

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DELTRAN USA LLC,
Petitioner

v.

THE NOCO COMPANY,
Patent Owner.

Case IPR2024-01219
U.S. Patent No. 11,667,203

**DECLARATION OF DR. AYMAN FAYED IN SUPPORT OF PATENT
OWNER'S RESPONSE**

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1. I am making this declaration at the request of The NOCO Company (“Patent Owner” or “NOCO”) in the matter of the *Inter Partes* Review 2024-01219 of U.S. Patent No. 11,667,203 (the “’203 Patent”).

2. I am being compensated for my work in this matter at my usual and customary consulting rate of \$750 per hour for the time I spend in connection with this matter. My compensation in no way depends on the outcome of this case or any other proceeding.

3. I previously prepared an initial Declaration (Ex. 2001) in support of Patent Owner’s Preliminary Response (Paper 7). For the sake of completeness, in this Declaration I have repeated and expanded upon many of the statements made in the initial Declaration.

4. In preparing this Declaration, I again considered all papers and exhibits that have been introduced in IPR2024-01219, including but not limited to the materials cited in the body of this Declaration:

- a. The ’203 Patent (Ex. 1001) and its file history (Ex. 1002);
- b. Petition for *Inter Partes* Review of the U.S. Patent No. 11,667,203 (“Petition”);
- c. The Declaration of Dr. C. Arthur MacCarley (Ex. 1003);
- d. U.S. Pat. App. Pub. No. 2013/0154543 to Richardson, *et al.* (“Richardson”) (Ex. 1005);

- e. U.S. Pat. No. 9,391,467 to Zhao, *et al.* (“Zhao”) (Ex. 1006);
- f. Chinese Utility Model Pat. No. CN 203211234 U to Yu (“Yu”) (Ex. 1007, 1008);
- g. U.S. Pat. No. 9,219,372 to Paparrizos, *et al.* (“Paparrizos”) (Ex. 1009);
- h. U.S. Patent Publication No. 2004/0130298 to Krieger et al. (“Krieger”) (Ex. 1010);
- i. Carku Product Brochure for the Epower-20 jump starter product (“Epower-20”) (Ex. 1012);
- j. Carku Product Brochure for the Epower-21 jump starter product (“Epower-21”) (Ex. 1013);
- k. U.S. Patent Publication No. 2013/0285596 A1 to Zhou et al. (“Zhou”) (Ex. 1016);
- l. Battery Charging Specification, Revision 1.0, Mar. 8, 2007 from the Universal Serial Bus Implementers Forum (“USB-IF”) (Ex. 1025);
- m. U.S. Pat. No. 9,005,015 (the “’015 Patent”) (Ex. 1003);
- n. PTAB Final Written Decision in IPR2020-00944 (Ex. 1034);
- o. PTAB Decision Granting Institution of *Inter Partes* Review for IPR2024-00577 (Ex. 1055);
- p. PTAB Decision Granting Institution of *Inter Partes* Review for IPR2024-01219 (“ID) (Paper 8);

- q. Car And Driver, “Tested: Best Portable Jump Starters for 2025” (Ex. 2008);
- r. U.S. Pat. No. 9,954,207 (Ex. 2009).

I. PROFESSIONAL BACKGROUND

5. I am a technical expert and have over 26 years of experience in the fields of electrical, computer, and electrical communications engineering. Ex. 2004. My industry and research experience and expertise specifically relevant to the challenged patent includes, but is not limited to, power management and power electronics integrated circuits, linear and switching power converters, regulators, and modulators, dynamic power supplies, low-noise low-EMI switching power supplies; high-frequency switching power converters, high-efficiency adaptive power regulators, linear and switching battery chargers and battery management systems; and analog and mixed-signal integrated circuits.

6. I received my B.S. degree in Electronics and Electrical Communications Engineering from Cairo University and my M.S. and Ph.D. degrees in Electrical and Computer Engineering from The Ohio State University. I am currently a Professor in the Department of Electrical and Computer Engineering at The Ohio State University.

7. A selected summary of my specific experience relevant to the challenged patents includes my experience in the field as an analog, mixed-signal,

and power management/electronics IC (integrated circuit) designer for the Connectivity Department at Texas Instruments in 2000 and 2002-2005. In that role, I designed systems and circuits for the power management/electronics module of single-chip media players in 90nm digital CMOS process with support for multiple battery chemistries and power/charge through USB. This included architecture development and definition, load sharing and distribution strategy, power states definition, and circuit techniques for configurable buck/boost DC-DC converters, Li-Ion switching battery chargers, and linear regulators.

8. My relevant experience also includes my 2005-2008 role as a member of the technical staff and as an analog, mixed-signal, and power management/electronics IC (integrated circuit) designer for the Wireless Terminal Business Unit at Texas Instruments. In that role, I led the system and circuit design of embedded power management/electronics solutions for integrated wireless, RF, and baseband applications in 65nm/45nm digital CMOS technologies. My responsibilities included power system architecture, supply domain definition and specifications, noise and power budgeting, RF-friendly dc-dc converter techniques, ripple suppression and cancellation techniques, and low-leakage circuit techniques for linear and switching power regulators for RF and mixed-signal modules. I have also led the clear spectrum task force at Texas Instruments, where I was responsible for the development of design & verification methodology for power

management/electronics modules in large mixed-signal System-on-Chip with multi noise-sensitive RF cores. This encompassed circuit design, power distribution networks, package and board parasitics modeling, communication across supply domains, and power supply isolation.

9. My relevant experience also includes my role as an assistant professor (2009-2014) then associate professor (2014-2015) at Iowa State University, then as an associate professor (2015-2020) then full professor (2020-present) at The Ohio State University, where I supervised the research of 14 Ph.D. students, over 11 M.Sc. students, who, for example, designed various classes of integrated linear and switching power regulators, low-noise low-EMI power converters for RF circuits, high-frequency switching converters with on-chip outputs, and continuous- and discrete-time signal filters, all in 350nm/65nm/45nm/28nm CMOS technologies.

10. Much of the focus of my professional and research work has been on analog, mixed-signal, and power management/electronics integrated circuits. I have authored or co-authored over 71 technical papers in international journals and conferences and have been an inventor or co-inventor on 8 US and international patents. Much of my published work, including my Master's and Ph.D. research, covers the area of analog, mixed-signal, and power management/electronics integrated circuits.

11. My expertise in and contributions to the field of analog, mixed-signal, and power management/electronics integrated circuits have been recognized in many ways. For example, from 2016 to 2023, I have been serving on the editorial board (as an associate editor) of the IEEE Transactions on Circuits and Systems I, which is the leading journal of the IEEE Circuits and Systems Society. I have also been serving as a member of the Technical Program Committee of many leading IEEE international conferences, such as RF Integrated Circuits Symposium (2011-2021), Applied Power Electronics Conference (2018-present), and International Symposium of Circuits and Systems (2012-present). I am also currently serving as the chair of the Analog Signal Processing Technical Committee of the IEEE Circuits and Systems Society.

12. I have received the Best Associate Editor Award from IEEE Transactions on Circuits and Systems–I in 2020, 2021 and 2022, and the 2022 IEEE Circuits and Systems Society Outstanding Technical Committee Award. I have also received the 2021 IEEE Transactions on Power Electronics Second Place Prize Paper Award from the IEEE Power Electronics Society, the 2015 Darlington Best Transactions Paper Award from the IEEE Circuits and System Society, the National Science Foundation CAREER Award in 2013, and the Northrop Grumman Chair Professorship from Iowa State University in 2013 and 2014.

13. Based upon on my education, my professional experience from 2000 through the present, my scholarly publications, I am an expert in the relevant field of the challenged patent. Through my education and experience, 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 ’203 patent at the time of its claimed priority date.

II. RELEVANT LEGAL STANDARDS

14. I have been asked to provide my opinion as to whether claims 1-11 (“the Challenged Claims”) of the ’203 Patent are anticipated by the prior art or would have been obvious to a person having ordinary skill in the art (“PHOSITA”) at the time of the alleged invention in view of the prior art.

15. I am an engineer by education and profession. The opinions I am expressing in this Declaration involve the application of my engineering knowledge and experience to the evaluation of certain prior art with respect to the ’203 Patent. I am not an attorney or patent agent. I therefore have requested that the attorneys from Jones Day, who represent NOCO, provide me with guidance as to the applicable patent law in this matter. The paragraphs below express my understanding of how I must apply current principles related to patentability.

16. It is my understanding that in determining whether a patent claim is anticipated or obvious in view of the prior art in an *inter partes* review (IPR)

proceeding, the Patent Trial and Appeal Board (PTAB) gives claims their ordinary and customary meaning, or the meaning that the term would have to a PHOSITA at the time of the invention in view of the intrinsic record. I understand that the claim language, specification, and prosecution history are relevant to determine the meaning of a claim term. I understand that the prosecution history of a patent provides the record of the examination of a patent application before the U.S. Patent and Trademark Office (PTO). The prosecution history provides evidence of how the patent examiner and the inventors understood the patent application and the claims and can therefore be instructive on how to interpret the claims. My understanding is that extrinsic evidence may also be used in understanding the meaning of a claim term. Extrinsic evidence includes dictionaries, treatises, expert testimony, and prior art. But it is my understanding that one should first look to the intrinsic evidence in construing claims.

17. My understanding is that there are at least two circumstances where the words in a patent claim may differ from and not be given their plain and ordinary meaning. One circumstance is when the applicants act as their own lexicographer by clearly setting forth a definition of a claim term that may differ from the plain and ordinary meaning it would otherwise possess. Another circumstance is when the applicant includes or provides an intentional disclaimer, or disavowal, of claim scope. My understanding is that an applicant may act as their own lexicographer, or

disclaim or disavow claim scope, in either the specification or the prosecution history of the patent. My understanding is also that the applicant may act as a lexicographer, or disclaim or disavow claim scope, by making amendments to the claims during prosecution, or by making assertions to the PTO about the differences between the claimed inventions and the prior art.

18. It is my understanding that a claim is unpatentable under 35 U.S.C. § 102 if each and every element and limitation of the claim is found either expressly or inherently in a single prior art reference.

19. It is my understanding that a claim is unpatentable under 35 U.S.C. § 103 if the claimed subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time of the alleged invention. I also understand that an obviousness analysis considers the scope and content of the prior art, the differences between the claimed subject matter and the prior art, and the level of ordinary skill in the art at the time of the invention.

20. In determining the scope and content of the prior art, it is my understanding that a reference is considered appropriate prior art if it falls within the field of the inventor's endeavor. In addition, a reference is prior art if it is reasonably pertinent to the particular problem with which the inventor was involved. A reference is reasonably pertinent if it logically would have commended itself to an inventor's attention in considering their problem. If a reference relates to the same

problem as the claimed invention, that situation supports use of the reference as prior art in an obviousness analysis.

21. To assess the differences between prior art and the claimed subject matter, it is my understanding that 35 U.S.C. § 103 requires that the claimed invention be considered as a whole. I also understand that a finding of obviousness requires more than merely demonstrating that each claim element was known in the prior art. Obviousness requires showing that a person of ordinary skill in the art would have been motivated to combine the teachings of the prior art to achieve the claimed invention and would have had a reasonable expectation of success in doing so.

22. It is my understanding that the Supreme Court has recognized several rationales for combining references or modifying a reference to show the obviousness of claimed subject matter. Some of these rationales include: combining prior art elements according to known methods to yield predictable results; simple substitution of one known element for another to obtain predictable results; a predictable use of prior art elements according to their established functions; applying a known technique to a known device (method or product) ready for improvement to yield predictable results; choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and some teaching, suggestion, or motivation in the prior art that would have led one of

ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

III. THE '203 PATENT

23. I have reviewed the '203 Patent (Ex. 1001), which has a priority date of July 3, 2014, in detail and understand its contents.

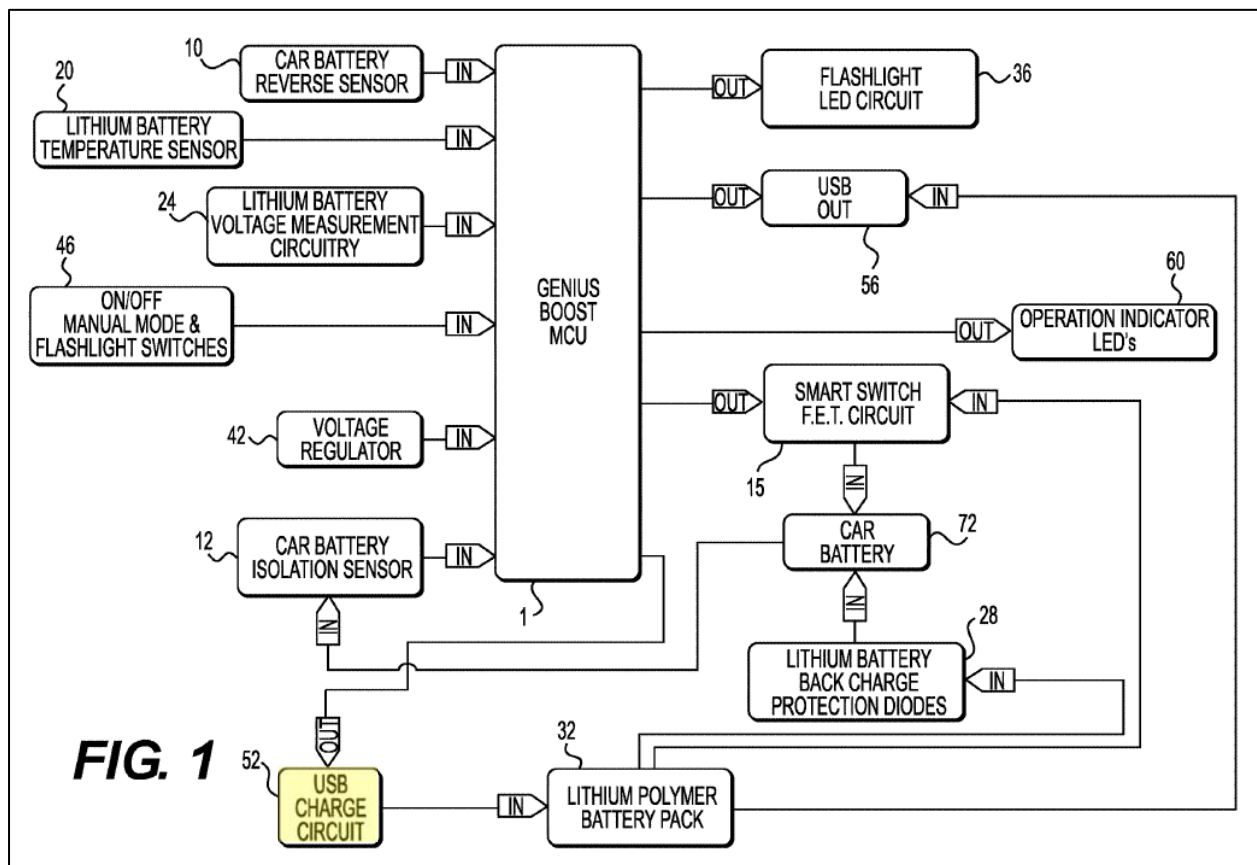
A. Overview Of The State Of The Art

24. As explained in the '203 Patent, portable booster devices, often referred to as jump start devices or jump starters, include a high-discharge rechargeable battery that can be connected in circuit with a vehicle's battery through a pair of cables in order to jump start the vehicle. *See* Ex. 1001, 1:13-16. Previously, recharging a jump starter powerful enough to jump start a 12-volt car battery relied on a high-power charger through a specialized 12-volt plug connector, such as a barrel charger. While various attempts were made to address problems associated with traditional jump starters (*e.g.*, safety concerns due to improper usage) before the '203 Patent, "each of the prior art solutions suffer[ed] from other shortcomings, either in complexity, cost or potential for malfunction." Ex. 1001, 3:15-18. Thus, at the time of filing, there remained a need for further improvements to vehicle jump start devices. *Id.*, 3:18-20.

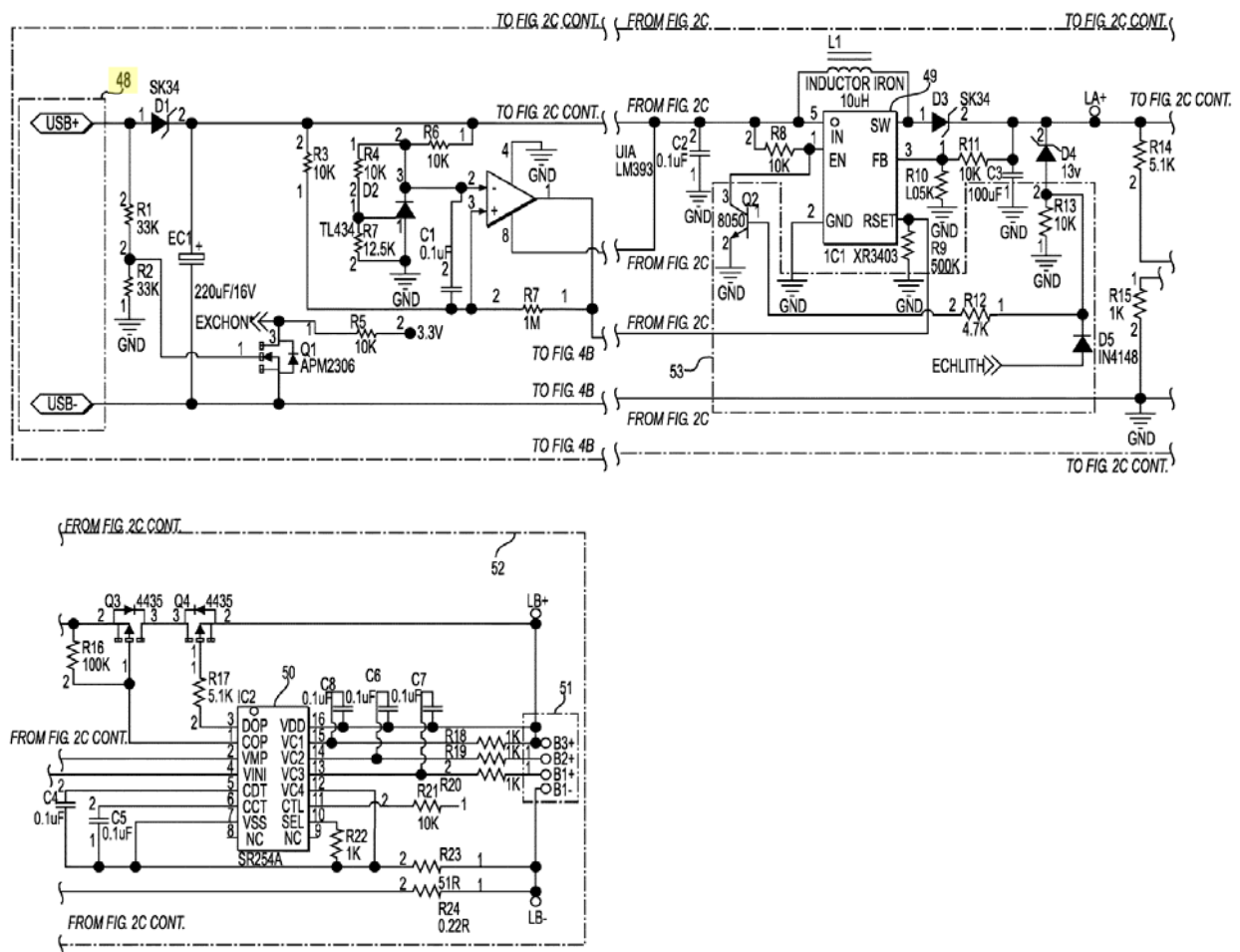
B. The Invention Claimed In The '203 Patent

25. Recognizing the need for improved jump starter devices, NOCO developed a "Portable Vehicle Battery Jump Start Apparatus" that greatly reduced

the complexity and potential for malfunction associated with its usage through a variety of included advancements. Ex. 1001, Title. The '203 Patent discloses techniques that, for example, “prevent[] the lithium battery pack from being connected to the vehicle battery 72 when the terminals of the battery 72 are connected to the wrong terminals of the booster device.” Ex. 1001, 4:47-52. As shown in Figure 1 below, the '203 Patent also discloses that a “USB charge circuit 52 converts power from any USB charger power source, charge voltage and current for charging the lithium battery pack 32,” (*id.*, 5:32-34), as shown in Fig. 1 (color annotation added):



26. Beneficially, “[t]he USB charge circuit 52 allows the internal lithium battery pack 32 to be charged using a standard USB charger.” *Id.*, 7:40-41. In other words, in order to further simplify the user experience, the “charge input uses a standard micro-USB connector 48 allowing standard cables to be used.” *Id.*, 7:42-43. The micro-USB connector (item 48) described in the ’203 Patent for charging the lithium polymer battery pack is included in the USB charge circuit (item 52) depicted by Figure 2C (color annotations added):



27. The jump starter of the ’203 Patent relies on the limited charging capabilities of a standard USB charger even though, “[a]t the heart of the handheld

battery booster is a lithium polymer battery pack 32, which stores sufficient energy to jump start a vehicle engine served by a conventional 12 volt lead-acid or valve regulated lead-acid battery.” *Id.* 4:23-27. The ’203 Patent even illustrates the large size of the battery pack by providing an example configuration: “three 3.7V, 2666 mAh lithium polymer batteries in a 3S1P configuration.” *Id.*, 4:29-30. In order to permit the jump starter to be charged using a USB cable, “[t]he 5V potential provided from standard USB chargers is up-converted to the 12.4 VDC voltage required for charging the internal lithium battery pack using a DC-DC converter 49.” *Id.*, 7:43-46. The advancement of using a USB type connector to charge a portable jump start device, as well as various components like the DC-DC converter that make this solution possible, are captured in the claims of the ’203 Patent.

C. The Challenged Claims

28. I understand that the Petition challenges claims 1-11 of the ’203 Patent. Pet., p. 4. Claim 1 is the only independent claim challenged, and all other challenged claims depend directly from claim 1. Ex. 1001, 8:61-10:17.

IV. THE ALLEGED GROUNDS OF UNPATENTABILITY

29. The alleged Grounds of unpatentability asserted in the Petition are:

- Ground 1: Claims 1, 3-5, and 9 are unpatentable under 35 U.S.C. § 103(a) over U.S. Patent Publication No. 2013/0154543 A1 (“Richardson”) (Ex. 1005) in view of U.S. Patent No. 9,391,467 B2 (“Zhao”) (Ex. 1006).

- Ground 2: Claims 2, 10, and 11 are unpatentable under 35 U.S.C. § 103(a) over Richardson and Zhao in further view of Applicant Admitted Prior Art (AAPA) or Carku Product Brochure for the Epower-20 jump starter product (“Epower-20”) (Ex. 1012)/Carku Product Brochure for the Epower-21 jump starter product (“Epower-21”) (Ex. 1013).
- Ground 3: Claims 6-8 are unpatentable under 35 U.S.C. § 103(a) over Richardson and Zhao in further view of U.S. Patent Publication No. 2004/0130298 A1 (“Krieger”) (Ex. 1010).
- Ground 4: Claims 1, 3-5, and 9 are unpatentable under 35 U.S.C. § 103(a) over Chinese Utility Model Patent No. CN 203211234 U (“Yu”) (Ex. 1007; Ex. 1008) and U.S. Patent No. 9,219,372 B2 (“Paparrizos”) (Ex. 1009).
- Ground 5: Claims 2, 10, 11 are unpatentable under 35 U.S.C. § 103(a) over Yu in view of Paparrizos and further in view of AAPA or Epower-20/Epower-21.
- Ground 6: Claims 6-8 are unpatentable under 35 U.S.C. § 103(a) over Yu in view of Paparrizos and further in view of Krieger.

30. As further detailed below, none of these references teach or suggest a method or apparatus for charging a jump starter using a USB connection.

A. Overview Of The Asserted Prior Art

31. I have been informed and understand that Richardson, Zhao, Yu, Krieger, and Paparrizos are prior art to the '203 Patent.

1. Richardson

32. I have reviewed the Richardson prior art reference (Ex. 1005) and understand its contents.

33. Richardson is titled “Method And Apparatus For Providing Supplemental Power To An Engine.” Ex. 1005, p. 1. Richardson was cited and relied upon by the Patent Office as the primary reference during the prosecution of the '203 Patent. *See, e.g.*, Ex. 1002, p. 1072. Richardson discloses a large “supplemental power source (jump starter)” for use in commercial applications. Ex. 1005, ¶ [0014]. Richardson’s jump starter is “useful when starting fleets of vehicles with dead batteries” since the device may be “rapidly recharged to start many vehicles in a row.” *Id.*, ¶ [0055]. While the Petition relies on Richardson to teach numerous elements of claim 1, Richardson fails to disclose either the use of a USB input charger or boost conversion of an input charge. *See* Ex. 1005.

2. Zhao

34. I have reviewed the Zhao prior art reference (Ex. 1006) and understand its contents.

35. Zhao (Ex. 1006) is titled “Step-Up Battery Charging Management System And Control Method Thereof.” Ex. 1006, p. 1. Zhao discloses “a step-up

battery charging management system,” (*id.*, 1:14-15), that may “receive DC input voltage V_{in} and may generate an output signal by boosting DC input voltage V_{in} .” *Id.*, 3:1-3. Zhao states that the “DC input voltage V_{in} can be provided to the step-up converter by a universal serial bus (USB) charger, or any other suitable low voltage power supply system.” *Id.*, 3:8-10. Zhao does not teach or suggest applying its techniques to charge a vehicle jump starter or comparable high-power device. *See* Ex. 1006.

3. Epower-20/Epower-21

36. I have reviewed the Epower-20/Epower-21 prior art references (Ex. 1012, 1013) and understand its contents.

37. Epower-20 (Ex. 1012) and Epower-21 (Ex. 1013) “brochures” are two single-page fliers showing a portable vehicle charger (EPower-20) and a portable jump starter unit (EPower-21) that each include a USB output port for external charging of small electronic devices such as “mobile phone, tablet PC, other digital devices.” Ex. 1012, p. 1; Ex. 1013, p. 1. These devices did not include a USB input charging port for charging the jump starter itself through a USB connection. Instead, both portable jump starter units relied on “14V/1A” input barrel chargers. Ex. 1012, p. 1; Ex. 1013, p. 1.

4. Krieger

38. I have reviewed the Krieger prior art reference (Ex. 1010) and understand its contents.

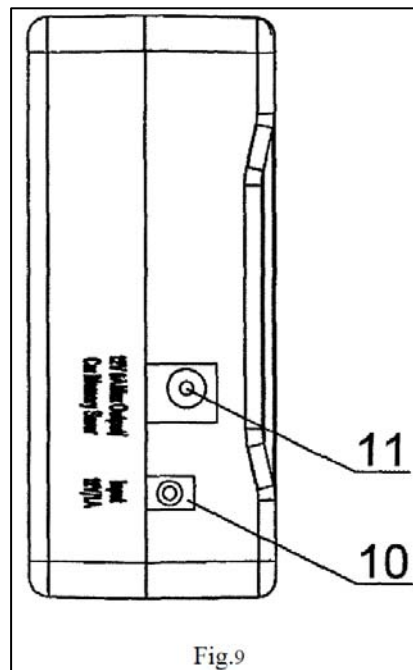
39. Krieger (Ex. 1010) is titled “Microprocessor Controlled Booster Apparatus With Polarity Protection,” and relates to a vehicle jump starter. Ex. 1010, p. 1. Krieger identifies safety issues, including fire and explosion risks, as concerns in the field of battery-charging devices. *See* Ex. 1010, ¶ [0005]. To address these issues, Krieger’s jump starter includes a “switch 12 [that] is activated to complete a boosting circuit between the boosting battery 2 and the depleted battery 11 only when a correct polarity connection between the batteries is attained.” Ex. 1010, ¶ [0029]. Krieger does not describe its input charging circuit in detail, stating only that the “booster system may be plugged into a Standard 110/220-volt electrical outlet via a standard wall charger 82 to recharge the boosting battery 2.” Ex. 1010, ¶ [0053].

5. Yu

40. I have reviewed the Yu prior art reference (Ex. 1007, 1008) and understand its contents.

41. Yu (Ex. 1007; Ex. 1008) is titled “Automotive Emergency Starting Device.” Ex. 1008, p. 1. Yu was considered by the Patent Office during prosecution and published on the face of the ’203 Patent. Ex. 1001, p. 4. Yu discloses “an

emergency automotive starting device” having various components, including “an internal battery, a charging input interface, a display module, a control module, a relay, input buttons and an output terminal.” Ex. 1008, Abstract. Similar to Richardson, Yu fails to teach or suggest the use of a USB input charging, and instead depicts the use a traditional barrel charger (item 10), as shown in Figure 9:



42. In addition to the barrel charger, Yu discloses a “19V output terminal 9” and a USB port that it describes as “a 5V output terminal 8.” Ex. 1008, ¶ [0028]; *see id.*, Fig. 7 (items 8 and 9).

6. Paparrizos

43. I have reviewed the Paparrizos prior art reference (Ex. 1009) and understand its contents.

44. Paparrizos (Ex. 1009) is titled “Buck Boost Charging For Batteries.” Ex. 1009, p. 1. Paparrizos seeks to solve the problem that “[c]omputer tablets and other mobile devices, such as mobile phones, digital SLR cameras, video recorders, audio devices, and so on are moving to battery packs with two (or more) Li-ion cells in series” but “since a large majority of USB devices are defined at 5V, it may not be possible to charge high voltage (>5V) 2S or 3S battery packs using a typically [sic] USB power source.” *Id.*, 1:9-26. In order to address this issue, Paparrizos discloses that a “buck boost circuit 212 may be operated as a forward boost converter to increase the voltage level that is received at input terminal 102 to produce a suitable voltage level at charging terminal 104 or system terminal 106.” *Id.*, 3:67-4:4. Paparrizos further discloses that the charged device “may be a smartphone, personal data assistant, portable computer, computing tablet, digital imaging devices, audio devices, and so on.” *Id.*, 2:26-29. Paparrizos does not disclose applying its techniques to charge a vehicle jump starter or comparable high-power device. *See* Ex. 1009.

V. THE PROSECUTION HISTORY OF THE '203 PATENT

45. I have reviewed the prosecution history (Ex. 1002) of the '203 Patent and the Final Written Decision in IPR2020-00944 (Ex. 1034) and I understand their contents.

46. It is my opinion that the Petition provides only a limited overview of the prosecution history, dismissing the care taken by the Patent Office and misrepresenting the proceedings in IPR2020-00944, which previously challenged issued claims of a parent application to the '203 Patent. *See* Pet., p. 6.

A. The Parent Application's Claim Related To USB Charging Features Was Held Not Unpatentable In IPR2020-00944

47. I understand that the '203 Patent is a continuation application that claims priority back to, among other applications, U.S. Patent Application No. 14/325,938, which issued as U.S. Patent No. 9,007,015 ("'015 Patent"). During the prosecution of the '203 Patent, it is my understanding that all claims of the '015 Patent were previously challenged in IPR2020-00944, which resulted in a Final Written Decision ("'015-FWD") finding all claims unpatentable (Ex. 1034, p. 2), with the exception of claim 11 (Ex. 1033, 9:1-3):

The apparatus of claim 1, further comprising a USB charging port configured to provide charging power from an external power source to said internal power supply.

48. Specifically, while the secondary references of the prior art applied (which were combined with Richardson) did not include USB charging features and instead used non-USB, 14V 1A input ports, Petitioner still argued that:

It would be *readily apparent* from the references that a USB port, which is simply a different physical plug and socket combination from the round plug and socket used in the Epower-20 and 21 products, *could*

also be incorporated into portable jump starters in place of or in addition to the 14V 1 A input port to charge the internal batteries of jump starter devices. A PHOSITA would be motivated to provide such a USB charging port to provide the added convenience to users of using another commonly used power input for charging the jump starter device.

Ex. 1034, p. 92 (emphasis in original).

49. I understand that the Board rejected this argument, finding that “Petitioner’s articulation of a motivation for one with ordinary skill in the art to incorporate a USB input charging port in Richardson based on Epower-20’s or Epower-21’s disclosure is conclusory.” *Id.* In particular, I understand that the ’015 FWD stated that Petitioner’s expert did “not identify any jump starter device having a USB input charging port.” *Id.*, p. 93. The ’015 FWD continued to explain:

The matter is much more complicated than what Petitioner’s argument makes it out to be. There is insufficient accounting by Petitioner of the expectation at the time of one with ordinary skill in the art about the ease or difficulty in locating a usable source to provide input charge to a USB port on a jump starter.

Id. I understand that, although Patent Owner had submitted “reasons why it would not have been obvious to one with ordinary skill in the art to include in a jump starter a USB input charging port,” the board found that it “need not discuss Patent Owner’s showings with regard to claim 11, because, . . . Petitioner has not established obviousness of claim 11 over the applied references.” *Id.*, p. 94.

50. I further understand that the '015-FWD, including its findings with respect to the USB charging features of claim 11, were subsequently affirmed as patentable by the Federal Circuit. *The NOCO Company, Inc. v. Shenzhen Caraku Tech. Co., Ltd.*, Appeal Nos. 2022-1646, 2022-1741, 2024 U.S. App. LEXIS 3221 (Fed. Cir. Feb. 12, 2024) (Ex. 1015).

B. The Patent Office Expressly Considered Richardson, Krieger, And The EPower-20 Brochure Before Allowing The '203 Patent

51. It is my opinion that the prosecution of the '203 Patent was thorough and searching. I understand that the Patent Office considered numerous prior-art references and applied many of them to the claims throughout the lengthy prosecution history.

52. I understand that the '203 Patent issued from U.S. Patent Application No. 16/819,831, which was filed on March 16, 2020. Ex. 1001, p. 1. Dependent claim 11 of the originally-filed application required “a USB charging port configured to provide charging power from an external power source to said internal power supply.” Ex. 1002, p. 27. A preliminary amendment was made to the application (*see id.*, pp. 71-86) prior to issuance of the first Office Action on August 23, 2021. *Id.*, pp. 1069-1097. The preliminary amendment added new dependent claim 69, which required a “USB charging port configured to provide charging power from an external power source.” Ex. 1002, p. 83. As part of the first Office Action, dependent claim 69 was rejected by the Patent Office based on a

combination of Richardson and the EPower-20 brochure. Ex. 1002, pp. 1091-1092. In response to this Office Action, Applicant argued that neither Richardson nor Epower-20 teach the limitation of claim 69. Ex. 1002, p. 1208.

53. I understand that the Patent Office responded to the amendment incorporating the USB charging features by issuing a final Office Action that identified claims 24-27 and 29-77 as being allowable if a terminal disclaimer were to be filed over U.S. App. No. 16/450,422, now issued as U.S. Pat. No. 11,447,023. *See* Ex. 1002, pp. 1210-1218. A terminal disclaimer was subsequently filed by Applicant. Ex. 1002, p. 1241. Additionally, Applicant filed a request for continued examination along with an information disclosure statement that included the Petition in IPR2020-00944. Ex. 1002, pp. 2028-2133; *see id.*, pp. 2536-2549.

54. I understand that a non-final Office Action was subsequently issued (*see* Ex. 1002, pp. 6033-6060) before Applicant filed an amendment adding in several new claims, including dependent claims 87-89 which related to USB input charging, similar to the prior-rejected dependent claim 69. Ex. 1002, pp. 6135-6143. A final Office Action subsequently issued (*see* Ex. 1002, pp. 6153-6164), before an amendment (*see* pp. 6208-6214) to incorporate dependent claim 87 into independent claim 78 led to a notice of allowance being issued. Ex. 1002, pp. 6239-6249. In the Reasons for the Allowance section, the examiner explained that the prior art failed to teach or suggest a “jump starter apparatus” having both a “USB port” and a “DC-

DC converter,” two features that were emphasized by the examiner. *Id.* The ’203 Patent issued on June 6, 2023. Ex. 1002, p. 6311.

VI. CLAIM CONSTRUCTION

55. It is my understanding that the claims of the ’203 Patent should be given their plain meaning, which is the meaning understood by a PHOSITA at the time of the invention in view of the patent and file history. I am not aware of any claim constructions put forth by either party for any claim terms, but I reserve the right to amend or supplement my analysis in this report based on future claim constructions proposed by either party.

VII. LEVEL OF SKILL IN THE ART

56. It is my understanding that when interpreting the claims of the ’203 Patent, I must do so based on the perspective of the PHOSITA at the relevant priority date. I understand that the priority date for the ’203 Patent is July 3, 2014. I will therefore consider July 3, 2014 to be the relevant date to ascertain the perspective of one of ordinary skill in the art.

57. I understand that the Petitioner has proposed that the PHOSITA would have been a “person with a bachelor’s degree in electrical engineering or its equivalent and two years of experience in the field of electrical engineering including some experience in design of battery charging systems.” I agree with this description of the PHOSITA.

VIII. THE PETITION MISREPRESENTS HOW A PHOSITA WOULD HAVE VIEWED JUMP STARTER DEVICES AND USB CHARGING TECHNIQUES AT THE TIME OF FILING

58. As further detailed below, it is my opinion that the challenged claims are not unpatentable over the combinations of Richardson and Zhao or Yu and Paparrizos, whether alone or in further combination with AAPA, EPower-20/Epower-21, or Krieger.

59. Before addressing Grounds 1-6 in detail, I will provide necessary background information relating to a PHOSITA's understanding of jump starter devices and charging techniques at the time.

A. General Battery Performance Metrics And Charging Properties

1. Fundamentals Of Battery Cell Capacity And Internal Resistance

60. Battery cell capacity refers to the amount of electric charge a battery cell can store and deliver after it has been fully charged. Key factors that determine the capacity of a battery cell include the cell type (*e.g.*, lithium-ion, lead acid, nickel–cadmium battery, etc.) and the cell size (*i.e.*, volume). The units used for measuring charge in the International System of Units is the coulomb (C), where 1 coulomb corresponds to the total charge a 1 ampere (A) current delivers in 1 second.

61. Nonetheless, battery cell capacity is hardly ever represented in the units of coulomb. Instead, a more common convention for representing battery cell capacity is in the units of current multiplied by the time, *e.g.*, amp-hours, which still

describes charge since charge is nothing but the product of current (rate of charge) and time. One reason the amp-hours convention is quite common is that it describes battery cell capacity in terms of parameters that are easily understood by the users and more relevant to what they care about when using a battery cell, *i.e.* how much current a battery can deliver and for how long. For example, if a battery cell capacity is presented as 3,600 coulombs, a user will not easily interpret what that number means, while if that same capacity is presented as 1 Ah, a user will easily interpret that the battery cell would last for 1 hour if discharged with 1 A, or for 2 hours if discharged with 0.5 A, and so on.

62. Another reason the amp-hours convention is quite common is that it informs the user of the discharge current at which the reported battery cell capacity has been characterized. This discharge current is often referred to as the nominal discharge current of the battery cell, while the reported capacity at that discharge current is often referred to as the nominal cell capacity. Using the previous example, a battery cell capacity of 1 Ah means that the nominal cell capacity is 1 Ah and that this cell capacity was measured at a discharge current of 1A, which is the nominal discharge current.

63. The simple linear relationship described above between the discharge current and the time the battery would last is only theoretical as it inherently assumes that the battery cell capacity is not a function of the discharge current. This

assumption is generally correct for discharge currents that are equal to or lower than the nominal discharge current. At higher discharge currents, however, the battery cell capacity drops from its nominal value, and the higher the discharge current the larger the drop. This is because the electrochemical process within the battery cell has a finite rate by which it can produce the charge.

64. As a result, when the discharge current (rate of charge extracted from the battery cell) is higher than what the electrochemical process can keep up with, the output voltage of the battery cell will drop below its value at the nominal discharge current. This drop in the voltage of the battery cell with the discharge current is modeled by introducing a series resistance with the battery cell, where the actual voltage delivered to a load is reduced from the battery cell voltage by the product of the discharge current and the series resistance of the battery cell, which is commonly termed “battery cell internal resistance.” Thus, for a given minimum voltage required to operate a load, the duration of which the voltage delivered to that load can be sustained before it drops below the required minimum voltage will be less at higher discharge currents. In other words, the “effective” capacity of the battery cell in the system becomes less than its nominal capacity at higher discharge currents. How much less that “effective” capacity will be is a strong function of how much higher the discharge current is, the minimum acceptable voltage for the load to operate, and the output resistance of the battery cell.

65. Therefore, the size of the battery cell must be increased (thus increasing its nominal capacity and reducing its internal resistance by the same factor) if a certain effective capacity is desired at discharge currents that are higher than the battery cell's nominal discharge current. Consequently, in applications requiring very high discharge currents, the battery cell size and its nominal capacity are often substantially larger than what would have been needed to provide the same capacity at lower discharge currents.

2. Fundamentals Of Battery Charging

66. There are various schemes for charging a battery cell. In general, charging a battery cell is accomplished by transferring charge from an energy source to the battery cell for a period of time until the battery is fully charged. This energy source can be a voltage source applied across the battery cell and has a voltage higher than the cell's voltage, or it can be a current source in series with the battery cell and pushing current through it. In either case, the transfer of charge from the energy source to the battery cell until it is fully charged may be continuous or may be in discrete bursts. Moreover, some charging schemes may use only a voltage source or only a current source, while others may split the charging process between using a voltage source and a current source. The selection of the battery cell charging scheme in a given application is influenced by the battery cell type and size, and the cell's tolerance to voltage and current spikes, overcharging, and charging

current/voltage inaccuracies. The selection will also be influenced by other factors, such as charging circuit complexity, cost, and the power rating of available energy sources.

67. Regardless of the charging scheme employed to charge a battery cell, the goal is to transfer a total charge that is equal to the battery cell's nominal capacity from an energy source to the battery cell (assuming the battery cell is initially fully discharged). Ignoring any losses, the energy that must be provided by the energy source to fully charge the battery cell can be represented as the product of the average battery cell voltage (often referred to as the nominal cell voltage) and the battery cell's nominal capacity. This can be stated mathematically:

$$E_{src} = V_{Cell-nom} \times C_{Cell-nom} \quad (1)$$

where E_{src} is the total energy provided by the energy source (measured in watt-hours), while $V_{Cell-nom}$ and $C_{Cell-nom}$ are the battery cell's nominal voltage (measured in volts) and capacity (measured in amp-hours), respectively.

Furthermore, the total energy provided by the energy source can also be represented as:

$$E_{src} = \int_0^{T_{chrg}} P_{src} \times dt \quad (2)$$

where P_{src} is the power provided by energy source (measured in Watts), while T_{chrg} is the total charging time (measured in hours). This can be simplified if the energy source is providing a constant power to:

$$E_{src} = P_{src} \times T_{chrg} \quad (3)$$

68. Combining (1) and (3), the charging time can be written as:

$$T_{chrg} = \frac{V_{Cell-nom} \times C_{Cell-nom}}{P_{src}} \quad (4)$$

As one would expect, higher nominal battery cell capacity or voltage, as well as lower power rating of the charging energy source will all result in longer charging time. Equation (4) can be further written in terms of the voltage and current ratings of the charging energy source as:

$$T_{chrg} = \frac{V_{Cell-nom} \times C_{Cell-nom}}{V_{src} \times I_{src}} \quad (5)$$

where V_{src} and I_{src} are the voltage and current ratings of the charging energy source. As expected, the lower the voltage rating of the charging source the higher its current rating must be in order to maintain a desired charging time. It is worth noting that in many cases the charging source voltage may be different than battery cell's nominal voltage. Therefore, a power converter (*e.g.*, buck, boost, or buck-boost) can be introduced between the energy source and the battery cell in order to

adapt the charging voltage to the battery cell voltage. In this case, equations (4) and (5) can be modified as:

$$T_{chrg} = \frac{V_{Cell-nom} \times C_{Cell-nom}}{\eta_{src} \times P_{src}} \quad (6)$$

$$T_{chrg} = \frac{V_{Cell-nom} \times C_{Cell-nom}}{\eta_{src} \times V_{src} \times I_{src}} \quad (7)$$

where η_{src} is the power conversion efficiency of the power converter between the charging energy source and the battery cell. As shown in Eqs. (6) and (7), if the power converter's efficiency is less than 100%, the charging time will be longer unless the power rating of the charging source is increased.

69. In applications where the power of a single battery cell is insufficient to support the operation of the device for the desired period, it is common to use multi-cell battery packs instead. Battery packs are simply multiple identical battery cells that are connected in a series or parallel configuration, or a combination of both. In a parallel configuration, the nominal voltage of the battery pack is the same as the nominal voltage of a single battery cell, while the nominal capacity of the battery pack is the product of the nominal capacity of a single battery cell times the number of cells in the pack. In a series configuration, the nominal voltage of the battery pack is the product of the nominal voltage of a single battery cell times the number of cells in the pack, while the nominal capacity of the battery pack is the same as the

nominal capacity of a single battery cell. Therefore, in the ideal case, the total power of the battery pack is always equal to the power of a single cell times the number of cells in the battery pack regardless of the configuration (series or parallel).

70. The charging process of a multi-cell battery pack is very similar to a single battery cell, albeit additional circuitry is usually employed to ensure balancing the charge among the multiple cells (in the series configuration) and preventing over charging. When charging a multi-cell battery pack, the charging time (assuming a fully discharged initial state) can be written as:

$$T_{chg} = \frac{V_{Cell-nom} \times C_{Cell-nom}}{P_{src}} \times N \quad (8)$$

where $V_{Cell-nom}$ and $C_{Cell-nom}$ are the individual cell's nominal voltage (measured in volts) and capacity (measured in amp-hours), respectively, N is the number of cells in the battery pack, and P_{src} is the power provided by the charging energy source (measured in Watts and assumed constant), while T_{chg} is the total charging time of the battery pack (measured in hours). As expected, higher nominal battery cell capacity or voltage, larger number of cells in the pack, and lower power rating of the charging energy source will all result in longer charging time of the battery pack. Equation (8) can be further written in terms of the voltage and current ratings of the charging energy source as:

$$T_{chg} = \frac{V_{Cell-nom} \times C_{Cell-nom}}{P_{src}} \times N \quad (9)$$

where V_{src} and I_{src} are the voltage and current ratings of the charging energy source. Like the single cell case, the lower the voltage rating of the charging source the higher its current rating must be in order to maintain a desired charging time. Moreover, in many cases the charging source voltage may be different than battery pack's nominal voltage, and thus, it is very common that a power converter (e.g., buck, boost, or buck-boost) is introduced between the energy source and the battery pack in order to adapt the charging voltage to the battery pack voltage. In this case, equations (8) and (9) can be modified as:

$$T_{chg} = \frac{V_{Cell-nom} \times C_{Cell-nom}}{\eta_{src} \times P_{src}} \times N \quad (10)$$

$$T_{chg} = \frac{V_{Cell-nom} \times C_{Cell-nom}}{\eta_{src} \times V_{src} \times I_{src}} \times N \quad (11)$$

where η_{src} is the power conversion efficiency of the power converter between the charging energy source and the battery pack. Like the single cell case, a power converter's efficiency that is less than 100% will result in a longer charging time unless the power rating of the charging source is increased. As can be seen, the charging time is inversely proportional to the power provided to the battery. If, for example, η_{src} is 0.8, then P_{src} will have to be increased by 1.25 (1/0.8) in order for

the total power available to the battery (and thus the charging time) to remain the same as the reference case were the converter is 100% efficient.

B. Charging Jump Starter Devices

1. Peak Current Requirements In Jump Starters

71. One of the key performance metrics of a jump starter device is the maximum current it can supply for the duration needed to jump start an engine (approximately 20-50 ms). This maximum current is also known as the peak current of the jump starter. The reason the peak current of a jump starter is so important is that it determines the largest engine displacement or the largest depleted battery of a vehicle that the jump starter can successfully jump. Depending on the target engine size the jump starter is intended for, the peak current the jump starter needs to provide is typically between 1000-4000 amps, which matches the specifications of many jump starter devices available in the market today. *See* Ex. 2008, pp. 9-21 (listing peak current values for six modern jump starters as “2000 amps,” “1000 amps,” “1000 amps,” “1700 amps,” “1400 amps,” and “3000 amps”). The same 1000-4000 amps would have been required as the peak current for jump starting a typical vehicle at the time of filing of the ’203 Patent.

72. The peak current of a jump starter is proportional to the peak current that its internal battery pack is able to provide. Although the battery cells comprising a battery pack can in principle be configured in series or in parallel without affecting

the total power it can deliver, battery packs in jump starter devices always employ a series configuration. In fact, the number of battery cells connected in series within the battery pack of a jump starter is always such that the nominal voltage of the battery pack is equal to or higher than the nominal voltage of the vehicle's battery that it is targeting to jump. The reason behind this choice is that it eliminates the need for any intermediate power conversion stage between the jump starter's internal battery pack and the vehicle's battery. This is essential since any intermediate power conversion stage would drastically limit the peak current that can be delivered from the jump starter, and thus renders the jump starter ineffective.

73. Therefore, a typical jump starter device has a peak current that is proportional to the peak current of only one battery cell within its battery pack, regardless of the number of cells in the pack, since all the cells are connected in series and carry the same current. It is important to recognize that, even though the peak current of the pack is the same as one cell, the power delivered by the battery pack is the sum of the power delivered by all the cells since the peak current is delivered at the voltage of the pack, which is the sum of the voltages of all the cells in a series configuration. Moreover, the peak current of the jump starter will also vary with ambient conditions, including the temperature. Therefore, it is common for typical and worst-case peak current values to be reported, as well as other worst-

case battery property values to be reported, such as reporting cold cranking amps at 32° F.

74. The above analysis regarding the peak current requirements of a jump starter has two key implications. First, since the peak current of the jump starter's multi-cell series-connected battery pack is the same as the peak current of only one battery cell, each battery cell must be sufficiently large to provide the needed peak current on its own. Second, since the peak current is much larger than the nominal discharge current of the battery cell, each battery cell must be sufficiently large to provide the needed peak current while keeping the total voltage of the battery pack above the minimum voltage for the time period needed to jump start the vehicle's engine or battery. These aforementioned factors necessitate that the battery cells (and thus the battery pack) of a jump starter have a substantially larger nominal capacity than what would otherwise be needed in most other electronics applications, which generally require substantially lower peak current.

2. Battery Capacity In Jump Starters

75. Another key performance metric of a jump starter device is its battery capacity. As discussed above, the battery capacity of any battery pack will be directly influenced by its peak current requirements. *See* Ex. 2009, col. 11, Table 2 (demonstrating the direct relationship between battery capacity and peak current for a lithium-based battery cell). To gain some insight into how much battery capacity

would be needed for a jump starter device in order to provide 1000-4000 amps (peak current), we will focus on the peak current and capacity of a single lithium-ion battery cell. This is because series-connected multi-cell battery packs employed in jump starter devices have the same peak current and capacity as a single cell as discussed in the previous section. If we assume each lithium-ion battery cell in the jump starter device has a capacity $C_{cell-nom}$, output resistance $R_{cell-nom}$, and nominal output voltage $V_{Cell-nom}$, and considering that the peak current the battery cell can provide is its own voltage divided by its internal resistance (since any load will be in series with the battery internal resistance and thus reduces the current), then the following simplified relation can be written:

$$I_p = \frac{V_{Cell-nom}}{R_{cell-nom}} \quad (12)$$

where I_p is the battery cell peak current. Assuming a reference size lithium-ion battery cell that has a capacity $C_{cell-ref}$ and output resistance $R_{cell-ref}$, where the size of this reference cell is K times smaller than the size of the battery cells in the jump starter device, then $R_{cell-nom}$ and $C_{cell-nom}$ can be written in terms of the parameters of the reference cell as $(R_{cell-ref}/K)$ and $(K \times C_{cell-ref})$, respectively. This is because increasing the size of a reference battery cell by a factor K increases the capacity (stored charge) and the total charge produced per

unit time by the same factor without changing the cell voltage, which is equivalent to the output resistance being reduced by the same factor. Therefore, Eq. (12) can be rewritten as:

$$I_p = \frac{K \times V_{Cell-nom}}{R_{cell-ref}} \quad (13)$$

which can be further rewritten in term of $C_{cell-nom}$ and $C_{cell-ref}$ and rearranged as:

$$C_{cell-nom} = \frac{I_p \times R_{cell-ref} \times C_{cell-ref}}{V_{Cell-nom}} \quad (14)$$

Eq. 14 provides a simple formula to assess the battery cell capacity of a jump starter device in terms of the peak current required to jump start the vehicle and the parameters of a reference size lithium-ion battery cell.

76. As can be seen from Eq. 14, the battery cell capacity $C_{cell-nom}$ is directly related to battery cell peak current I_p which, as discussed above, is required to be very large for any vehicle jump starter, due to the peak current requirements needed to jump start a typical commercial vehicle engine or battery.

3. Requirements For Charging Jump Starters

77. With the previous discussion in mind and by inspecting Eqs. 10 and 14 above, it becomes clear that charging a jump starter device presents a unique

challenge compared to any other handheld low-peak-current device. This is because of two reasons. First, the nominal capacity of each battery cell in a jump starter's battery pack is much larger than other low-peak-current applications (*e.g.*, a handheld multimeter). This large nominal capacity requires a high-power charging energy source in order to maintain a reasonable/practical charging time. Second, the typical voltage of a vehicle's battery is 12 volts, which requires the jump starter battery pack voltage to be at least the same.

78. If lithium-ion battery cells are used, this would usually entail using at least four battery cells (which is N in Eq. 10). The number of cells becomes even larger for vehicles that utilize higher than the 12V standard, such as 48V. This again requires an even larger charging energy source to maintain a useful charging time, since the battery cell capacity will be larger. Given consistent charging power, the charging time will essentially quadruple if the internal battery pack of the jump starter is 48V (16 series-connected lithium-ion batteries).

C. The Petition Misrepresents How A PHOSITA Would Have Viewed Jump Starter Devices And USB Charging Techniques At The Time Of Filing

79. Universal Serial Bus (USB) is a digital communication standard that governs both data transmission and power delivery between electronic devices. This includes data rates, power levels, and cable and connector types and specifications. Originally intended for providing power to low-power computer peripherals, the

USB standard has evolved over the years in terms of power ratings. Relevant to the '203 Patent, the various USB standards have always defined a specific, limited power rating, including both a maximum current and a maximum voltage that may be utilized when charging a device via a USB connection.

80. I have reviewed Petitioner's exhibit addressing USB charging power limits (Battery Charging Specification, Revision 1.0, Mar. 8, 2007 from the Universal Serial Bus Implementers Forum ("USB-IF") (Ex. 1025)), and I confirm that the USB-IF document provides an adequate example of the power limitations that might have been associated with a USB charger on the priority date. I understand that USB charging power limitations described in the USB-IF document are limited to a specific power, and that any input charge that is boosted to a higher voltage would be limited to, at best, that same specific charging power. Thus, a PHOSITA would have understood that USB charging had limited power at the time, and one would have also understood that boost conversion of any USB charging current would only further reduce that charging power.

81. When addressing the motivation to combine the references in Grounds 1-6, the Petition repeatedly argues that "charging a battery pack rated above 5V with a 5V USB input . . . is a known technique that a POSITA would have been motivated to implement in a predictable manner to charge 12V batteries." Pet., p. 31; *see* Pet., p. 60. In my opinion, this reasoning oversimplifies the combination and is not how

a PHOSITA would have actually considered jump starter devices and charging techniques at the time.

82. As explained above, vehicle jump starter devices are high-power tools used to jump start the engines of automobiles and other commercial vehicles. Given this purpose, a key performance metric of a jump starter is the peak current it can supply for the duration needed to jump start an engine (approximately 20-50 ms). The peak current of a jump starter determines the largest engine displacement or the largest depleted battery of a vehicle that the jump starter can successfully jump start. Given the size of typical vehicle engines, jump starters are required to provide a massive peak current in order to properly function, typically between 1000 and 4000 amperes. For larger vehicles and those having diesel engines, the required peak current for a successful engine jump start will be even higher.

83. Consistent with the above discussion, a PHOSITA would have understood that the peak current needed to jump start a typical vehicle engine or battery requires jump starter devices to have large-capacity internal battery cells. The peak current of a jump starter is limited by the peak current that its internal battery pack can provide. And for a typical series-connected battery pack, each individual battery cell in a jump starter must have a large enough capacity to provide the necessary peak current while keeping the total voltage of the battery pack above the minimum required level for the time period needed to successfully jump start a

vehicle engine or battery. As a result, the massive peak current requirement needed for vehicle jump starters to properly function requires internal battery cells that have very large individual capacities.

84. Because of the high capacity batteries required in a jump starter, it is my opinion that a PHOSITA would not have considered 2014-era USB to be a viable charging solution. Unlike barrel chargers, a PHOSITA would have known that USB charging had a limited, specified power output. It was also understood that higher nominal battery cell capacity, larger number of cells in the pack, and lower power rating of the charging energy source will all result in longer charging times of a battery pack. Therefore, in order to maintain a typical charging time, a PHOSITA would have recognized that jump starters needed to rely on a high-power charging energy source. Moreover, the inefficiencies associated with boost converting a low voltage would have only added to the discrepancies in charging power between USB and barrel chargers.

85. As discussed above, unlike digital multimeters, pocket calculators, cellphones, or other small consumer electronic devices that Petitioner uses in its prior art examples, the high-power functionality of jump starters requires such devices to have large-capacity battery packs. Because of this, vehicle jump starters are more equivalent to electric lawnmowers, snowblowers, and other high-power cordless tools. In fact, many jump starter devices have even larger capacity batteries

than many power-tools, including electric snow blowers and lawnmowers. This distinction continues to be well understood by many craftsmen and home owners. Even with the advancements of USB charging capabilities, if one walks into any garage in the U.S. today, they are likely to find a barrel charger or proprietary charging unit for one of these high-power electric devices. The use of such “non-standard” chargers, even to this day, is not because of a limited understanding of how to boost convert a low-voltage USB input to charge these high-power devices, but rather because of the power limitations historically associated with USB charging. Thus, while capable of charging most devices if boosted to a sufficient voltage, a PHOSITA would have recognized that USB is not suitable for charging every battery pack.

86. When discussing the motivation to combine the references in Grounds 1-6, the Petition never even addresses the fact that jump starter battery packs are required to have larger-capacity battery packs than common consumer electronic devices. Instead, the Petition wrongly narrows its discussion to addressing only charging voltage differences; namely, the desirability of charging higher voltage batteries with a 5V input. *See* Pet., pp. 32, 60. In doing so, Petitioner wrongly assumes that a boosted USB charge would be suitable to charge any 12 volt battery pack, regardless of its size. But again, overcoming the voltage difference between a USB charger and a jump starter battery pack is not the reason why a PHOSITA

would not have applied USB charging techniques to these devices. Indeed, DC-DC boost conversion was known in the art at the time. But the relevant question, and what the Petition fails to address, is whether a PHOSITA would have chosen to charge the large, high-capacity battery pack of a jump starter using the limited power output capabilities of USB at the time. It is my opinion that one would not have done so. And more importantly, they certainly would not have modified the specific vehicle jump starter systems of Richardson and Yu to include USB.

D. No Problem With Traditional Barrel Chargers Was Perceived In The Art At The Time, Nor Was USB A Known Technique For Charging Large-Capacity Batteries

87. As explained above, charging of portable jump starter devices, like every other device having a large-capacity battery in July of 2014, relied on barrel chargers or other proprietary charging techniques, which provided charging power that was suitable for these large-capacity batteries. Indeed, it is not surprising that Petitioner was not able to identify any prior art that teaches or suggests charging a jump starter device, or even a device having a comparable battery capacity, via USB. But when considering this lack of recognition in the art, the ID rejected the extended charging time as a mere drawback. The ID specifically noted that a PHOSITA “would have considered the relative advantages, including convenience and availability, against these disadvantages in assessing the combination.” DI, p. 32. But part of the inventive aspect of the ’203 Patent was the recognition that USB

charging, even with severe drawbacks that deterred all others from considering it a viable charging solution for high-capacity jump starter batteries, would be accepted by consumers, and ultimately successful.

88. In this instance, USB was not a known technique for charging any large-capacity battery due, in part, to the extended charging times that would result from the limited power levels that were associated with USB in 2014. The Grounds of the Petition fail to account for the market demands known in the art at the time, and therefore overlooked the fact that USB was not a known solution to charging large capacity batteries. Here, there was no perceived problem with using barrel chargers, nor was USB charging considered a known solution for charging any large-capacity batteries.

E. Even If Considered, A PHOSITA Would Have Deemed USB To Be A *Nonviable* Option For Charging A Jump Starter, Not Simply An Alternative With Some Drawbacks

89. As discussed, there was no perceived problem with prior charging systems, and a PHOSITA would not have considered USB to be a charging solution for large capacity batteries. Yet, even if the Board were to weigh the disadvantages against the advantages of USB charging, the PHOSITA at the time considered USB to be a nonviable option for portable jump starters, rather than simply a less-desirable alternative.

90. As explained above, given the size of typical vehicle engines, jump starters are required to provide a massive peak current in order to properly function, typically between 1000 and 4000 amperes, which thereby requires portable jump starter devices to have large-capacity internal battery cells. Because of the high capacity batteries required in a jump starter, a PHOSITA would not have considered 2014-era USB, which was known to have a limited, specified power output, to be a viable charging solution. Moreover, the inefficiencies associated with boost converting a low voltage would have only furthered the distance between the limited charging power of USB and barrel chargers.

91. When discussing the motivation to combine the references in Grounds 1-6, the Petition never even addresses the fact that jump starter battery packs are required to have larger-capacity battery packs than common consumer electronic devices. Instead, the Petition wrongly narrows its discussion to addressing only charging voltage differences; namely, the desirability of charging higher voltage batteries with a 5V input. *See* Pet., pp. 32, 60. In doing so, Petitioner has wrongly assumed that a boosted USB charge would be suitable to charge any 12 volt battery pack, regardless of its size. But, unlike digital multimeters, pocket calculators, cellphones, or other small consumer electronic devices that Petitioner uses in its prior art examples, portable vehicle jump starters are more equivalent to electric lawnmowers, snowblowers, and other high-power cordless tools. Petitioner also

presents evidence that USB as a charger has been well-known and utilized for years before the '203 patent “in over 7 *billion* consumer devices.” Pet., p. 39. However, despite the fact that USB charging and portable jump starters had previously been widely adopted by consumers, Petitioner can point to no example of USB charging of a portable jump starter or any other large-capacity battery. This only further confirms that those skilled in the art did not consider USB a viable charging solution for jump starters.

92. The relevant inquiry, and what the Petition fails to address, is whether a PHOSITA would have chosen to charge the large, high-capacity battery pack of a jump starter using the limited power output capabilities of USB at the time. One would not have done so. And more importantly, they certainly would not have modified the specific vehicle jump starter systems of Richardson and Yu to include USB charging.

93. In the following, I will provide more detail to support my opinions addressing the specific prior art references included in the Grounds. A PHOSITA would not have modified the particular systems of Richardson and Yu—one of which has a very large capacity battery that relies on rapid recharging from a vehicle’s electrical system and the other already implements a USB port but still chose not to rely on it for charging.

IX. RICHARDSON AND ZHAO DO NOT RENDER CLAIMS 1-11 OBVIOUS (GROUND 1), EITHER ALONE OR IN COMBINATION WITH AAPA, EPOWER-20/EPOWER-21, OR KRIEGER (GROUNDS 1-3)

94. As further detailed below, it is my opinion that the challenged claims are not unpatentable over the combination of Richardson and Zhao, either alone or in combination with AAPA, EPower-20/Epowers-21, or Krieger.

95. A PHOSITA would not have modified the particular systems of Richardson and Yu—one of which has a very large capacity battery that relies on rapid recharging from a vehicle's electrical system and the other already implements a USB port but still chose not to rely on it for charging.

A. A PHOSITA Would Not Have Been Motivated To Modify The Particular System Of Richardson To Have A USB Input Circuit

96. It is my understanding that it is the Petitioner's burden to show with particularity why the '203 Patent it challenges is unpatentable. Here, it is my opinion that Petitioner has failed to demonstrate that a PHOSITA would have combined the teachings of Richardson and Zhao.

1. Petitioner's Motivation To Combine Richardson And Zhao Is Deficient

97. The reasoning provided in the Petition does not support modifying a jump starter to include a USB input, much less the specific vehicle jump starter of Richardson. The Petition argues that:

A POSITA therefore would have been motivated to combine the teachings of Richardson and Zhao because Zhao is directed to the *known technique of charging (and recharging) a multicell battery pack of series-connected cells of a battery-powered device*—which is the same battery architecture in Richardson’s jump starter—by using a DC-DC boost converter in accordance with its established function of converting a lower voltage input to a higher voltage output. EX1003, ¶ 77. Additionally, Zhao specifically teaches the desirable feature of charging a battery pack rated above 5V with a 5V USB input, which is a known technique that a POSITA would have been motivated to implement in a predictable manner to charge 12V batteries such as those disclosed by Richardson.

Pet., p. 32 (emphasis added). It is my understanding that the Petition argues that “charging a battery pack rated above 5V with a 5V USB input” was a known technique, and that the systems of Richardson and Zhao related to similar devices since they share the “same battery architecture” of a “multicell battery pack of series-connected cells.” Pet., p. 32. By Petitioner’s logic, it would have been obvious to charge a full-size electric vehicle battery (e.g., a Tesla Model 3’s battery) using USB, since it is similarly formed of modules of “multicell battery pack[s] of series-connected cells.” But this is not the case, and one cannot simply ignore the capacity of the battery pack being charged. In other words, Petitioner’s position “that the use of a battery is a different issue than how it was charged” is simply incorrect. Pet., p. 15.

98. As discussed above, a PHOSITA would not understand the small battery systems contemplated by Zhao and the vehicle jump starter described by Richardson to be similar devices. Zhao discloses a step-up battery charging management system that uses a step-up converter to boost a DC input charging voltage. *See* Ex. 1006, Abstract. But Zhao does not teach or suggest applying its techniques at voltages above 8.4V or to devices having large-capacity batteries. *See, e.g.,* Ex. 1006, 4:39-41 (disclosing how an example “final voltage V_{CV} can be about 8.4V if two lithium batteries”). While the Petition also relies on Ex. 1016 to demonstrate that boosting a 5V USB input to charge higher voltage batteries was known in the art (*see* Pet., p. 40), this reference relates to small electronics devices with low-capacity batteries. *See* Ex. 1016 (discussing boosting input power to devices such as “a smart phone, a cell phone, a personal digital assistant (PDA), a tablet, a laptop, a desktop, a portable music player . . .”).

99. The Petition discloses no prior art examples of USB being used to charge a battery with a comparable capacity to that required for a vehicle jump starter. Moreover, the Petition never even discusses why a PHOSITA would have applied the low-power charging technique of traditional USB to an electronic system with a battery having a high capacity. As explained above, charging such a large-capacity battery with USB was counterintuitive, not because boost converting an input voltage was not understood in the art, but instead because it was well

understood that the limited charging current that traditional USB provided was not capable of quickly charging high-capacity battery systems. By failing to even address the primary reason—battery capacity, not voltage—that a PHOSITA would not have applied a USB charging circuit to a jump starter system like that of Richardson, Petitioner has fallen short of demonstrating that a skilled artisan would have made the proposed combination.

2. Richardson’s Commercial Jump Starter System Requires A Larger Internal Battery Capacity Than A Typical Vehicle Jump Starter And Would Therefore Greatly Suffer From A Switch To USB Charging

100. In addition to the above, the Petition fails to consider the actual system of Richardson that it sought to modify in light of Zhao’s teachings. Richardson is not a traditional portable jump starter, but rather a heavy-duty jump starter with very powerful internal batteries that, despite their large charge capacity demands, can be recharged in a short period of time and then used to jump a fleet of vehicles, such as a commercial truck fleet. *See* Ex. 1005, ¶¶ [0007], [0055]. As evidence, Richardson states that “[n]ormal vehicle charging voltages fall within certain ranges for 12, 18, 24, 30, 36, 42 and **48 volts systems.**” *Id.*, ¶ [0054] (emphasis added). And Richardson further explains how its jump starter has to be powerful enough to accommodate the demands of batteries up to 48 volts by appropriately configuring the batteries in the jump starter and selecting voltage outputs. *Id.*, ¶¶ [0034]-[0035], [0054]. Therefore, the system of Richardson differs dramatically in design,

configuration, purpose, and performance relative to the vehicle jump starter recited in the challenged '203 Patent.

101. As discussed in detail above, a 48 volt battery pack would require four times the number of series-connected battery cells of a typical 12V vehicle charger, assuming peak current is maintained. As a result, and because the current in a series-connected battery pack is equal to the current in every battery cell in the pack, Richardson contemplates a battery pack with a capacity that is at least four times larger than that of a standard 12 volt vehicle charger. In connection with my prior involvement with an ITC proceeding involving the related '023 Patent and the Richardson prior art reference, I have personally viewed the commercial embodiment of Richardson, which is quite large. In fact, the commercial embodiment of Richardson is roughly the size of a suitcase and had wheels so that a user could roll it from vehicle to vehicle. Charging Richardson's system would therefore take at least four times longer than a jump starter designed to jump start only 12 volt vehicle batteries, assuming the same peak current requirements.

102. The high power requirements that would be needed to charge Richardson's jump starter in a reasonable amount of time is the main reason why Richardson relies on charging its jump starter directly through the vehicle's electrical system (the vehicle's battery or alternator). Commercial vehicle alternators at the time would have generated between 720 and 960 watts of power,

given their typical 12 volt output and output current of between 60 and 80 amps. This massive power output would have dwarfed the power output of a common USB charger many times over. A PHOSITA would have understood that Richardson relied on the vehicle's electrical system rather than on a barrel charger (let alone a USB charger) due to its large output power that allows for the charging of the jump starter in a reasonable amount of time. Therefore, a PHOSITA would have recognized that it would have been nonsensical to charge Richardson's massive internal battery with USB, as it would have drastically increased the charging time of the device. In fact, the current that USB could have provided would be reduced proportionally when boosted from 5 volts to 48 volts, which would entail reducing the current by more than 9 times from its already-limited value.

103. The Institution Decision recognized that “Richardson expresses some desire to start a fleet of vehicles (Ex. 1005 ¶ 55), voltages up to 48 volts (*id.* ¶¶ 34, 54), and rapid recharging (*id.* ¶ 54). DI, p. 25. Yet the Institution Decision noted that “Richardson’s teachings are not so limited” because “Richardson broadly describes a battery charger for charging a vehicle battery and voltages ranging from 12 to 48 volts.” *Id.* But, in Richardson’s depicted system, “the batteries 23 are 12-volt batteries and a battery 25 is a 6-volt battery,” such that the output may be either 12, 18, 24, or 30 volts. Ex. 1005, ¶ [0034]. The fact that Richardson’s system includes three batteries, two of which are 12 volt batteries that are individually

capable of jumpstarting a standard vehicle, in no way demonstrates that Richardson's system would not present a unique charging challenge that would have further deterred a PHOSITA from relying on USB charging.

104. The Institution Decision also noted that "Richardson does not discuss any specific capacity requirements." DI, p. 25. While it is true that Richardson does not expressly discuss specific capacity requirements, by the nature of being a portable jump starter, Richardson's batteries are required to have a minimum capacity such that they can be used to jump start "fleets of vehicles with dead batteries." *See* Ex. 1005, ¶ [0055]. The Board also stated in the Institution Decision that it "disagree[d] that limitation 1[C] requires increasing to a particular power voltage or battery capacity." DI, p. 32; *see id.*, p. 45. But the Grounds that Deltran put forth rely on Richardson's and Yu's automotive jump starters. Both the jump starter of Richardson and Yu provide a battery output above 12 volts and at a high current, because that is what is required to jumpstart any standard automobile.

105. Based solely on the size of Richardson's jump starter battery, a PHOSITA would not have modified its device to include a USB input circuit.

3. Richardson's System Is Focused On Rapid Recharging

106. Even though Richardson's system includes a huge battery pack, a main focus of the disclosure is to provide a jump starter that may be rapidly recharged. By permitting rapid recharging of its large-capacity batteries from a vehicle charging

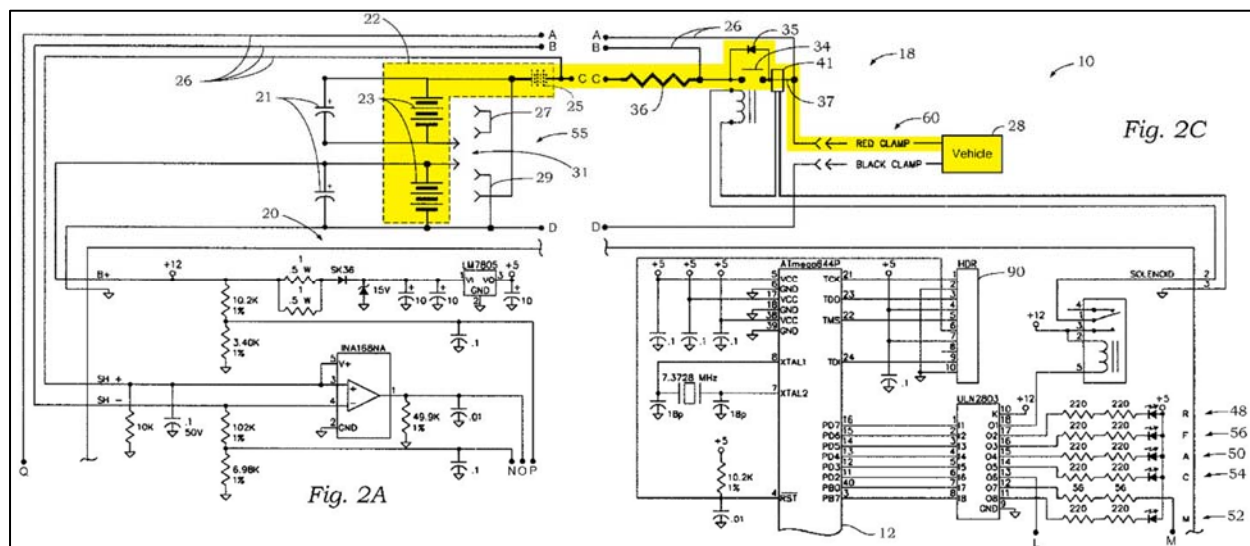
system (*i.e.*, a vehicle alternator), Richardson states that its system would be “useful when starting fleets of vehicles with dead batteries,” since the device may be “rapidly recharged to start many vehicles in a row.” Ex. 1005, ¶ [0055]. Richardson emphasizes the importance of rapidly recharging the device in such a situation, stating that this functionality “allows the capacitors 21 and jump starter batteries 22 to be fully recharged in about *1 to 5 minutes* and can therefore start many vehicles in a row without becoming discharged.” *Id.* (emphasis added). Moreover, Richardson notes that “[t]he jump starter batteries 22 only need to reach a 50% charge in order for the system to attempt to start the vehicle,” thereby further emphasizing the importance that Richardson places on fast recharging of its system. *Id.*, ¶ [0029].

107. Given the focus of Richardson on rapid recharging, the Petition fails to demonstrate that a PHOSITA would have modified Richardson’s jump starter to include a traditional USB charger which, again, had much lower power capabilities than other charging options available at the time.

4. Richardson Relies On Recharging From A Connected Vehicle

108. In addition to overlooking the nature of Richardson, the Petition also oversimplifies the complexities associated with adding a second charging means to Richardson’s system. Richardson’s only disclosed method for recharging the internal batteries involves using its red and black shunt cable ports. Richardson’s

schematics do not show any other way to charge the batteries 22 other than the highlighted path from the vehicle 28 through the jumper cables 60:



Ex. 1005, Figures 2A, 2C (color annotations added). There is no existing charging port of any kind described or depicted in Richardson’s device, nor does the Petition point to any.

109. Petitioner argues that one would have been motivated to “combine the teachings of Richardson and Zhao” through the additional “inclusion of a standardized power input port such as USB.” Pet., p. 32. In other words, the Petition only suggests modifying Richardson to include a second charging path, which “would allow the jump starter batteries to be charged in ways [sic].” *Id.* But such an alteration would add additional cost and complexity to the device. Indeed, while any electronic device (e.g., cell phone) may theoretically benefit from having multiple different kinds of charging options, it would have been a less-common

design choice, and one that would have required additional circuitry to address the safety risk of a user plugging in two chargers at the same time. A well-known issue in such designs is the short circuit condition between the two power sources that are plugged into the device since power from both sources is routed to the same destination (*i.e.* the battery). That short circuit condition can be catastrophic and poses a major safety risk, not just in terms of damaging the devices involved, but in terms of the safety of the user due the explosion or fire that may result from the condition. Therefore, such multicharger systems must employ a combination of additional power switches, diodes, current/voltage sensors, and control circuitry to ensure that plugging more than one power source at the same time is properly and immediately detected and to ensure that only one power path is activated (*i.e.*, a path from one of power sources to the battery). Due to the large power levels involved, the additional power switches and diodes must be rated accordingly and are typically bulky and expensive. Moreover, additional circuits must be employed to select which of the power sources that are plugged in is to be utilized for charging, which is typically based on charging power capability.

110. The Petition provides no discussion or examples of jump starters or any other devices configured to have multiple input charging ports. The system of Richardson is already capable of being recharged either by connecting its red and black shunt cable ports to a vehicle battery or to a battery charger. *See* Ex. 1005,

¶¶ [0055], [0028]. This existence of an existing charging path weakens the reasoning provided for this proposed combination.

111. More importantly, even if a PHOSITA decided to add a separate charging circuit, the Petition still fails to address why they would have chosen a USB port over the actually-suitable charging arrangements that were available at the time, especially given the large-capacity battery of Richardson and the reference's focus on quick recharging, as explained above.

112. Thus, the combination of Richardson with Zhao is detached from the actual prior-art system being relied on, and the motivation to make the asserted combination is deficient. It is my opinion that Petitioner has ignored Richardson's teachings and has failed to demonstrate that a PHOSITA would have modified Richardson to include a USB input circuit.

B. The Petition Fails To Show, With Particularity, How A PHOSITA Would Have Combined Richardson And Zhao

113. In addition to the deficiencies in the motivation to combine Richardson and Zhao, it is my opinion that Petitioner also fails to demonstrate *how* the step-up converter of Zhao would allegedly be incorporated into the Richardson's jump starter.

1. Ground 1 Fails To Explain How Zhao's Teachings Would Have been Incorporated Into Richardson's Jump Starter, Which Describes No Input Charging Circuitry Outside Of Its Shunt Cable Ports

114. The Petition provides no explanation as to how a PHOSITA would have actually incorporated Zhao's step-up charging system into Richardson's jump starter. Instead, Petitioner makes the general statement that:

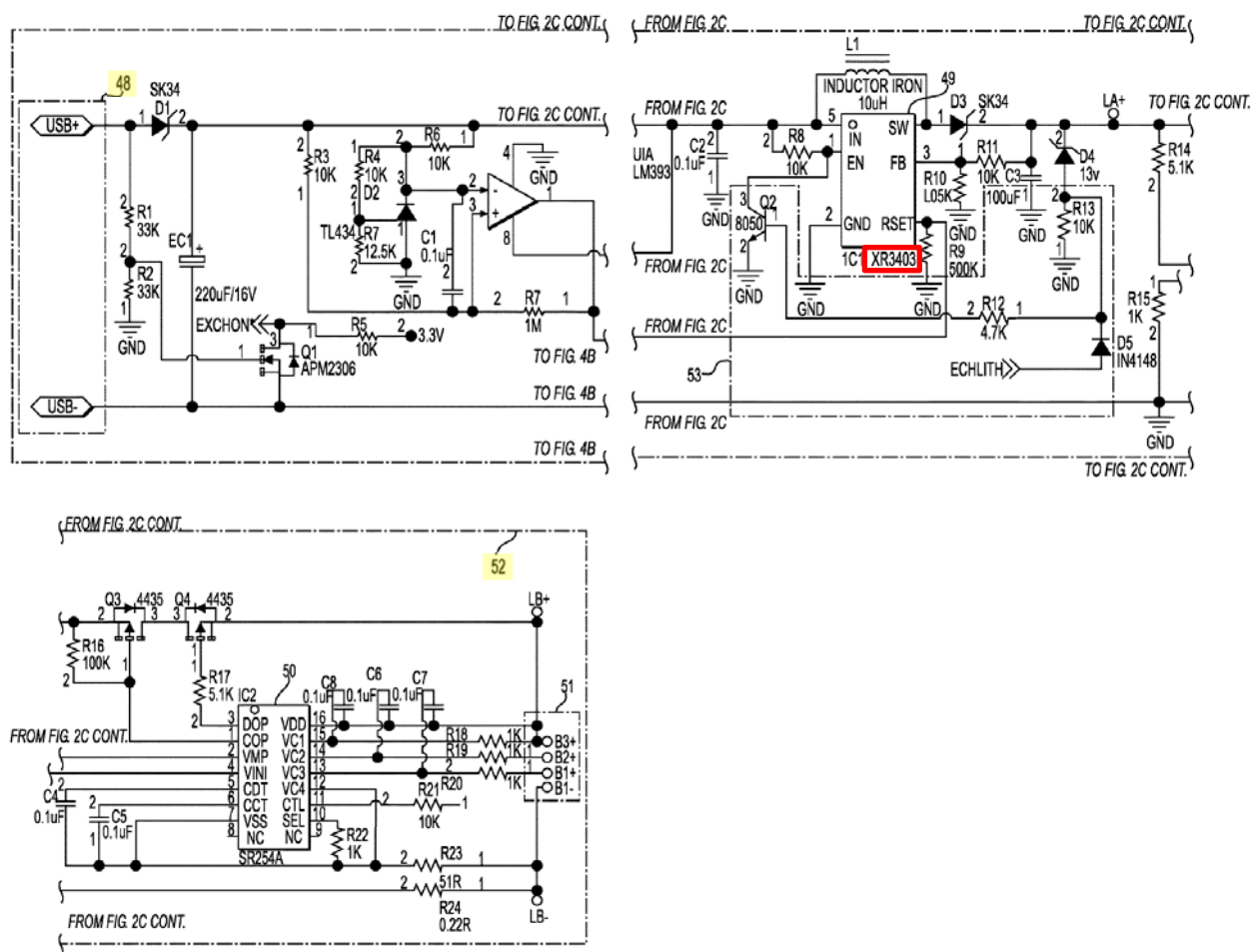
A POSITA would have been familiar with the relevant USB standards and been motivated to implement USB technology when designing a portable battery-powered device. When modifying Richardson to implement a USB input circuit as taught by Zhao, a POSITA would have necessarily relied upon their knowledge regarding implementation of commercially available USB receptables (such as a micro-USB receptable) when designing a USB charging feature.

Pet., p. 33.

115. As detailed above, Richardson's schematics do not show any other way to charge the batteries 22 other than the path through the jumper cables 60. *See* Ex. 1005, Figures 2A, 2C. The Petition fails to explain *how* Zhao's step-up converter would have been specifically incorporated into Richardson's jump starter device. Instead, Petitioner superficially argues that "Zhao describes the details of the USB charging circuit in sufficient detail for a POSITA to implement the circuit in Richardson's system." Pet., p. 33. But it is not the level of detail of Zhao's step-up battery charging management system that is lacking from the Petition, but rather the

lack of description as to how a PHOSITA would have successfully incorporated this circuit into Richardson's system.

116. Petitioner tries to obscure this deficiency by arguing that “Zhao describes its USB charging circuit in more detail than the '203 patent which only alludes to the off-the-shelf XR3403 chip.” Pet., p. 34. This statement wrongly conflates the USB charging circuit with the boost converter itself, which is only a part of the overall USB charging circuit. In actuality, the entire arrangement of the USB charge circuit (item 52) in the system of the '203 Patent, including the use of the XR3403 chip (boxed in red) is expressly detailed in, for example, Figure 2C:



Id., Fig. 2C (color annotations added). Nowhere does the Petition make any comparable attempt to show how Zhao's step-up converter (comparable to the XR3403 chip) would be actually integrated into Richardson's circuitry. Furthermore, Petitioner pointing to evidence that Patent Owner was working together with a third party manufacturer to develop its USB powered jump starters (*see* Pet., p. 34) in no way shows that a PHOSITA could have manufactured such a device without Patent Owner's involvement, and certainly does not support the position that one would have combined the specific teachings of Richardson and Zhao.

117. At bottom, it is unclear where Petitioner is proposing that the step-up charging system be added to Richardson's circuitry. As one specific example of the Petition's deficiency, it cannot be determined whether Ground 1 is using Zhao's step-up charging system to charge each of Richardson's internal batteries simultaneously, or individually. *See* Ex. 1005, Figures 2A (depicting two distinct battery packs). These considerations matter, since the required capabilities of the added step-up converter are directly related to the battery pack to be charged.

2. Ground 1 Fails To Demonstrate That Zhao's Step-up Converter Could Be Used To Charge Richardson's Jump Starter

118. In addition to providing no explanation as to how Zhao's step-up converter would be implemented in Richardson's jump starter, the Petition provides

no evidence demonstrating that Zhao's system could be successfully implemented into Richardson's specific jump starter system. Richardson's large internal battery pack enables jump starting of vehicle batteries up to 48 volts, and therefore contemplates an internal battery pack with at least 48 volts in some configurations. *See* Ex. 1005, ¶¶ [0034]-[0035]. The Petition fails to address whether Zhao's boost converter could have boosted a 5V input voltage to a voltage suitable to charge a 48 volt battery. Petitioner has simply stated, without evidence, that Zhao's step-up converter is capable of being implemented into Richardson's device.

119. Commercially-available step-up converters are typically limited to having a maximum output voltage, which operates as the upper limit that an input voltage may be boosted to. That upper limit is a function of a variety of factors, including the voltage rating of the converter's power and control circuits, the maximum switching frequency and/or switching duty cycle the converter can support, the expected input voltage range, and the targeted efficiency and transient response requirements of the converter. In fact, the only relevant evidence that Petitioner provides shows that boost converters had limited output voltage capabilities. Specifically, the Petition points to the example XR3403 identified in the '203 Patent, but that boost converter is only "capable of providing an output voltage up to 26V." Ex. 1029, p. 1. Given this restriction, and given that Zhao only describes boosting an input voltage up to "8.4 volts," it was unreasonable for

Petitioner to simply assume that Zhao's step-up converter could properly function in Richardson's jump starter. Without an explanation of how Zhao's teachings are being incorporated into Richardson's device, and without any evidence demonstrating the boost conversion capabilities of Zhao's circuit, Petitioner has not articulated specific reasoning for the proposed combination.

120. The additional asserted evidence of AAPA, EPower-20/Epowers-21, and Krieger all fail to cure the deficiencies associated with the underlying Richardson and Zhao combination. Thus, it is my opinion that Petitioner has failed to show, with particularity, how a PHOSITA would have made the proposed combination of Ground 1.

X. YU AND PAPARRIZOS DO NOT RENDER CLAIMS 1-11 OBVIOUS EITHER ALONE OR IN COMBINATION WITH AAPA, EPOWER-20/EPOWER-21, OR KRIEGER (GROUNDS 4-6)

121. As further detailed below, it is my opinion that the challenged claims are not unpatentable over the combination of Yu and Paparrizos.

A. A PHOSITA Would Not Have Been Motivated To Modify The Particular System Of Yu To Have A USB Input Circuit

122. Similar to Ground 1 discussed above, the Petition fails to address why a PHOSITA would have modified a jump starter system having a large-capacity battery to include a USB charging input. Petitioner also completely ignores teachings in Yu that weaken the proposed combination. In doing so, Petitioner has

failed to demonstrate that a PHOSITA would have combined the specific teachings of Yu and Paparrizos.

1. Petitioner’s Motivation To Combine Yu And Paparrizos Is Deficient

123. The reasoning provided in the Petition does not support modifying Yu’s jump starter to include a USB. The Petition argues that:

A POSITA therefore would have combined Yu and Paparrizos with are [sic] reasonable expectation of success and predictable results because Paparrizos employs *well-known* and widely utilized concepts of using 5V USB input and a DC-DC boost converter to charge higher voltage batteries. EX1003, ¶141.

Pet., p. 60 (emphasis added). Just like for Ground 1, it is my understanding that this reasoning follows a typical obviousness rationale of a known technique used to improve similar devices in the same way. Specifically, the Petition argues that a PHOSITA would have applied the “well-known” concept of “using 5V USB input and a DC-DC boost converter to charge higher voltage batteries” to Yu’s system.

124. But as discussed above, a PHOSITA would not understand the small battery systems contemplated by Paparrizos and the vehicle jump starter described by Yu to be similar devices. Paparrizos discloses a battery charging circuit that can operate in a boost mode to step up a DC input charging voltage. *See* Ex. 1009, 1:30-39. But just like Zhao, Paparrizos does not teach or suggest applying its techniques beyond small electronics devices known to have low-capacity batteries. *See* Ex.

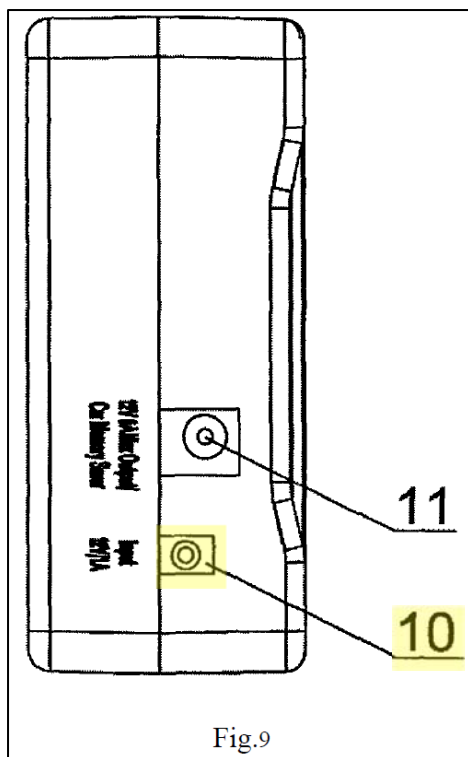
1009, 2:26-29. Paparrizos' techniques relate to charging of "[c]omputer tablets and other mobile devices, such as mobile phones, digital SLR cameras, video recorders, audio devices" (*id.*, 2:26-29), with battery packs that "typically range from 3.0V to 8.4V," not to charging jump starters or comparable devices. *Id.*, 1:13-15. In fact, Paparrizos expressly notes that "the USB specification imposes current limits for various devices that can be connected to the battery charging circuit," which further confirms that its charging circuit is not intended for charging large-capacity battery systems. *Id.*, 4:48-58. When considering charging techniques, a PHOSITA would understand that these small electronics devices are not similar to a vehicle jump starter.

125. Suffering from the same deficiency as Ground 1, the Petition never discusses why a PHOSITA would have applied the low current charging technique of traditional USB to an electronic system with a battery having a high battery capacity. As explained above, it was well understood that the limited charging current that traditional USB provided was not capable of quickly charging high-capacity battery systems like those of jump starters. By failing to recognize that a PHOSITA would not have added a USB charging circuit to a jump starter system like that of Yu, Petitioner has fallen short of demonstrating that a skilled artisan would have made the proposed combination.

2. Yu Already Contemplated USB Charging And Boost Conversion, Yet Still Chose To Rely On A Barrel Charger

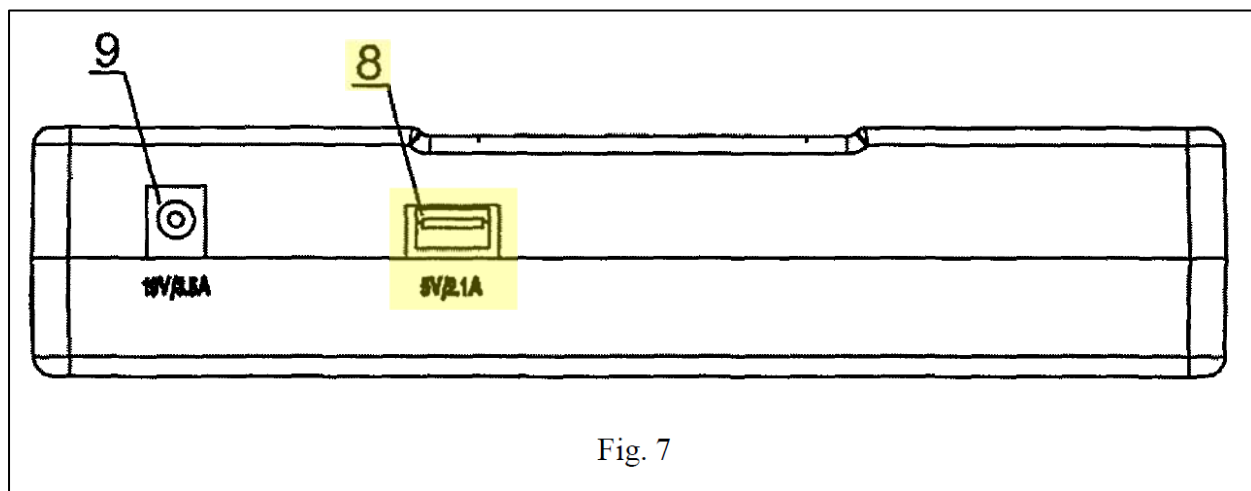
126. Yu itself is perhaps the best evidence against Petitioner's Grounds. The Petition essentially argues that, had a PHOSITA known about Yu's systems and the USB boost conversion techniques of Paparrizos, then they would have naturally arrived at the claimed invention. The problem with this reasoning, however, and what the Petition fails to mention, is that Yu already contemplates and incorporates both USB output charging and DC-DC boost conversion. Specifically, Yu's system already contains both a USB port and a DC-DC boost converter. Despite this, and likely for the disadvantages associated with charging jump starters via USB discussed above, Yu's inventors chose to include a separate barrel charger and incorporated USB only as an output port to charge other smaller devices from the jump starter battery. This choice is strong evidence that a PHOSITA would not, in fact, have made the proposed combination suggested in Grounds 4-6.

127. Yu discloses a female barrel charging port for use with a traditional barrel charger (item 10):



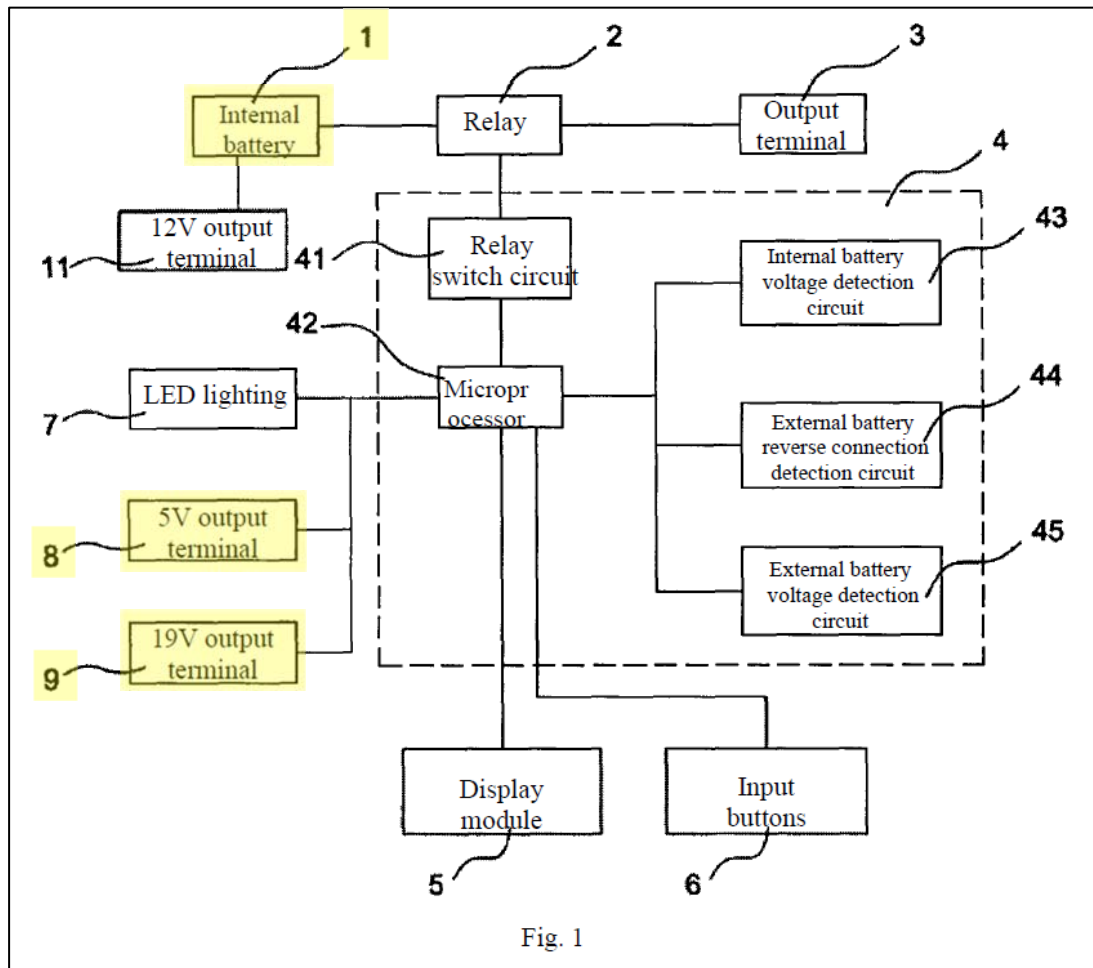
Ex. 1008, Fig. 9 (color annotations added).

128. Yu also discloses a USB port which it describes as a “5V output terminal 8” (Ex. 1008, ¶ [0025]):



Id., Fig. 7 (color annotations added). This 5V terminal of Yu is depicted as a USB Type A port configured to receive a USB cable connected to an external device or

power source. The “19V output terminal 9” also shown above in Figure 7 (*see id.*, ¶ [0025]) and the 5V USB terminal of Yu are both connected to a 12V “internal battery 1”:



Id., Fig. 1 (color annotations added). As shown, the internal battery 1 may directly supply output power to a “12V output terminal 11” (*see id.*, ¶ [0025]) and may also indirectly provide output power to the USB output terminal and the 19V output terminal through a relay switch circuit and a microprocessor. *See id.*, Fig. 1. A PHOSITA would have understood that, in order to provide an output voltage of 19

volts, any charge provided by Yu's 12 volt internal battery would have to be boost converted from 12 volts up to 19 volts. So, in addition to disclosing the 5V USB port, Yu inherently discloses a DC-DC boost converter as well.

129. Therefore, the authors of Yu's disclosure were already contemplating USB output charging and boost conversion techniques at the time, and still chose to rely on a separate barrel charger over a USB outlet for its input charging. In my opinion, this choice, even when possessing the knowledge of Zhao's teachings, is strong evidence that a PHOSITA would not have modified Yu's system to rely on USB input charging.

130. With respect to Yu, the Institution Decision initially found Patent Owner's argument that "Yu included a separate barrel charger and therefore implicitly rejects USB charging" to be unpersuasive because the addition of a secondary input does not negate the capability of USB charging. DI, p. 46. As explained, the knowledge that the authors of Yu were already contemplating USB output charging and boost conversion techniques, yet still chose to rely on a barrel charger, is evidence that is relevant to whether a PHOSITA would have made the proposed combination. But even if one ignores Yu's choice to use a barrel charger instead of USB, this still would not change the fact that Petitioner has failed to demonstrate that a PHOSITA would have modified Yu's large-capacity battery to be charged via USB, as previously demonstrated.

131. Thus, Ground 4 of the Petition fails to appreciate how a PHOSITA would have viewed the actual system of Yu, including recognizing how its already-existing USB port and DC-DC boost converter weaken the proposed combination. For these reasons, and in addition to the above, a PHOSITA would not have added a USB charging circuit to Yu’s specific jump starter device.

B. The Petition Fails To Show, With Particularity, How A PHOSITA Would Have Combined Yu and Paparrizos

132. In addition to the deficiencies in the motivation to combine Yu and Paparrizos, Petitioner also fails to demonstrate *how* the battery charging circuit of Paparrizos would allegedly be incorporated into the system of Yu.

133. Yu does not specify its internal battery type and provides very limited disclosure of its charging input circuit, beyond the use of a barrel charger. *See*, Ex. 1008, Fig. 8, ¶ [0028]. Similar to the deficiencies associated with Ground 1, nowhere does Petitioner attempt to show how Yu’s system, depicted in the circuit diagrams of Figures 1-5, would have been modified to include Paparrizos’ complex charging circuit. In fact, Paparrizos’ charging circuit includes numerous operating modes—many of which would be useless to the system of Yu (*e.g.*, reverse boost mode, forward buck mode)—and relies on a “configuration detector 216 [to] generate suitable signals 222 that are used to configure the buck boost circuit 212 to operate accordingly.” Ex. 1009, 4:42-47. The Petition provides no explanation for how the PHOSITA allegedly would have integrated Paparrizos’ configuration

detector into Yu's circuit to ensure that the correct operating mode (*i.e.*, forward boost mode) is applied.

134. The Petition incorrectly argues that "implementing Paparrizos USB charging circuit . . . would have required nothing more than implementing a well-known circuit into the jump-starter-battery-charging portions of Richardson's [sic] jump-starter." Pet., p. 60. But the Petition only proposes that Paparrizos' charging circuit is added as an additional input circuit, separate from the existing barrel-charger input circuit of Yu. And adding a second charging circuit to a device (as opposed to replacing an existing charging circuit) is not so straightforward. Petitioner fails to address the added complexity and the safety risks associated with adding a second input charging circuit, including the modifications that would need to be made to Paparrizos' system to account for the possibility that a user attempts to hook up multiple chargers simultaneously.

135. Petitioner's conclusory attempt to combine these two prior-art systems therefore falls short of showing unpatentability with particularity. The additional asserted evidence of AAPA, EPower-20/Epowers-21, and Krieger all fail to cure the deficiencies associated with the underlying Yu and Paparrizos combination.

XI. PETITIONER’S PRIOR ART FAILS TO RENDER THE VEHICLE BATTERY ISOLATION SENSOR LIMITATIONS OF CLAIMS 1 AND 5 OBVIOUS

A. Richardson Fails To Teach The Controlled Connection Of A Power Switch Based On A Vehicle Battery Isolation Sensor Prior To The Power Supply Being Connected To The Vehicle Battery (Claim 1)

136. The challenged claims require a vehicle battery isolation sensor that serves as a safety feature by monitoring for vehicle battery connection and controlling the power switch based on the detected connection. Richardson does not disclose this limitation.

1. Claim 1 Requires That The Vehicle Battery Isolation Sensor Control The Connection Of The Power Switch Prior To The Power Supply Being Connected To The Vehicle Battery

137. Claim 1 of the challenged ’203 Patent relates to a battery jumpstart apparatus that requires, among other limitations:

a vehicle battery isolation sensor configured to detect presence of the vehicle battery connected to the jump starter apparatus;

...

wherein the power switch is controlled based on signals from the vehicle battery isolation sensor and the reverse polarity sensor such that the power supply is *connected* to the vehicle battery *when* both (i) the vehicle battery isolation sensor currently indicates that the vehicle battery is connected to the jump starter apparatus, and (ii) the reverse polarity sensor currently indicates that the jump starter

and the vehicle battery are connected with the proper polarity connection.

Ex. 1001, 8:43-60 (emphases added).

138. As can be seen, claim 1 requires that the power switch is controlled such that the power supply only becomes connected to the vehicle battery when both of two conditions are met, one of which being that the vehicle battery isolation sensor indicates a connected vehicle battery. In other words, claim 1 requires actively monitoring the vehicle battery connection before the power supply is connected (i.e., before the beginning of jumpstarting of the vehicle). If the vehicle isolation sensor indicates that no vehicle battery is connected, then the jumpstarting process will not be initiated, since no power supply connection will be formed.

139. The specification of the '203 Patent confirms that the vehicle battery isolation sensor of claim 1 requires the safety feature of monitoring for improper vehicle battery connection prior to initiating jumpstarting, and explains that:

Using these specific inputs, *the microcontroller software of MCU 1 can determine when it is safe to turn on the smart switch FET 15, thereby connecting the lithium battery pack to the jumper terminals of the booster device.* Consequently, if the car 10 battery 72 either is not connected to the booster device at all, or is connected with reverse polarity, the MCU 1 can keep the smart switch FET 15 from being turned on, thus prevent sparking/short circuiting of the lithium battery pack.

Ex. 1001, 5:67-613 (emphasis added).

140. This safety feature of detecting whether a vehicle battery is connected prior to connecting the power supply to the vehicle battery can help prevent the misuse of the claimed jump starter apparatus.

**2. Richardson Teaches Detection Of A Disconnection Only
After The Jump Starter Has Been Connected To The
Vehicle**

141. The Petition conflates teachings from two separate features of Richardson: (1) Step 302, which involves monitoring whether the jumper cables have become disconnected after the jumpstarting energy transfer has already begun; and (2) Step 252, which involves monitoring vehicle voltage prior to jumpstarting, but does not relate to controlling the power switch based on an indication of the connection with the vehicle battery. Neither of these features of Richardson disclose the vehicle battery isolation sensor limitation of claim 1 which, as explained above, requires control of the power source connection prior to jumpstarting based on an indication that the vehicle battery is connected.

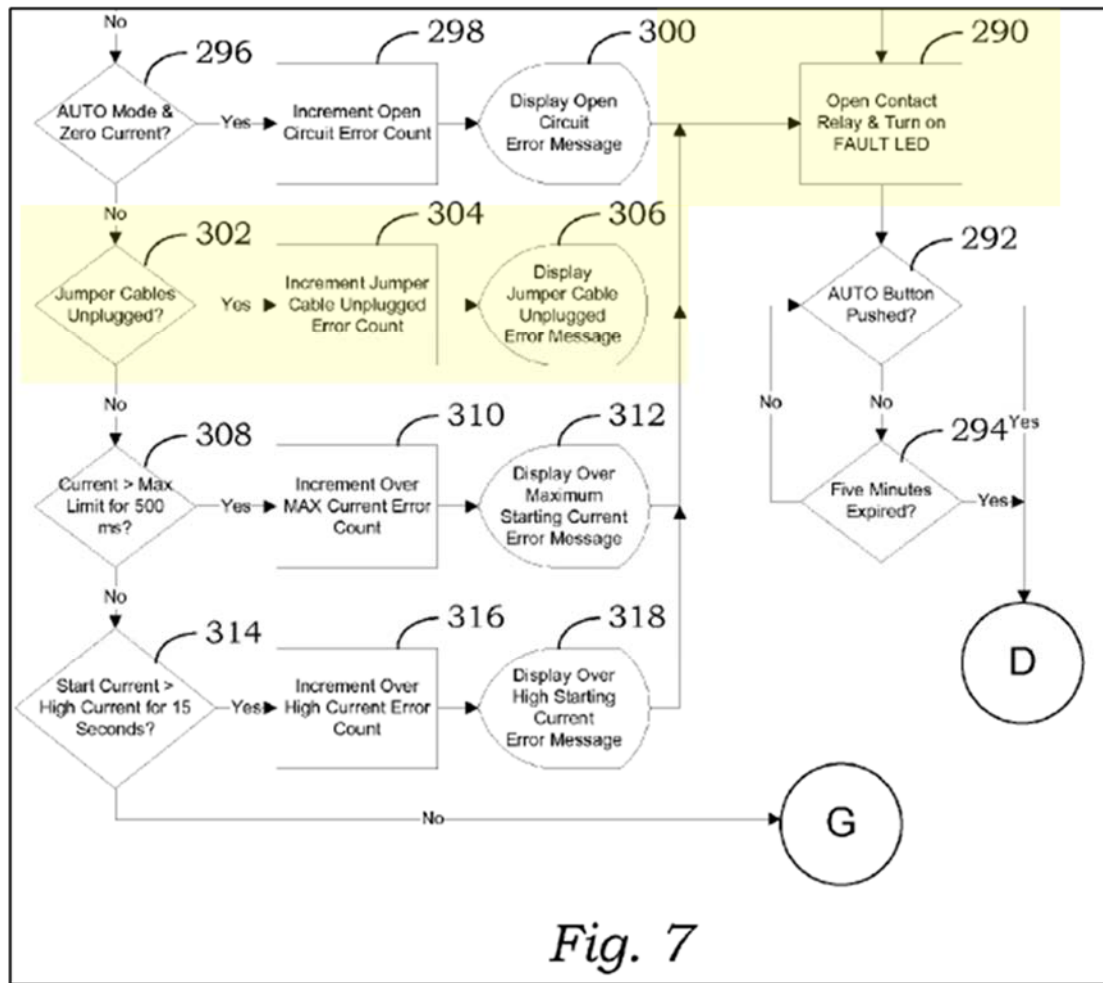
142. Examining Step 302 of Richardson first, the prior art reference makes clear that this process step exclusively occurs after the jumpstarting energy transfer has already begun. Petitioner cites to paragraphs [0007] and [0041] when claiming that “Richardson discloses a vehicle battery isolation sensor as claimed.” Pet., p. 42. These paragraphs relate to Richardson’s ability to measure voltage during actual

jumpstarting and open a relay circuit if the jump starter cables are determined to become disconnected:

If the system detects an increase in the difference between the measured jump starter battery voltage 20 and the voltage measured 30 across the contact relay 34 *indicating that one of the jump starter cables has been disconnected 302* from the vehicle's battery or starter system 28 then a jumper cable unplugged error count is incremented 304, a "Jumper Cable Unplugged" error message is displayed 306 on the LCD 46, *the contact relay 34 is opened* and the fault LED 56 is illuminated 290.

Ex. 1005, ¶ [0041] (emphases added).

143. These process steps can be seen in the lower portion of Figure 7 in Richardson:

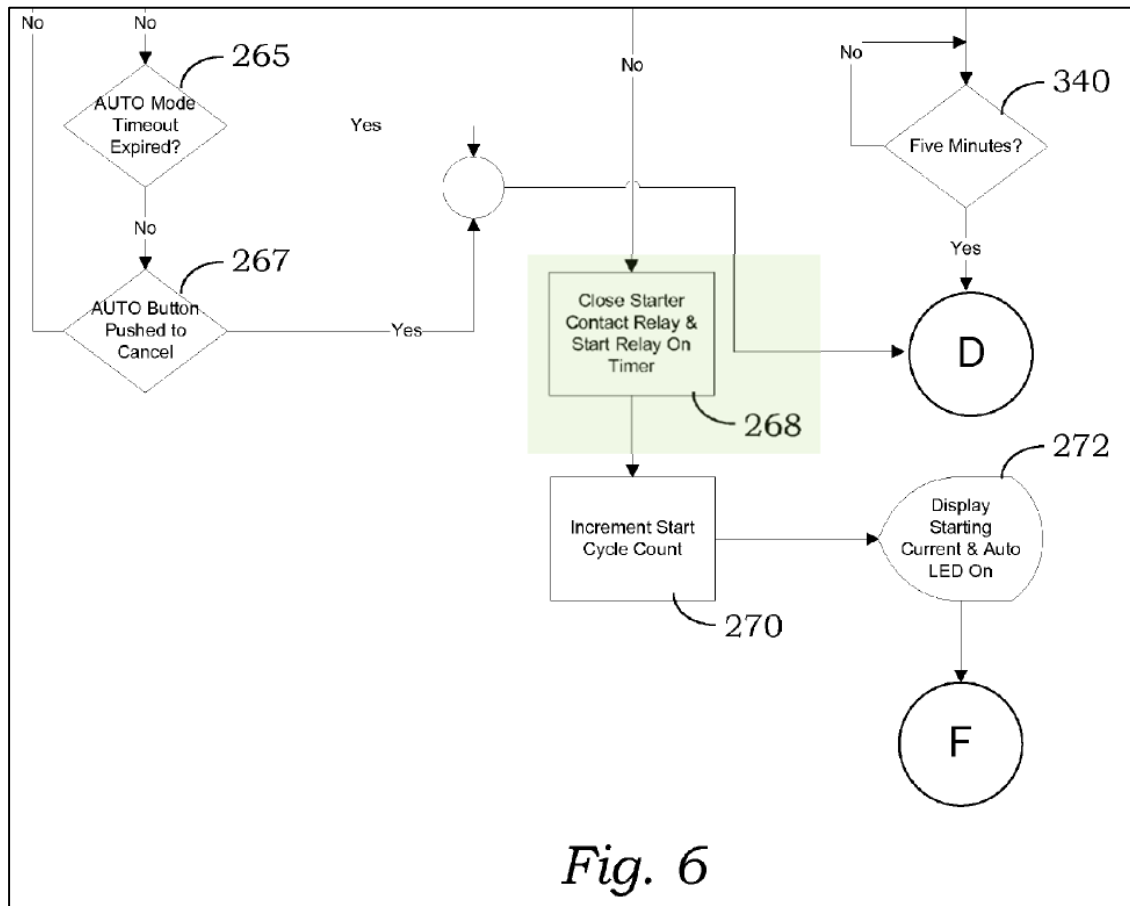


Ex. 1005, Fig. 7 (color annotations added).

144. Critical to the present analysis of claim 1, however, is recognizing that Step 302 of Richardson occurs only after the jumpstarting energy transfer has already begun, which occurs at Step 268:

If the maximum number of start attempts has not been exceeded 266, ***the contact relay 34 is closed and the contact relay on timer is started 268***, connecting the jump starter's capacitors 21 and batteries 22 to the vehicle's starting system 28.

Ex. 1005, ¶ [0035] (emphasis added). This process step of beginning the energy transfer can be seen in the lower portion of Figure 6 in Richardson:



Ex. 1005, Fig. 6 (color annotations added). Indeed, Petitioner’s expert confirmed that Step 302 of Richardson occurs only after the power supply is connected to the vehicle battery. *See* Ex. 2005, 47:10-14 (confirming that Step 302 occurs after Step 268, when “charging is in process.”)

145. There is no discussion anywhere in Richardson of Step 302’s determination of vehicle battery connection being used prior to the start of energy

transfer, nor does the Petition try to point to any. Therefore, the vehicle battery isolation sensor limitations of claim 1 cannot be taught by step 302 of Richardson.

3. The Voltage Monitoring Performed By Richardson Prior To The Jumpstarting Does Not Control The Connection Of The Power Supply Based On An Indication Of A Connected Vehicle Battery

146. Perhaps recognizing that Richardson's teachings with respect to Step 302 fail to teach the vehicle battery isolation sensor limitations, the Petition further cites to paragraphs [0027] and [0034], which describe Step 252 of Richardson's jumpstarting process as it relates to a "vehicle voltage sensor 30." Pet., p. 42. While Step 252 does occur prior to the beginning of the energy transfer at Step 268, it does not involve controlling the power supply connection based on an indication of whether a vehicle battery is present. As explained below, regardless of whether a vehicle battery is properly connected to Richardson's jump starter, the jumpstarting process of Richardson will proceed past Step 252. Accordingly, this feature of Richardson also fails to teach the vehicle battery isolation sensor limitations of challenged claim 1.

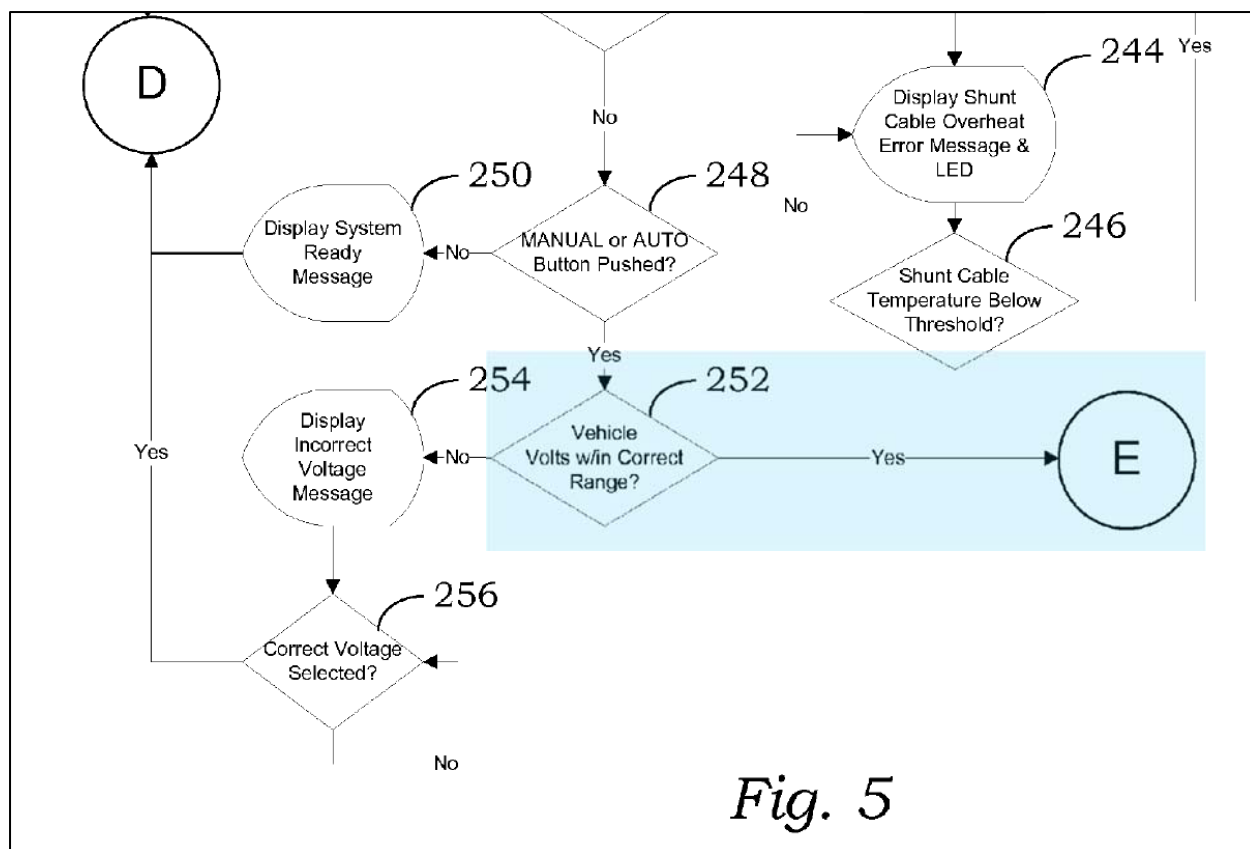
147. The Petition asserts that "Richardson discloses a vehicle battery isolation sensor as claimed" because "Richardson's device makes a determination of battery presence at step 252 of the processing loop in connection with the operation of vehicle voltage sensor 30." *Id.* Petitioner interprets step 252 as preventing Richardson's system from initiating jump starting if the vehicle battery

is near zero volts (e.g., because it is in a disconnected state), but they fail to understand that Richardson permits low voltage readings to proceed past this step.

148. Richardson discloses that Step 252 involves checking the voltage difference between the measured vehicle voltage and the selected voltage in order to determine if the jump starter has the correct battery voltage configuration:

If one of the push buttons 42 or 44 has been selected, the system will compare the operator-configured starter voltage against the voltage of the vehicle to be started 28. The jump starter 10 may be configured for 12, 18, 24, 30, 36, 42 or 48 volts, for example, using a selector jumper 55. For example, if the batteries 23 are both 12-volt batteries, the system may be configured for 12- or 24-volt operation It should be understood that two or more batteries of the same or different voltage levels may be used to meet the voltage requirements of the vehicle to be started. *If the difference between the voltage selected and the voltage measured is not within a predetermined range and tolerance 252, a “Wrong Selector Volts” message is displayed 254 on the LCD 46 and further operation is prohibited until the correct voltage is selected 256* at which point processing returns to the main processing loop 210.

Ex. 1005, p. 34 (emphasis added). Step 252 of checking for the correct voltage can be seen in the lower portion of Figure 5 in Richardson:



Ex. 1005, Fig. 5 (color annotations added).

149. Petitioner’s claim that “Richardson’s device makes a determination of battery presence at step 252” misunderstands what is actually occurring in this step. Petitioner’s position appears to be that Step 252 inherently teaches an isolation sensor that indicates when the vehicle battery is connected since a disconnected battery will not have a measured voltage within the correct range and will not be able to proceed past Step 252. *See* Pet., pp. 41-43. This understanding was confirmed during the examination of Petitioner’s expert. *See* Ex. 2005, 27:7-29:15 (Q: “according to your interpretation, without a vehicle battery connected, Richardson’s process can never get to Step 258 in Figure 6, correct?” A: “Yes.”).

But that understanding of Step 252 is inaccurate, and a disconnected battery state would not prevent a user of Richardson's device from proceeding past Step 252.

150. Step 252 of Richardson is not monitoring for a disconnected state. Instead, Step 252 only determines if the user voltage selection is appropriate. Although Richardson does not expressly disclose what the "correct range" of voltage measurement in Step 252 would be, it is clear based on subsequent steps in Richardson's process that Step 252 does not prevent low voltage vehicle battery measurements from proceeding past this step. This is because Richardson expressly states that "manual mode," which only occurs after Step 252, must be able to "be used when the battery voltage of the vehicle is below 10 volts, *or if the vehicle's battery is not connected.*" See Ex. 1005, ¶ [0047].

151. Specifically, Richardson explains how the next step in the process after Step 252 is to determine whether the manual or automatic operation buttons were pressed by the user (*see* Ex. 1005, Fig. 5, Step 248):

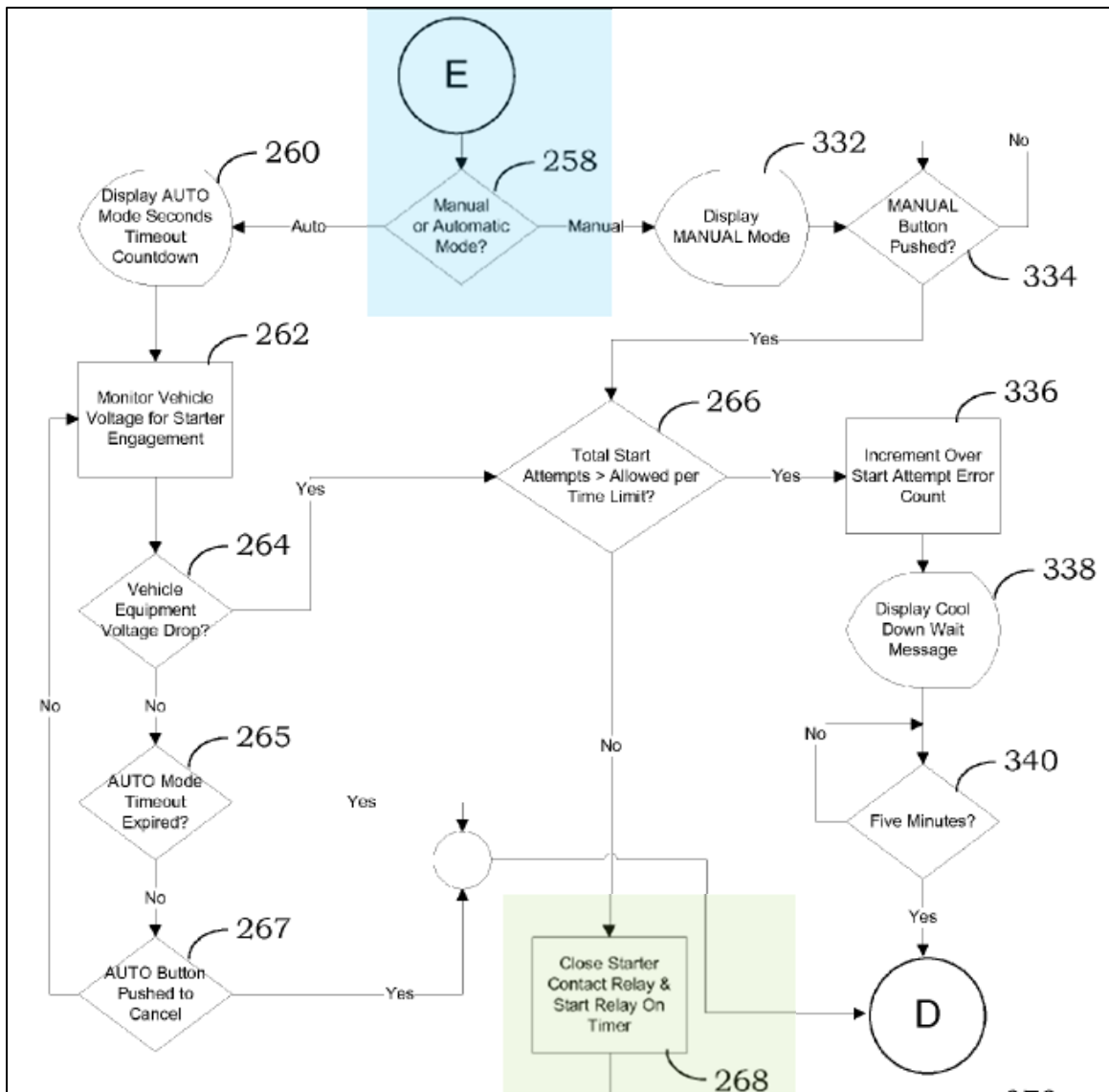
If the selected voltage is within the correct range 252, then the system determines which button [manual or automatic mode] was selected 258.

Ex. 1005, ¶ [0035]; *see* Ex. 1005, 29:16-30:8. Richardson then describes the automatic process before continuing to discuss the manual process:

If manual mode is selected 258, "Manual" is displayed 332 on the LCD 46, the system will prompt the operator to press the manual button 44 again. If the manual button 44 is pressed a second time 334, then the

system checks the number of start attempts 266 If the total start attempts have not exceeded the limit 266, the processing continues at block 268 as described above.

Ex. 1005, ¶ [0047]. As discussed above, Step 268 is where energy transfer from Richardson's jump starter battery to the vehicle begins. Thus, Richardson discloses activating its jump starter while operating in a manual mode. *See* Ex. 2005, 31:3-32:13. This entire process workflow, which occurs after Step 252, is depicted in Figure 6 of Richardson:



Ex. 1005, Fig. 6 (color annotations added).

152. Critically, Richardson is clear that manual mode may be used when the vehicle battery is depleted below 10 volts or even when “the vehicle’s battery is not connected”:

If in manual mode, *the jump starter 10 may be used when* the battery voltage of the vehicle is below 10 volts, or if *the vehicle's battery is not connected*.

Ex. 1005, ¶ [0047] (emphasis added); see Ex. 2005, 35:22-24. Because Step 252 (the vehicle voltage check) occurs prior to the “manual mode” process (beginning at Step 258 and continuing through Step 268), the vehicle voltage check of Step 252 must allow for Richardson’s process to continue even if when the vehicle battery is below 10 volts or disconnected.

153. As a result, when Step 252 checks the vehicle battery voltage for the “correct range,” a disconnected vehicle battery cannot lead to a “wrong selector volts” message being displayed and further operation being “prohibited.” See Ex. 1005, p. 34. This initial voltage check must instead permit Richardson’s jumpstarting process to proceed for low voltages (*e.g.*, a disconnected state), or else the described operation in manual mode would not be possible.

154. When questioned about whether a battery with zero volts that needed to be jumpstarted using the manual process would have to proceed past Step 252, Petitioner’s expert conceded that the voltage “test must have been satisfied before it gets to connector E.” Ex. 2005, 39:16-40:4. Petitioner’s expert then admitted that the acceptable voltage range measured in Step 252 could exclude the zero voltage

case where no battery is present, and that a different acceptable vehicle voltage range would prevent you from going into manual mode:

Can you arrive at Step 258 with a battery that has zero volts?
That's the question.

A. Oh, my apologies, then. It does not appear from Step 252 of the prior case that that is possible. That would, that would be a volt -- a vehicle voltage outside of the correct range.

Q. Well, then, how is it possible that if in manual mode the jump starter, 10, may be used when the battery voltage of the vehicle is below 10 volts or if the vehicle's battery is not connected?

A. You're raising it being that it is being blocked at 252 because it's out of the correct range. And *I see your point*.

Q. So you're saying, under your interpretation, that's not possible?

MR. CHANDRA: Objection. Misstates his testimony.

A. Well, it does depend. And I would -- to get to the bottom of this question, I'd like to determine definitively what is meant by vehicle voltage within the correct range because that correct range could exclude the zero -- the, basically, zero voltage case or the no battery present case.

But if one assumes that this decision -- vehicle volts within correct range inside the decision diamond, 252, includes the possibility of reading zero voltage at the battery which could occur either if the battery is not connected or if the battery is so stone dead that it is still -- it is reading zero, that *that would prevent you from going into manual mode*, which I believe is your question.

Ex. 2005, 40:8-41:17 (emphases added).

155. Because Step 252 must allow Richardson's system to go into manual mode in the case where the battery is at a low voltage or disconnected, the voltage check occurring in Step 252 cannot be monitoring for a voltage range that does not include a zero or low-voltage reading. If Petitioner's interpretation of Step 252 were accurate, then Richardson would be entirely incapable of using its manual mode. Step 252 of Richardson therefore cannot provide a vehicle battery isolation sensor that "indicates that the vehicle battery is connected to the jump starter apparatus," as required in challenged claim 1.

156. Accordingly, Richardson fails to teach the vehicle battery isolation sensor limitations of claim 1.

4. A PHOSITA Would Not Have Expected Richardson's Voltage Monitoring Prior To Jumpstarting To Include Battery Presence Detection

157. Richardson's failure to disclose the safety feature of monitoring the connection to the vehicle battery prior to closing the power switch, as required in claim 1, is unsurprising. While the invention required by claim 1 prevents a user from activating the jump starter with an improper connection (i.e. vehicle battery is connected in reverse polarity or not connected at all), Richardson's system relies on a user to visually confirm that cables are properly connected. In other words, claim 1 requires a "dummy proof" jump starter, but Richardson describes a jump starter in

which a user could accidentally begin the transfer of energy when the battery cables are disconnected. Richardson's method of relying on a user to visually ensure that the jumper cables are properly connected to a vehicle battery is consistent with traditional jumpstarting techniques, which for decades have relied on users taking the time to ensure proper connection between jumper cables clamped to a dead vehicle battery and a donor battery of a second vehicle. While it may be easy for a user to visually determine that a jumpstarter clamps are indeed connected to a vehicle battery, if a user mistakenly begins jumpstarting without performing this safety check, the results can be disastrous. Instead of relying on the user not making a mistake when connecting the clamps to the vehicle battery, the claimed invention of the '203 Patent implements a safety feature that does not allow jumpstarting to begin until the vehicle battery isolation sensor determines the presence of a vehicle battery.

158. Petitioner's understanding of Step 252 to inherently prevent a disconnected vehicle battery from proceeding with the jumpstarting process cannot be correct, otherwise Richardson would never be able to proceed to Step 268 via manual mode, which Richardson explains that can be used when the vehicle battery is disconnected. *See* Ex. 1005, [0049]. It is understandable that Richardson would not focus on low voltage measurements, especially given its optional manual bypass mode, but rather seek to exclude vehicle higher voltages at Step 252. Indeed, it would be difficult for Richardson to identify an improperly low vehicle battery

voltage. Relying on battery voltage alone, one cannot distinguish between an 18-volt vehicle battery and a 24-volt vehicle battery that has been depleted to have an output voltage of 18 volts. Both voltage measurements may be similar, but only one of these vehicle batteries would be improper to charge via Richardson's 24-volt configuration. Conversely, if the measured vehicle voltage is above what the system expects it to be (e.g., measuring 48 volts when the system is configured for a 12-volt battery), Richardson can always definitively determine that a user has selected the wrong setting.

159. It is unsurprising that Richardson's Step 252 does not perform vehicle battery presence detection, since that function is already occurring in Richardson at Step 302. Richardson's Step 302 determines a disconnected battery not by looking for a minimum difference in the voltage value between the vehicle battery voltage and the jump starter voltage, but rather by monitoring for changes, such as a sharp increase, in the voltage difference. *See* Ex. 1005, ¶ [0041] ("If the system detects an increase in the difference between the measured jump starter battery voltage 20 and the voltage measured 30 across the contact relay 34 indicating that one of the jump starter cables has been disconnected 302") (emphasis added). Identifying a change in voltage over time can help identify a sudden disconnection of the jump starter. But simply calculating the voltage difference (i.e., what is occurring at Step

252) will be generally ineffective for determining whether a battery has been disconnected, since the charge state of the vehicle battery is unknown.

5. If Petitioner's Understanding Of Step 252 Were Correct, Then Richardson Would Be Inoperable

160. Were the Board to agree with Petitioner's interpretation—that Step 252 of Richardson would prevent jump starting and display an incorrect voltage message when no vehicle battery is present—then the Petition's Grounds would be inoperative.

161. Petitioner has relied on Richardson alone to teach many of the jump starter limitations of claim 1. But, as explained above, if Petitioner's interpretation of Richardson is accepted, then Richardson's device could never proceed past Step 252 in the event of a low voltage or no voltage reading. And if this were the case, then Richardson could never proceed down its manual operation pathway (Steps 332, 334) to reach the point that its power supply is connected at Step 268. Ex. 1005, Figs. 5-6. In other words, if Petitioner's interpretation is accepted, then it is my opinion that Richardson would not enable a PHOSITA to arrive at the claimed invention.

B. Richardson Fails To Teach The Automatic Controlled Connection Of A Power Switch Based On A Vehicle Battery Isolation Sensor When The Jump Starter Apparatus Becomes Operational (Claim 5)

162. In addition to failing to teach the vehicle isolation sensor limitations of claim 1, Richardson particularly fails to teach the limitation of dependent claim 5, which further narrows the time period for which the vehicle battery detection is occurring:

5. The jump starter apparatus of claim 4, wherein the controller is configured to automatically cause the vehicle 10 battery isolation sensor to detect presence of the vehicle battery and the reverse polarity sensor to detect polarity of the vehicle battery *when* the vehicle battery is electrically connected to the jump starter apparatus and *the jump starter apparatus becomes operational*.

Ex. 1001, 9:8-14 (emphasis added). As shown above, claim 5 specifies that the controller (an element introduced in claim 4) automatically causes the vehicle battery isolation sensor to perform presence detection when the jump starter apparatus becomes “operational.”

163. During cross-examination, Petitioner’s expert suggested two possible points in time for when Richardson’s jump starter device would become “operational:” (1) “the device is operational if its electronics are working, which would follow as soon as you turn the power on,” and (2) when current “is actually flowing from the jump starter into the subject vehicle battery” after Step 268 in

Richardson. Ex. 2005, 15:5-11, 13:3-11. But the language of the '203 Patent makes clear that the jump starter apparatus becomes operational at the first point in time: when the device is powered on. *See* Ex. 1001, 8:3-4 (“309 is a ‘power on’ indicator showing that the device is powered up ***for operation***”) (emphasis added). And given that claim 1 already requires presence detection prior to connecting the power supply, claim 5 would not make sense as a further narrowing limitation of claim 1 if “operational” meant when the device started to transfer energy to a connected vehicle.

164. Thus, claim 5 adds a further temporal restriction to claim 1 that functions as a more-stringent safety feature. While claim 1 requires that the vehicle battery isolation sensor perform its safety check sometime prior to the power supply being connected to the vehicle battery, claim 5 goes even further and requires this safety check when the “jump starter apparatus becomes operational.” Richardson does not disclose vehicle battery presence detection at any time prior to connecting the power supply, and it certainly does not teach claim 5’s requirement of doing so as soon as the jump starter becomes operational.

165. When addressing claim 5, the Petition claims that “Richardson teaches this limitation.” Pet., pp. 52-53. Petitioner provides only a superficial analysis of this claim limitation, largely repeating and citing to its arguments from limitation 1[D]. *See id.* (citing Ex. 1005, ¶¶ 16, 27, 35). Nowhere does the Petition address

the temporal restriction of claim 5 that requires presence detection as soon as the device becomes operational.

166. Therefore, even if Petitioner’s understanding of Step 252 disclosing vehicle battery presence detection of claim 1 were correct, which, as explained above, it is not, the Grounds involving the unpatentability of claim 5 are still lacking. As explained, Richardson becomes operational when it “is initially powered on **200.**” Ex. 1005, ¶ [0022]; *see id.*, Fig. 3, Step 200. After powering on, Richardson goes through numerous steps before even reaching Step 252. *See id.*, Figs. 3-5. For example, Richardson’s device first performs numerous checks, including “self-test operations,” before starting its main processing loop “210.” *Id.*, ¶ [0023]. Continuing through its process, the reverse polarity detection of Step 214 occurs only “once jumper cables 60 have been manually connected to the vehicle to be started.” *Id.*, ¶ [0027], Fig. 3. Also occurring after the device is powered on is the requirement that a manual or auto button have been pushed at step 248, otherwise a “Ready” message is displayed. *Id.*, ¶ [0033], Fig. 5. Then, well after the device has already been powered on and become operational, and only after the jump starter has been manually connected to the vehicle, and only after a user has made a selection of manual or automatic operation, does Richardson’s Step 252 finally check if the vehicle voltage is within a correct range. *Id.*, ¶ [0035], Fig. 5. Because it is occurring so long after Richardson’s device is powered on, and only after

numerous manual tasks, Step 252 does not disclose claim 5's required presence detection occurring when the jump starter apparatus becomes operational.

167. Therefore, Petitioner has failed to show that claim 5 is unpatentable over Richardson in view of Zhao.

C. Yu Fails To Teach The Controlled Connection Of A Power Switch Based On Signals From A Vehicle Battery Isolation Sensor

168. Yu also fails to teach the vehicle battery isolation sensor limitations of claim 1. While Richardson failed to teach control of the power switch prior to initiation of energy transfer, Yu fails to teach this limitation because it simply does not teach or suggest using the vehicle battery isolation sensor to control the power switch at any point in time. Rather than implementing this automatic safety feature required by claim 1, Yu instead relies on a user to evaluate a measured voltage on a display and make manual safety decisions.

169. The Petition first claims that Yu teaches the vehicle battery isolation sensor limitations of claim 1 because it discloses an “external battery voltage detection circuit 45 which detects whether a battery is present (i.e. connected) or absent (i.e., disconnected).” Pet., p. 66. In support, Petitioner points to Yu's statement that “[w]hen the device is connected to an external vehicle battery, the device will detect the external battery voltage and display the voltage on the LCD simultaneously.” Pet., p. 66 (citing Ex. 1008, ¶ [0009]). According to Petitioner, “[a] POSITA would have understood that, to prevent generating sparks, Yu's

microprocessor would determine whether a battery is present (i.e., connected to Yu's jump starter) before switching on the relay 2." Pet., p. 66; *see id.*, pp. 65-69, 72. But this is not how Yu functions.

170. Yu's "external battery voltage detection circuit 45" only provides a voltage signal to be displayed on Yu's display module. Unlike the "external battery reverse connection detection circuit 44" in Yu, which does control the relay 2 via microprocessor 42 (*see* Ex. 1008, ¶ [0003]), Yu's "voltage detection circuit 45" is not used to control the relay 2. Instead, the reference makes repeated statements that confirm that this detection circuit is only intended to provide visual information to a user of Yu's jump starter system:

- ***"So that the external battery voltage can be displayed on the display module,*** the control module also includes an external battery voltage detection circuit" Ex. 1008, ¶ [0006] (emphasis added).
- "When the device is connected to an external vehicle battery, the device will ***detect the external battery voltage and display the voltage on the LCD simultaneously.*** At this time, pressing the JUMP button of the input buttons controls whether the relay is on or off, so that the device will not generate sparks when it is connected." Ex. 1008, ¶ [0009] (emphasis added).

- “*So that the internal battery 1 voltage can be displayed on the display module 5*, it is characterized by a control module 4 that also includes an internal battery voltage detection circuit 43” Ex. 1008, ¶ [0022] (emphasis added).
- “The microprocessor 42 will *detect the external battery voltage and simultaneously display this voltage on the LCD*. If the external battery voltage is within the normal range, then the JUMP button of the input buttons 6 can be pressed to close the relay 2, and the internal battery will output current to the vehicle to be started through the output terminal 3.” Ex. 1008, ¶ [0026] (emphasis added).
- “A signal is provided to the microprocessor 42 through the external battery voltage detection circuit 45, *so the external battery voltage can be displayed on the display module 5 to facilitate understanding of the external battery condition*.” Ex. 1008, ¶ [0027] (emphasis added).

171. Nowhere does Yu suggest using the signal received from the voltage detection circuit 45 to control the relay 2. The microprocessor 42 does not make a determination of whether the vehicle battery voltage is within a normal range or even present. Instead, it is the user who makes this determination and manually controls the relay 2. Specifically, the measured voltage is displayed to a user of the device, so that the user can use this information to determine whether or not to press the

“JUMP button” to close relay 2 and begin the jumpstarting process. In other words, Yu has no vehicle battery detection sensor that is used to control a relay switch, as required in challenged claim 1. This safety feature is completely absent from Yu, which instead chooses to rely on a manual determination by the user of when to activate the device.

172. As a fallback position, Petitioner tries to argue that “it would have been obvious to a POSITA to detect the presence of vehicle battery based upon the OUT-CHECK signal received from external battery detection circuit 45.” Pet., p. 68. Petitioner claims that modifying Yu to control the relay 2 via the external battery detection circuit 45 would have been straightforward and “a POSITA would have been motivated to implement these changes to obtain the known benefit of enhancing safety and avoiding generation of sparks, as taught by Yu.” *Id.*, p. 67. In other words, Petitioner effectively argues that, if the prior art does not actually teach the claimed limitation, then the invention would still nevertheless have been obvious, because it would have been straightforward to implement.

173. Even putting aside the fact that Petitioner has provided no evidence in support of the proposed modification, altering Yu in this manner makes little sense for a number of reasons. First, Yu’s jump starter system already presents a solution that it claims avoids sparks, so a PHOSITA would not have sought to further modify Yu based on the reference’s teachings alone. In particular, Yu waits until a user

presses the “JUMP button” before transferring energy, so that the device “will not generate sparks when it is connected.” Ex. 1008, ¶ [0009]. Petitioner’s suggested motivation to modify Yu is therefore deficient.

174. Furthermore, modifying Yu’s system to rely on the vehicle battery voltage to controllably connect/disconnect its power supply would not be as straightforward as Petitioner claims. Yu currently relies on a user to evaluate the displayed vehicle battery voltage and to determine whether to press the “JUMP button.” But, if Yu was modified to simply prevent jumpstarting when a vehicle battery voltage is undetected, then Yu’s system would not be able to jumpstart vehicles when the battery voltage is so low that automatic detection is not possible. In other words, the proposed modification would render Yu worthless in many actual jump-starting applications. This is precisely why the challenged ’203 Patent includes a “manual button” to “allow[] the user to jump-start vehicles that have either a missing battery, or the battery voltage is so low that automatic detection by the MCU is not possible.” Ex. 1001, 5:20-23. Put simply, Petitioner’s proposed modification restricts the manual operation that Yu’s device relies on. Without building in a manual override—something that would require further redesign of Yu’s system, which is not suggested by the Petition—the proposed modification to Yu’s system would render it partially inoperable.

175. In light of these deficiencies, and similar to Richardson, Yu fails to teach the vehicle battery isolation sensor limitations.

XII. CONCLUSION

176. For at least the above reasons, it is my opinion that the Board should determine that claims 1-11 of the '203 Patent are not unpatentable.

XIII. DECLARATION

I declare that all statements made herein on 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 the 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.

Dated: June 9, 2025

By: 

Ayman Fayed, Ph.D.