UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD

SHENZHEN FBTECH ELECTRONICS LTD AND
SHENZHEN LITIME TECHNOLOGY CO., LTD
Petitioners

v.

LITHIUMHUB TECHNOLOGIES, LLC,
Patent Owner

United States Patent No.: 9,412,994

"LITHIUM STARTER BATTERY AND SOLID STATE SWITCH THEREFOR"

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,412,994 UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. §§ 42.100 *et seq*.

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I. INTRODUCTION

Shenzhen Fbtech Electronics Ltd. ("Fbtech") and Shenzhen LiTime Technology Co., Ltd. ("LiTime"), collectively "Petitioners," petition for *inter partes* review ("IPR") under 35 U.S.C. §§ 311-319 and 37 C.F.R. § 42 of claims 1-23 of U.S. Patent No. 9,412,994 ("the '994 Patent" or Ex. 1001), which is assigned to LithiumHub Technologies, LLC ("PO"). Petitioners request cancellation of these claims.

II. MANDATORY NOTICES (§ 42.8)

A. Real Party-in-Interest (37 C.F.R. § 42.8(b)(1))

Fbtech and LiTime are real parties-in-interest. No unnamed entity is funding, controlling, or directing the Petition.

B. Related Matters (37 C.F.R. § 42.8(b)(2))

1. Related International Trade Commission Investigation

PO, together with LithiumHub, LLC and Martin Koebler, filed a Complaint with the International Trade Commission ("ITC") on September 12, 2024, alleging infringement of claims 1-10 and 12-20 of the '994 Patent. The Complaint also alleged infringement of claims 1, 4-9, 11-16, and 18-23 of related U.S. Pat. No. 9,954,207. The ITC instituted Investigation No. 337-TA-1421 on October 16, 2024. The ITC Investigation is ongoing and Petitioners are two of numerous Respondents.

2. Related Litigation

PO, together with LithiumHub, LLC, asserted claims 1 and 14 of the ’994 Patent against Fbtech in 5:2024cv00133 (E.D. Tex.) and LiTime in 5:2024cv00134 (E.D. Tex.), (“copending litigation”). PO and LithiumHub, LLC also asserted claims 1 and 14 of the ’994 Patent against different parties in 5:2024cv00135 (E.D. Tex.), 5:2024cv00136 (E.D. Tex.), 5:2024cv00137 (E.D. Tex.), and 7:2024cv00220 (W.D. Tex.). In each case against Petitioners and other parties, PO and LithiumHub LLC also asserted claims 1 and 12 of the ’207 Patent. All cases have been stayed pending final disposition of the ITC Investigation.

C. Lead and Back-Up Counsel (37 C.F.R. § 42.8(b)(3))

Petitioners provide the following designation of counsel.

Lead Counsel	Back-Up Counsel
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D. Service Information

This Petition is being served by Federal Express overnight to the correspondence address of record for the '994 Patent, Ralph H. Dougherty, 1235 Avalon Place, Matthews, NC 28104. Courtesy copies are being provided electronically to PO's ITC counsel at tburns@bartkowskipllc.com; pbartkowski@bartkowskipllc.com; and LITH-ITC@dority-manning.com.

Petitioners consent to electronic service at the addresses provided above for lead and back-up counsel.

III. STANDING (37 C.F.R. § 42.104(A))

Petitioners certify that the ’994 Patent is eligible for, and Petitioners are not barred or estopped from requesting, IPR. Petitioners were served with a Complaint asserting infringement of the ’994 Patent on or after September 12, 2024. Neither Petitioners nor any other real party-in-interest or privy was served with a complaint asserting infringement of the ’994 Patent before that date or has initiated a civil action challenging the ’994 Patent’s validity.

IV. GROUNDS (37 C.F.R. § 42.22 AND 37 C.F.R. § 42.104(B))

The Petitioners request IPR of claims 1-23 as unpatentable under § 103:

Ground	Prior Art	Basis	Claims Challenged
Ground 1	Pevear, Poff, and Porsche	103	1, 4-9, 11-16 and 18-23
Ground 2	Pevear, Poff, Porsche, and Wu	103	2
Ground 3	Pevear, Poff, Porsche, and Kashine	103	3
Ground 4	Pevear, Poff, Porsche, and Shibano	103	10 and 17

Pevear, Porsche, Poff, Kashine, and Shibano were not considered by the Examiner during the ’994 Patent’s prosecution. Wu was cited against dependent claims. However, the Examiner allowed the application based on limitations in the independent claims unrelated to the citations of Wu. Ex. 1004: pp. 13-14. Therefore, the prior art grounds presented herein are not cumulative to grounds deemed by the Examiner to substantively lack merit.

§ VI(D)-(G) specifies how the prior art renders the Claims unpatentable. The Declaration of technical expert, Louis Hruska, is attached in support (Ex. 1002: ¶¶1-114) and Mr. Hruska's credentials are established in his CV (Ex. 1003).

V. THE '994 PATENT

The Claim Listing Appendix provides a listing of Challenged Claims 1-23.

A. Priority Claims

The '994 Patent was filed on May 23, 2013, as a U.S. National Phase Entry of WIPO International Application No. PCT/US2011/001937, filed November 28, 2011, and also claimed priority to U.S. Provisional Application No. 61/458,657 (the '657 Provisional; Ex. 1004: pp. 141-163), filed November 29, 2010, and U.S. Provisional Application No. 61/463,736 (the '736 Provisional; Ex. 1004: pp. 168-186), filed February 22, 2011.

B. The Priority Date of the '994 Patent Claims

Independent claim 1 recites "a 12 volt to 120 volt operating system" and "a battery pack housing having at least a first portion and a mating second portion." Independent claim 14 recites "a 1 volt to 120 volt operating system" and "a battery pack housing having at least first and second mating portions."

The '657 Provisional fails to provide support for numerous claim limitations recited in independent claims 1 and 14 of the '994 Patent, including the plurality of pairs of solid state switches, the parallel configuration of the pairs, and the

connection of drains or sources for switches of each pair. The ’736 Provisional fails to provide support for the voltages other than 12 volts in the “12 volt to 120 volt” operating system voltage range. The ’736 Provisional further fails to provide support for the “battery pack housing having at least a first portion and a mating second portion” (claim 1) and the “battery pack housing having at least first and second mating portions” (claim 14).

Petitioners note that possession of an invention can only be established when a single priority application discloses the claimed invention. *Studiengesellschaft Kohle, M.B.H. v. Shell Oil Co.*, 112 F.3d 1561, 1564–65 (Fed. Cir. 1997). Therefore, the challenged claims are not entitled to the priority dates of the ’657 Provisional or the ’736 Provisional. The effective filing date of these claims does not precede the November 28, 2011, filing date of PCT No. PCT/US2011/001937.

C. Specification

The specification discloses a common battery housing containing cells with positive and negative ends connected in series within the housing, and the housing having positive and negative terminals. The specification purports to disclose a novel configuration of solid state devices with connected sources or drains “allows current to flow in one direction but not the other with an internal diode.” Ex. 1001: 2:46-47. The specification further purports to disclose a novel configuration of “solid state switches in parallel” used “to increase the current capabilities.” Ex. 1001: 9:2-3.

VI. DETAILED REASONS FOR RELIEF

There is at least a reasonable likelihood that the Petitioners will prevail with respect to at least one of the Claims, as they are unpatentable under § 103.

A. Claim Construction

Generally, the terms should receive their respective plain and ordinary meaning as understood by a person having ordinary skill in the art under *Phillips v. AWH Corp.,* 415 F.3d 1303 (Fed. Cir. 2005). In the related ITC proceeding, an Order construing certain claim terms issued on February 21, 2025. Ex. 1005. This order adopted the definition discussed below in § VI(B) concerning the level of ordinary skill in the art. *Id.* at p. 4. In the Order, the term "1 volt" in the preamble of claim 14 is construed to mean "12 volt." *Id.* at pp. 8-11. Moreover, there remains a dispute in the ITC proceeding regarding whether "a circuit board within said housing configured to balance each individual cell within said housing" (claim 1) and "a circuit board within said housing having a cutoff function incorporated therein" (claims 1 and 14) are means-plus-function limitations.

Without waiving any right to raise indefiniteness in the District Courts or in the ITC proceeding, review is still appropriate here because a determination of unpatentability is not impossible given that the prior art references disclose at least the same structure for performing the same functions described in the specification

and claims. *Samsung Electronics v. Prisua Engineering,* 948 F.3d 1342, 1355 (Fed. Cir. 2020).

B. Level of Ordinary Skill

A person of ordinary skill in the art ("POSITA") on or before November 28, 2011, would have a minimum of a Bachelor of Science degree in electrical engineering or an equivalent degree, and two or more years of engineering experience in the design of rechargeable Lithium-ion batteries as well as at least some experience in the design of battery management systems for such batteries. An advanced degree in electrical engineering or an equivalent field of study, such as a Masters or doctorate, may be substituted for the required experience. Further education could also suffice in lieu of experience in the field or further experience in the field could substitute for formal education. Ex. 1002: ¶¶10-11. A POSITA is presumed to have knowledge of all relevant prior art, and would thus have been familiar with each of the references cited herein, as well as the background knowledge in the art, and the full range of teachings they contain.

C. Summary of Cited Prior Art

1. U.S. Patent Publication No. 2013/0101874 ("Pevear")

Pevear (Ex. 1006) published on April 25, 2013. Pevear is a National Phase Entry of PCT Application No. PCT/US10/59127, filed December 6, 2010, and claims priority to U.S. Provisional Application No. 61/266,724, filed December 4, 2009 ("the Pevear Provisional;" Ex. 1007: pp. 4-18 and 23-74). Pevear is prior art to the '994 Patent under pre-AIA 35 U.S.C. § 102(e).

The critical reference date of a U.S. patent application publication may be the filing date of a relied upon provisional application if the disclosure relied upon finds support in the provisional application and at least one of the claims in the U.S. patent application publication is supported by the written description of the provisional application. *Amgen Inc. v. Sanofi,* 872 F.3d 1367, 1380 (Fed. Cir. 2017). Pevear's reference date under § 102(e) is December 4, 2009. The chart below explains where support for each claim of Pevear finds support in the Pevear Provisional.

Pevear Claim Element	Pevear Provisional Support (Ex. 1007)
1. A battery system comprising:	Ex. 1007: p. 5, ¶[0012]: "An automotive battery consists of […]"

a battery housing with first and second voltage output terminals;	Ex. 1007: p. 6, ¶[0013]: "FIG. 1 shows an automotive battery 100 with a outer case 110, a negative terminal 102 and a positive terminal 104, and a LIN (Local Interconnect Network) management interface 106. Case 110 is molded, and **lead-free terminals 102 and 104 are insert-molded in place into the case**. The case consists of a top cover that includes the terminals, and an enclosure base."
a plurality of rechargeable battery cells within the battery housing and having first and second voltage terminals;	Ex. 1007: p.4, ¶[0003]: "A rechargeable battery may be used in terrain, marine, or aeronautic vehicles in various applications. One application is as a starter battery to drive the starter motor of the vehicle. Starter battery applications may require high electrical currents to drive the starter motor, and the ability to be recharged from the vehicle's alternator. Most current automotive starter batteries are of lead acid construction. However, lithium-ion (Li-Ion) batteries may be used instead of lead acid batteries. Li-Ion batteries can provide improved power-to-weight ratios, longer cycle lives, and environmental benefits due to the lack of lead." Ex. 1007: p. 5, ¶[0012]: "[…]an assembly of cell subassemblies, each containing prismatic Li-Ion battery cells, where the cells are electrically connected to the other cells in the module to form the battery."

a power management system for generating an external control signal and an internal control signal based upon monitored operating parameters of the plurality of rechargeable battery cells, said external control signal for controlling an external power source and/or an external load, said power management system forming an integral part of the battery system; and	Ex. 1007: p. 5, ¶[0012]: "The battery has an **integrated power management system that provides passive (through control of components external to the battery) and active (through internal controls) protection** against over-charge, over-discharge, over-temperature, and over-current." Ex. 1007: p. 8, ¶[0020]: "Power management system 400 **communicates directly or indirectly to the automobile's alternator to passively control the amount of charge current to the battery**. In this manner, the battery pack is able to optimize the amount of current flow to passively control the battery's state of charge. This is accomplished by the **power management system internally monitoring the voltage, current, temperature, and other relevant parameters of the system**. Microprocessor 402 processes this information to determine appropriate charging parameters, and then communicates to and/or controls the alternator to increase or decrease the amount of charge current into the battery pack." Ex. 1007: p. 8, ¶[0021]: "Power management system 400 **communicates with the automobile's body/load controller to control the amount of discharge current to passively control the battery's state of charge**. In this manner, the battery pack is able to optimize the amount of current flow to passively control the battery's state of charge. This is also accomplished by **the power management system internally monitoring the voltage,**

	current, temperature, and other relevant parameters of the system." Ex. 1007: p. 9, ¶[0022]: "In addition to the above passive control of the battery's state by controlling the battery's external power sources and loads, **power management system 400 also detects and actively prevents excessive current flow through the battery, in order to actively control the state of charge of the battery. Microprocessor 402 internally monitors the voltage, current, temperature, and other relevant parameters of the system. Microprocessor 402 uses this information to control a very high power cutoff switch** (described below) to actively control the flow of current through the battery pack."
a cutoff switch circuit within the battery housing and for making and breaking a conductive path between the first voltage terminal of the plurality of battery cells and the first voltage output terminal of the battery housing in response the internal control signal from the battery management system.	Ex. 1007: p. 9, ¶[0023]: "As part of performing the above functions, **the microprocessor 402 is configured to control and monitor a cutoff component** 322 that can be used to selectively connect or disconnect the battery from the load(s) connected to its terminals. Cutoff component 322 provides over- voltage, under-voltage, over-current and over-temperature protection. **The cutoff component 322 is effectively a bi-directional switch that can be used to control whether the cells in battery cell assembly 320 are electrically connected to the terminals for charging, and separately control this connection for discharging**. The cutoff component may also be configured to be a uni-directional switch, used only to control battery charging.

2. The battery system of claim 1, wherein the battery cells are lithium ion cells.	Ex. 1007: p. 5, ¶[0012]: "An automotive battery consists of an assembly of cell subassemblies, each containing prismatic Li-Ion battery cells, where the cells are electrically connected to the other cells in the module to form the battery."
3. The battery system of claim 1, wherein the cutoff switch comprises a plurality of metal-oxide semiconductor field effect transistors (MOSFETs).	Ex. 1007: p. 9, ¶[0024]: "Cutoff component 322 includes two groups of parallel MOSFET devices, each of which the power management system 400 operates as a single, uni-directional switch to selectively allow or disallow current flow to the battery depending on whether the MOSFETs are switched to an ON or OFF state."
4. The battery system of claim 3, wherein the plurality of MOSFETs are arranged as groups of parallel MOSFETs.	Ex. 1007: p. 10, ¶[0025] and p. 16, FIG. 4: "Each MOSFET is electrically connected in parallel with the other MOSFETS within its group, with its drain and source terminals oriented so that when the MOSFET is in an ON state, current is allowed to flow to charge/discharge the battery. The gate terminals of each MOSFET in a group are connected together to effect a single switching control. The two groups of parallel MOSFETs are electrically connected in series with each other and in series with the battery cells within the battery."

5. The battery system of claim 3, wherein the plurality of MOSFETs include a first group of MOSFETs connected in parallel with each other and a second group of MOSFETs connected in parallel with each other and wherein the first group is connected in series with the second group.	Ex. 1007: p. 10, ¶[0025] and p. 16, FIG. 4: "Each MOSFET is electrically connected in parallel with the other MOSFETS within its group, with its drain and source terminals oriented so that when the MOSFET is in an ON state, current is allowed to flow to charge/discharge the battery. The gate terminals of each MOSFET in a group are connected together to effect a single switching control. The two groups of parallel MOSFETs are electrically connected in series with each other and in series with the battery cells within the battery."
6. The battery system of claim 3, further comprising a busbar in electrical communication with the plurality of rechargeable battery cells and the plurality of MOSFETs.	Ex. 1007: p. 6, ¶[0014] and p. 14, FIG. 2: "The individual battery cells are electrically connected in parallel and/or series by busbars (described in the Related Application) which connect the cells to one another and to the terminals of the battery. One such busbar 208 is shown in FIG. 2 connecting one respective terminal of each of four different battery cells together. Busbar 208 also connects the four terminals to positive terminal 104." Ex. 1007: p. 12, ¶[0033] and p. 18, FIG. 6: "The MOSFET devices are chosen in part so that the drain and source terminals are on opposite sides of the device, with each attached to a respective one of the conductors of the busbar 610 or 612."

7. The battery system of claim 3, further comprising a shunt resistor in electrical communication with the plurality of MOSFETs.	Ex. 1007: p. 10, ¶[0027] and p. 16, FIG. 4: "Cutoff component 322 can provide an indication of the current flow through the component (and thus of the current through the battery) in one of two ways. First, the voltage across a **shunt resistor** 436 of known resistance can be used to provide a voltage signal proportional to the current, as is shown in FIG. 4."
8. The battery system of claim 3, further comprising a temperature sensor in thermal communication with the MOSFETs.	Ex. 1007: p. 10, ¶[0028]: "This is accomplished by using **temperature measuring devices 438 packaged in close thermal proximity to the MOSFET devices**, which are themselves packaged in close thermal proximity to each other."
9. The battery system of claim 1, wherein the battery is an automotive battery.	Ex. 1007: p. 4, ¶[0002]: "The present invention relates to automotive batteries and scalable architectures for manufacturing automotive batteries."
10. The method of claim 9, wherein the external power source comprises an alternator.	Ex. 1007: p. 8, ¶[0020]: "Power management system 400 communicates directly or indirectly to the automobile's alternator to passively control the amount of charge current to the battery."
11. The battery system of claim 1, wherein the battery is a telecommunications battery.	Ex. 1007: p. 12, ¶[0034]: "The cutoff component and/or power management system may also be used separately from the battery. Systems of multiple batteries that use just a single series cutoff component and/or power management system may also be used, for example, in telecom applications."

12. A method for operating a battery system comprising:	Ex. 1007: p. 5, ¶[0012]: "The battery has an integrated power management system that provides passive (through control of components external to the battery) and active (through internal controls) protection against over-charge, over-discharge, over-temperature, and over-current. The battery also includes a scalable battery cutoff component controlled by the power management system."
monitoring operating parameters of a plurality of rechargeable battery cells within a battery housing;	Ex. 1007: p. 8, ¶[0020]: "This is accomplished by the power management system internally monitoring the voltage, current, temperature, and other relevant parameters of the system." Ex. 1007: p. 8-9, ¶ [0021]: "This is also accomplished by the power management system internally monitoring the voltage, current, temperature, and other relevant parameters of the system." Ex. 1007: p. 9, ¶[0022]: "Microprocessor 402 internally monitors the voltage, current, temperature, and other relevant parameters of the system." Ex. 1007: p. 6, ¶[0013]: "FIG. 1 shows an automotive battery 100 with a outer case 110, a negative terminal 102 and a positive terminal 104, and a LIN (Local Interconnect Network) management interface 106." Ex. 1007: p. 5, ¶[0012]: "[…]an assembly of cell subassemblies, each containing prismatic Li-Ion battery cells, where the cells are electrically connected to the other cells in the module to form the battery." Ex. 1007: p. 16, FIG. 4.

generating an external control signal and an internal control signal based upon the monitored operating parameters of a plurality of rechargeable battery cells, said external control signal for controlling an external power source and/or an external load; and	Ex. 1007: p. 5, ¶[0012]: "The battery has an integrated power management system that **provides passive (through control of components external to the battery) and active (through internal controls) protection** against over-charge, over-discharge, over-temperature, and over-current." Ex. 1007: p. 8, ¶[0020]: "Power management system 400 **communicates directly or indirectly to the automobile's alternator to passively control the amount of charge current to the battery**. In this manner, the battery pack is able to optimize the amount of current flow to passively control the battery's state of charge. This is accomplished by the power management system internally monitoring the voltage, current, temperature, and other relevant parameters of the system. Microprocessor 402 processes this information to determine appropriate charging parameters, and then communicates to and/or controls the alternator to increase or decrease the amount of charge current into the battery pack." Ex. 1007: p. 8-9, ¶[0021]: "Power management system 400 **communicates with the automobile's body/load controller to control the amount of discharge current to passively control the battery's state of charge**. In this manner, the battery pack is able to optimize the amount of current flow to passively control the battery's state of charge. This is also accomplished by the power management system internally monitoring the voltage, current, temperature, and other relevant parameters of the system."

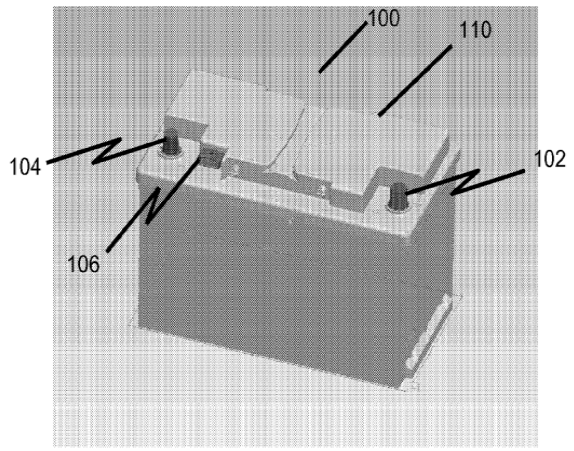
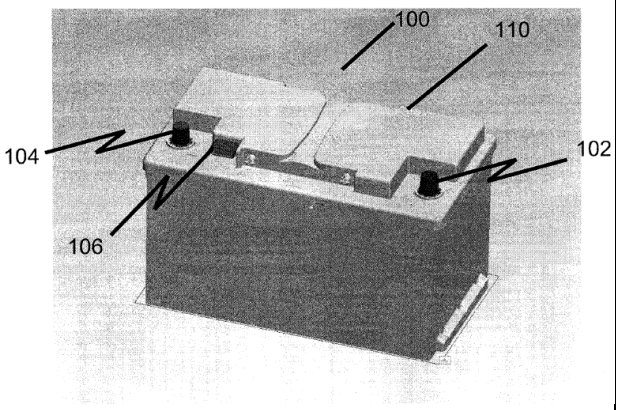
making or breaking a conductive path between the first voltage terminal of the plurality of battery cells and the first voltage output terminal of the battery housing in response to the internal control signal.	Ex. 1007: p. 9, ¶[0022]: "In addition to the above passive control of the battery's state by controlling the battery's external power sources and loads, **power management system 400 also detects and actively prevents excessive current flow through the battery, in order to actively control the state of charge of the battery. Microprocessor 402 internally monitors the voltage, current, temperature, and other relevant parameters of the system. Microprocessor 402 uses this information to control a very high power cutoff switch** (described below) to actively control the flow of current through the battery pack."
13. The method for operating a battery system of claim 12, wherein the operating parameters comprise voltage across a shunt resistor within the battery housing.	Ex. 1007: p. 10, ¶[0027]: "Cutoff component 322 can provide an indication of the current flow through the component (and thus of the current through the battery) in one of two ways. First, the voltage across a shunt resistor 436 of known resistance can be used to provide a voltage signal proportional to the current, as is shown in FIG. 4."

14. The method for operating a battery system of claim 12, wherein the operating parameters comprise temperature and voltage across a plurality of metal-oxide semiconductor field effect transistors (MOSFETs) within the battery housing.	Ex. 1007: p. 10, ¶[0028]: "Second, the current may be measured by determining the voltage across the drain-source resistance in the MOSFET's ON state ($R_{DS(on)}$) using a temperature-compensated resistance measurement. This is accomplished by using temperature measuring devices 438 packaged in close thermal proximity to the MOSFET devices, which are themselves packaged in close thermal proximity to each other." Ex. 1007: p. 10, ¶[0029]: "Specifically, power management system 400 uses the measured temperature to determine a temperature-calibrated $R_{DS(on)}$, which is the used to convert the voltage measured across the drain-source terminals into a current without the need for a relatively expensive precision current sensor."
15. The method for operating a battery system of claim 12, wherein the making or breaking a conductive path comprises activating a cutoff switch comprising a plurality of metal-oxide semiconductor field effect transistors (MOSFETs).	Ex. 1007: p. 9, ¶[0024]: "Cutoff component 322 includes two groups of parallel MOSFET devices, each of which the power management system 400 operates as a single, uni-directional switch to selectively allow or disallow current flow to the battery depending on whether the MOSFETs are switched to an ON or OFF state. One MOSFET group controls whether current can flow in a direction that charges the battery, and the second group controls whether current can flow in a direction that discharges the battery."

In this section, for each pertinent disclosure, Petitioners will cite both Pevear and the corresponding disclosure in the Pevear Provisional to illustrate support for the earlier reference date. In subsequent sections, Petitioners will only cite Pevear.

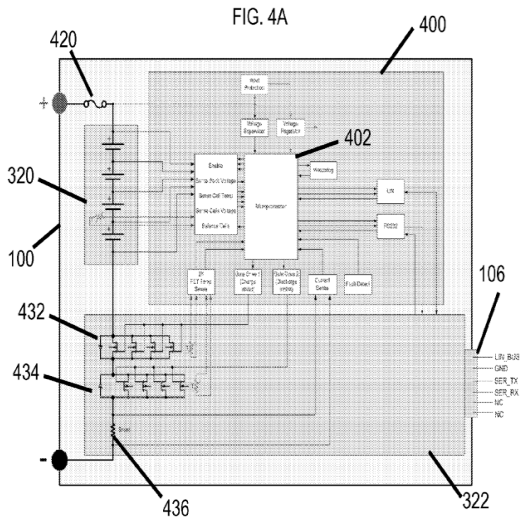
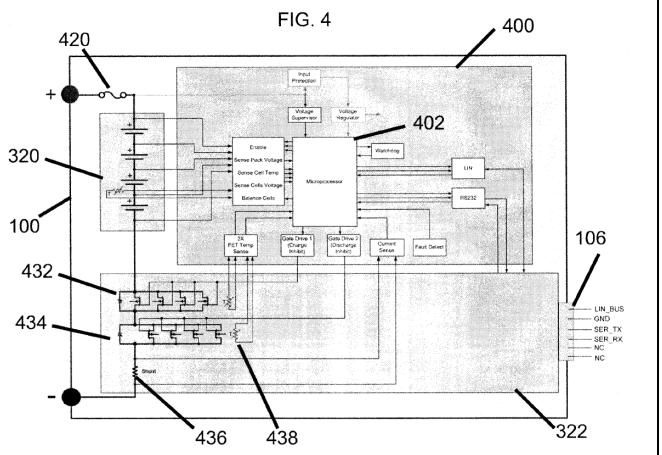
Pevear discloses a battery with an integrated power management system and a scalable cutoff component. Ex. 1006: Abstract; Ex. 1007: p. 1, Title. Pevear discloses that the battery may be an automotive battery. Ex. 1006: claim 9; Ex. 1007: p. 1, Title. Pevear specifically discloses rechargeable batteries which may be used as starter batteries to drive the starter motor of the vehicle. Ex. 1006: ¶[0004]; Ex. 1007: p. 4, ¶[0003]. The batteries may be lithium ion batteries which can be used instead of lead acid batteries and provide improved power-to-weight ratios, longer cycle lives, and environmental benefits due to the lack of lead. Ex. 1006: ¶[0004]; Ex. 1007: p. 4, ¶[0003].

The battery includes an outer case (110) having a top cover and an enclosure based, with terminals (102, 104) insert-molded in place on the top cover of the case. Ex. 1006: ¶[0019] and FIG. 1; Ex. 1007: p. 6, ¶[0013] and p. 13, FIG. 1. The drawings from Pevear and the Pevear Provisional are reproduced below. For ease of reading, the Pevear figures, which were elongated in the vertical direction, have been copied here with a corrected aspect ratio to diminish the distortion. The Pevear figures in their original aspect ratio are shown in Ex. 1006.

Pevear's FIG. 1:	Pevear Provisional's FIG. 1:
FIG. 1 	FIG. 1 

The power management system is configured to sense individual battery cell voltages and to balance the voltages of each cell by controlling each cell's connection to small resistive loads placed in parallel with each cell. Ex. 1006: ¶[0031]; Ex. 1007: p. 7-8, [0019]. The power management system includes a microprocessor configured to control and monitor a cutoff component that can be used to selectively connect or disconnect the battery from the load(s) connected to its terminals. Ex. 1006: ¶[0039]; Ex. 1007: p. 9, ¶[0023]. The cutoff component can effectively be a bidirectional switch that can be used to control charging and discharging separately and which provides over-voltage, under-voltage, over-current, and over-temperature protection for the battery system. Ex. 1006: ¶[0039]; Ex. 1007: p. 9, ¶[0023].

The cutoff component includes two groups of parallel arranged MOSFET devices (432, 434) connected in series. Ex. 1006: ¶[0040] and FIG. 4A; Ex. 1007: p. 9, ¶[0024] and p. 16, FIG. 4. The drawings from Pevear and the Pevear Provisional are reproduced below.

Pevear's FIG. 4A:	Pevear Provisional's FIG. 4:
	

Paragraph [0040] of Pevear is reproduced below:

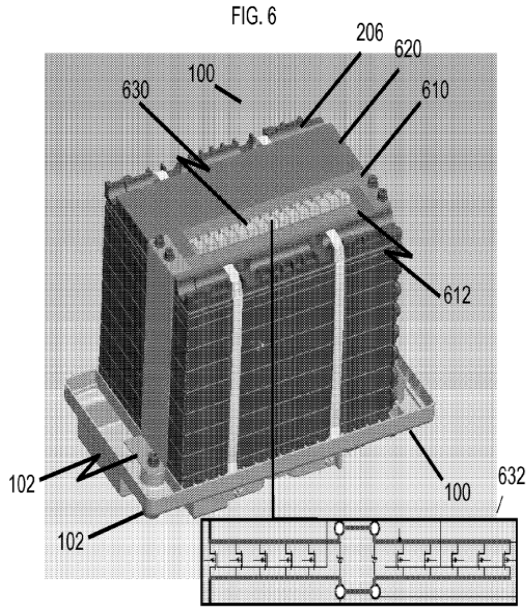
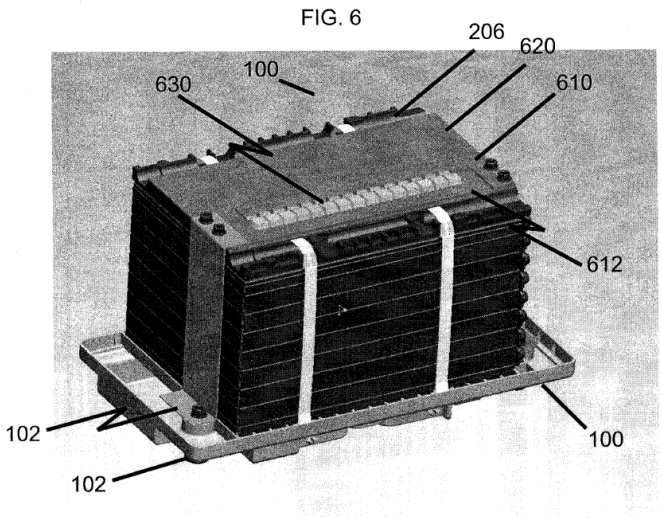
> As shown in FIG. 4A, cutoff component 322 includes two groups of parallel arranged MOSFET devices 432 and 434 connected in series. Power management system 400 operates each group to selectively allow or disallow current flow to or from the battery, depending on whether the MOSFETs are switched to an On or Off state. Because the MOSFET groups 432, 434 are arranged in series, the MOSFETs, one MOSFET group controls whether current can flow in a direction

> that charges the battery, and the second group controls whether current can flow in a direction that discharges the battery. Therefore, the series arrangement of the two groups creates a bi-directional switch. The parallel arrangement of the MOSFETs within each group splits the current flow across the MOSFETs, allowing the use of MOSFETs with lower current-carrying ratings than the maximum currents expected for charging and discharging of the battery.

Ex. 1006: ¶[0040]; Ex. 1007: p. 9, [0024].

Pevear discloses an embodiment with the two groups of MOSFETs (432, 434) connected in series with each other and in series with the cells (320) between the negative terminal (-) of the battery pack and the positive terminal (+) of the battery pack. Ex. 1006: FIG. 4A; Ex. 1007: p. 16, FIG. 4.

The MOSFETs (630) may be positioned on a printed circuit board (620) within the case/housing. Ex. 1006: ¶[0053] and FIG. 6; Ex. 1007: pp. 12-13, ¶[0033] and p. 18, FIG. 6. The drawings from Pevear and the Pevear Provisional are reproduced below.

Pevear's FIG. 6:	Pevear Provisional's FIG. 6:
	

Pevear further discloses that the microprocessor processes parameters of the system, such as monitored voltage, current, temperature, etc. to determine appropriate charging parameters and controls the load controller to increase or decrease the discharge current from the battery by selectively connecting or disconnecting loads to/from the battery. Ex. 1006: ¶[0037]; Ex. 1007: p. 8-9, ¶[0021].

Pevear also discloses monitoring voltage, current, temperature, and other relevant parameters and using this information to control a power cutoff switch to actively control the flow of current through the battery pack. Ex. 1006: ¶[0038]; Ex. 1007: p. 9, ¶[0022].

2. "World Debut: Starter Battery in Lithium-Ion Technology," dated November 23, 2009 ("Porsche")

Porsche (Ex. 1008) is a press release dated November 23, 2009 and was published online and available to the public through Porsche's website. Two articles from motortrend.com dated November 23, 2009 (Ex. 1009) and November 24, 2009 (Ex. 1010) further corroborate the publication date of the Porsche reference being November 23, 2009. Further, the Internet Archive's Wayback Machine archived Porsche at least as early as September 14, 2010 (Ex. 1015: ¶¶ 5-8). Porsche is prior art under at least pre-AIA 35 U.S.C. § 102(b). and is prior art under at least pre-AIA 35 U.S.C. § 102(b).

Porsche discloses a lithium-ion starter battery weighing 22 pounds less than a conventional lead battery. Ex. 1008: p. 1. The battery has a nominal capacity of 18 Ah. Ex. 1008: p. 1. An advantage of the lithium-ion battery is that it allows a significantly greater number of charging and discharging cycles. Ex. 1008: p. 2. The battery is a lithium-iron-phosphate battery and "consistently guarantees the usual voltage of 12 V in the car's on-board network." Ex. 1008: p. 2. The battery is made up of four cells and integrated control electronics including a battery management system that protects from major discharge and guarantees a consistent charge level within the individual cells. Ex. 1008: p. 2.

3. U.S. Patent Publication No. 2007/0145944 ("Poff")

Poff (Ex. 1011) published on June 28, 2007, and is prior art to the '994 Patent under at least pre-AIA 35 U.S.C. § 102(b). Poff discloses an enhanced battery pack having an enhanced protection system. Ex. 1011: Abstract. The enhanced protection system includes a conventional protection circuit and a redundant protection circuit, which are connected in parallel. *Id.* When an undesirable condition (e.g., overcharge of one of the lithium ion cells) occurs, the conventional protection circuit prevents electrical current from flowing to protect the lithium ion cells and any external devices connected to the battery pack. Ex. 1011: ¶ [0009]. However, this conventional protection system may undesirably detract from the effectiveness of the battery pack when there is a fault in one of the components of the conventional protection system instead of an undesirable internal or external condition that would potentially harm the lithium ion cell(s) or an external device connected to the battery pack. Ex. 1011: ¶ [0011]. Advantageously, the inclusion of the redundant protection circuit allows the battery pack to continue functioning when there is a fault in the conventional protection system but no unsafe internal or external condition. Ex. 1011: ¶ [0017]. "Likewise, if the redundant protection circuit becomes inoperable due to one or more of the components of the redundant protection circuit being faulty, the conventional protection circuit 20 can be used as a backup so that the enhanced battery pack will continue to function while the enhanced protection

system continues to protect the enhanced battery pack." Ex. 1011: ¶ [0017].

4. U.S. Patent Publication No. 2007/0080662 ("Wu")

Wu (Ex. 1012) published on April 12, 2007, and is prior art to the '994 Patent under pre-AIA 35 U.S.C. § 102(b). Wu discloses a Master Control Module for controlling a battery back which includes a controller having di-electrical impedance detection circuitry, a fuse that can disconnect power to the battery pack when the battery pack is short-circuited, and the capability of switching on/off a high voltage bus in response to a command or power on signal. Ex. 1012: ¶¶[0070]-[0073].

5. U.S. Patent No. 2003/0169021 ("Kashine")

Kashine (Ex. 1013) published on September 11, 2003, and is prior art to the '994 Patent under pre-AIA 35 U.S.C. § 102(b). Kashine relates to secondary battery protection devices. Ex. 1013: Title. Kashine discloses that, when an excess current is generated in a power supply circuit, an output can be generated by a current detection means and a sense amplifier. Ex. 1013: ¶[0021]. The output is input to a latch and an output of the latch is inputted to a logic circuit having an output which turns off a switching element, thereby shutting off the path of the battery. Ex. 1013: ¶[0021].

6. U.S. Patent Publication No. 2004/0096745 ("Shibano")

Shibano (Ex. 1014) published on May 20, 2004, and is prior art to the '994 Patent under pre-AIA 35 U.S.C. § 102(b). Shibano discloses lithium ion conductors for rechargeable batteries. Ex. 1014: Title. Shibano teaches that preferred positive electrode materials include "transition metal oxides such as $LiCoO_2$, $LiNiO_2$, $LiMn_2O_4$, $LiNi_{0.4}Mn_{1.6}O_4$, $LiCo_{0.3}Ni_{0.7}O_2$, V_2O_5 and MnO_2" and "olivine oxides such as $LiCoPO_4$, $LiFePO_4$, $LiCoPO_4F$ and $LiFePO_4F$." Ex. 1014: ¶[0030].

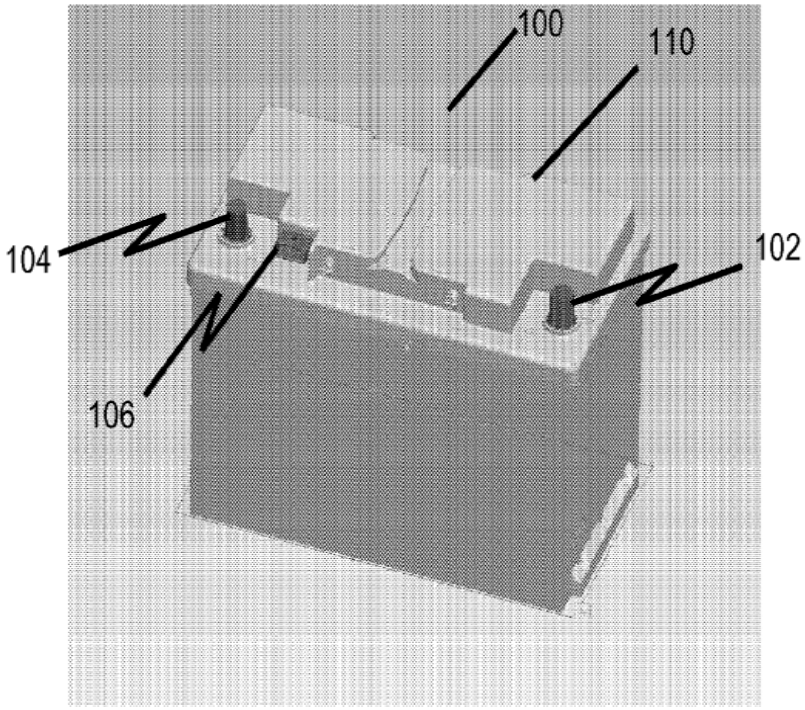
D. Claims 1, 4-9, 11-16 and 18-23 are unpatentable under § 103 over Pevear, Porsche, and Poff (Ground 1)

1. Invalidity of Claim 1 Over Pevear in view of Porsche and Poff

(a) Element [1pre]: "A battery pack for driving an electrical device in a 12 volt to 120 volt operating system, said battery pack having a positive terminal and a negative terminal, comprising"

To the extent that the preamble is limiting, Pevear discloses an automotive battery (100) having a positive terminal (104) and a negative terminal (102) insert molded on an outer case (110). Ex. 1006: ¶[0019] and FIG. 1.

FIG. 1



Pevear discloses that the battery may be used as a starter battery to drive the starter motor of the vehicle. Ex. 1006: ¶[0004]. The starter motor is an electrical device. Ex. 1002: ¶39. Pevear also discloses that a battery is designed for used vehicle operating systems, such as a replacement for lead acid batteries in vehicles, that can be charged from the vehicle's alternator and used to provide power for micro-hybrid (start-stop) drive systems, where 12-volt is the standard voltage. Ex. 1006: ¶[0005]; Ex. 1002: ¶39. Pevear also discloses four cells in series, which at standard lithium cell voltages is more than 12 Volts. Ex. 1006: FIG. 4A; Ex. 1002: ¶39. To the extent, PO argues that Pevear does not disclose the 12 volt to 120 volt

operating system voltage. Porsche discloses a lithium iron phosphate starter battery which "consistently guarantees the usual voltage of 12 V in the car's on-board network." Ex. 1008: p. 2. 12 V is a standard operating system voltage for car starter batteries as taught by Porsche and known to a POSITA. Ex. 1002: ¶39.

(b) Element [1a]: "a battery pack housing having at least a first portion and a mating second portion;"

Pevear also refers to the case as a housing. Ex. 1006: claim 1. Pevear discloses that the case consists of a top cover and an enclosure base. Ex. 1006: ¶[0019]. The top cover and the enclosure base are a first portion and a mating second portion. Ex. 1006: FIGS. 1 and 2; Ex. 1002: ¶40.

(c) Element [1b]: "at least one lithium-based rechargeable cell within said housing, each such cell having a positive pole and a negative pole;"

Pevear discloses "a plurality of rechargeable battery cells within the battery housing and having first and second voltage terminals." Ex. 1006: claim 1. The first and second voltage terminals are positive and negative poles. Ex. 1002: ¶41. The cells may be lithium ion cells. Ex. 1006: claim 2.

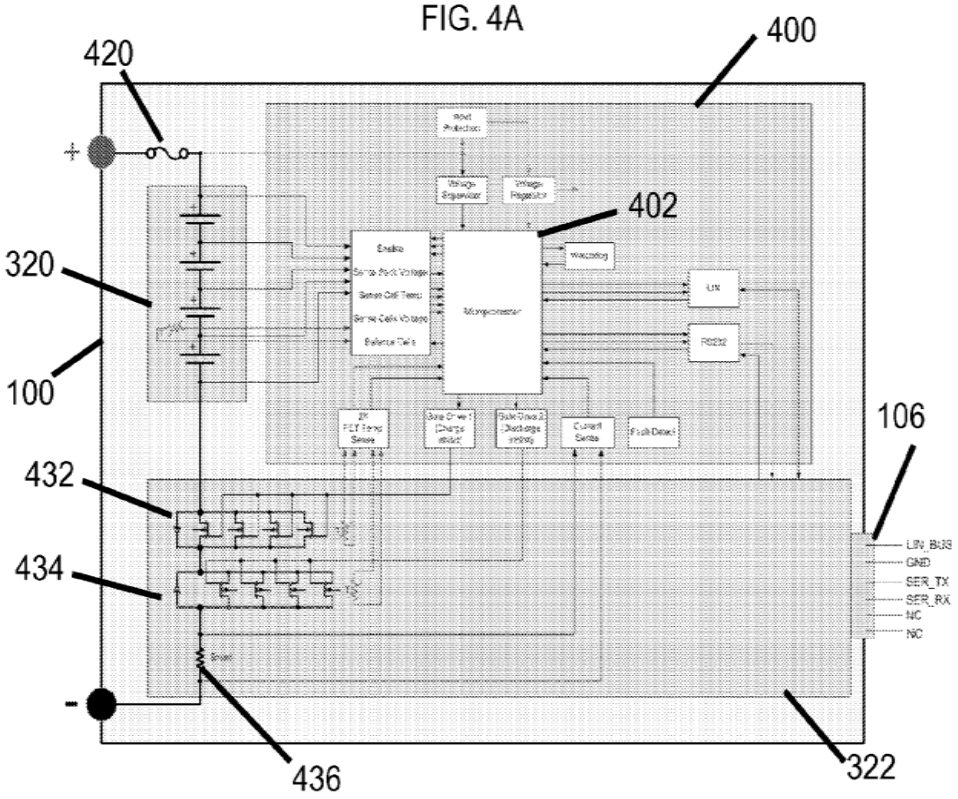
(d) Element [1c-i]: "a circuit board within said housing configured to balance each individual cell within said housing, and having a cutoff function incorporated therein,"

Pevear discloses an electronic power management system "to maintain balance between individual battery cells." Ex. 1006: ¶[0022]. The power

management system (400) includes a microprocessor (402) and is configured to sense individual battery cell voltages and balance the voltages of each cell. Ex. 1006: ¶¶ [0025], [0030], and [0031] and FIG. 4A. This constitutes balancing each individual cell. Ex. 1002: ¶42. The power management system is contained on a circuit board within the housing. Ex. 1006: ¶¶[0024], [0040], [0053], FIG. 4A, Claim 1.

The microprocessor (402) is also configured to control and monitor a cutoff component (322) that can be used to selectively connect or disconnect the battery from the load(s) connected to its terminals. Ex. 1006: ¶[0039] and FIG. 4A. This constitutes a cutoff function. Ex. 1002: ¶43. The control components can be provided on a printed circuit board or similar substrate. Ex. 1006: ¶[0053].

FIG. 4A



(e) Element [1c-ii]: "said circuit board including a plurality of pairs of solid state switches with each pair of solid state switches connected in a parallel configuration to another pair of solid state switches,"

Pevear discloses solid state switches on a circuit board, including a first group of MOSFETs arranged in parallel (432) and a second group of MOSFETs arranged in parallel (434). Ex. 1006: claim 5, ¶¶[0007], [0053], and FIG. 4A. MOSFETs are solid state switches. Ex. 1002: ¶44. The MOSFETs are not arranged in parallel pairs. Instead, the first and second groups (432, 434) are in series with each other. Ex. 1006: claim 5, ¶[0007], and FIG. 4A.

In the same field, Poff discloses an enhanced protection system for a battery pack including a conventional protection circuit and a redundant protection circuit.

Ex. 1011: Abstract. The protection system may cause an open circuit such that current is not allowed to flow from the battery back when an overvoltage or other undesirable condition occurs "with one or more of the Li ion cells" in the battery pack. Ex. 1011: ¶[0018]. Stopping current when an undesirable condition occurs is a cutoff function. Ex. 1002: ¶45. The conventional protection circuit includes conventional transistor pair (22) having a discharge transistor (24) and a charge transistor (26). Ex. 1011: ¶[0022]. The redundant protection circuit includes a redundant transistor pair (106) having a discharge transistor (108) and a charge transistor (110). Ex. 1011: ¶[0023]. The conventional transistor pair (22) and the redundant transistor pair (106) are in parallel in Poff. Ex. 1011: FIG. 4; Ex. 1002: ¶45.

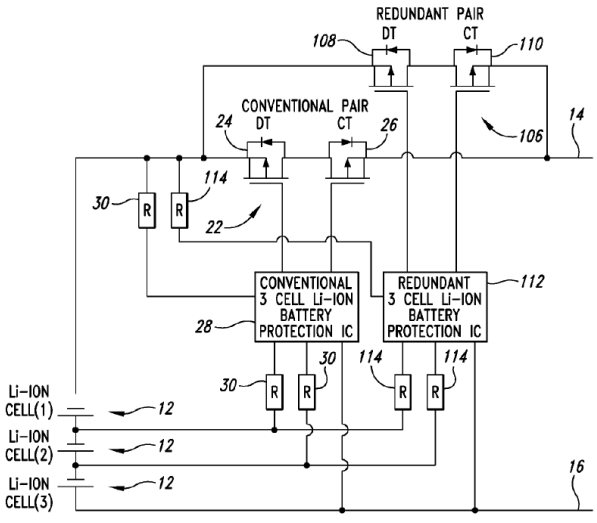


Fig. 4

(f) Element [1c-iii]: "each switch having a source and a drain, the switches of a pair of solid state switches being configured such that either the drains of the switches are connected or the sources of the switches are connected; and"

Poff discloses that the transistors can be MOSFETs. Ex. 1011: ¶¶[0022]-[0023]. MOSFETs inherently include a source, a gate, and a drain. Ex. 1002: ¶46. Poff illustrates the two MOSFETs in each pair of transistors where either the drains of the switches are connected or the sources of the switches are connected. Ex. 1011: Fig. 4; Ex. 1002: ¶46.

(g) Element [1d]: "said parallel configuration of the plurality of solid state switches being connected in series with said one or more cells between said positive and negative terminals of the battery pack."

Poff discloses that the battery pack includes a plurality of lithium-ion cells (12), a first external (negative) terminal (14), a second external (positive) terminal

(16), and parallel pairs (22, 106) of MOSFETs (24, 26, 108, 110) connected in series with the cells (12) between the terminals (14, 16). Ex. 1011: Fig. 4; Ex. 1002: ¶47.

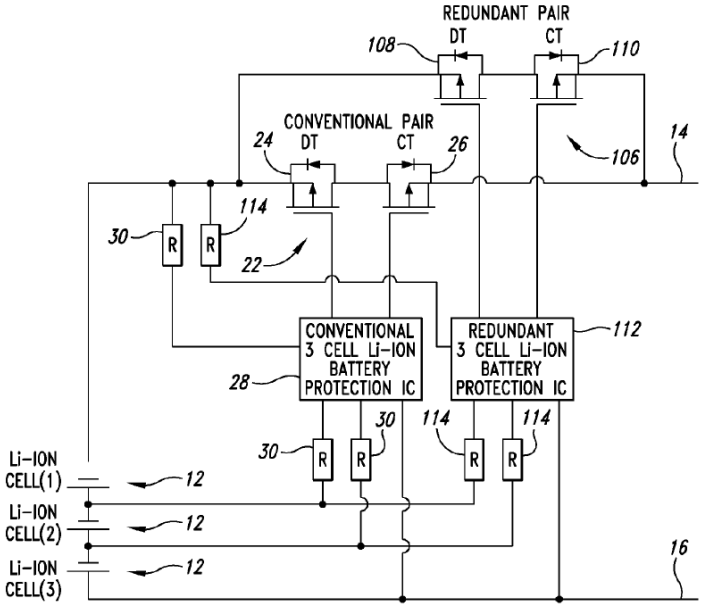


Fig. 4

2. Invalidity of Claim 4 Over Pevear in view of Porsche and Poff: "The battery pack according to claim 1, wherein said solid state switches are MOSFETs or IGBTs."

Pevear, Porsche, and Poff disclose Claim 1. *See* § VI(D)(1). Pevear discloses MOSFETs. Ex. 1006: ¶[0007]. Poff also discloses MOSFETs. Ex. 1011: ¶¶[0022]-[0023].

3. Invalidity of Claim 5 Over Pevear in view of Porsche and Poff: "The battery pack according to claim 1, wherein said solid state switches are transistors, FET, JFET, BJT, CMOS, VMOS, TMOS, vertical DMOS or HEXFET."

Pevear, Porsche, and Poff disclose Claim 1. *See* § VI(D)(1). Poff discloses MOSFETs, which are transistors and FETs. Ex. 1011: ¶¶[0022]-[0023].

4. Invalidity of Claim 6 Over Pevear in view of Porsche and Poff: "The battery pack according to claim 1, wherein said solid state switches are either n-type or p-type."

Pevear, Porsche, and Poff disclose Claim 1. *See* § VI(D)(1). Poff discloses that the transistors can be MOSFETs. Ex. 1011: ¶¶[0022]-[0023]. MOSFETs are inherently either n-type or p-type. Ex. 1002: ¶50. In the context of Poff's Fig. 4, the MOSFETs would be p-type if the terminal (14) is the positive terminal or n-type if the terminal (14) is the negative terminal. Ex: 1011: Fig. 4; Ex. 1002: ¶50.

5. Invalidity of Claim 7 Over Pevear in view of Porsche and Poff: "The battery pack according to claim 1, wherein said one or more cells are selected from the group consisting of LiFePO, $LiFePO_4$, $LiFeMgPO_4$, $LiFeYPO_4$, $LiCoO_2$, $LiMn2O_4$, $LiNiCoAlO_2$, $LiNiMnCoO_2$, Li4Ti5O12, lead-acid, NiCd, and nickel metal hydride (NiMH) batteries."

Pevear, Porsche, and Poff disclose Claim 1. *See* § VI(D)(1). Pevear discloses lithium ion cells but does not specifically disclose any particular lithium ion material. Pevear discloses that lithium ion batteries can be used instead of lead acid batteries to provide improved power-to-weight ratios. Ex. 1006: ¶[0004]. Pevear also discloses a battery with four lithium ion cells connected in series. Ex. 1006: FIG.

4A. Porsche discloses a lithium ion battery that is 22 pounds lighter than conventional lead batteries. Ex. 1008: p. 1. The battery includes four cells and integrated control electronics. Ex. 1008: p. 2. The cells are made from "lithium-iron-phosphate" and the battery "consistently guarantees the usual voltage of 12 V in the car's on-board network." Ex. 1008: p. 2. As used in Porsche, "lithium-iron-phosphate" is $LiFePO_4$. Ex. 1002: ¶51.

6. Invalidity of Claim 8 Over Pevear in view of Porsche and Poff: "The battery pack according to claim 1, wherein the lithium-based cell is a lithium iron phosphate cell."

Pevear, Porsche, and Poff disclose Claim 1. *See* § VI(D)(1). Pevear discloses lithium ion cells but does not specifically disclose any particular lithium ion material. Pevear discloses that lithium ion batteries can be used instead of lead acid batteries to provide improved power-to-weight ratios. Ex. 1006: ¶[0004]. Pevear also discloses a battery with four lithium ion cells connected in series. Ex. 1006: FIG. 4A. Porsche discloses a lithium ion battery that is 22 pounds lighter than conventional lead batteries. Ex. 1008: p. 1. The battery includes four cells and integrated control electronics. Ex. 1008: p. 2. The cells are made from "lithium-iron-phosphate" and the battery "consistently guarantees the usual voltage of 12 V in the car's on-board network." Ex. 1008: p. 2. As used in Porsche, "lithium-iron-phosphate" is $LiFePO_4$. Ex. 1002: ¶52.

7. Invalidity of Claim 9 Over Pevear in view of Porsche and Poff: "The battery pack according to claim 1, wherein the lithium iron phosphate cell is selected from the group consisting of LiFePO, $LiFePO_4$, $LiFeMgPO_4$, and $LiFeYPO_4$ cells."

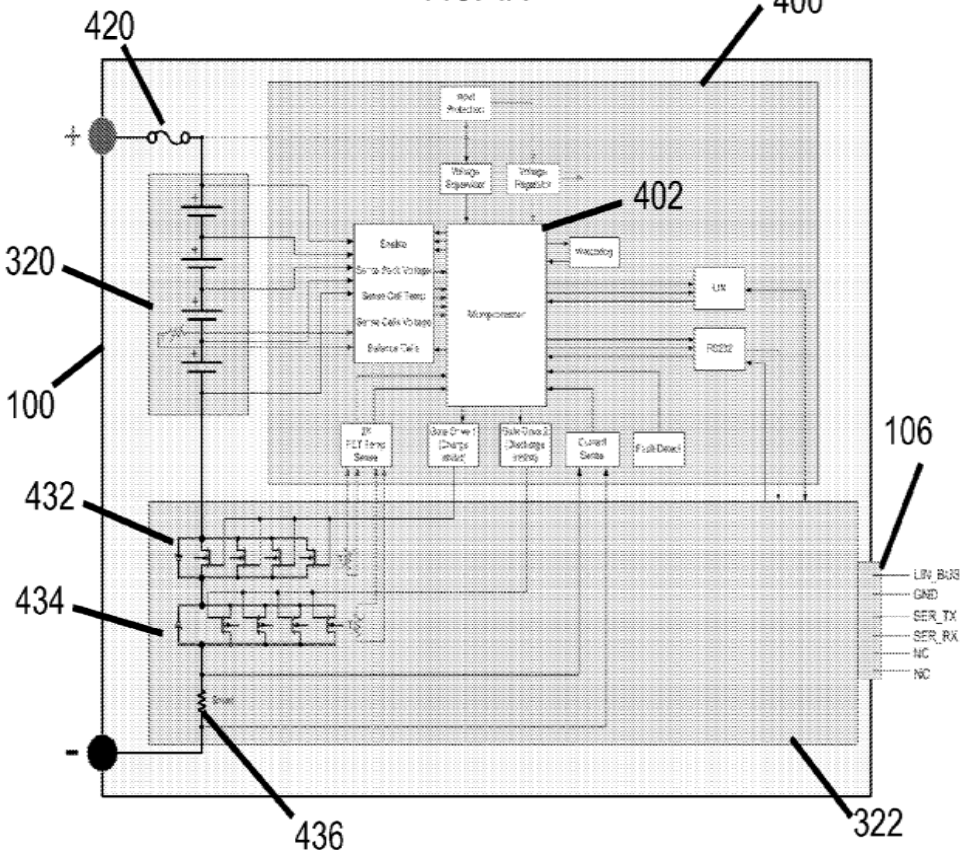
Pevear, Porsche, and Poff disclose Claim 1. *See* § VI(D)(1). Pevear discloses lithium ion cells but does not specifically disclose any particular lithium ion material. Pevear discloses that lithium ion batteries can be used instead of lead acid batteries to provide improved power-to-weight ratios. Ex. 1006: ¶[0004]. Pevear also discloses a battery with four lithium ion cells connected in series. Ex. 1006: FIG. 4A. Porsche discloses a lithium ion battery that is 22 pounds lighter than conventional lead batteries. Ex. 1008: p. 1. The battery includes four cells and integrated control electronics. Ex. 1008: p. 2. The cells are made from "lithium-iron-phosphate" and the battery "consistently guarantees the usual voltage of 12 V in the car's on-board network." Ex. 1008: p. 2. As used in Porsche, "lithium-iron-phosphate" is $LiFePO_4$. Ex. 1002: ¶53.

8. Invalidity of Claim 11 Over Pevear in view of Porsche and Poff: "The battery pack according to claim 1, wherein said battery pack comprises four lithium-based rechargeable cells in series in said housing."

Pevear, Porsche, and Poff disclose Claim 1. *See* § VI(D)(1). Pevear discloses rechargeable cells within the housing and that the cells are lithium ion cells. Ex.

1006: claims 1 and 2. Pevear further discloses four cells in series in the housing. Ex. 1006: FIG. 4A.

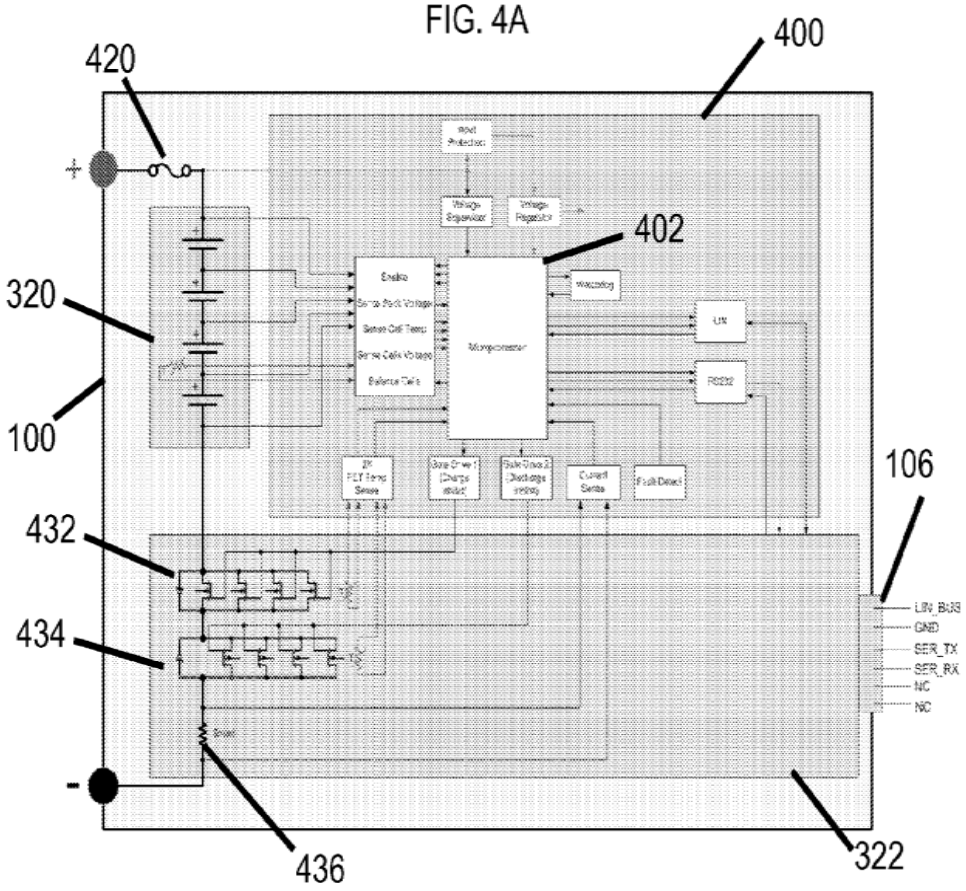
FIG. 4A



9. Invalidity of Claim 12 Over Pevear in view of Porsche and Poff: "The battery pack according to claim 1, wherein said battery pack comprises an even number of lithium-based rechargeable cells in said housing."

Pevear, Porsche, and Poff disclose Claim 1. *See* § VI(D)(1). Pevear discloses rechargeable cells within the housing and that the cells are lithium ion cells. Ex. 1006: claims 1 and 2. Pevear further discloses four cells in series in the housing. Ex. 1006: FIG. 4A.

FIG. 4A


420
400
402
320
100
106
432
434
436
322
LIN_BUS
GND
SER_TX
SER_RX
NC
NC

10. Invalidity of Claim 13 Over Pevear in view of Porsche and Poff: "The battery pack according to claim 1, wherein said circuit board has an associated controller, said controller being adapted to control one of each pair of said solid state switches in parallel separately and independently, whereby said controller has independent control of charging and discharging."

Pevear, Porsche, and Poff disclose Claim 1. *See* § VI(D)(1). Pevear discloses a microprocessor configured to provide "control of charging, including over-voltage and over-current protection" and "under-voltage protection." Ex. 1006: ¶¶[0025]-[0027]. Pevear further discloses selectively allowing current to flow to or from the battery and that one set of MOSFETs controls charging and the other set of MOSFETs controls discharging. Ex. 1006: ¶ [0040].

Although Poff does not expressly use the term "controller," the protection circuit necessarily includes a controller. Ex. 1002: ¶57. Additionally, Poff illustrates separate connections between the integrated circuit and each MOSFET, indicating independent control thereof. Ex. 1011: Fig. 4; Ex. 1002: ¶57.

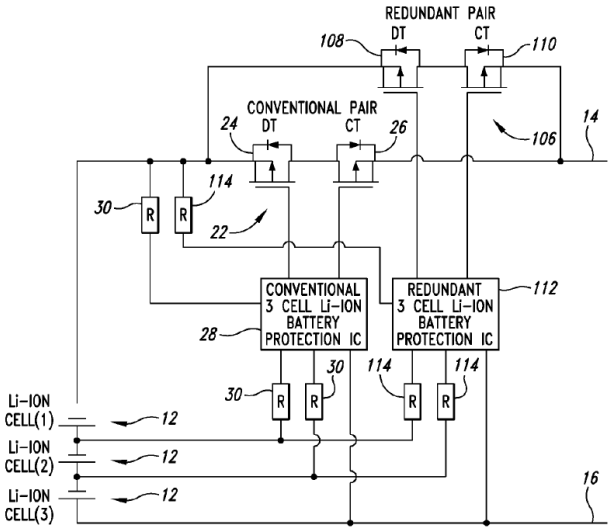


Fig. 4

11. Invalidity of Claim 14 Over Pevear in view of Porsche and Poff

(a) Element [14pre]: "A battery pack for driving an electrical device in a 1 volt to 120 volt operating system, said battery pack comprising:"

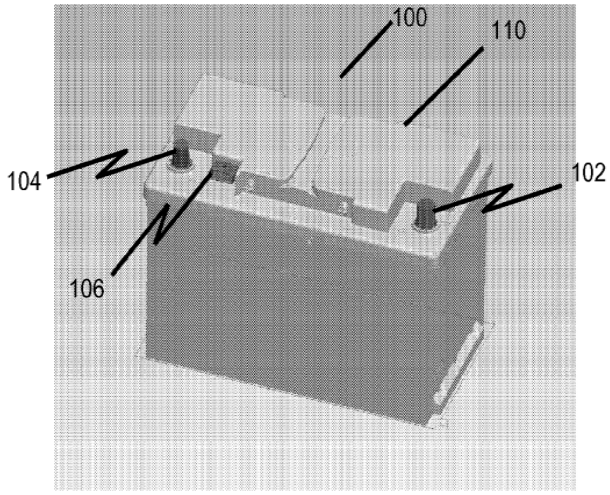
To the extent that the preamble is limiting, Pevear discloses an automotive battery which may be used as a starter battery to drive the starter motor of a vehicle. Ex. 1006: ¶[0004]. The starter motor is an electrical device. Ex. 1002: ¶59. Pevear also discloses that a battery is designed for used vehicle operating systems, such as a replacement for lead acid batteries in vehicles, that can be charged from the vehicle's alternator and used to provide power for micro-hybrid (start-stop) drive systems, where 12-volt is the standard voltage. Ex. 1006: ¶[0005]; Ex. 1002: ¶59. Pevear also discloses four cells in series, which at standard lithium cell voltages is

more than 12 Volts. Ex. 1006: FIG. 4A; Ex. 1002: ¶59. To the extent, PO argues that Pevear does not expressly disclose the 12 volt to 120 volt operating system voltage. Porsche discloses a lithium iron phosphate starter battery which "consistently guarantees the usual voltage of 12 V in the car's on-board network." Ex. 1008: p. 2. 12 V is a standard operating system voltage for car starter batteries as taught by Porsche and known to a POSITA. Ex. 1002: ¶59.

(b) Element [14a]: "a battery pack housing having at least first and second mating portions, said housing having a positive terminal and a negative terminal;"

Pevear discloses that the case consists of a top cover and an enclosure base. Ex. 1006: ¶[0019]. The top cover and the enclosure base are first and second mating portions. Ex. 1002: ¶60. A positive terminal (104) and a negative terminal (102) are insert molded on the outer case (110). Ex. 1006: ¶[0019] and FIG. 1.

FIG. 1



Pevear also refers to the case as a housing. Ex. 1006: claim 1.

(c) Element [14b]: "at least one lithium-based rechargeable cell within said housing, said cell having a positive pole and a negative pole;"

Pevear discloses "a plurality of rechargeable battery cells within the battery housing and having first and second voltage terminals." Ex. 1006: claim 1. The first and second voltage terminals are positive and negative poles. Ex. 1002: ¶62. The cells may be lithium ion cells. Ex. 1006: claim 2.

(d) Element [14c-i]: "a circuit board within said housing having a cutoff function incorporated therein,"

Pevear discloses an electronic power management system including a microprocessor (402) configured to control and monitor a cutoff component (322) that can be used to selectively connect or disconnect the battery from the load(s) connected to its terminals. Ex. 1006: ¶[0039] and FIG. 4A. This constitutes a cutoff function. Ex. 1002: ¶63. The control components can be provided on a printed circuit board or similar substrate. Ex. 1006: ¶[0053]. The power management system is contained on a circuit board within the housing. Ex. 1006: ¶[0024], [0040], [0053], FIG. 4A, Claim 1.

(e) Element [14c-ii]: "said circuit board including a plurality of pairs of solid state switches with each pair of solid state switches connected in a parallel configuration to another pair of solid state switches,"

Pevear discloses solid state switches on a circuit board, including a first group of MOSFETs arranged in parallel (432) and a second group of MOSFETs arranged in parallel (434). Ex. 1006: claim 5, ¶¶[0007], [0053] and FIG. 4A. MOSFETs are solid state switches. Ex. 1002: ¶64. However, the MOSFETs are not arranged in parallel pairs. Instead, the first and second groups (432, 434) are in series with each other. Ex. 1006: claim 5, ¶[0007], and FIG. 4A.

In the same field, Poff discloses an enhanced protection system for a battery pack including a conventional protection circuit and a redundant protection circuit. Ex. 1011: Abstract. The protection system may cause an open circuit such that current is not allowed to flow from the battery back when an overvoltage or other undesirable condition occurs "with one or more of the Li ion cells" in the battery pack. Ex. 1011: ¶[0018]. Stopping current when an undesirable condition occurs is a cutoff function. Ex. 1002: ¶65. The conventional protection circuit includes conventional transistor pair (22) having a discharge transistor (24) and a charge transistor (26). Ex. 1011: ¶[0022]. The redundant protection circuit includes a redundant transistor pair (106) having a discharge transistor (108) and a charge transistor (110). Ex. 1011: ¶[0023]. The conventional transistor pair (22) and the redundant transistor pair (106) are in parallel in Poff. Ex. 10011: FIG. 4; Ex. 1002: ¶65.

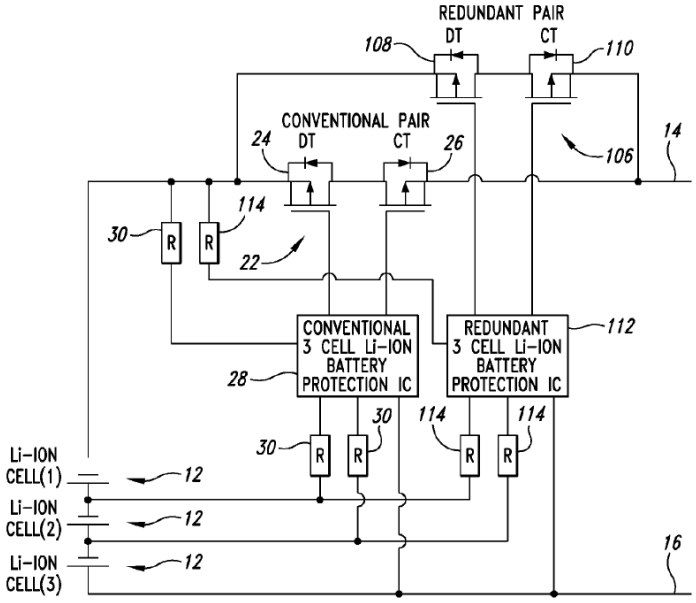


Fig. 4

(f) Element [14c-iii]: "each switch having a source and a drain, the switches of a pair of solid state switchers being configured such that either the drains of the switches are connected or the sources of the switches are connected; and"

The pairs of field effect transistors in Poff are configured such that either the drains of the switches are connected or the sources of the switches are connected. Ex. 1011: Fig. 4; Ex. 1002: ¶66. This configuration allows the control system to prevent both over-voltage and under-voltage. Ex. 1002: ¶66.

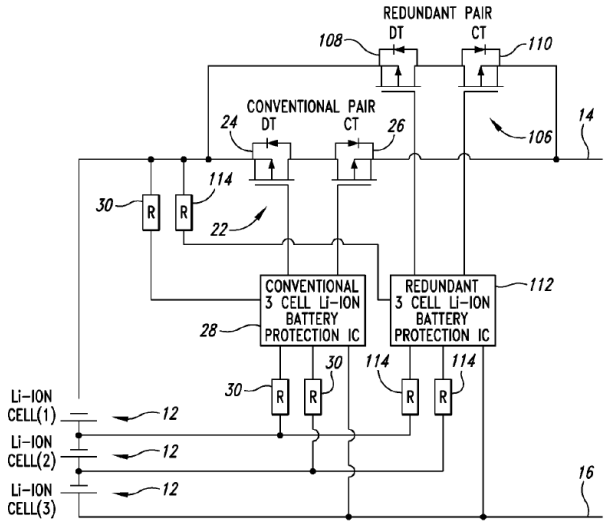

REDUNDANT PAIR
DT
CT
108
110
CONVENTIONAL PAIR
DT
CT
24
26
106
14
114
30
R
R
22
CONVENTIONAL
3 CELL Li-ION
BATTERY
PROTECTION IC
REDUNDANT
3 CELL Li-ION
BATTERY
PROTECTION IC
112
28
30
114
114
Li-ION
CELL(1)
Li-ION
CELL(2)
Li-ION
CELL(3)
12
12
12
16

Fig. 4

(g) Element [14d]: "said parallel configuration of the plurality of solid state switches being connected in series with said one or more cells between said positive and negative terminals of the battery pack."

Poff discloses that the battery pack includes a plurality of lithium-ion cells (12), a first external terminal (14), a second external terminal (16), and parallel pairs (22, 106) of MOSFETs (24, 26, 108, 110) connected in series with the cells (12) between the terminals (14, 16). Ex. 1011: Fig. 4; Ex. 1002: ¶67.

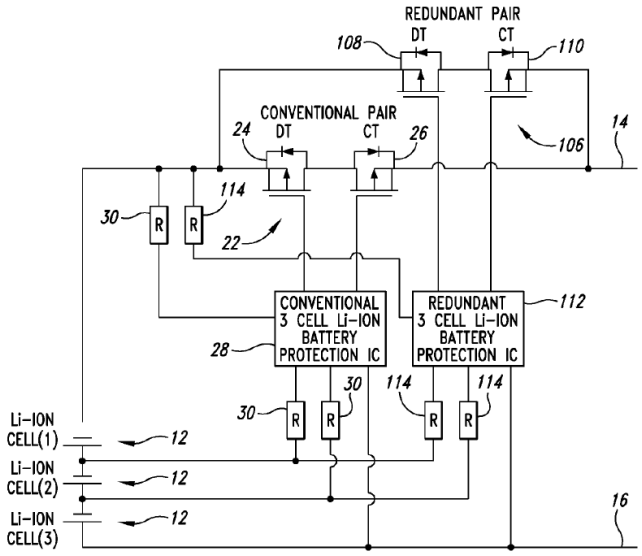


Fig. 4

12. Invalidity of Claim 15 Over Pevear in view of Porsche and Poff: "The battery pack according to claim 14, wherein the lithium-based cell is a lithium iron phosphate cell."

Pevear, Porsche, and Poff disclose Claim 14. *See* § VI(D)(11). Pevear discloses lithium ion cells but does not specifically disclose any particular lithium ion material. Pevear discloses that lithium ion batteries can be used instead of lead acid batteries to provide improved power-to-weight ratios. Ex. 1006: ¶[0004]. Pevear also discloses a battery with four lithium ion cells connected in series. Ex. 1006: FIG. 4A. Porsche discloses a lithium ion battery that is 22 pounds lighter than conventional lead batteries. Ex. 1008: p. 1. The battery includes four cells and integrated control electronics. Ex. 1008: p. 2. The cells are made from "lithium-iron-phosphate" and the battery "consistently guarantees the usual voltage of 12 V in the car's on-board network." Ex. 1008: p. 2. As used in Porsche, "lithium-iron-phosphate" is $LiFePO_4$. Ex. 1002: ¶68.

13. Invalidity of Claim 16 Over Pevear in view of Porsche and Poff: "The battery pack according to claim 14, wherein the lithium iron phosphate cell is selected from the group consisting of LiFePO, $LiFePO_4$, $LiFeMgPO_4$, and $LiFeYPO_4$ cells."

Pevear, Porsche, and Poff disclose Claim 11. *See* § VI(D)(11). Pevear discloses lithium ion cells but does not specifically disclose any particular lithium ion material. Pevear discloses that lithium ion batteries can be used instead of lead acid batteries to provide improved power-to-weight ratios. Ex. 1006: ¶[0004].

Pevear also discloses a battery with four lithium ion cells connected in series. Ex. 1006: FIG. 4A. Porsche discloses a lithium ion battery that is 22 pounds lighter than conventional lead batteries. Ex. 1008: p. 1. The battery includes four cells and integrated control electronics. Ex. 1008: p. 2. The cells are made from "lithium-iron-phosphate" and the battery "consistently guarantees the usual voltage of 12 V in the car's on-board network." Ex. 1008: p. 2. As used in Porsche, "lithium-iron-phosphate" is $LiFePO_4$. Ex. 1002: ¶69.

14. Invalidity of Claim 18 Over Pevear in view of Porsche and Poff: "The battery pack according to claim 14, wherein said battery pack comprises four lithium-based rechargeable cells in series in said housing."

Pevear, Porsche, and Poff disclose Claim 14. *See* § VI(D)(11). Pevear discloses rechargeable cells within the housing and that the cells are lithium ion cells. Ex. 1006: claims 1 and 2. Pevear further discloses four cells in series in the housing. Ex. 1006: FIG. 4A.

15. Invalidity of Claim 19 Over Pevear in view of Porsche and Poff: "The battery pack according to claim 14, wherein said battery pack comprises an even number of lithium-based rechargeable cells in said housing."

Pevear, Porsche, and Poff disclose Claim 14. *See* § VI(D)(11). Pevear discloses rechargeable cells within the housing and that the cells are lithium ion cells. Ex. 1006: claims 1 and 2. Pevear further discloses four cells in series in the housing. Ex. 1006: FIG. 4A.

16. Invalidity of Claim 20 Over Pevear in view of Porsche and Poff: "The battery pack according to claim 14, wherein said solid state switches are MOSFETs or IGBTs."

Pevear, Porsche, and Poff disclose Claim 14. *See* § VI(D)(11). Pevear discloses MOSFETs. Ex. 1006: ¶[0007]. Poff also discloses MOSFETs. Ex. 1011: ¶¶[0022]-[0023].

17. Invalidity of Claim 21 Over Pevear in view of Porsche and Poff: "The battery pack according to claim 14, wherein said solid state switches are transistors, FET, JFET, BJT, CMOS, VMOS, TMOS, vertical DMOS or HEXFET."

Pevear, Porsche, and Poff disclose Claim 14. *See* § VI(D)(11). Pevear discloses MOSFETs which are transistors and FETs. Ex. 1006: ¶[0007]. Poff also discloses MOSFETs. Ex. 1011: ¶¶[0022]-[0023]. MOSFETs are both transistors and FETs as recited in claim 5 of the '994 Patent.

18. Invalidity of Claim 22 Over Pevear in view of Porsche and Poff: "The battery pack according to claim 14, wherein said solid state switches are either n-type or p-type."

Pevear, Porsche, and Poff disclose Claim 14. *See* § VI(D)(11). Poff discloses that the transistors can be MOSFETs. Ex. 1011: ¶¶[0022]-[0023]. MOSFETs are inherently either n-type or p-type. Ex. 1002: ¶74. In the context of Poff's Fig. 4, the MOSFETs would be p-type if the terminal (14) is the positive terminal or n-type if the terminal (14) is the negative terminal. Ex. 1002: ¶74.

19. Invalidity of Claim 23 Over Pevear in view of Porsche and Poff: "The battery pack according to claim 14, wherein said one or more cells are selected from the group consisting of LiFePO, $LiFePO_4$, $LiFeMgPO_4$, $LiFeYPO_4$, $LiCoO_2$, $LiMn2O_4$, $LiNiCoAlO_2$, $LiNiMnCoO_2$, Li4Ti5O12, lead-acid, NiCd, and nickel metal hydride (NiMH) batteries."

Pevear, Porsche, and Poff disclose Claim 14. *See* § VI(D)(11). Pevear discloses lithium ion cells but does not specifically disclose any particular lithium ion material. Pevear discloses that lithium ion batteries can be used instead of lead acid batteries to provide improved power-to-weight ratios. Ex. 1006: ¶[0004]. Pevear also discloses a battery with four lithium ion cells connected in series. Ex. 1006: FIG. 4A. Porsche discloses a lithium ion battery that is 22 pounds lighter than conventional lead batteries. Ex. 1008: p. 1. The battery includes four cells and integrated control electronics. Ex. 1008: p. 2. The cells are made from "lithium-iron-phosphate" and the battery "consistently guarantees the usual voltage of 12 V in the car's on-board network." Ex. 1008: p. 2. As used in Porsche, "lithium-iron-phosphate" is $LiFePO_4$. Ex. 1002: ¶75.

20. Motivation to Combine Pevear, Porsche, and Poff and Reasonable Expectation of Success

A POSITA would have been motivated to use Porsche's lithium-iron-phosphate cells as the lithium ion cells in modified Pevear for at least the following reasons.

First, both references deal with automotive batteries with battery management systems and specifically disclose the weight reduction advantages of lithium ion cells. Second, Porsche discloses lithium-iron-phosphate as a known lithium ion cell material for automotive batteries and using a known material for its known purpose to obtain predictable results is obvious. Third, both references disclose batteries with exactly four lithium ion cells in series. Fourth, using Porsche's lithium-iron-phosphate cells would be suitable for a conventional 12 V operating system in the car's on-board network. Ex. 1002: ¶34.

A POSITA would have been motivated to replace Pevear's cutoff circuitry with Poff's cutoff circuitry having parallel pairs of solid state switches with the two switches in each pair having connected sources or drains for at least the following reasons.

First, the cutoff functions of both references utilize field effect transistors which enable independent control of charging and discharging in connection with lithium ion batteries. Second, both references disclose cutoff functions. The modification involving replacing Pevear's cutoff function/circuitry with that of Poff would constitute a simple substitution of one known element for another known element to obtain predictable results and would use a known technique to improve similar devices. Ex. 1002: ¶36. Third, there are a finite number of known solutions

for voltage cutoff and it would have been obvious to try Poff's solution, with a reasonable expectation of success. Ex. 1002: ¶36.

E. Claim 2 is unpatentable under § 103 over Pevear, Porsche, Poff, and Wu (Ground 2)

1. Invalidity of Claim 2 Over Pevear in view of Porsche, Poff, and Wu: "The battery pack according to claim 1, wherein said circuit board has an associated controller within said housing, said controller having associated means for periodically measuring a load to detect a change in load impedance, and a switch within said housing between said battery pack and said electrical device, and means for turning on said switch to provide power to the electrical device to restart the device."

Pevear, Porsche, and Poff disclose Claim 1. *See* § VI(D)(1). Pevear further discloses that the microprocessor processes parameters of the system, such as monitored voltage, current, temperature, etc. to determine appropriate charging parameters and controls the load controller to increase or decrease the discharge current from the battery by selectively connecting or disconnecting loads to/from the battery. Ex. 1006: ¶[0037]. Although Pevear discloses monitoring parameters such as voltage and current and using the parameters for control purposes and to connect and disconnect loads (i.e., switch on or off an electrical device), there is no express disclosure of "periodically measuring a load to detect a change in load impedance." In the field of battery pack modules, Wu discloses a Master Control Module, or MCM 102, within a lithium ion battery pack 1a. Ex. 1012: ¶[0042] and FIG. 1(a).

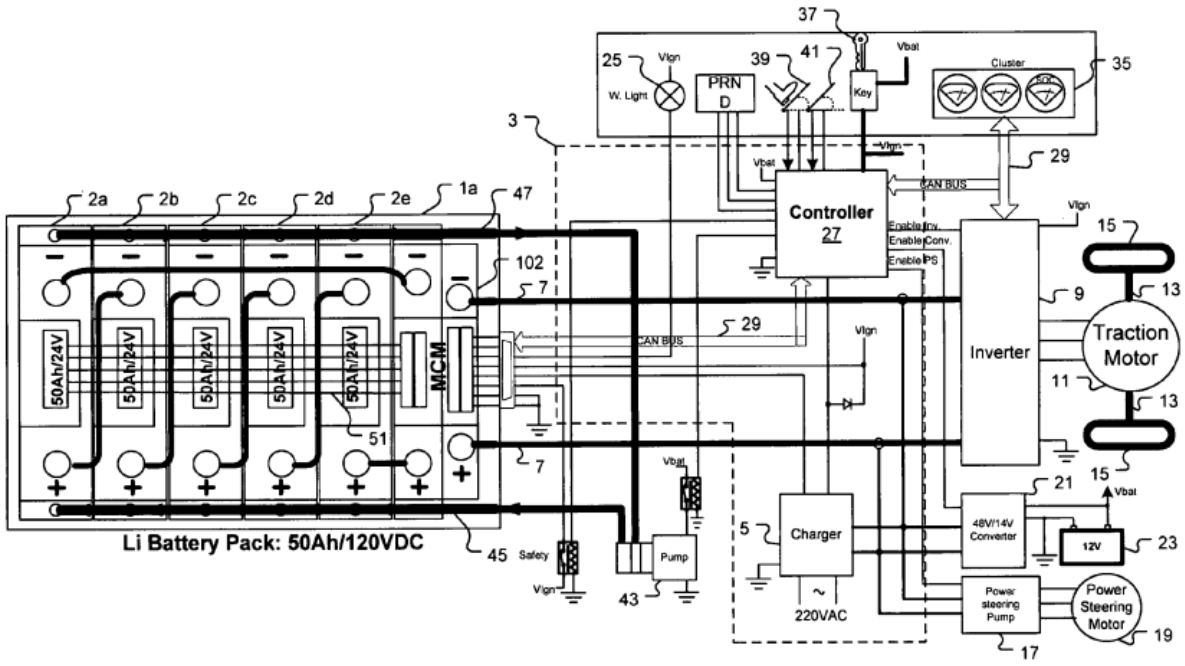


FIG. 1(a)

The MCM has a controller that includes di-electrical impedance detection circuitry, and optionally a fuse that disconnects power to the battery pack when the battery pack is short-circuited. Ex. 1012: ¶[0073]. The MCM can switch on/off a high voltage bus using a command or power on signal. Ex. 1012: ¶[0073]; Ex. 1002: ¶¶80-82.

2. Motivation to Combine Pevear, Porsche, Poff, and Wu and Reasonable Expectation of Success

The motivation to combine Pevear, Porsche, and Poff is discussed in § VI(D)(20). The POSITA would have been motivated to further incorporate Wu's impedance detection functionality into the protection circuit of Pevear-Porsche- Poff

and had a reasonable expectation of success because the references all deal with protecting lithium ion batteries and Pevear uses various measured parameters to determine whether a switch should be turned on or off, thereby turning on or off power to an electrical device. Ex. 1002: ¶78.

F. Claim 3 is unpatentable under § 103 over Pevear, Porsche, Poff, and Kashine (Ground 3)

1. Invalidity of Claim 3 Over Pevear in view of Porsche, Poff, and Kashine: "The battery pack according to claim 1, wherein said circuit board has an associated controller within said housing, said battery pack being connected to a current monitor, said current monitor being connected to a current comparator and a set-reset latch, whereby upon the occurrence of a short circuit, the set-reset latch will turn off an associated switch."

Pevear, Porsche, and Poff disclose Claim 1. *See* § VI(D)(1). Pevear discloses monitoring voltage, current, temperature, and other relevant parameters and using this information to control a power cutoff switch to actively control the flow of current through the battery pack. Ex. 1006: ¶[0038]. Pevear does not expressly disclose that the "current monitor is connected to a current comparator and a set-reset latch, whereby upon the occurrence of a short circuit, the set-reset latch will turn off an associated switch."

In the field of battery protection devices, Kashine discloses that, when an excess current is generated in a power supply circuit, an output can be generated by a current detection means and a sense amplifier. Ex. 1013: ¶[0021]. The output is

input to a latch and an output of the latch is inputted to a logic circuit having an output which turns off a switching element, thereby shutting off the path of the battery. Ex. 1013: ¶[0021].

2. Motivation to Combine Pevear, Porsche, Poff, and Kashine and Reasonable Expectation of Success

The POSITA would have been motivated to incorporate Kashine's components for monitoring current and preventing overcharging and had a reasonable expectation of success because the references all deal with protecting batteries, Pevear discloses current monitoring and a cutoff switch to turn off current when an undesirable event occurs, and Kashine discloses a particular current detection and control mechanism that constitutes one of a finite number of predictable solutions for monitoring and managing current flow. Ex. 1002: ¶86.

G. Claims 10 and 17 are unpatentable under § 103 over Pevear, Porsche, Poff, and Shibano (Ground 4)

1. Invalidity of Claim 10 Over Pevear in view of Porsche, Poff, and Shibano: "The battery pack according to claim 1, wherein the lithium-based cell is selected from the group consisting of LiCoO2, LiMn2O4, LiNiCoAlO2, LiNiMnCoO2, and Li4Ti5O12 cells."

Pevear, Porsche, and Poff disclose Claim 1. *See* § VI(D)(1). Porsche discloses lithium ion cells made from "lithium-iron-phosphate." Ex. 1008: p. 2. As used in Porsche, "lithium-iron-phosphate" is $LiFePO_4$. Ex. 1002: ¶92. Pevear, Porsche, and Poff do not disclose the specific materials recited in claim 10 or the '994 Patent.

Shibano discloses that $LiFePO_4$, $LiCoO_2$, $LiMn_2O_4$, and $Li_4Ti_5O_{12}$ are preferred materials for positive electrodes in rechargeable batteries. Ex. 1014: ¶[0030].

2. Invalidity of Claim 17 Over Pevear in view of Porsche, Poff, and Shibano: "The battery pack according to claim 1, wherein the lithium-based cell is selected from the group consisting of LiCoO2, LiMn2O4, LiNiCoAlO2, LiNiMnCoO2, and Li4Ti5O12 cells."

Pevear, Porsche, and Poff disclose Claim 1. *See* § VI(D)(1). Porsche discloses lithium ion cells made from "lithium-iron-phosphate." Ex. 1008: p. 2. As used in Porsche, "lithium-iron-phosphate" is $LiFePO_4$. Ex. 1002: ¶93. Pevear, Porsche, and Poff do not disclose the specific materials recited in claim 10 or the '994 Patent. Shibano discloses that $LiFePO_4$, $LiCoO_2$, $LiMn_2O_4$, and $Li_4Ti_5O_{12}$ are preferred materials for positive electrodes in rechargeable batteries. Ex. 1014: ¶[0030].

3. Motivation to Combine Pevear, Porsche, Poff, and Shibano and Reasonable Expectation of Success

The motivation to combine Pevear, Porsche and Poff is discussed in § VI(D)(20). The POSITA would have been further motivated to replace lithium iron phosphate, as disclosed by Porsche, with $LiCoO_2$, $LiMn_2O_4$, or $Li_4Ti_5O_{12}$ as taught by Shibano because Shibano teaches these materials and $LiFePO_4$ are suitable positive electrode materials in rechargeable batteries and the simple substitution of one known element for another to obtain predictable results would have been obvious. Ex. 1002: ¶91.

VII. DISCRETIONARY DENIAL WOULD BE INAPPROPRIATE

A. This Petition Presents New Invalidity Grounds Not Addressed in Prosecution

None of the prior art presented in Grounds 1, 3, and 4 of this Petition was considered by the USPTO prior to the allowance of the ’994 Patent.

Wu was cited in a rejection of the same dependent claim Petitioners are citing Wu against. Petitioners note that the Examiner’s reasons for allowance indicate that this claim was allowed based on its dependence on an allowable independent claim, not based on any novel and nonobvious features recited in claim 2. Ex. 1004: p. 195-196. Additionally, Wu is being cited in combination with references not considered by the USPTO prior to the allowance of the ’994 Patent.

B. The Board Should Not Deny Institution Under Fintiv

Petitioners respectfully submit that five of the Fintiv factors weigh in favor of institution. *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (P.T.A.B. Mar. 20, 2020).

With respect to Fintiv factor 1, the parallel district court cases are stayed pending the resolution of the ITC investigation. The ITC investigation cannot resolve all or substantially all of the patentability disputes between the parties. In particular, claims 2, 3, 10, and 17 are not involved in the ITC investigation but are challenged in this Petition. Additionally, Petitioners have strong arguments concerning non-infringement and a lack of domestic industry in connection with the

ITC investigation. Accordingly, it is likely that the outcome of the ITC investigation is determined on issues unrelated to patentability and that the ITC does not resolve any of the patentability disputes between the parties. Moreover, Petitioners served final invalidity contentions in connection with the ITC Investigation on February 14, 2025. The invalidity grounds and the prior art relied upon in this Petition are different. Of the six prior art references relied upon in the invalidity grounds presented herein, only Poff and Wu were charted in Petitioners' final invalidity contentions in the ITC proceeding. However, Wu is only relied upon in this Petition in connection with claim 2 of the '994 Patent which is not asserted by PO in the ITC investigation. Neither Poff nor Wu were charted in combination with Pevear or Porsche. Accordingly, the invalidity contentions in the ITC proceeding and the invalidity grounds presented herein do not overlap. This factor weighs against a discretionary denial of institution.

Regarding Fintiv factor 4, in the district court cases, only independent claims 1 and 14 are asserted. In the ITC investigation, only claims 1, 4-9, 11-16, and 18-23 are asserted. In contrast, this petition challenges all of the claims (i.e., claims 1-23), including claims 2, 3, 10, and 17 which are not involved in the district court cases or the ITC investigation. Moreover, the invalidity grounds presented in this Petition do not match Petitioners' final invalidity contentions in the ITC investigation. Pevear, Porsche, Kashine, and Shibano were not presented in those contentions or

Petitioners' expert report on invalidity in connection with the ITC investigation. Wu is only relied upon in this Petition in connection with claim 2 of the '994 Patent which is not asserted by PO in the ITC investigation. Therefore, this petition raises issues that do not overlap with the ITC investigation. This factor weighs strongly against a discretionary denial of institution.

With respect to Fintiv factor 6, the strength of the merits of Petitioners' grounds raised in this petition weigh in favor of institution. Additionally, similar claims in a corresponding European patent application (published as EP2647102A1) were rejected and the application abandoned after the European Patent Office (EPO) cited one of many prior art references disclosing parallel pairs of switches with their drains or sources connected, which the inventor of the '994 Patent erroneously described as unique. Specifically, the EPO cited EP 2 124 340 A2 for disclosing the switch configuration in a communication dated September 3, 2018, and the application was deemed withdrawn because the applicant never responded.

C. The Board Should Not Deny Institution Under General Plastic

The *General Plastic* factors do not apply because this is the first and only *inter partes review* petition filed by Petitioners with respect to the '994 Patent. *General Plastic Industrial Co., Ltd. v. Canon Kabushiki Kaisha*, IPR2016-01357, Paper 19 (P.T.A.B. Sept. 6, 2017).

VIII. FEES

Petitioners authorize charge of fees to Deposit Account 06-0308.

IX. CONCLUSION

For all grounds discussed herein based on § 103, to the extent further disclosure is required for a limitation identified herein as having been disclosed, a POSITA would certainly have found that limitation obvious to include based on the same disclosures and analysis identified herein.

Petitioners have demonstrated a reasonable likelihood that claims 1-23 of the '994 are invalid in view of the prior art. Accordingly, *inter partes* review of those claims is requested.

DATED: April 1, 2025

Respectfully submitted,

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CLAIM LISTING APPENDIX (CLAIMS 1-23)

Claim 1
[1pre] A battery pack for driving an electrical device in a 12 volt to 120 volt operating system, said battery pack having a positive terminal and a negative terminal, comprising
[1a] a battery pack housing having at least a first portion and a mating second portion;
[1b] at least one lithium-based rechargeable cell within said housing, each such cell having a positive pole and a negative pole;
[1c-i] a circuit board within said housing configured to balance each individual cell within said housing, and having a cutoff function incorporated therein,
[1c-ii] said circuit board including a plurality of pairs of solid state switches with each pair of solid state switches connected in a parallel configuration to another pair of solid state switches,
[1c-iii] each switch having a source and a drain, the switches of a pair of solid state switches being configured such that either the drains of the switches are connected or the sources of the switches are connected; and

[1d] said parallel configuration of the plurality of solid state switches being connected in series with said one or more cells between said positive and negative terminals of the battery pack.
Claim 2
[2] The battery pack according to claim 1, wherein said circuit board has an associated controller within said housing, said controller having associated means for periodically measuring a load to detect a change in load impedance, and a switch within said housing between said battery pack and said electrical device, and means for turning on said switch to provide power to the electrical device to restart the device.
Claim 3
[3] The battery pack according to claim 1, wherein said circuit board has an associated controller within said housing, said battery pack being connected to a current monitor, said current monitor being connected to a current comparator and a set-reset latch, whereby upon the occurrence of a short circuit, the set-reset latch will turn off an associated switch.
Claim 4
[4] The battery pack according to claim 1, wherein said solid state switches are MOSFETs or IGBTs.

Claim 5
[5] The battery pack according to claim 1, wherein said solid state switches are transistors, FET, JFET, BJT, CMOS, VMOS, TMOS, vertical DMOS or HEXFET.
Claim 6
[6] The battery pack according to claim 1, wherein said solid state switches are either n-type or p-type.
Claim 7
[7] The battery pack according to claim 1, wherein said one or more cells are selected from the group consisting of LiFePO, $LiFePO_4$, $LiFeMgPO_4$, $LiFeYPO_4$, $LiCoO_2$, $LiMn_2O_4$, $LiNiCoAlO_2$, $LiNiMnCoO_2$, $Li_4Ti_5O_{12}$, lead-acid, NiCd, and nickel metal hydride (NiMH) batteries.
Claim 8
[8] The battery pack according to claim 1, wherein the lithium-based cell is a lithium iron phosphate cell.
Claim 9
[9] The battery pack according to claim 1, wherein the lithium iron phosphate cell is selected from the group consisting of LiFePO, $LiFePO_4$, $LiFeMgPO_4$, and $LiFeYPO_4$ cells.

Claim 10
[10] The battery pack according to claim 1, wherein the lithium-based cell is selected from the group consisting of $LiCoO_2$, $LiMn_2O_4$, $LiNiCoAlO_2$, $LiNiMnCoO_2$, and $Li_4Ti_5O_{12}$ cells.
Claim 11
[11] The battery pack according to claim 1, wherein said battery pack comprises four lithium-based rechargeable cells in series in said housing.
Claim 12
[12] The battery pack according to claim 1, wherein said battery pack comprises an even number of lithium-based rechargeable cells in said housing.
Claim 13
[13] The battery pack according to claim 1, wherein said circuit board has an associated controller, said controller being adapted to control one of each pair of said solid state switches in parallel separately and independently, whereby said controller has independent control of charging and discharging.
Claim 14
[14pre] A battery pack for driving an electrical device in a 1 volt to 120 volt operating system, said battery pack comprising:

[14a] a battery pack housing having at least first and second mating portions, said housing having a positive terminal and a negative terminal;
[14b] at least one lithium-based rechargeable cell within said housing, said cell having a positive pole and a negative pole;
[14c-i] a circuit board within said housing having a cutoff function incorporated therein,
[14c-ii] said circuit board including a plurality of pairs of solid state switches with each pair of solid state switches connected in a parallel configuration to another pair of solid state switches,
[14c-iii] each switch having a source and a drain, the switches of a pair of solid state switchers being configured such that either the drains of the switches are connected or the sources of the switches are connected; and
[14d] said parallel configuration of the plurality of solid state switches being connected in series with said one or more cells between said positive and negative terminals of the battery pack.
Claim 15
[15] The battery pack according to claim 14 wherein the lithium-based cell is a lithium iron phosphate cell.

Claim 16
[16] The battery pack according to claim 14, wherein the lithium iron phosphate cell is selected from the group consisting of LiFePO, $LiFePO_4$, $LiFeMgPO_4$, and $LiFeYPO_4$ cells.
Claim 17
[17] The battery pack according to claim 14, wherein the lithium-based cell is selected from the group consisting of $LiCoO_2$, $LiMn_2O_4$, $LiNiCoAlO_2$, $LiNiMnCoO_2$, and $Li_4Ti_5O_{12}$ cells.
Claim 18
[18] The battery pack according to claim 14, wherein said battery pack comprises four lithium-based rechargeable cells in series in said housing.
Claim 19
[19] The battery pack according to claim 14, wherein said battery pack comprises an even number of lithium-based rechargeable cells in said housing.

Claim 20
[20] The apparatus according to claim 14, wherein said solid state switches are MOSFETs or IGBTs.
Claim 21
[21] The apparatus according to claim 14, wherein said solid state switches are transistors, FET, JFET, BJT, CMOS, VMOS, TMOS, vertical DMOS or HEXFET.
Claim 22
[22] The apparatus according to claim 14, wherein said solid state switches are either n-type or p-type.
Claim 23
[23] The apparatus according to claim 14, wherein said one or more cells are selected from the group consisting of LiFePO, $LiFePO_4$, $LiFeMgPO_4$, $LiFeYPO_4$, $LiCoO_2$, $LiMn_2O_4$, $LiNiCoAlO_2$, $LiNiMnCoO_2$, $Li_4Ti_5O_{12}$, lead-acid, NiCd, and nickel metal hydride (NiMH) batteries.

CERTIFICATION UNDER 37 CFR § 42.24(d)

Pursuant to 37 CFR § 42.24(d), the undersigned certifies that this Petition complies with the type-volume limitation of 37 CFR § 42.24(a). According to the word processing system's word count, the Petition contains 11,377 words, excluding the parts exempted by 37 C.F.R. § 42.24(a).

DATED: April 1, 2025

Respectfully submitted,

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on April 1, 2025, a complete and entire copy of this Petition for *Inter Partes* Review, including exhibits was provided via FedEx overnight, to the Patent Owner by serving the correspondence address of record as follows:

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Courtesy copies are being provided electronically to PO's ITC counsel at tburns@bartkowskipllc.com; pbartkowski@bartkowskipllc.com; and LITH-ITC@dority-manning.com.

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