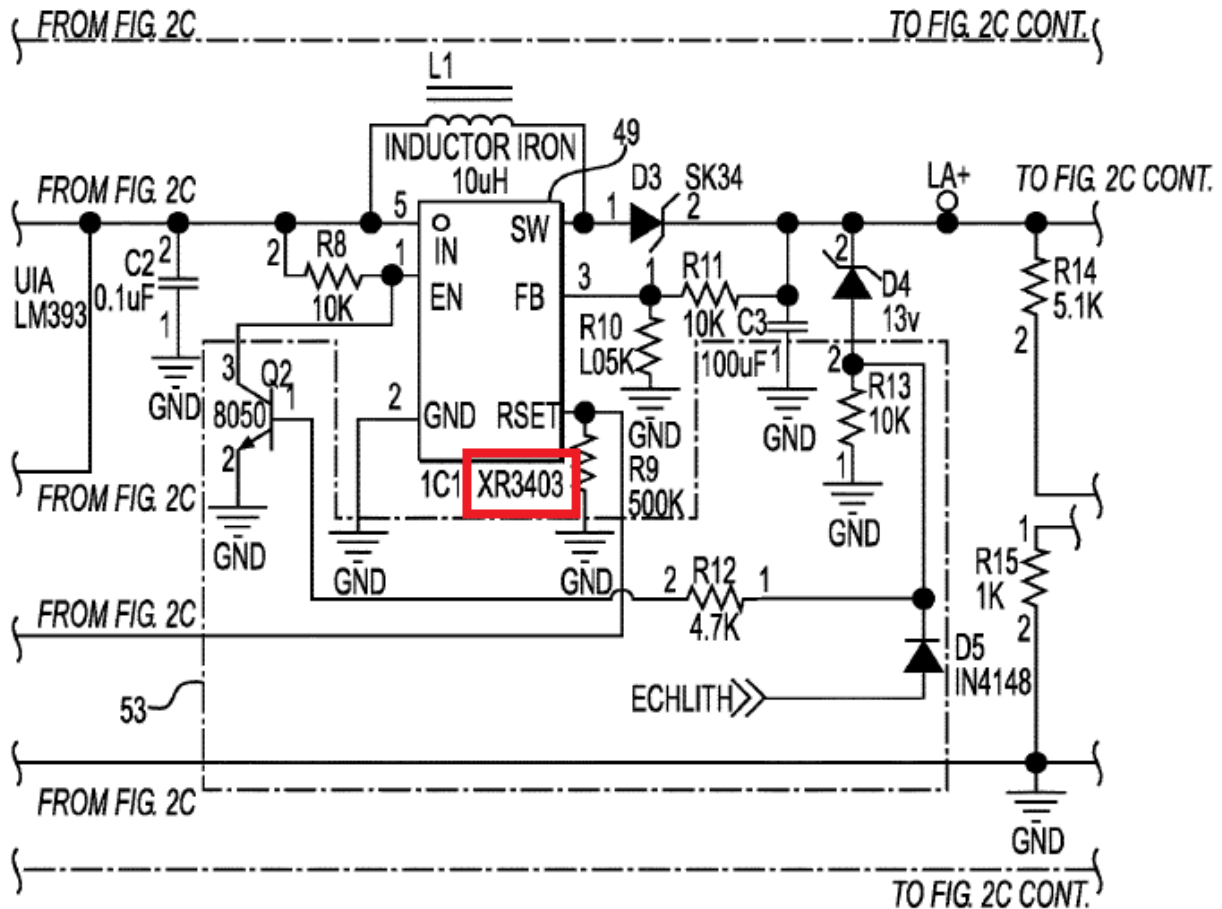
23. The jump starter disclosed in the '243 patent also includes a FET used as an electronic switch, controlled by the microcontroller. EX1001, Abstract, Fig. 1, 6:6-21.

24. The jump starter disclosed in the '243 patent includes two safety features: reverse polarity detection and battery presence detection. Both features were common in commercially-available jump starters and battery chargers well before July 3, 2014. EX1001, Abstract, 1:11-3:10. These safety features are implemented in connection with Car Battery Reverse Sensor 10 and Car Battery Isolation Sensor 12. EX1001, Fig. 1, Fig. 2A. These sensors interact with the microcontroller as part of a system that controls the power switch to provide power output for a jump start. EX1001, 3:23-47, 4:37-48, 5:33-6:5.

25. The jump starter of the '243 patent also includes USB charge circuit 52. EX1001, Fig. 1, Fig. 2C. "USB charge circuit 52 converts power from any USB charger power source, charge voltage and current for charging the lithium

battery pack 32.” EX1001, 5:24-26. This charge circuit can utilize “a standard USB charger”, “a standard micro-USB connector”, and “standard cables” for charging the battery pack of the jump starter. EX1001, 7:32-35. A DC-DC converter is used to boost or up-convert the 5V USB input “to the 12.4 VDC required for charging the internal lithium battery pack.” EX1001, 7:35-38. “DC-DC converter 49 can be turned on and off via circuit 53 by an output from the microcontroller 1.” EX1001, 7:38-40.

26. The component labeled “XR3403” is a controller for the voltage-boosting DC-DC converter used in the USB charge circuit. EX1001, Figure 2C (as annotated in the red box shown below).



27. I understand that NOCO submitted a datasheet for the XR3403 chip to the Patent Office during patent prosecution. EX1012. The XR3403 chip is a commonly available integrated circuit for controlling and regulating the voltage output of a DC-DC converter of the type used to boost a 5V USB input to various outputs such as 9V, 12V, and 24V. EX1012 at 6. Based on my review of this datasheet, it appears that the '243 patent inventors disclosed schematic circuits which implemented the "Typical Application Circuit" shown in the datasheet for the XR3403 as Figure 1. EX1012 at 1. The datasheet does suggest or allow a wide range of voltage boost applications, among them being the increase of a 5V

input to a higher voltage appropriate for recharging the lithium battery in a jump starter battery.

A. Prosecution History of the '243 Patent

28. I have been advised that consideration of the full prosecution history of the 2013-issued '243 patent is beneficial to support my testimony herein. A summary of my understanding of the pertinent aspects of patent prosecution relating to the '243 patent and the invalidity of the challenged claims is provided below. At the outset, I understand that the '243 patent is part of a family of applications claiming priority back to U.S. Patent Application No. 14/325,938, which was filed on July 3, 2014, and issued as U.S. Patent No. 9,007,015 (the "'015 patent").

29. I understand that all claims of the '015 patent were challenged in *inter partes* review assigned the case number IPR2020-00944, which resulted in a Final Written Decision (which I will refer to as the "'015-FWD" for the sake of consistency with the petition) finding all 20 of its claims except dependent claim 11 unpatentable. EX1014. I also understand that the United States Court of Appeals for the Federal Circuit affirmed the '015-FWD.

30. During prosecution of the '243 patent, it is my understanding that NOCO began with a set of claims that are very similar to those of the '015 patent. EX1002 at 37-40; EX1013 at 8:4-10:22. After that, NOCO amended the claims so

that the only independent claim, claim 24, recited a “USB charging input” among other limitations. EX1002 at 79-89.

31. On August 31, 2021, the Examiner issued a non-final rejection which rejected all pending claims. EX1002 at 441-468. I understand there were several rejections of the claims including those where the Examiner found the sole independent claim (claim 24) and many dependent claims unpatentable as obvious over Richardson in view of Tinaphong. EX1002 at 443-459.

32. As next steps, NOCO amended its claims, including amending independent claim 24 to recite two separate limitations directed to USB charging functionality, specifically a “USB input charge circuit “USB input charge circuit connected to the power supply, the USB input charge circuit comprising a DC/DC converter, the USB input charge circuit configured for converting power from a USB charger to increase charge voltage for charging the power supply” and a “USB charging input connected to the USB input charge circuit, the USB charging input configured for electrically connecting to the USB charger and providing charging input from the USB charger through the USB charging input and the USB input charge circuit to the power supply.” EX1002 at 485-495.

33. With its amendments, NOCO argued the following:

Richardson does not disclose a USB charge input and a USB input charge circuit, let alone the claimed subject matter, including “a USB input charge circuit connected to the power supply, the USB input charge circuit comprising a DC/DC converter, the USB input charge

circuit configured for converting power from a USB charger to increase charge voltage for charging the power supply; and a USB charging input connected to the USB input charge circuit, the USB charging input configured for electrically connecting to the USB charger and providing charging input from the USB charger through the USB charging input and the USB input charge circuit to the power supply.

EX1002 at 475 (emphasis by NOCO). NOCO did not specifically argue that any of the remaining limitations of independent claim 24 were disclosed by Richardson.

EX1002 at 473-476.

34. With its amendments, NOCO also argued the following:

Dropping down the voltage as taught by Tinaphong is the exact opposite and wrong direction to the requirement of stepping up or increasing the charging voltage to charge the internal lithium polymer battery 18 of Tinaphong to at least 12 V so that the apparatus could be modified to become or be used as a jump starter as asserted in this rejection.” Applicant disagrees with the rejection in attempting to use the teaching of Tinaphong to further modify Richardson, since again Richardson does not disclose a USB input charge input and USB input charge circuit.

EX1002 at 476.

35. The Examiner issued more rejections on March 9, 2022, including rejections of claims as unpatentable as obvious over Richardson in view of Balmeffrezol. EX1002 at 602-635. NOCO then made further amendments to its claims and provided additional argument on June 15, 2022. EX1002 at 1777-1790. The claim amendments included modifying the language of the USB charging limitations of claim 24 to recite a “USB input connector” and “a USB charge

circuit electrically connecting the USB input connector to the power supply, the USB charge circuit comprising a DC-DC converter configured to up-convert voltage from the USB connector to the power supply,” as well as adding a new independent claim 80. EX1002 at 1777-78, 1789-90.

36. NOCO argued again that Richardson does not disclose limitations relating to the USB charging feature. EX1002 at 1797. NOCO also argued the following:

Balmefrezol does not teach or suggest up-converting (i.e. increasing or boosting) the voltage from the USB interface to the internal battery, but instead teaches away from the claimed USB charging feature by disclosing down-converting (i.e. decreasing or bucking) the voltage from the USB interface to the internal battery of the electronic device.

EX1002 at 1794 (emphasis by NOCO). NOCO further argued the following:

The power management circuit of Balmefrezol is for charging a low voltage internal battery (e.g. 3.5V) of a portable electronic device such as a mobile phone. Balmefrezol does not disclose the power management circuit being applied to a jump starter using a relatively higher voltage (e.g. 11.1V or higher). The power management circuit of Balmefrezol cannot be used to charge, for example, an internal rechargeable battery of a jump starting device, since the power management circuit of Balmefrezol is configured for down-converting (i.e. decreasing or bucking) the voltage from the USB interface (e.g. about 5V) to the internal battery of the mobile phone (e.g. 3.5V) instead of up-converting (i.e. increasing or boosting) the voltage from a USB interface (e.g. USB connector) to the power supply (e.g. rechargeable lithium ion battery) of the jump starting device.

EX1002 at 1797-98.

37. Next, the Examiner issued more rejections on August 4, 2022. EX1002 at 1914-1951. This time, the Examiner rejected both of the pending independent claims (claims 24 and 80) and a majority of the dependent claims as obvious over Richardson in view of Butler. EX1002 at 1918-1939.

38. NOCO then submitted arguments in response, arguing that Butler does not qualify as prior art. EX1002 at 2045-46.

39. Next, the Examiner issued a final rejection which noted that claims 24-80 would be allowable if there was a terminal disclaimer over claims 1-54 of U.S. Patent No. 11,447,023. EX1002 at 2134. NOCO then filed this terminal disclaimer and a Notice of Allowability issued on January 4, 2023. EX1002 at 2155-57, 2277-78.

B. Listing of Challenged Claims

40. The issued claims of the '243 patent challenged in the Petition are listed in the table below. To maintain consistency with the Petition, I have adopted the same shorthand numbering for the claims, and individual claim limitations, of the '243 patent. For example, as indicated in the table below, I may use "Limitation 1(a)" as a shorthand reference to the limitation "a power supply" in Claim 1.

Claim Designation	Claim Language
Claim 1 Preamble	A jump starting device for boosting or charging a depleted or discharged battery having a positive battery terminal and a negative battery terminal, the jump starting device

Claim Designation	Claim Language
	comprising:
Limitation 1(a)	a power supply;
Limitation 1(b)	a positive battery connector for electrically connecting the jump starting device to the positive battery terminal of the depleted or discharged battery;
Limitation 1(c)	a negative battery connector for electrically connecting the jump starting device to the negative battery terminal of the depleted or discharged battery;
Limitation 1(d)	a power switch or switch circuit connected in circuit with the power supply and the positive and negative battery connectors,
Limitation 1(e)	the power switch or switch circuit configured to switch power on from the power supply to boost or charge the depleted or discharged battery when connected between the positive and negative battery connectors;
Limitation 1(f)	a USB input connector; and
Limitation 1(g)	a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit comprising a DC-DC converter configured to upconvert voltage from the USB input connector to the power supply.
Claim 2	The device according to claim 1, wherein the power switch or switch circuit is controlled to turn on power to the depleted or discharged battery only when the jump starting device is connected with correct polarity to the depleted or discharged battery.
Claim 15	The device according to claim 1, further comprising a USB output connector for providing a power output from the power supply to a USB-chargeable device.
Claim 17	The device according to claim 15, wherein the USB output connector is electrically connected to a USB output circuit, the USB output circuit connecting the power supply to the USB output connector.
Claim 18	The device according to claim 17, further comprising a microcontroller with a control circuit, the control circuit

Claim Designation	Claim Language
	for the microcontroller allows the USB output circuit to be turned on and off by software control to prevent the power supply getting too low in capacity.
Claim 51	The device according to claim 1, wherein the power supply is a rechargeable lithium battery pack.
Claim 54	The device according to claim 51, further comprising a rechargeable lithium battery pack voltage measurement circuit configured to monitor the rechargeable lithium battery pack to prevent voltage potential from rising too high during a charging operation and from dropping too low during a discharge operation.
Claim 57 Preamble	A jump starting device for boosting or charging a depleted or discharged battery having a positive battery terminal and a negative battery terminal, the jump starting device comprising:
Limitation 57(a)	a power supply;
Limitation 57(b)	a positive battery connector for electrically connecting the jump starting starter device to the positive battery terminal of the depleted or discharged battery;
Limitation 57(c)	a negative battery connector for electrically connecting the jump starting starter device to the negative battery terminal of the depleted or discharged battery;
Limitation 57(d)	a power switch or switch circuit in circuit with the power supply and the positive and negative battery connectors,
Limitation 57(e)	the power switch or switch circuit configured to switch power on from the power supply to boost or charge the depleted or discharged battery when connected between the positive and negative battery connectors;
Limitation 57(f)	a USB input connector;
Limitation 57(g)	a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit configured to up-convert voltage from a USB charger power source connected to the USB input connector to the power supply using a DC-DC converter;
Limitation 57(h)	a USB output connector; and

Claim Designation	Claim Language
Limitation 57(i)	a USB output circuit electrically connecting the power supply to the USB output connector.

V. LEVEL OF ORDINARY SKILL IN THE ART

A. Legal Principles

41. I have been informed that patents are considered from the perspective of a person having ordinary skill in the art, and that this is a hypothetical person who is presumed to know the relevant prior art. As noted previously, I will generally use the shorthand “PHOSITA” to refer to a person having ordinary skill in the art throughout my declaration.

42. I have been informed that the following five factors inform the analysis for determining the level of ordinary skill in the art: (1) type of problems encountered in the art; (2) prior art solutions to those problems; (3) rapidity with which innovations are made; (4) sophistication of the technology; and (5) educational level of active workers in the field. *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). I apply these factors in the section below in providing my opinion as to the level of one having ordinary skill in the art.

B. Opinion as to the Level of a Person Having Ordinary Skill in the Art (“PHOSITA”) for the ’243 Patent

43. I have knowledge of what a person having ordinary skill in the art at the time of the claimed invention would understand and do. As of July 3, 2014, the claimed priority date of the ’243 patent, I had over 35 years of experience in this

field and was at least a person having ordinary skill in the art.

44. In my opinion, based on the five favors above at the priority date July 3, 2014, a PHOSITA would have been a person with at least a bachelor's degree in electrical engineering or its equivalent and at least two years of experience in the field of electrical engineering, including some experience with DC power supply or battery charger design. Less work experience could be compensated for by a higher level of education, such as a master's degree, and vice versa.

VI. CLAIM CONSTRUCTION

A. Legal Principles

45. I have been informed that in a proceeding for *inter partes* review, claims terms in an unexpired patent are to be given their plain and ordinary meaning, as understood by a person having ordinary skill in the art, in view of the patent's specification. 37 C.F.R. § 42.100(b); 83 FR 51340; *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). I have also been informed of the principle that "claim terms need only be construed to the extent necessary to resolve the controversy." *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011); *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

B. Opinion of Claim Construction

46. I believe that all claim terms used in the challenged claims, for the purposes of *inter partes* review, can be given their plain and ordinary meaning.

47. In my opinion, there is no need to otherwise construe terms in the challenged claims because I am not aware of terms that are in controversy in a manner which would require construction to resolve the controversy. Thus, in my opinion each and every claim term can be given its plain and ordinary meaning, and the challenged claims are invalid under the plain and ordinary meaning of each recited term.

VII. SUMMARY OF THE PRIOR ART

48. I have been informed that each of Richardson, Zhao, Yu, Paparrizos, and Dao are prior art to the '243 patent under the law.

A. Richardson

49. Richardson discloses a portable power source that can provide supplemental power to a vehicle's electrical system and jump start vehicle batteries. EX1005, ¶¶ [0002], [0006], [0007]. Richardson discloses a system which includes batteries to provide the power to the battery of the vehicle to be jump started. EX1005, ¶ [0007]. The system of jump starter 10 includes a programmable microprocessor 12 which receives inputs and produces outputs to control the system. EX1005, ¶ [0014].

50. Richardson discusses problems that can occur when jump starting a vehicle battery such as cross-connecting the jump starter's battery with the vehicle battery or inadvertently contacting electrified cable clamps. EX1005, ¶ [0005]. The

short circuit that would occur in such a situation could cause sparking, extreme heating of the connector or cables, or even battery explosion and fire. EX1005, ¶ [0005]. To address these problems, Richardson's device performs real-time monitoring of all system parameters to increase the safety and effectiveness of the unit's operation while providing additional parametric and diagnostic information obtained before, during and after the vehicle starting operation. EX1005, ¶ [0006]. Among these safety features are Richardson's disclosure of a jump starter that both (1) determines whether a proper polarity connection exists between the jump starter battery and the vehicle battery via reverse voltage sensor 24 (EX1005, ¶ [0016]), and (2) determines the connection status of a vehicle battery via vehicle voltage sensor 30. EX1005, ¶ [0016]. In other words, Richardson's jump starter determines both whether a battery is present or absent in the first instance, and if present, whether such connection has been made with proper or improper polarity.

51. Richardson is in the same field of endeavor as the '243 patent. EX1001, Abstract; EX1005, Abstract. Additionally, Richardson's teachings are reasonably pertinent to problems that the '243 patent claims to address. EX1001 at 1:18-25; EX1005, Abstract.

B. Zhao

52. Zhao discloses a battery charging system that includes a step-up converter for boosting a DC input voltage. EX1006, Abstract. Zhao's battery

charging system can charge a multicell, series-connected lithium-ion battery pack from a 5V input provided by a USB power source. EX1006 at 1:22-27, 2:63-3:11. Zhao's system also includes control circuit 102 which can control the ON/OFF state of the step-up converter. EX1006 at 4:59-64.

53. Zhao is in the same field of endeavor as the '243 patent. EX1001, 4:4-16; EX1006, 1:19-30. Additionally, Zhao's teachings are reasonably pertinent to problems identified in the '243 patent. EX1001, 4:4-16, 7:25-28; EX1006 at 1:25-27, 3:6-11.

C. Dao

54. Dao discloses a portable power supply that can jump start vehicle batteries using the electrical output of one or more lithium cells in a battery pack. EX1031, Abstract, ¶¶ [0001], [0002]. Dao also discloses overcharge and overdischarge protections for the lithium battery pack. EX1031, ¶ [0020], [0024], [0031].

55. Dao is in the same field of endeavor as the '243 patent. EX1001, Abstract; EX1031, Abstract, ¶ [0001]. Additionally, Dao addresses subject matter that was reasonably pertinent to problems facing the named inventors. EX1001, 7:41-48; EX1031, ¶ [0020], [0024], [0031].

D. Yu

56. Yu discloses an automotive starting assist device, commonly referred

to as a jump starter. EX1007; EX1008, Abstract. Yu's device comprises an internal battery pack, a control module with a microprocessor, and an output terminal. EX1008, Abstract, ¶ [0004]. The device further comprises a microprocessor-controlled relay which can connect power from the internal battery a vehicle battery for a jump start. EX1008, ¶ [0004]. Before initiating a jump start, Yu's device detects an external battery voltage to determine if a vehicle battery is present, and separately it detects whether the device is connected with the wrong polarity. EX1008, ¶ [0009].

57. Yu is in the same field of endeavor as the '243 patent. EX1001, Abstract; EX1008, Abstract. Yu also addresses problems that are identified in the text of the '243 patent. EX1001 at 1:18-25; EX1008, Abstract.

E. Paparrizos

58. Paparrizos discloses a battery charging circuit with a forward boost mode that can boost a lower input voltage to a sufficient voltage to charge higher voltage batteries. EX1009, Abstract, 3:31-35, 8:17-31. Paparrizos's circuit can charge multicell, series-connected lithium-ion battery packs specifically from a 5V USB power source. EX1009, 2:30-40, 8:17-31.

59. Paparrizos is in the same field of endeavor as the '243 patent. EX1001, 4:4-16; EX1009, 1:18-26, 1:30-39, 2:30-40. Paparrizos also addresses problems that are identified by the '243 patent. EX1001, 4:4-16, 7:25-28; EX1009,

1:23-26, 8:17-31.

VIII. OPINION ON GROUNDS OF UNPATENTABILITY

A. Legal Principles of Obviousness

60. I have been told that according to 35 U.S.C. § 103(a), “[a] patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains.”

61. When considering the issues of obviousness, I have been instructed to:

- (a) determine the scope and content of the prior art;
- (b) ascertain the differences between the prior art and the claims at issue;
- (c) resolve the level of ordinary skill in the pertinent art; and
- (d) consider evidence of secondary indicia of non-obviousness (if available).

62. I have been told that the relevant time for considering whether a claim would have been obvious to a PHOSITA is the time of alleged invention, assumed to be the priority date of the patent.

63. I have been told that a reference may be modified or combined with other references or with the PHOSITA’s own knowledge if the person would have

found the modification or combination obvious. A PHOSITA is presumed to know all relevant prior art, and the obviousness analysis may consider the inferences and creative steps that a PHOSITA would employ.

64. In determining whether a prior-art reference could have been combined with another prior-art reference or other information known to a PHOSITA, I have been told that the following principles may be considered:

- (a) a combination of familiar elements according to known methods is likely to be obvious if it yields predictable results;
- (b) the substitution of one known element for another is likely to be obvious if it yields predictable results;
- (c) the use of a known technique to improve similar items or methods in the same way is likely to be obvious if it yields predictable results;
- (d) the application of a known technique to a prior art reference that is ready for improvement is likely obvious if it yields predictable results;
- (e) any need or problem known in the field and addressed by the reference can provide a reason for combining the elements in the manner claimed;
- (f) a person of ordinary skill often will be able to fit the teachings of multiple references together like a puzzle; and
- (g) the proper analysis of obviousness requires a determination of whether a person of ordinary skill in the art would have a “reasonable expectation of success”—not “absolute predictability” of success—in achieving the claimed invention by combining prior art references.

65. I have been told that whether a prior art reference renders a patent claim unpatentable as obvious is determined from the perspective of a PHOSITA. Further, I have been told that while there is no requirement that the prior art

contain an express suggestion to combine known elements to achieve the claimed invention, a suggestion to combine known elements to achieve the claimed invention may come from the prior art as a whole or individually, as filtered through the knowledge of one skilled in the art. I have also been told that the inferences and creative steps a PHOSITA would employ are also relevant to the determination of obviousness.

66. I have been told that when a work is available in one field, design alternatives and other market forces can prompt variations of it, either in the same field or in another. If a PHOSITA can implement a predictable variation and would see the benefit of doing so, that variation is likely to be obvious. In many fields, there may be little discussion of obvious combinations, and in these fields market demand—not scientific literature—may drive design trends. When there is a design need or market pressure and there are a finite number of predictable solutions, a PHOSITA has good reason to pursue those known options.

67. I have been told that there is no rigid rule that a reference or combination of references must contain a “teaching, suggestion, or motivation” to combine references. But I also have been told that the “teaching, suggestion, or motivation” test can be a useful guide in establishing a rationale for combining elements of the prior art. This test poses the question whether there is an express or implied teaching, suggestion, or motivation to combine prior art elements in a way

that yields the claimed invention and avoids impermissible hindsight analysis.

B. Ground 1: Claims 1 and 2 are unpatentable under 35 U.S.C. § 103(a) over Richardson in view of Zhao

1. Exemplary Rationale for Combining Richardson and Zhao

68. A PHOSITA would have found it obvious to combine the teachings of Richardson and Zhao. Both references relate to systems that have a multicell battery pack, and a PHOSITA would have been motivated to modify Richardson in view of Zhao to include a USB input connector and charge circuit to achieve the predictable result of effectively charging the batteries of Richardson's jump starter.

69. Richardson teaches a device having a battery pack consisting of series-connected cells. EX1005, Fig. 2A. As one example, Richardson discloses the battery as a nominally 12V battery. EX1005, ¶ [0034]. To reach a 12V rating, a PHOSITA would understand that Richardson's battery requires multiple cells connected in series, such as a series string of lithium-ion cells or a series of lead-acid cells. Zhao discloses a system for charging battery-powered devices that have a multicell pack of series-connected battery cells. EX1006, 2:63-3:11. Zhao specifically contemplates that its battery charging system can use low voltage charging systems like 5V USB to charge batteries with a voltage rating above that of the input voltage received from the USB power source. EX1006 at 1:22-27, 2:51-54, 3:6-11.

70. A PHOSITA therefore would have been motivated to modify

Richardson in view of Zhao because Zhao is directed to the known technique of charging, via USB technology, a multicell battery pack of series-connected cells of a battery-powered device, which is the same battery architecture in Richardson's jump starter, using a DC-DC converter in accordance with its established function of converting a lower voltage input to a higher voltage output. Additionally, Zhao's primary objective is the charging of a battery pack with a voltage higher than that of the 5V USB input. This had been in common practice well prior to the 2014 priority date of the '243 patent. A PHOSITA would have been motivated to implement Zhao's method in a predictable manner to charge nominally 12V automotive starting batteries such as those envisioned by Richardson.

71. In the following, I will provide more detail to support my opinions as applied to specific claims and limitations of the '243 patent.

2. Independent Claim 1

- a. Claim 1 Preamble: “A jump starting device for boosting or charging a depleted or discharged battery having a positive battery terminal and a negative battery terminal, the jump starting device comprising:”**

72. Richardson discloses in detail a jump starting device. EX1005, Abstract, claim 26. Richardson's device provides supplemental power to jump start a vehicle battery. EX1005, ¶¶ [0002], [0006], [0007]. Richardson discloses jump starter 10 which includes microcontroller 12 to control the system, thereby

allowing the jump starter to boost or charge a battery by connecting the internal battery of the jump starter to the positive and negative terminals of a vehicle battery. EX1005, ¶¶ [0007], [0014], [0016], [0021], [0035], Fig. 1, Fig. 2C, Figs. 3-8, ¶ [0004].

73. Similar findings regarding Richardson were provided by the Board in the '015-FWD. EX1014 at 50.

b. Limitation 1(a): “a power supply;”

74. Richardson teaches its jump starting device has one or more batteries. EX1005, Abstract, ¶ [0007], claim 1. Jump starter batteries 22 supply power to jump start a vehicle's battery. EX1005, ¶¶ [0016], [0021], [0035]. This is further shown by Figures 1 and 2A, which are highlighted below to show the batteries which operate as a power supply.

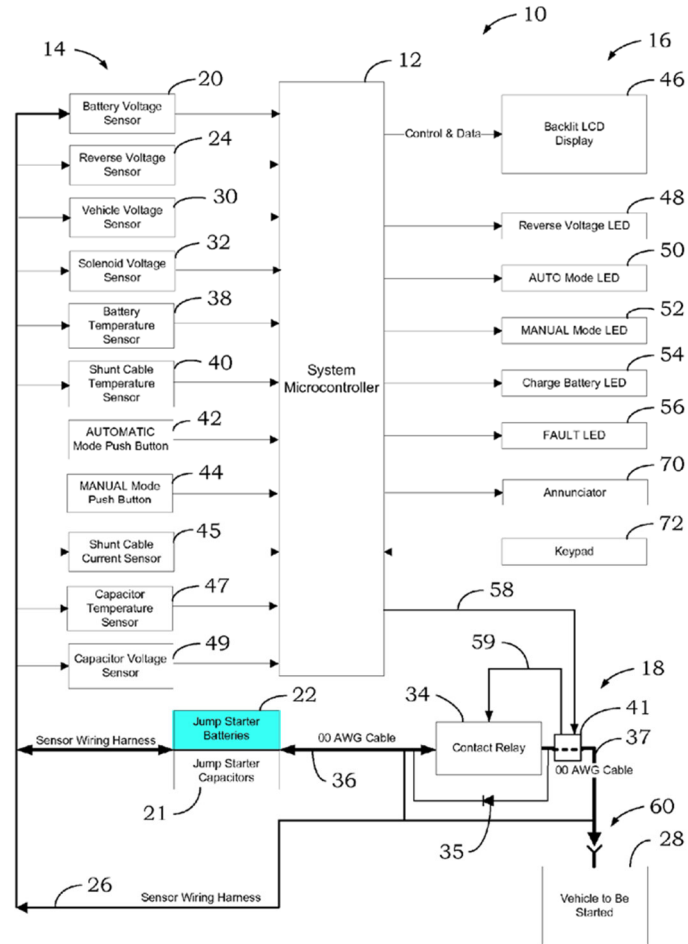
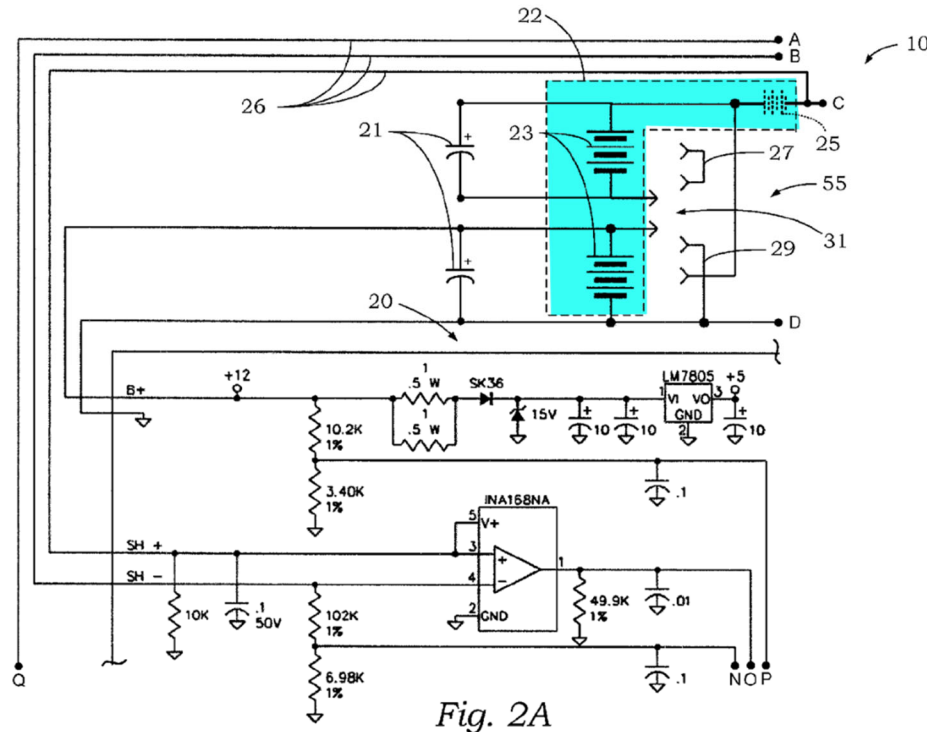


Fig. 1

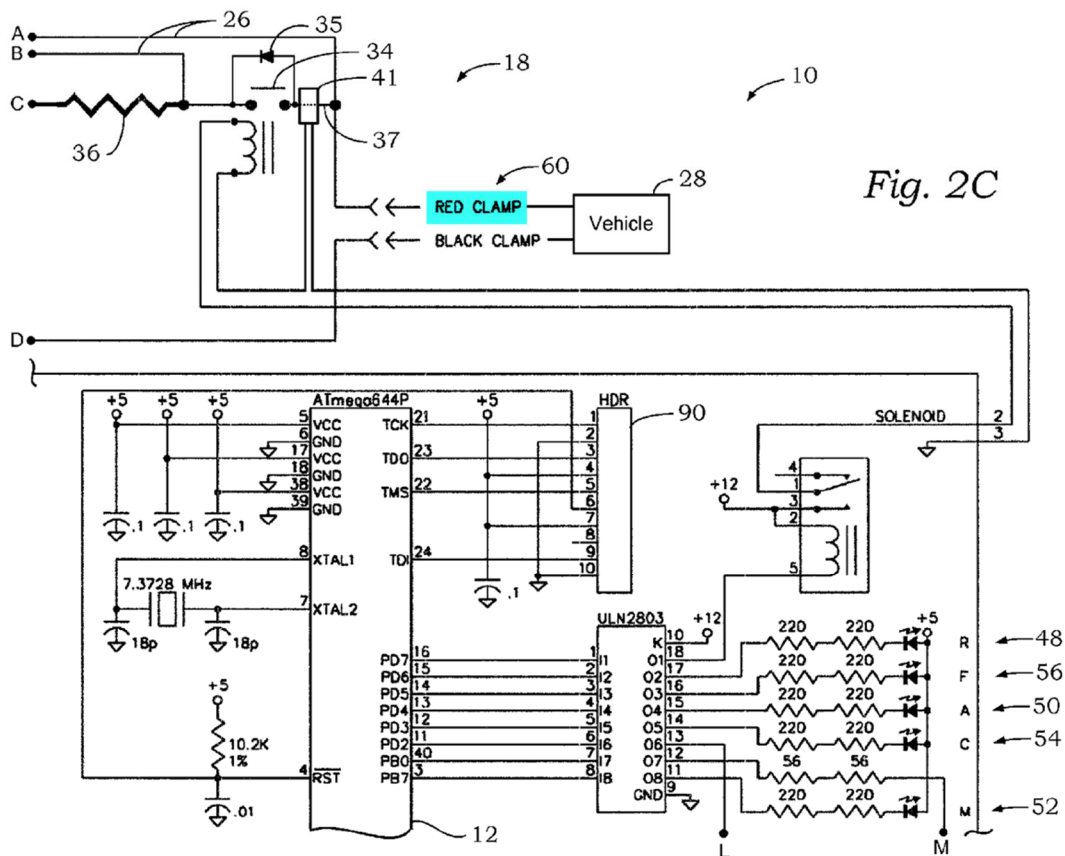


75. Similar findings regarding Richardson were provided in the '015-FWD. EX1014 at 50-51.

c. Limitation 1(b): “a positive battery connector for electrically connecting the jump starting device to the positive battery terminal of the depleted or discharged battery;”

76. Speaking to this limitation and to limitation 1(c) below, it seems almost pedantic to claim as a feature a positive and/or negative connector to couple the jump starter to the vehicle battery. A PHOSITA would know that positive and negative connection are necessary for *any* complete electrical circuit. Nevertheless, it is my opinion that Limitation 1(b) is fully disclosed by Richardson. Richardson discloses a “pair of conductive leads” which include a

positive battery connector as claimed. EX1005, Abstract; see also EX1005, claim 26. Richardson's leads may include conductive clamps or other types of connectors. EX1005, ¶ [0016]. For example, jumper cables 60 include the conventionally-colored red cable clamp for electrically connecting the positive cable to the positive battery terminal. EX1005, ¶ [0027]; FIG. 2C (with highlighting showing the red cable clamp).

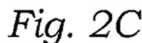


77. A PHOSITA would further understand that Richardson discloses a positive battery connector as claimed, as the cables are disclosed with different polarities. EX1005, ¶¶ [0016]; [0027], [0028]. A PHOSITA would understand that one of the two clamps of the conductive leads or jumper cables would be the

positive clamp of the positive cable.

- d. Limitation 1(c): “a negative battery connector for electrically connecting the jump starting device to the negative battery terminal of the depleted or discharged battery;”**

78. As discussed in the previous Section, Richardson discloses a pair of conductive leads, and these leads would also include a negative battery connector as claimed. EX1005, Abstract, claim 26. Richardson’s leads may include conductive clamps or other types of connectors. EX1005, ¶ [0016]. Richardson shows that the jumper cables 60 include the conventionally-colored black cable clamp for connecting the negative cable to the negative battery terminal. EX1005, ¶ [0027], EX1005 at FIG. 2C (highlighted to show the black cable clamp).



e. Limitation 1(d): “a power switch or switch circuit connected in circuit with the power supply and the positive and negative battery connectors,”

35

battery, thereby transferring power for a jump start. EX1005, ¶¶ [0021], [0035]-[0036], [0054], Fig. 2C; Fig. 1 (highlighted to show the contact relay serving as a power switch or switch circuit).

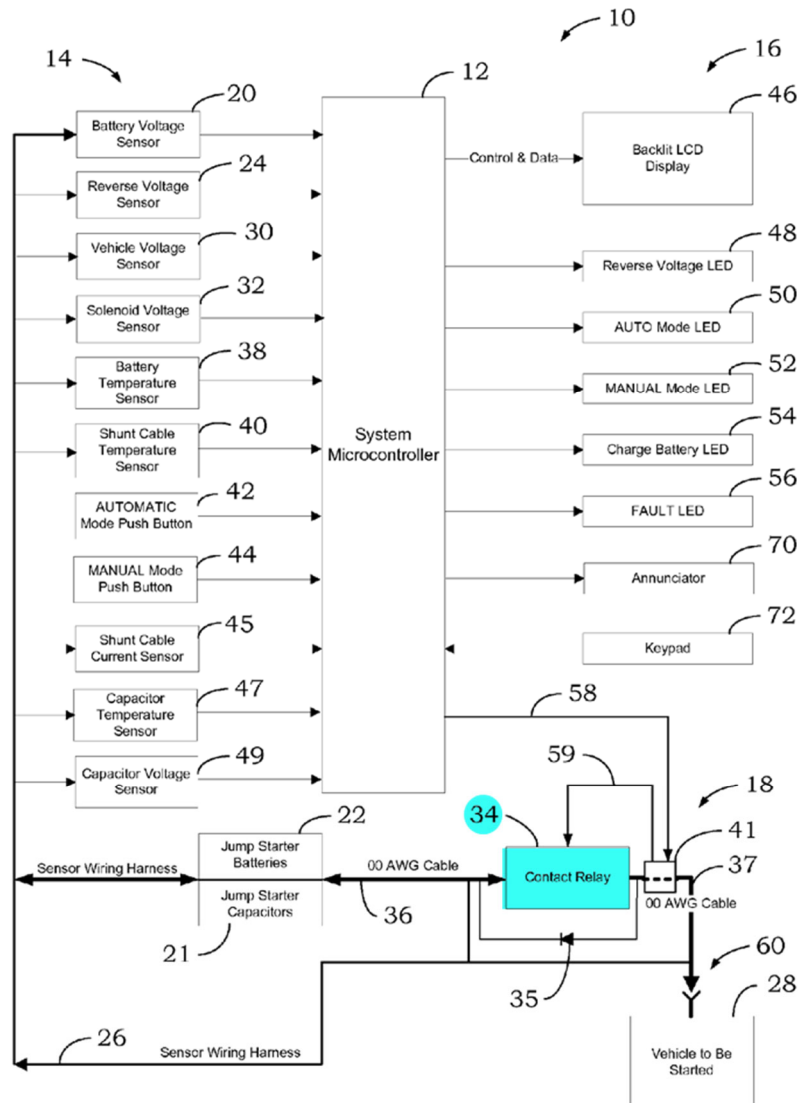


Fig. 1

81. Richardson similarly discloses a jump starter with a relay connected to said conductive leads and a processor for controlling said relay to selectively apply electrical power from said jump starter batteries and said jump starter capacitors to

said electrical system of the engine. EX1005, claim 26. Richardson's flow charts of the processing steps further demonstrate that the relay operates as a power switch or switch circuit as claimed, such as Step 268 in Figure 6 where the starter contact relay is closed. EX1005, Fig. 6.

82. Similar findings regarding Richardson were provided in the '015-FWD. EX1014 at 54-55.

f. Limitation 1(e): “the power switch or switch circuit configured to switch power on from the power supply to boost or charge the depleted or discharged battery when connected between the positive and negative battery connectors;”

83. Richardson discloses that contact relay 34 is configured to switch power on as claimed. This is due to the fact that contact relay 34 is configured to be controlled by a system comprised of microprocessor 12 (which is also referred to as microcontroller 12 in other parts of Richardson) and associated sensors and circuitry. EX1005, Fig. 1 (highlighted to show parts of the control system).

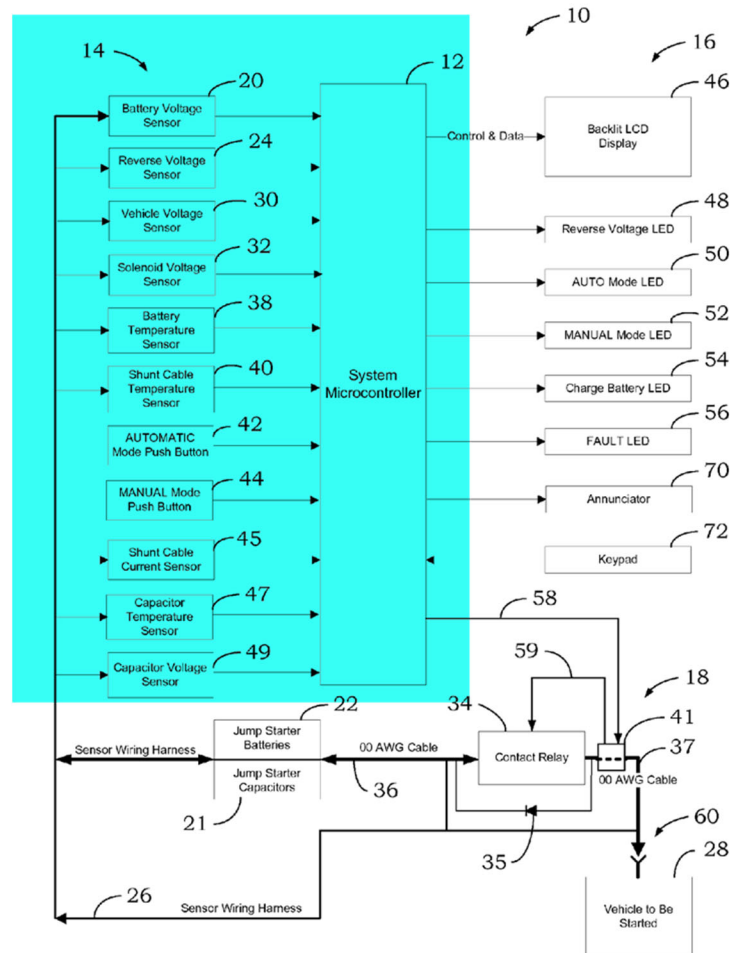


Fig. 1

84. For example, Richardson's jump starter has a processor for controlling the contact relay to selectively apply electrical power to the engine electrical system. EX1005, Abstract; ¶¶ [0018], [0036], claim 26. This microprocessor produces outputs which control the jump start function. EX1005, ¶¶ [0014], [0020], Fig. 2A, Fig. 2B, Fig. 2C. Richardson explains that contact relay is configured to be closed (which is the state where power is on and current can flow through the relay) "[w]hen the jump starter operation has been successfully initiated." EX1005, ¶ [0021].

85. This process generally begins with a user connecting the jumper cables to the vehicle battery (which would be done by hand). EX1005, ¶ [0026]. Richardson's device then proceeds through various processing steps and, if the appropriate conditions have been satisfied, the processing reaches step 268 where the contact relay is closed for a jump start. EX1005, ¶ [0027]-[0035]; Figs. 3-6. If the jumper cables are disconnected or unplugged during this process, Richardson's device will open contact relay 34 so that power is no longer switched on. EX1005, ¶¶ [0036], [0041]. Accordingly, Richardson teaches contact relay 34 is configured to switch power on during the time that the device is connected to the vehicle battery via the jumper cables.

g. Limitation 1(f): “a USB input connector; and”

86. Richardson is not explicit regarding the type of input connector utilized for charging its jump starter batteries. EX1005, ¶ [0029]. However, since the Universal Serial Bus (USB) had been standardized and commonly used for charging of electronic devices since 1996, a PHOSITA would have been familiar the capabilities of the USB and been motivated to implement this technology when designing a portable battery-powered device well before the '243 patent's claimed priority date of July 3, 2014.

87. A PHOSITA would have been motivated to modify Richardson to implement a USB input connector (and associated circuitry) as taught by Zhao.

EX1006, 1:22-27; 3:1-11. A PHOSITA would have necessarily relied upon their knowledge regarding the USB standards and implementation of USB receptacles such as micro-USB when designing a USB charging feature for Richardson's device by adding a USB input connector and USB charge circuit for purposes of charging the device's batteries.

88. For example, Zhao teaches a system where the input voltage of the system is provided by a "universal serial bus (USB) charger." EX1006, 3:6-11). A PHOSITA would have known that Zhao's system necessarily implements a design that includes the remaining portions of a USB charging system, especially a USB-compliant receptacle which could include a connector such as a micro-USB connector. A PHOSITA's knowledge of the standard USB input connectors is further evidenced by the USB standards and other prior art discussing these standard connectors. EX1009, 1:20-23 (identifying USB, mini-USB, and micro-USB connectors); EX1018; EX1019, ¶ [0004] (identifying a "Mini-USB interface").

89. It is also worth noting that the '243 patent recognizes there were standard USB connectors before July 3, 2014. EX1001, 7:23-25. This type of standard USB receptacle can receive the corresponding plug on a USB cable from a USB charger, thereby allowing the receipt and transmission of power from the USB power source to the USB charge circuit and ultimately the jump starter's

batteries.

90. A PHOSITA would understand Zhao's USB-input system is suitable for use with a variety of battery pack configurations and battery chemistries, such as a 3S (3 cells connected in series) pack of lithium-ion cells rated at 11.1V or a 4S (4 cells in series) pack of lithium-ion cells rated at 14.8V. EX1006, 3:6-11. It is worth noting that both of these pack configurations would be well-suited for jump starting a vehicle with a traditional lead-acid SLI battery, nominally rated at 12V. It is my opinion that Zhao directs the reader to use a USB input feature with a system like Richardson's jump starter.

91. A PHOSITA would have been motivated to modify the design of Richardson's jump starter in one of two ways. One modification would be replacing the existing charging connector and circuitry with Zhao's step-up charging system and connecting the output to charge Richardson's jump starter batteries. A second modification would be adding Zhao's step-up charging system and connecting and connecting the output to charge Richardson's jump starter batteries as an additional and alternative pathway for charging the batteries beyond the 12V nominal DC input envisioned by Richardson. Either option would have provided desirable features or improvements to Richardson's jump starter. For example, the first option allows the device manufacturer or supplier to avoid the need to provide a proprietary charger or other type of AC "power brick" that would

be less ubiquitous or less standardized than a USB charger. The second option would add the desirable benefit of increased flexibility, allowing the jump starter batteries to be charged multiple ways: via a traditional AC power brick when available, but alternatively by a USB charger if only USB power is readily available. Both options cater to perceived or actual consumer demand for USB technology as well as the other benefits and desirable features of USB charging discussed herein.

92. A PHOSITA would have understood the benefits of utilizing USB technology to charge battery-powered devices before the claimed priority date. For example, in 2007 the Universal Serial Bus Implementers Forum (“USB-IF”) issued its Battery Charging Specification, Revision 1.0 which noted that the convenience of USB charging has led to the creation of dedicated chargers that simply expose a downstream USB port. EX1025 at 6. A PHOSITA would know that USB charging allows the same USB cable to be used for charging devices from multiple different USB charging sources such as a PC or a dedicated charger. EX1025 at 6. On a related note, a PHOSITA would understand other desired benefits of USB technology before the claimed priority date such as (1) reducing the need for suppliers to develop or purchase proprietary chargers to sell with their products, which would reduce cost of goods and also serve the benefit of reducing the electronic waste associated with proprietary chargers, (2) providing device users

with a universal power source for battery charging reducing their need to own multiple proprietary chargers and cables for their battery-powered devices, (3) the ease of use of USB technology, and (4) the durability of USB parts and connectors, many of which were known to be more robust than previous non-USB charging options. Convenience was a hallmark of USB technology, and before July 3, 2014 there was a known market need for USB to cater to actual or perceived consumer demand for USB charging of consumer electronics. EX1016, ¶ [0002].

93. The desirability of using a USB input to recharge batteries at the voltage level of those found in jump starters is also documented in many patents or publications which were filed or published before NOCO's claimed July 3, 2014 priority date, which further supports my opinion that a PHOSITA would have been motivated to use USB technology and understood the benefits of USB technology for battery charging. For example, USB charging outlets (ports) had become or were becoming standard equipment in many cars and trucks before 2014, and a PHOSITA would have recognized the convenience of these USB outlets for recharging a portable jump starter that would logically be carried in a vehicle for emergency use. EX1029; EX1030. As another example, the Paparrizos reference states the following:

The USB specification has become very popular and consumers have become used to being able to charge their USB devices from universal USB power sources. Consumers are used to USB, mini-USB, and

micro-USB connectors being present in portable electronics and their use for battery charging from a USB power source.

EX1009 at 1:18-23. The '243 patent recognizes that USB connectors, chargers, and cables were “standard” before the claimed priority date. EX1001 at 7:32-35. As another example, by the earlier 2000’s component suppliers such as Linear Technologies had developed and marketed integrated circuits for the specific application of boosting a 5V USB input to charge higher voltage batteries. EX1027 at 26-28; EX1026 at 28:14-31:13, 32:22-38:24, 42:23-43:22, 44:2-19, 51:14-54:13, 54:25-56:14. Linear Technologies (and several other IC and ASIC manufacturers) had provided integrated circuits that enabled USB charging for higher voltage batteries from a 5V USB source, as further explained by Bryan Legates who formerly worked for Linear Technologies. EX1026 at 53:2-18.

94. Similar to the USB charging applications achieved by customers of Linear Technologies, before the claimed priority date the use of DC-DC converters to boost a USB input voltage to charge a battery with a nominal voltage rating above the USB input voltage was both desirable and known to be interchangeable with non-USB charging systems. My opinion that this type of application was known to a PHOSITA is further supported by patents and publications filed or published before July 3, 2014. For example, CN 202512152 U is a Chinese utility model patent published and issued in 2012 that discloses a digital multimeter device with a 9V internal battery that can be charged from the 5V input from a

USB power supply via DC-DC boosting circuit. EX1018; EX1019, ¶ [0005]. As another example, CN 201226449Y is a Chinese utility model published and issued in 2009 which discloses “a booster type charging control circuit is widely used” in applications where the 5V from a USB charging source cannot meet the charging needs of an electronic device. EX1020; EX1021, Background. As yet another example, U.S. Patent Application Publication No. 2013/0285596 (“Zhou”) which was filed April 30, 2012 discloses circuit with components that can “increase (e.g., step-up) the voltage received from a battery charger via the USB 104 (e.g., about 5V) to the voltage required to charge the battery 110 (e.g., about 10V to 24V).” EX1016, ¶ [0011]. As another example, U.S. Patent No. 9,035,599 (“Amemiya”) which was filed May 20, 2013 discloses a charging circuit where “the input power supply is a USB power supply and the input voltage V_{in} is about 5 volts” and the battery to be charged “is a two-cell lithium-ion secondary battery and the full charge voltage thereof is 8.4 volts.” EX1017, 2:48-59. Lastly as a final example here, Chinese utility model patent CN 203788026 U which was filed April 18, 2014 explicitly contemplates USB charging the batteries of a jump starter via a DC-DC boosting technique. EX1022; EX1023, ¶ [0013]. This further supports my opinion that a PHOSITA would have recognized and understood the charging of higher voltage batteries using a 5V USB input, along with proposed solutions.

95. In conclusion, it is my opinion that USB charging for higher voltage

batteries was a well-known technique for the charging of higher voltage batteries devices such as Richardson's jump starter. A PHOSITA would have been motivated to implement this known technique as disclosed by Zhao in Richardson's device to include a USB in connector as part of the Richardson jump starter.

h. Limitation 1(g): “a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit comprising a DC-DC converter configured to upconvert voltage from the USB input connector to the power supply.”

96. Richardson teaches its device includes various features and components that are involved in the process of charging the jump starter batteries, such as circuitry for detecting a charger voltage and monitoring battery voltage to determine when the charging process is complete. EX1005, ¶ [0029]; EX1005, ¶ [0020], ¶ [0028]. While Richardson does not discuss that the jump starter's charging circuitry utilizes USB technology, Zhao in its embodiments teaches USB input circuits configured for converting 5V from a USB input into the voltage required for higher voltage battery charging. Zhao explains that this feature was a well-known means for charging portable battery-powered devices that require charging a multicell battery pack with a voltage rating above the voltage received from the power source. EX1006, Abstract, 1:22-23, 1:25-27, 3:6-11.

97. Zhao makes clear that a step-up topology can be used to charge a

multicell battery pack using a lower input voltage, such as a 5V USB power source. EX1006, 1:22-23, 1:25-27, Abstract, 1:34-45, 1:46-55, 2:51-62, 2:63-3:11. The step-up topology in this case refers to a circuit that boosts an input voltage to a higher output voltage.

98. Zhao teaches a step-up battery charger or charging management system 100 which constitutes a USB input circuit as claimed. EX1006, 2:63-66, FIG. 1, 3:1-39. Zhao's system can include a step-up converter and charging control circuit 201. EX1006, 2:66-67. The step-up converter is a well-known DC-DC converter configured as a boost converter, which boosts an input voltage to a higher-voltage output that can charge a multi-cell pack of series-connected cells, such as lithium cells. EX1006, 3:1-11.

99. Zhao further discloses "power stage circuit 101 of the step-up converter can be a synchronous rectifier Boost topology including inductor L, main switch S1, synchronous switch S2, and output capacitor CBD." EX1006, 3:12-15. Control circuit 102 can control main switch S1 via control signal G1 and synchronous switch S2 via control signal G2. EX1006, 3:17-21. An output of power stage circuit 101 can connect to charging control circuit 201 and can then be regulated or controlled for purposes of charging the battery or battery-powered device. EX1006, 3:3-6, 3:25-26. In certain situations, the battery device can be directly charged by the output signal from the step-up converter. EX1006, 8:21-24.

Accordingly, a PHOSITA would understand how to connect the boosted output voltage of Zhao's step-up charging system to a battery pack for purposes of charging the battery.

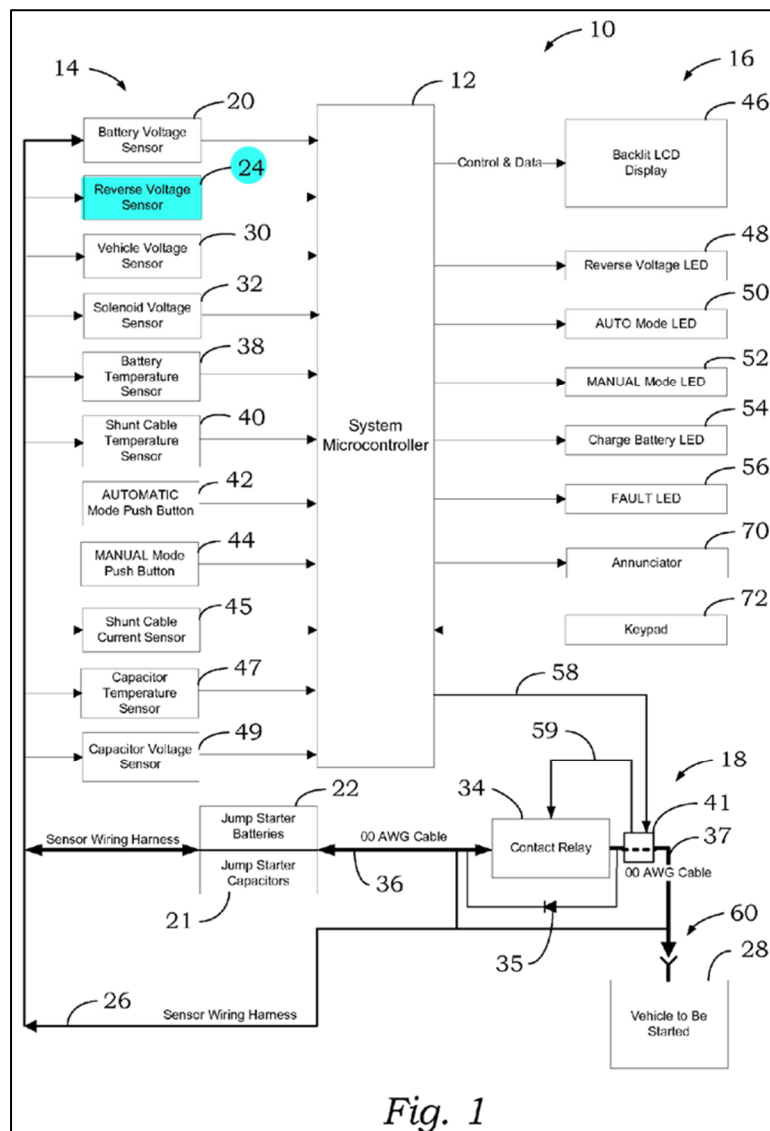
100. For at least the reasons discussed above in connection with Limitation 1(f), a PHOSITA would have been motivated to modify the design of Richardson's jump starter to either (1) replace the existing charging circuitry with Zhao's step-up charging system and connect the output to Richardson's jump starter batteries, or (2) add Zhao's step-up charging system and connect the output to Richardson's jump starter batteries as an additional and alternatively pathway for charging the jump starter batteries. And as noted above in connection with Limitation 1(f), Zhao directs a PHOSITA to implement Zhao's USB input circuit (and connector) with a system like Richardson's jump starter. EX1006, 3:6-11. In addition to the explicit teachings of Zhao, the desirability of utilizing USB technology to charge higher-voltage battery-powered devices was well-known before the claimed priority date, as discussed above in paragraphs 92-94.

101. In conclusion, it is my opinion that USB charging for higher voltage batteries was a predictable technique to achieve the desirable function of charging the higher voltage batteries of Richardson's jump starter.

- 3. Claim 2: "The device according to claim 1, wherein the power switch or switch circuit is controlled to turn on power to the depleted or discharged battery only when the**

jump starting device is connected with correct polarity to the depleted or discharged battery.”

102. Richardson’s device includes a control system that has a “reverse voltage sensor 24” which is used to detect whether the battery connectors are connected to a vehicle battery with correct polarity prior to controlling contact relay 34 to connect power to the vehicle battery. EX1005, ¶¶ [0016], [0020], FIG. 1 (highlighted to show the reverse voltage sensor 24).



103. Richardson further explains that “once jumper cables 60 have been manually connected to the vehicle to be started 28, the voltage is measured by the reverse voltage sensor 24 to determine if the cables have been properly connected to the vehicle 214.” EX1005, ¶ [0027]. “If the voltage measured is significantly less than the voltage of the jump starter capacitors 21 and batteries 22, then a reverse polarity connection of the jumper cables to the vehicle is determined and an error flag is set and the even saved in non-volatile memory 216.” EX1005, ¶ [0027]. Accordingly, “[a]ny further jump starter action by the operator is ignored until the reverse polarity condition is corrected 220, at which point processing returns to the start of the main processing loop 210.” EX1005, ¶ [0027]. Richardson further discloses an exemplary implementation of a reverse voltage sensor in Figure 2B. EX1005, FIG. 2B. Accordingly, Richardson teaches that contact relay 34 is closed only when the device is connected with correct polarity to the vehicle battery.

104. Similar findings regarding Richardson were provided in the ’015-FWD. EX1014 at 51-67.

C. Ground 2: Claims 15, 17, 18, 51, 54, and 57 are unpatentable under 35 U.S.C. § 103(a) over Richardson in view of Zhao and Dao

1. Exemplary Rationale for Combining Richardson and Dao

105. A PHOSITA would have found it obvious to combine the

disclosures of Richardson and Dao to implement in Richardson's device these features as taught by Zhao: (1) a USB output connector, circuit, and control circuitry, (2) using lithium chemistry cells as the cell type for the battery pack, and (3) implementing overcharge and overdischarge protections for the lithium battery pack via voltage measurement circuitry. Overdischarge in Dao refers to the depletion of the portable power supply / jump starter batteries below a voltage that could permanently degrade their storage capacity.

106. Both Richardson and Dao describe portable power supplies which can jump start vehicle batteries and include various safety features. EX1005, Abstract; EX1031, ¶¶ [0001]-[0002], [0023]. Richardson discloses measuring and monitoring the voltage of the jump starter batteries to prevent overdischarge and overcharge. EX1005, ¶¶ [0028]-[0029]. Dao similarly discloses a portable power supply that measures the voltage of the device's internal battery pack to prevent the pack's voltage from exceeding an upper threshold, which is commonly called "overcharge", or falling below a lower threshold, which is common called "overdischarge." EX1031, Abstract, ¶¶ [0020], [0024], [0031].

107. A PHOSITA would have understood that Richardson and Dao could be combined with predictable results because Dao is similarly directed to a jump starter with safety protections. Dao specifically teaches the desirable features of (1) utilizing lithium-ion battery cells for the battery pack and (2) a USB output port to

allow the device to charge portable devices such as smartphones. EX1031, Abstract, ¶¶ [0002], [0019], [0032].

2. Claim 15: “The device according to claim 1, further comprising a USB output connector for providing a power output from the power supply to a USB-chargeable device.”

108. Claim 15 speaks to the output of the jump starter rather than the input for charging its internal batteries. Richardson does not teach a USB output connector as claimed. However, a PHOSITA would have understood the desirability and advantages of adding a commonly used USB output feature to Richardson’s device to provide the further convenience of allowing the device to charge portable electronics such as smartphones in addition to the jump start functionality.

109. Dao discloses USB output functionality for its portable power supply to provide 5V USB power to other devices. EX1031, ¶ [0008], [0032], claim 13. Specifically, Dao discloses a 5V DC output 114 and 5V USB output ports 243a and 234b. EX1031, ¶ [0023], [0032], Fig. 1, Fig. 2B. This enhances the functionality, versatility, and convenience of Dao’s device by allowing it to serve as power bank for USB-chargeable devices in addition to a jump starter for vehicle batteries.

110. As one example, since jump starters are often needed in emergency situations, the USB output feature ensures that the user is not left stranded with a

dead smartphone (since all or virtually all except Apple smartphones utilized USB charging connectors at the claimed priority date). EX1032 at ¶ [0048] (“The USB adaptor 50 provides additional assurance that the operator is able to make an emergency phone call even if the cellular phone has a depleted battery 60”). Thus, Dao is not unique in implementing a USB output with a jump starter, as numerous references demonstrate it was a well-known and routine practice to implement a USB output as an accessory feature of a portable power supply or jump starter. EX1033 at ¶ [0014]; EX1034 at ¶ [0008], [0025], [0032]. A PHOSITA would have predictably implemented a USB output feature for a higher-voltage (e.g. >5V) battery through a DC-DC converter configured as a buck converter, which was a well-known circuit for decreasing a higher voltage source down to the voltage of a typical 5V USB output. EX1035. Being a core curriculum topic in an electrical engineering bachelor’s degree program, a PHOSITA would recognize how to use buck and boost converters to obtain various output voltages such as 5 volts from a power supply and provide such power to a USB outlet).

111. Thus, a PHOSITA would have understood the benefits of including a USB output in Richardson’s device to add the convenient feature of allowing the jump starter to double as a USB power bank and would have implemented this feature with predictable results.

3. Claim 17: “The device according to claim 15, wherein the USB output connector is electrically connected to a USB

output circuit, the USB output circuit connecting the power supply to the USB output connector.”

112. Dao discloses an electrical connection between the USB output connector and a USB charge circuit which includes inverter 212 and a switch which connects Dao’s battery pack 102 to the USB output 114 and/or USB ports 234a and 234b. EX1031, ¶ [0008], [0023], [0032]-[0033], Fig. 1, Fig. 2A, Fig. 2B. A PHOSITA would have been motivated to modify Richardson with predictable results to include the USB output connector and USB output circuit disclosed by Dao for at least the reasons discussed above in connection with claim 15.

4. **Claim 18: “The device according to claim 17, further comprising a microcontroller with a control circuit, the control circuit for the microcontroller allows the USB output circuit to be turned on and off by software control to prevent the power supply getting too low in capacity.”**

113. Dao discloses circuitry that turns the USB output circuit on and off to prevent unnecessary discharge or over-discharge of the battery pack. EX1031, ¶ [0033]. Specifically, Dao teaches deactivating the main switching unit 218 to isolate the inverter from the battery unit. EX1031, ¶ [0033], Fig. 2A, Fig. 2B. A PHOSITA would have been motivated to modify Richardson with predictable results to include the USB output connector and USB output circuit disclosed by Dao for at least the reasons discussed above in connection with claims 15 and 17.

114. A PHOSITA would further understand the advantages of configuring Richardson’s microcontroller to control the ON/OFF status of the USB

output circuit to prevent over-discharge of the jump starter batteries, particularly since Richardson discloses monitoring the jump starter batteries to ensure that they are adequately charged. EX1005, ¶ [0028]. Additionally, Richardson's microcontroller controls the system by software control and by producing various outputs. EX1005, ¶ [0014]. Accordingly, a PHOSITA would have been motivated to predictably implement the USB output circuit disclosed by Dao in Richardson's device such that Richardson's microcontroller and control circuitry would turn the USB output circuit on and off by software control as claimed. For example, a PHOSITA would have been motivated to configure Richardson's microcontroller to produce an output controlling a switch that would connect or disconnect Richardson's batteries and the USB output circuit. This configuration would prevent the batteries from getting too low in capacity due to discharge through the USB output circuit.

5. Claim 51: “The device according to claim 1, wherein the power supply is a rechargeable lithium battery pack.”

115. Richardson discloses that its batteries can be 12-volt batteries but does not specify the chemistry of the batteries, allowing any type with adequate capacity and peak power output for engine starting. EX1005, ¶ [0034]. A PHOSITA would have understood the known benefits of using lithium cells in the pack of Richardson's device. Specifically, lithium cells provide a significantly higher specific energy density compared to other common battery chemistries such

as lead-acid. This allows the cells to be more compact and lightweight for a given energy storage capacity. EX1040 at 5:15-21; EX1041 at ¶ [0002].

116. Dao discloses a jump starter with a battery pack comprised of lithium cells. EX1031, Abstract, ¶¶ [0002], [0007], [0009]-[0010], [0016], [0019]-[0027]. Dao further teaches that multiple lithium-ion cells can be connected in series to predictably achieve a 12V output for the pack. EX1031, ¶¶ [0021], [0027]. A PHOSITA would therefore have been motivated to implement a rechargeable lithium battery pack as disclosed by Dao as the power supply of Richardson's device. And using lithium cells in Richardson's device would have been predictable based upon the known interchangeability of battery cells of different types of chemistries.

6. **Claim 54: "The device according to claim 51, further comprising a rechargeable lithium battery pack voltage measurement circuit configured to monitor the rechargeable lithium battery pack to prevent voltage potential from rising too high during a charging operation and from dropping too low during a discharge operation."**

117. Richardson teaches measuring the voltage of the jump starter batteries to avoid overcharge and overdischarge. EX1005, ¶¶ [0028]-[0029]. When implementing a rechargeable lithium battery pack in Richardson's device (see claim 51, *supra*), a PHOSITA would have been motivated to implement a voltage measurement circuit as claimed to prevent voltage from rising too high during charging or from dropping too low during discharge. Specifically, before the

claimed priority date it was well-known that overcharge and overdischarge protections were desirable if not necessary to avoid battery degradation or failure, especially for lithium batteries due to their low tolerance for over-charge and over-discharge. EX1042 at ¶ [0005]; EX1041 at ¶ [0002]; EX1043 at ¶¶ [0017]-[0018].

118. Dao discloses measuring the voltage of the battery pack and comparing the voltage to upper and lower threshold levels to prevent over-charge and over-discharge, respectively. EX1031, ¶¶ [0020], [0024], [0031]. A PHOSITA would have been motivated to implement Dao's teachings regarding over-charge and over-discharge protections when implementing a lithium battery pack as the power supply of Richardson's device. Specifically, Richardson already contemplates measuring the voltage of the system batteries (via battery voltage sensor 20) to determine whether the batteries are undercharged or fully charged. EX1005, ¶¶ [0028]-[0029]. When implementing a lithium battery pack in Richardson's device and implementing overcharge and overdischarge protections as disclosed by Dao, a PHOSITA would have achieved predictable results by programming Richardson's microprocessor to make the necessary comparison between the measured voltage of the battery pack (received from battery voltage sensor 20) against upper and lower thresholds set for purposes of preventing the lithium pack from reaching a voltage level above or below its safe operational range.

7. **Claim 57**

- a. **Claim 57 Preamble: “A jump starting device for boosting or charging a depleted or discharged battery having a positive battery terminal and a negative battery terminal, the jump starting device comprising:”**

119. For the same reasons I have discussed above with respect to the preamble of claim 1 in Section VIII.B.2.a, it is my opinion that the preamble of claim 57 is fully disclosed by Richardson. Specifically, the opinions I have expressed in paragraphs 72-73 above are incorporated here by reference and also reflect my opinions with respect to the preamble of claim 57, which demonstrates that Richardson teaches the preamble of claim 57.

- b. **Limitation 57(a): “a power supply;”**

120. For the same reasons I have discussed above with respect to Limitation 1(a) in Section VIII.B.2.b, it is my opinion that Limitation 57(a) is fully disclosed by Richardson. Specifically, the opinions I have expressed above in paragraphs 74-75 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(a) and demonstrate that Richardson teaches Limitation 57(a).

- c. **Limitation 57(b): “a positive battery connector for electrically connecting the jump starting starter device to the positive battery terminal of the depleted or discharged battery;”**

121. For the same reasons I have discussed above with respect to

Limitation 1(b) in Section VIII.B.2.c, it is my opinion that Limitation 57(b) is fully disclosed by Richardson. Specifically, the opinions I have expressed above in paragraphs 76-77 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(b) and demonstrate that Richardson teaches Limitation 57(b).

d. Limitation 57(c): “a negative battery connector for electrically connecting the jump starting starter device to the negative battery terminal of the depleted or discharged battery;”

122. For the same reasons I have discussed above with respect to Limitation 1(c) in Section VIII.B.2.d, it is my opinion that Limitation 57(c) is fully disclosed by Richardson. Specifically, the opinions I have expressed above in paragraphs 78-79 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(c) and demonstrate that Richardson teaches Limitation 57(c).

e. Limitation 57(d): “a power switch or switch circuit in circuit with the power supply and the positive and negative battery connectors;”

123. For the same reasons I have discussed above with respect to Limitation 1(d) in Section VIII.B.2.e, it is my opinion that Limitation 57(d) is fully disclosed by Richardson. Specifically, the opinions I have expressed above in paragraphs 80-82 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(d) and demonstrate that Richardson teaches

Limitation 57(d).

- f. Limitation 57(e): “the power switch or switch circuit configured to switch power on from the power supply to boost or charge the depleted or discharged battery when connected between the positive and negative battery connectors;”**

124. For the same reasons I have discussed above with respect to Limitation 1(e) in Section VIII.B.2.f, it is my opinion that Limitation 57(e) is fully disclosed by Richardson. Specifically, the opinions I have expressed above in paragraphs 83-85 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(e) and demonstrate that Richardson teaches Limitation 57(e).

- g. Limitation 57(f): “a USB input connector;”**

125. For the same reasons I have discussed above with respect to Limitation 1(f) in Section VIII.B.2.g, it is my opinion that Limitation 57(f) is also obvious over Richardson in view of Zhao. Specifically, the opinions I have expressed above in paragraphs 86-95 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(f) and demonstrate that Richardson in view of Zhao renders Limitation 57(f) obvious.

- h. Limitation 57(g): “a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit configured to up-convert voltage from a USB charger power source connected to the USB input connector to the power supply using a DC-DC converter;”**

126. For the same reasons I have discussed above with respect to Limitation 1(g) in Section VIII.B.2.h, it is my opinion that Limitation 57(g) is also obvious over Richardson in view of Zhao. Specifically, the opinions I have expressed above in paragraphs 96-101 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(g) and demonstrate that Richardson in view of Zhao renders Limitation 57(g) obvious.

- i. Limitation 57(h): “a USB output connector; and”**

127. For the same reasons I have discussed above with respect to Claim 15 in Section VIII.C.2, it is my opinion that Limitation 57(h) is also obvious over Richardson in view of Dao. Specifically, the opinions I have expressed above in paragraphs 108-111 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(h) and demonstrate that Richardson in view of Dao renders Limitation 57(h) obvious.

- j. Limitation 57(i): “a USB output circuit electrically connecting the power supply to the USB output connector.”**

128. For the same reasons I have discussed above with respect to Claim 17 in Section VIII.C.3, it is my opinion that Limitation 57(i) is also obvious over

Richardson in view of Dao. Specifically, the opinions I have expressed above in paragraph 112 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(i) and demonstrate that Richardson in view of Dao renders Limitation 57(i) obvious.

D. Ground 3: Claims 1, 2, 15, 17, 18, and 57 are unpatentable under 35 U.S.C. § 103(a) over Yu in view of Paparrizos

1. Exemplary Rationale for Combining Yu and Paparrizos

129. A PHOSITA would have found it obvious to combine the disclosures of Yu and Paparrizos. Both references involve devices with internal batteries having voltages greater than 5V. A PHOSITA would have been motivated to modify Yu in view of Paparrizos to include a USB charging input and circuit to achieve the predictable result of charging the batteries of Yu's jump starter.

130. Yu teaches a battery-powered device for jump starting vehicles with 12V batteries. EX1008, Abstract, ¶ [0004]. Yu discloses an embodiment with a "12V/1A" input for charging a 12V battery. EX1008, FIG. 9.

131. Paparrizos discloses a circuit for charging electronic devices having a multicell pack of series-connected cells. EX1009, 2:32-40. Paparrizos specifically discloses that its circuit can use a 5V USB input to charge higher voltage batteries. EX1009, 8:17-31.

132. A PHOSITA therefore would have been motivated to combine Yu and Paparrizos with predictable results because Paparrizos is directed to the known

technique of charging a 12V battery from a 5V USB source by using a DC-DC boost converter to increase 5V to the higher battery voltage. Additionally, Paparrizos specifically teaches the desirability of charging higher voltage batteries with a 5V input, which is a known technique that a PHOSITA would have been motivated to implement predictably to charge Yu's battery.

133. I provide more detail regarding my opinions as applied to specific claims and limitations below.

2. Independent Claim 1

- a. **Claim 1 Preamble: "A jump starting device for boosting or charging a depleted or discharged battery having a positive battery terminal and a negative battery terminal, the jump starting device comprising:"**

134. Yu discloses a jump starting device as claimed. EX1008, Abstract, claim 1, ¶¶ [0001], [0003], [0004], [0009], [0021], [0026]. For example, Yu's device has an output terminal for conveying power to jump start a vehicle having a discharged battery. EX1008 at ¶ [0004], Fig. 1 (the "output terminal" is identified in the figure as reference numeral 3). Yu describes that its device includes a microprocessor-controlled relay, which can connect the device's internal batteries to an external battery of an automobile to jump start the battery. Yu, Abstract. Thus, Yu's device can boost or charge a battery by connecting the internal batteries of the jump starter to the positive and negative terminals of a vehicle battery via

output terminal 3 and associated wiring. EX1008, ¶ [0004], [0026]; Fig. 8 (indicating output terminal with reference numeral 3).

b. Limitation 1(a): “a power supply;”

135. Yu discloses a device with “an internal battery” constituting a power supply. EX1008, Abstract; Fig. 1, claim 1, ¶¶ [0004], [0009], [0021]. The internal battery “will output current to the vehicle to be started through the output terminal 3”, which indicates the internal battery is a multicell battery pack of series-connected cells with an output voltage of approximately 12V. EX1008, ¶ [0026].

c. Limitation 1(b): “a positive battery connector for electrically connecting the jump starting device to the positive battery terminal of the depleted or discharged battery;”

136. As I previously stated while discussing Limitation 1(b) in Ground 1, it seems almost pedantic to claim the inclusion a positive and/or negative connector to couple the jump starter to the vehicle battery. A PHOSITA would know that positive and negative connections are necessary for *any* complete electrical circuit. Nevertheless, it is my opinion that Limitation 1(b) is fully disclosed by Yu. Yu discloses “wiring” (also referred to as “external battery wiring” or “output terminal 3 wiring”) which includes a positive battery connector as claimed. EX1008, Abstract, claim 1, ¶¶ [0004], [0021], [0026]. Figure 8 depicts output terminal 3 as a receptacle that a PHOSITA would recognize as an EC5 connector, capable of mating with a plug integrated with wiring with cable clamps or other connectors

for connecting to the positive terminal of the vehicle battery. The '243 patent admits that such cables (and associated terminals, clamps or other connectors) were known in the prior art. EX1001 at 1:11-17, 1:17-24, 1:31-35. Thus, a PHOSITA would understand that Yu's wiring for connecting the device to a vehicle battery discloses or renders obvious a positive battery connector as claimed, particularly in light of Yu's emphasis on correct polarity versus reverse (or wrong) polarity connections. This indicates that there is both a positive battery connector and separately a negative battery connector. EX1008, Abstract, ¶¶ [0002], [0003], [0008], [0026]; Fig. 2.

d. Limitation 1(c): “a negative battery connector for electrically connecting the jump starting device to the negative battery terminal of the depleted or discharged battery;”

137. My comment above regarding limitation 1(b) is repeated here. Yu discloses “wiring” as discussed in the previous section, which is incorporated here by reference. Specifically, Yu's disclosure of wiring, the output terminal 3, and related discussions of polarity further demonstrate that Yu discloses or renders obvious a negative battery connector as claimed. EX1008, Abstract, ¶¶ [0002], [0003], [0004], [0008], [0021], [0026].

e. Limitation 1(d): “a power switch or switch circuit connected in circuit with the power supply and the positive and negative battery connectors,”

138. Yu discloses a relay which functions as a power switch or switch

circuit as claimed. EX1008, Abstract, claim 1, ¶¶ [0004], [0009], [0021], FIG 1, FIG. 2. For example, Yu discloses a control module with a microprocessor which “controls the opening and closing of the relay through the relay switch circuit to control current output from the internal battery to the output terminal.” EX1008, Abstract. Yu discloses the jump start process includes closing relay 2 which then causes the internal battery to output current to the vehicle battery through the output terminal 3. EX1008, ¶ [0026].

f. Limitation 1(e): “the power switch or switch circuit configured to switch power on from the power supply to boost or charge the depleted or discharged battery when connected between the positive and negative battery connectors;”

139. Yu discloses its relay is configured to switch power on as claimed. Specifically, the relay is configured to be controlled by a system comprised of the control module, microprocessor, and associated sensors and circuitry. EX1008, Abstract, claim 1, claim 3, ¶¶ [0004], [0006], [0021], [0023], [0026]-[0027], FIG. 1, FIG. 2.

140. For example, Yu discloses “the microprocessor controls the opening and closing of the relay through the relay switch circuit to control current output[.]” EX1008, Abstract, ¶ [0004]. Yu discloses that an initial step of the jump start process is connecting the device to an external battery. EX1008, ¶¶ [0009], [0026]. If appropriate conditions have been satisfied after processing inputs from

circuitry such as the external battery reverse connection detection circuit 44 and external battery voltage detection circuit 45, Yu's device can close its relay to output current to the vehicle battery. EX1008, ¶ [0009], [0026]. After the jump start is complete, the microprocessor will control the relay to open and the wiring can be disconnected from the vehicle battery. EX1008, ¶ [0009], [0026]. Accordingly, Yu teaches that its relay is configured to switch power on during the time that the device is connected to a vehicle battery via the device's wiring.

g. Limitation 1(f): “a USB input connector; and”

141. Yu discloses a charging input interface, which can be a 12V/1A barrel-style receptacle. EX1008, Abstract, FIG. 9 (reference numeral 10). While Yu is not explicit that the charger's input interface is a 5V USB input port processed by a boost converter, a PHOSITA would have been motivated to predictably modify Yu's device to implement the USB charging feature of Paparrizos. For example, Paparrizos identifies a need for using “very popular” USB technology for charging multicell battery packs rated above 5V. EX1009, 1:18-26. Paparrizos goes on to provide an explicit teaching and motivation to implement its USB charging interface (and associated circuit) in a device that has batteries that can output 12V, like Yu's jump starter. See EX1009, 2:32-38, 8:18-31. Thus, a PHOSITA would have been motivated to cater to the demand for, and interest in, the USB technology that consumers are “used to” having present for

battery charging from a USB power source. EX1009, 1:18-26.

142. As another example, outside the explicit teaching of Paparrizos, the desirability of 5V USB charging of devices with batteries above 5V was well-known to a PHOSITA before the claimed priority date, as discussed above in paragraphs 92-94 which are incorporated here by reference. And a PHOSITA would have found the combination of Paparrizos' USB charging feature in Yu's device to involve the predictable application of a standard USB connector and conventional DC-DC boosting technique that Paparrizos explicitly recognizes as prior art. EX1009, 9:36-46; FIG. 8A (identifying a "Basic Boost Converter Circuit" as "prior art").

143. For example, when implementing the USB charging feature of Paparrizos in Yu's device, a PHOSITA would have understood the need to add a USB receptacle, such as a micro-USB or other version of USB connector, as taught by Paparrizos. EX1009, 2:56-63, FIG. 1B (identifying USB connector 16b); FIG. 1C (identifying micro-USB connector 16c). As a standard power input connector, a PHOSITA would have been able to implement such a USB connector with Yu's disclosed device with relative ease. As disclosed by Paparrizos, the USB connectors serve as claimed to connect to an external USB power source and subsequently convey power input from that source to battery charging circuit 100 and ultimately the battery 14. EX1009, 2:59-67, 3:1-6, 4:36-39.

144. A PHOSITA would have been motivated to modify the design of Yu's jump starter in one of two ways. One modification would be replacing the existing charging connector and circuitry with Paparrizos's charging system and connecting the output to charge Yu's jump starter batteries. A second modification would be adding Paparrizos's charging system and connecting and connecting the output to charge Yu's jump starter batteries as an additional and alternative pathway for charging the batteries beyond the 12V nominal DC input envisioned by Yu. Either option would have provided desirable features or improvements to Yu's jump starter. For example, the first option allows the device manufacturer or supplier to avoid the need to provide a proprietary charger or other type of AC "power brick" that would be less ubiquitous or less standardized than a USB charger. The second option would add the desirable benefit of increased flexibility, allowing the jump starter batteries to be charged multiple ways: via a traditional AC power brick when available, but alternatively by a USB charger if only USB power is readily available. Both options cater to perceived or actual consumer demand for USB technology as well as the other benefits and desirable features of USB charging.

- h. Limitation 1(g): "a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit comprising a DC-DC converter configured to upconvert voltage from the USB input connector to the power supply."**

145. Yu teaches its device has a charging input interface, which is

depicted in Figure 9 as a 12V/1A barrel-style receptacle. EX1008, Abstract, FIG. 9 (reference numeral 10). Thus, while Yu does not teach a USB input circuit as claimed, such USB input circuits were well known at the '243 priority date and a PHOSITA would have been motivated to combine such a USB input circuit from the prior art to Yu's device with predictability in such circuit's ability to charge the internal battery of Yu's device. Specifically, Paparrizos teaches a USB input circuit as claimed which a PHOSITA would have been motivated to implement in Yu's device to either (1) replace the charging circuitry, or (2) provide additional charging circuitry to enable an alternate means to charge Yu's device from a USB power source. Either option would have provided desirable features or improvements to Yu's jump starter, as discussed in the previous section in connection with Limitation 1(f).

146. For example, Paparrizos discloses a battery charging circuit which can operate in a "boost (power stepped up mode)" and a "forward mode" to boost an input voltage from a USB source to a higher output to charge the internal battery of a device. EX1009, 1:34-38, FIG. 1B, FIG. 1C. Paparrizos discloses battery charging circuit 100 and related components which connect to and charge battery 14. EX1009, 2:30-40. The battery can constitute a series-connected configuration of cells of any suitable battery chemistry, such as lithium-ion batteries, at various voltages above 5V, such as 6-8.4V or higher. EX1009, 2:30-

40. Paparrizos further contemplates the charging circuit is an USB input circuit whereby power is received from a USB source. EX1009, 2:56-63, FIG. 1B (depicting an electronic device 16B serving as a power source connected to USB connector 16b), FIG. 1C (depicting a USB power source connected to micro-USB connector 16c).

147. The battery charging circuit of Paparrizos can operate in a “forward mode” where power from a USB source reaches the internal battery of a device via input terminal 102 and subsequently charging terminal 104. EX1009, 3:1-10. The battery charging circuit can include a buck-boost circuit 212 which can operate “as a boost converter” while the circuit is operating in “forward mode”, to deliver low-voltage input power to a higher voltage internal battery. EX1009, 3:11-21. And “[a]n output of the buck boost circuit 212 may drive a charger 214 (e.g., a linear charger, or any other suitable circuit) that is connected to the charging terminal 104 to provide a charging current for battery 14.” EX1009, 4:36-39.

148. As stated in Paparrizos, “[when] the voltage level at the input terminal 102 is lower than what is needed by the battery 14, then the battery charging circuit 100 may operate in a ‘forward boost’ mode in order to step up the voltage level to a suitable level.” EX1009, 3:31-35. Accordingly, if a 5V USB power source is connected to the battery charging circuit when the battery to be charged is above 5V, the circuit will operate “as a forward boost converter to

increase the voltage level that is receive at input terminal 102 to produce suitable voltage level at charging terminal 104 or system terminal 106.” EX1009, 3:58-4:4. Thus, a PHOSITA would understand Paparrizos teaches a USB input circuit that can receive a 5V USB input and increase that power voltage up to the nominal battery-charging voltage 12V via a DC-DC power conversion boosting technique to charge a device with a 3S (three Li-ion cells connected in series) battery pack; 2:31-38 (discussing application to 3S series-connected cells); 8:10-30 (discussing the use of forward boost mode to use a 5V USB input to charge a nominally 12V 3S battery pack); and 9:36-46 (discussing operation and components of boost converter).

149. In addition to the explicit teachings of Paparrizos, the desirability of utilizing USB technology to charge higher-voltage battery-powered devices was well-known before the claimed priority date, as discussed above in connection with Limitation 1(f) and incorporated herein by reference.

150. In sum, before the claimed priority date, USB charging for higher voltage batteries was a predictable technique to achieve the desirable feature of USB charging of higher voltage batteries of devices like Yu’s jump starter. Therefore, Yu and Paparrizos render this limitation obvious.

3. **Claim 2: “The device according to claim 1, wherein the power switch or switch circuit is controlled to turn on power to the depleted or discharged battery only when the**

jump starting device is connected with correct polarity to the depleted or discharged battery.”

151. Yu discloses that when the vehicle battery is connected with the wrong polarity, the microprocessor prevents the relay from closing. EX1008, Abstract, ¶ [0003], [0009], [0026]. This protection involves the external battery reverse connection detection circuit which provides a signal to the microprocessor indicating whether there is a reverse polarity connection. EX1008, claim 1, ¶¶ [0003]-[0004], [0009], [0021], [0026]; Fig. 1.

152. Yu further discloses an exemplary embodiment where the external battery reverse connection detection circuit is depicted as an optocoupler which can provide an output signal to the microprocessor labeled as “resvese” in Figure 2. EX1007, FIG. 2; EX1008, FIG. 2. Yu’s optocoupler is the same type of component that the ’243 patent discloses as part of the polarity detection feature. EX1001, 5:27-30 (“The reverse battery sensor 10 comprises an optically coupled isolator phototransistor (4N27) connected to the terminal of vehicle battery 72[.]”); 5:32-36 (explaining “if the battery 72 is connected to the terminals of the booster device with the correct polarity, the optocoupler LED 11 will not conduct current, and is therefore turned off, providing a ‘1’ or high output signal to the MCU 1.”). Accordingly, Yu teaches its relay is closed only when the device is connected with correct polarity to the vehicle battery.

4. Claim 15: “The device according to claim 1, further comprising a USB output connector for providing a power output from the power supply to a USB-chargeable device.”

153. Yu discloses a 5V *output* terminal 8 which is a USB output connector as claimed. EX1008, claim 5, ¶¶ [0008], [0025], [0028], Fig. 1, Fig. 4, Fig. 7. Specifically, Figure 7 depicts a 5V output receptacle 8 with an elongated rectangular cross-section containing a strip of pins which a PHOSITA would easily recognize as a standard Type-A USB receptacle. That Yu does not elaborate further on this ancillary power output is simply a recognition that USB charging connectors were ubiquitous in almost all portable electronics applications, and had been for many years prior to its April 26, 2013 application date, and the '243 patent's priority date. EX1036, ¶ [0065] (identifying “four USB type A female connectors 26”), Figs. 2-3 (depicting same); EX1037, ¶ [0021] (identifying “USB Type A receptacle 201”), Fig. 2 (depicting same); EX1038 at 4:19-22 (identifying “power outlet or port 36” as a “USB interface”), Fig. 3 (depicting same). Yu explicitly teaches that this 5V output receptacle “can be used as a general power supply for other electrical equipment.” EX1008, ¶ [0028].

154. Additionally, Figure 7 annotates the output terminal with a rating of 5V/2.1A, which a PHOSITA would further understand to indicate the output terminal is a Type-A USB connector since under certain circumstances this rating would be associated with a Type-A USB connector. EX1038 at 5:8-9 (identifying

the USB power outlet rating as “5V @ 2.1 A”); EX1039, ¶ [0037] (disclosing “5V 1A/2.1 A max out” for “USB outlets 40”).

5. Claim 17: “The device according to claim 15, wherein the USB output connector is electrically connected to a USB output circuit, the USB output circuit connecting the power supply to the USB output connector.”

155. Yu discloses an electrical connection between the 5V output terminal and a USB charge circuit which connects Yu’s internal battery to the 5V output terminal. Specifically, Yu discloses a “5V voltage output circuit” which is a USB charge circuit as claimed. EX1008, claim 5. The 5V output circuit is connected to the 5V USB receptacle to allow Yu’s device to serve as a power supply for other electrical equipment. EX1008, ¶ [0008], [0025], [0028], Fig. 4.

6. Claim 18: “The device according to claim 17, further comprising a microcontroller with a control circuit, the control circuit for the microcontroller allows the USB output circuit to be turned on and off by software control to prevent the power supply getting too low in capacity.”

156. Yu discloses microprocessor 42 which, together with control circuitry, allows the 5V output circuit to be turned on and off by software control as claimed. EX1008, Fig. 1, Fig. 4. As shown in Figure 4, Yu discloses an “ON/OFF” control signal that reaches an integrated circuit (IC9) connected to the +5V output of the USB output connector via an inductor (L2). EX1008, Fig. 4. A PHOSITA would thus understand that in Yu’s device, the control scheme allows signal control by the microprocessor and control circuit to turn the USB output

circuit on and off for the purpose of preserving power (e.g., preventing the battery from getting too low in capacity) when the 5V output feature is not needed for charging an external device.

7. Claim 57

- a. Claim 57 Preamble: “A jump starting device for boosting or charging a depleted or discharged battery having a positive battery terminal and a negative battery terminal, the jump starting device comprising:”**

157. For the same reasons I have discussed above with respect to the preamble of claim 1 in Section VIII.D.2.a, it is my opinion that the preamble of claim 57 is fully disclosed by Yu. Specifically, the opinions I have expressed in paragraph 134 above are incorporated here by reference and also reflect my opinions with respect to the preamble of claim 57, which demonstrates that Yu teaches the preamble of claim 57.

- b. Limitation 57(a): “a power supply;”**

158. For the same reasons I have discussed above with respect to Limitation 1(a) in Section VIII.D.2.b, it is my opinion that Limitation 57(a) is fully disclosed by Yu. Specifically, the opinions I have expressed above in paragraph 135 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(a) and demonstrate that Yu teaches Limitation 57(a).

- c. Limitation 57(b): “a positive battery connector for electrically connecting the jump starting starter**

device to the positive battery terminal of the depleted or discharged battery;”

159. For the same reasons I have discussed above with respect to Limitation 1(b) in Section VIII.D.2.c, it is my opinion that Limitation 57(b) is fully disclosed by Yu. Specifically, the opinions I have expressed above in paragraph 136 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(b) and demonstrate that Yu teaches Limitation 57(b).

d. Limitation 57(c): “a negative battery connector for electrically connecting the jump starting starter device to the negative battery terminal of the depleted or discharged battery;”

160. For the same reasons I have discussed above with respect to Limitation 1(c) in Section VIII.D.2.d, it is my opinion that Limitation 57(c) is fully disclosed by Yu. Specifically, the opinions I have expressed above in paragraph 137 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(c) and demonstrate that Yu teaches Limitation 57(c).

e. Limitation 57(d): “a power switch or switch circuit in circuit with the power supply and the positive and negative battery connectors;”

161. For the same reasons I have discussed above with respect to Limitation 1(d) in Section VIII.D.2.e, it is my opinion that Limitation 57(d) is fully disclosed by Yu. Specifically, the opinions I have expressed above in paragraph 138 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(d) and demonstrate that Yu teaches Limitation 57(d).

- f. Limitation 57(e): “the power switch or switch circuit configured to switch power on from the power supply to boost or charge the depleted or discharged battery when connected between the positive and negative battery connectors;”**

162. For the same reasons I have discussed above with respect to Limitation 1(e) in Section VIII.D.2.f, it is my opinion that Limitation 57(e) is fully disclosed by Yu. Specifically, the opinions I have expressed above in paragraphs 139-140 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(e) and demonstrate that Yu teaches Limitation 57(e).

- g. Limitation 57(f): “a USB input connector;”**

163. For the same reasons I have discussed above with respect to Limitation 1(f) in Section VIII.D.2.g, it is my opinion that Limitation 57(f) is also obvious over Yu in view of Paparrizos. Specifically, the opinions I have expressed above in paragraphs 141-144 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(f) and demonstrate that Yu in view of Paparrizos renders Limitation 57(f) obvious.

- h. Limitation 57(g): “a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit configured to up-convert voltage from a USB charger power source connected to the USB input connector to the power supply using a DC-DC converter;”**

164. For the same reasons I have discussed above with respect to Limitation 1(g) in Section VIII.D.2.h, it is my opinion that Limitation 57(g) is also

obvious over Yu in view of Paparrizos. Specifically, the opinions I have expressed above in paragraphs 145-150 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(g) and demonstrate that Yu in view of Paparrizos renders Limitation 57(g) obvious.

i. Limitation 57(h): “a USB output connector; and”

165. For the same reasons I have discussed above with respect to Claim 15 in Section VIII.D.4, it is my opinion that Limitation 57(h) is fully disclosed by Yu. Specifically, the opinions I have expressed above in paragraphs 153-154 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(h) and demonstrate that Yu teaches Limitation 57(h).

j. Limitation 57(i): “a USB output circuit electrically connecting the power supply to the USB output connector.”

166. For the same reasons I have discussed above with respect to Claim 17 in Section VIII.D.5 it is my opinion that Limitation 57(i) is fully disclosed by Yu. Specifically, the opinions I have expressed above in paragraph 155 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(i) and demonstrate that Yu teaches Limitation 57(i).

E. Ground 4: Claims 15, 17, 18, 51, 54, and 57 are unpatentable under 35 U.S.C. § 103(a) over Yu in view of Paparrizos and Dao

1. Exemplary Rationale for Combining Yu and Dao

167. A PHOSITA would have been motivated to combine the disclosures

of Yu and Dao. Both references describe portable power supplies which can jump start vehicle batteries and include various safety features. EX1008, Abstract; EX1031, ¶¶ [0001]-[0002], [0023]. Yu discloses a jump starter designed to jump start a vehicle. EX1008, Abstract. Yu's jump starter uses circuitry (including a microprocessor) to control the system and implement various safety features. EX1008, Abstract, Fig. 1, Fig. 2, ¶¶ [0004], [0006], [0009], [0026]. Dao similarly discloses a portable power supply with safety features such as overcharge and overdischarge protections for the device's battery pack. EX1031, Abstract, ¶¶ [0020], [0024], [0031].

168. A PHOSITA therefore would have understood that Yu and Dao could be combined with predictable results because Dao is similarly directed to a jump starter with safety protections. Additionally, Dao specifically teaches the desirable features of (1) utilizing lithium-ion battery cells for the battery pack with overcharge and overdischarge protections and (2) a USB output accessory to allow the device to charge portable USB-chargeable devices such as smartphones. EX1031, Abstract, ¶¶ [0002], [0019], [0032].

2. Claim 15: “The device according to claim 1, further comprising a USB output connector for providing a power output from the power supply to a USB-chargeable device.”

169. To the extent NOCO argues that Yu does not teach claim 15, a PHOSITA would have been motivated to predictably implement a USB power

output connector as claimed by modifying Yu in view of Dao. For example, the desirability and predictability of implementing a USB output accessory feature for a jump starter is detailed above in paragraph 110 above, which is incorporated herein by reference. Accordingly, a PHOSITA would have been motivated to add the USB output feature taught by Dao to Yu's device.

170. Specifically, Dao discloses USB output functionality for its device to provide 5V USB power to other devices. EX1031, ¶ [0008], [0032], claim 13. Specifically, Dao discloses a 5V DC output 114 and 5V USB output ports 243a and 234b. EX1031, ¶ [0023], [0032], Fig. 1, Fig. 2B. This enhances the functionality, versatility, and convenience of Dao's device by allowing it to serve as power bank for USB-chargeable devices in addition to a jump starter for vehicle batteries.

171. Thus, a PHOSITA would have understood the benefits of including a USB output in Yu's device to add the convenient feature of allowing the jump starter to double as a USB power bank, and would have been able to implement this feature with predictable results.

3. Claim 17: "The device according to claim 15, wherein the USB output connector is electrically connected to a USB output circuit, the USB output circuit connecting the power supply to the USB output connector."

172. To the extent NOCO argues that Yu does not teach claim 17, a PHOSITA would have been motivated to predictably implement a USB output

connector and USB output circuit as claimed by combining modifying Yu in view of Dao.

173. Dao specifically discloses an electrical connection between the USB output connector and a USB charge circuit which includes inverter 212 and a switch which connects Dao's battery pack 102 to the USB output 114 and/or USB ports 234a and 234b. EX1031, ¶ [0008], [0023], [0032]-[0033], Fig. 1, Fig. 2A, Fig. 2B. A PHOSITA would have been motivated to modify Yu with predictable results to include the USB output connector and USB output circuit disclosed by Dao for at least the reasons discussed above in connection with claim 15.

4. Claim 18: “The device according to claim 17, further comprising a microcontroller with a control circuit, the control circuit for the microcontroller allows the USB output circuit to be turned on and off by software control to prevent the power supply getting too low in capacity.”

174. To the extent NOCO argues that Yu does not teach claim 18, a PHOSITA would have been motivated to predictably implement a USB output connector, USB charge circuit, and microcontroller with a control circuit as claimed by modifying Yu in view of Dao.

175. Dao discloses circuitry that turns the USB power output circuit on and off to prevent unnecessary discharge or over-discharge of the battery pack. EX1031, ¶ [0033]. Specifically, Dao teaches deactivating the main switching unit 218 to isolate the inverter from the battery unit, turning off the USB power outlet.

EX1031, ¶ [0033], Fig. 2A, Fig. 2B. A PHOSITA would have been motivated to modify Yu with predictable results to include the USB output connector and USB output circuit disclosed by Dao for at least the reasons discussed above in connection with claims 15 and 17.

176. A PHOSITA would further understand the advantages of configuring Richardson's microcontroller to control the ON/OFF status of the USB output circuit to prevent over-discharge of the jump starter batteries, particularly since Yu discloses monitoring the jump starter's internal battery. EX1008, ¶¶ [0005], [0022], [0027]. Additionally, Yu's microcontroller is software-programmable to control the system. EX1008, Fig. 1. Accordingly, a PHOSITA would have been motivated to predictably implement the USB output circuit disclosed by Dao in Yu's device such that Yu's microcontroller and control circuitry would turn the USB output circuit on and off by software control as claimed. For example, a PHOSITA would have been motivated to configure Yu's microcontroller to produce an output controlling a switch that would connect or disconnect Yu's internal battery from the USB output circuit. This configuration would prevent the batteries from becoming excessively discharged due to the USB power output.

5. Claim 51: "The device according to claim 1, wherein the power supply is a rechargeable lithium battery pack."

177. Yu does not specify the chemistry of its device's internal battery.

However, a PHOSITA would have understood the known benefits of using lithium cells in the pack of Yu's device, particularly given the compact size of Yu's embodiment device. EX1008, Figs. 6-9. Specifically, lithium cells provide various advantages such as high instantaneous discharge current and a relatively higher mass and energy density compared to other common battery chemistries, which allows the cells to be more compact and lightweight at any given output (such as 12V, for example). EX1040 at 5:15-21; EX1041 at ¶ [0002].

178. Dao discloses a jump starter with a battery pack comprised of lithium cells. EX1031, Abstract, ¶¶ [0002], [0007], [0009]-[0010], [0016], [0019]-[0027]. Dao further teaches that multiple lithium-ion cells can be connected in series to predictably achieve a 12V output for the pack. EX1031, ¶¶ [0021], [0027]. A PHOSITA would therefore have been motivated to implement a rechargeable lithium battery pack as disclosed by Dao as the power supply in Yu's device. And using lithium cells in Yu's device would have been predictable based upon the known interchangeability of battery cells of different types of chemistries, the known suitability of lithium cells for providing the voltage and current needed for a jump start operation.

6. **Claim 54: “The device according to claim 51, further comprising a rechargeable lithium battery pack voltage measurement circuit configured to monitor the rechargeable lithium battery pack to prevent voltage potential from rising too high during a charging operation and from dropping too low during a discharge operation.”**

179. Yu discloses internal battery voltage detection 43 which is signal-connected to the microprocessor. EX1008, claim 2, ¶¶ [0005], [0022], [0027]. While Yu discloses that internal battery voltage detection circuit 43 is used to monitor the battery charge, Yu does not expressly disclose monitoring for purposes of overcharge and overdischarge protections. EX1008, ¶ [0027]. However, a PHOSITA would have been motivated to implement the overcharge and overdischarge protections of Dao as well as Yu and Zhao into Yu’s device. With reference to these same prior patents, when implementing a rechargeable lithium battery pack in Yu’s device (see claim 51, *supra*), a PHOSITA would have been motivated to implement a voltage measurement circuit as claimed to prevent voltage potential from rising too high during charging and from dropping to low during discharge. Well before the claimed priority date it was almost universally established that overcharge and overdischarge protections were desirable, if not necessary, to avoid degradation or failure of lithium batteries’ due to their low tolerance for over-charge and over-discharge. EX1042 at ¶ [0005]; EX1041 at ¶ [0002]; EX1043 at ¶¶ [0017]-[0018] as disclosed by Dao.

180. Dao discloses measuring the voltage of the battery pack and

comparing the voltage to upper and lower threshold levels to prevent over-charge and over-discharge, respectively. EX1031, ¶¶ [0020], [0024], [0031]. A PHOSITA would have been motivated to implement Dao's teachings regarding over-charge and over-discharge protections when implementing a lithium battery pack as the power supply of Yu's device. Specifically, Yu already contemplates measuring the voltage of the device's internal battery. EX1008, ¶ [0005], [0022], [0027]. When implementing a lithium battery pack in Yu's device and implementing overcharge and overdischarge protections as disclosed by Dao, a PHOSITA would have achieved predictable results by programming Yu's microprocessor to make the necessary comparison between the measured voltage of the battery pack (received from internal battery voltage detection circuit 43) with upper and lower voltage thresholds for purposes of preventing the lithium pack from reaching a voltage above or below its safe operating range.

7. Claim 57

- a. **Claim 57 Preamble: "A jump starting device for boosting or charging a depleted or discharged battery having a positive battery terminal and a negative battery terminal, the jump starting device comprising:"**

181. For the same reasons I have discussed above with respect to the preamble of claim 1 in Section VIII.D.2.a, it is my opinion that the preamble of claim 57 is fully disclosed by Yu. Specifically, the opinions I have expressed in

paragraph 134 above are incorporated here by reference and also reflect my opinions with respect to the preamble of claim 57, which demonstrates that Yu teaches the preamble of claim 57.

b. Limitation 57(a): “a power supply;”

182. For the same reasons I have discussed above with respect to Limitation 1(a) in Section VIII.D.2.b, it is my opinion that Limitation 57(a) is fully disclosed by Yu. Specifically, the opinions I have expressed above in paragraph 135 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(a) and demonstrate that Yu teaches Limitation 57(a).

c. Limitation 57(b): “a positive battery connector for electrically connecting the jump starting starter device to the positive battery terminal of the depleted or discharged battery;”

183. For the same reasons I have discussed above with respect to Limitation 1(b) in Section VIII.D.2.c, it is my opinion that Limitation 57(b) is fully disclosed by Yu. Specifically, the opinions I have expressed above in paragraph 136 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(b) and demonstrate that Yu teaches Limitation 57(b).

d. Limitation 57(c): “a negative battery connector for electrically connecting the jump starting starter device to the negative battery terminal of the depleted or discharged battery;”

184. For the same reasons I have discussed above with respect to Limitation 1(c) in Section VIII.D.2.d, it is my opinion that Limitation 57(c) is fully

disclosed by Yu. Specifically, the opinions I have expressed above in paragraph 137 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(c) and demonstrate that Yu teaches Limitation 57(c).

e. Limitation 57(d): “a power switch or switch circuit in circuit with the power supply and the positive and negative battery connectors;”

185. For the same reasons I have discussed above with respect to Limitation 1(d) in Section VIII.D.2.e, it is my opinion that Limitation 57(d) is fully disclosed by Yu. Specifically, the opinions I have expressed above in paragraph 138 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(d) and demonstrate that Yu teaches Limitation 57(d).

f. Limitation 57(e): “the power switch or switch circuit configured to switch power on from the power supply to boost or charge the depleted or discharged battery when connected between the positive and negative battery connectors;”

186. For the same reasons I have discussed above with respect to Limitation 1(e) in Section VIII.D.2.f, it is my opinion that Limitation 57(e) is fully disclosed by Yu. Specifically, the opinions I have expressed above in paragraphs 139-140 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(e) and demonstrate that Yu teaches Limitation 57(e)

g. Limitation 57(f): “a USB input connector;”

187. For the same reasons I have discussed above with respect to Limitation 1(f) in Section VIII.D.2.g, it is my opinion that Limitation 57(f) is also

obvious over Yu in view of Paparrizos. Specifically, the opinions I have expressed above in paragraphs 141-144 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(f) and demonstrate that Yu in view of Paparrizos renders Limitation 57(f) obvious.

h. Limitation 57(g): “a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit configured to up-convert voltage from a USB charger power source connected to the USB input connector to the power supply using a DC-DC converter;”

188. For the same reasons I have discussed above with respect to Limitation 1(g) in Section VIII.D.2.h, it is my opinion that Limitation 57(g) is also obvious over Yu in view of Paparrizos. Specifically, the opinions I have expressed above in paragraphs 145-150 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(g) and demonstrate that Yu in view of Paparrizos renders Limitation 57(g) obvious.

i. Limitation 57(h): “a USB output connector; and

189. For the same reasons I have discussed above with respect to Claim 15 in Section VIII.E.2, it is my opinion that Limitation 57(h) is also obvious over Yu in view of Dao. Specifically, the opinions I have expressed above in paragraphs 169-171 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(h) and demonstrate that Yu in view of Dao renders Limitation 57(h) obvious.

j. Limitation 57(i): “a USB output circuit electrically connecting the power supply to the USB output connector.”

190. For the same reasons I have discussed above with respect to Claim 17 in Section VIII.E.3, it is my opinion that Limitation 57(i) is also obvious over Yu in view of Dao. Specifically, the opinions I have expressed above in paragraphs 155, 172-173 above are incorporated here by reference and also reflect my opinions with respect to Limitation 57(i) and demonstrate that Yu in view of Dao renders Limitation 57(i) obvious.

IX. CONCLUSION

191. For these reasons, it is my opinion that claims 1, 2, 15, 17, 18, 51, 54, and 57 of the '243 patent are unpatentable.

* * *

I understand that this declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also understand that I may be subject to cross-examination concerning this declaration, and I will appear if required, at the time allotted for cross-examination.

I hereby declare that all of the statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code. I reserve the option to modify my conclusions in the event that authentic contradictory information should become known at a future time.

Executed on this 11th day of March, 2024.



C. Arthur MacCarley, Ph.D., P.E.