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Nook et al.

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(54) **JUMP STARTING DEVICE WITH USB**

(71) Applicant: **THE NOCO COMPANY**, Glenwillow, OH (US)

(72) Inventors: **Jonathan Lewis Nook**, Gates Mills, OH (US); **William Knight Nook**, Shaker Heights, OH (US); **James Richard Stanfield**, Glendale, AZ (US); **Derek Michael Underhill**, Tempe, AZ (US)

(73) Assignee: **The NOCO Company**, Glenwillow, OH (US)

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Primary Examiner — M Baye Diao
(74) *Attorney, Agent, or Firm* — Jones Day

(57) **ABSTRACT**

A jump starting device having USB. For example, a handheld jump starting device having USB for boosting or charging a depleted or discharged battery. The handheld jump starting device, for example, can include a rechargeable lithium ion battery pack and a microcontroller. The lithium ion battery can be coupled to a power output port of the device through a power switch circuit actuated by the microcontroller.

57 Claims, 13 Drawing Sheets

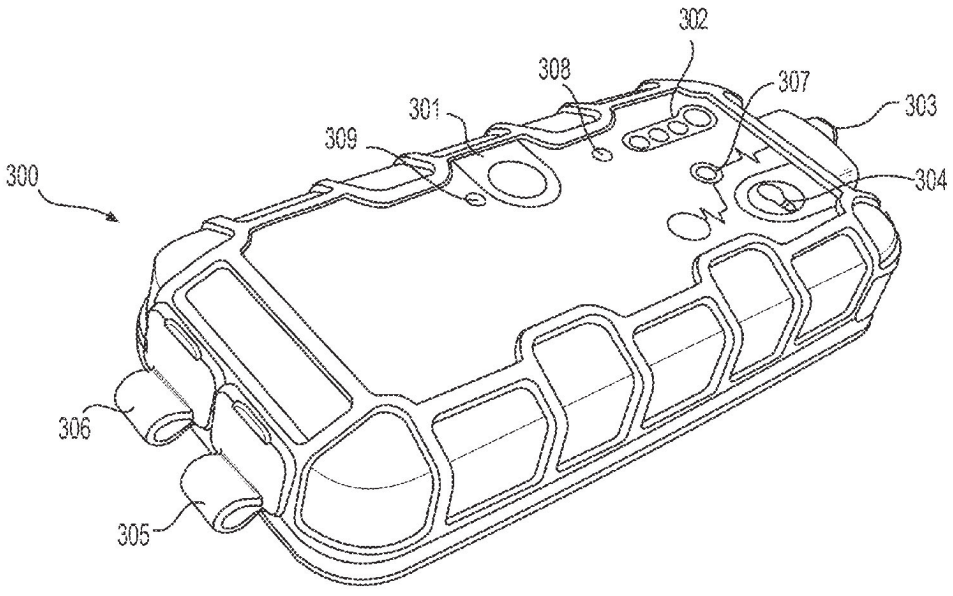


EXHIBIT 1001
Petitioner ADC (IPR2024-00671)

Related U.S. Application Data

continuation of application No. 14/619,655, filed on Feb. 11, 2015, now Pat. No. 9,770,992, which is a division of application No. 14/325,938, filed on Jul. 8, 2014, now Pat. No. 9,007,015, which is a continuation of application No. PCT/US2014/045434, filed on Jul. 3, 2014.

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See application file for complete search history.

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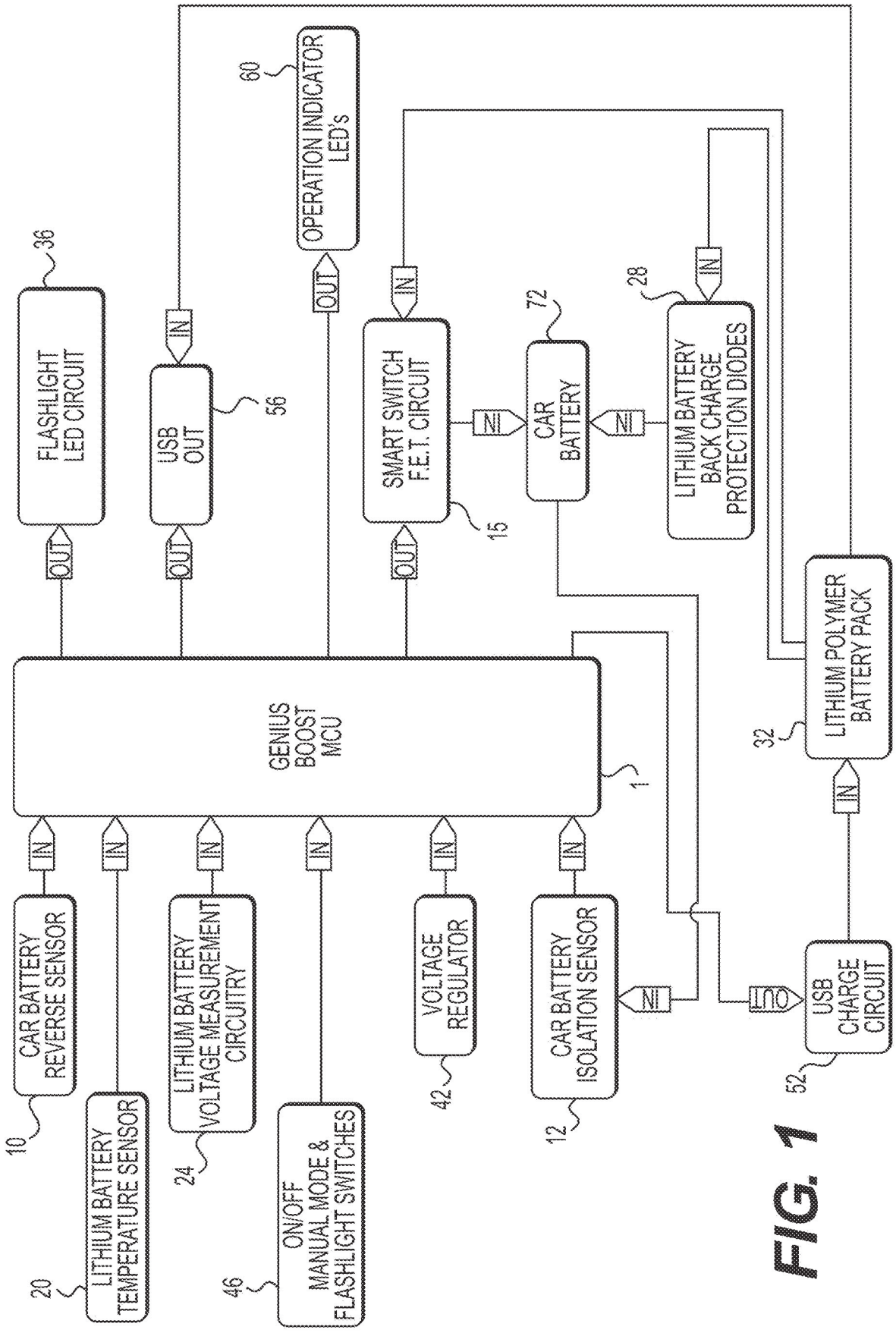


FIG. 1

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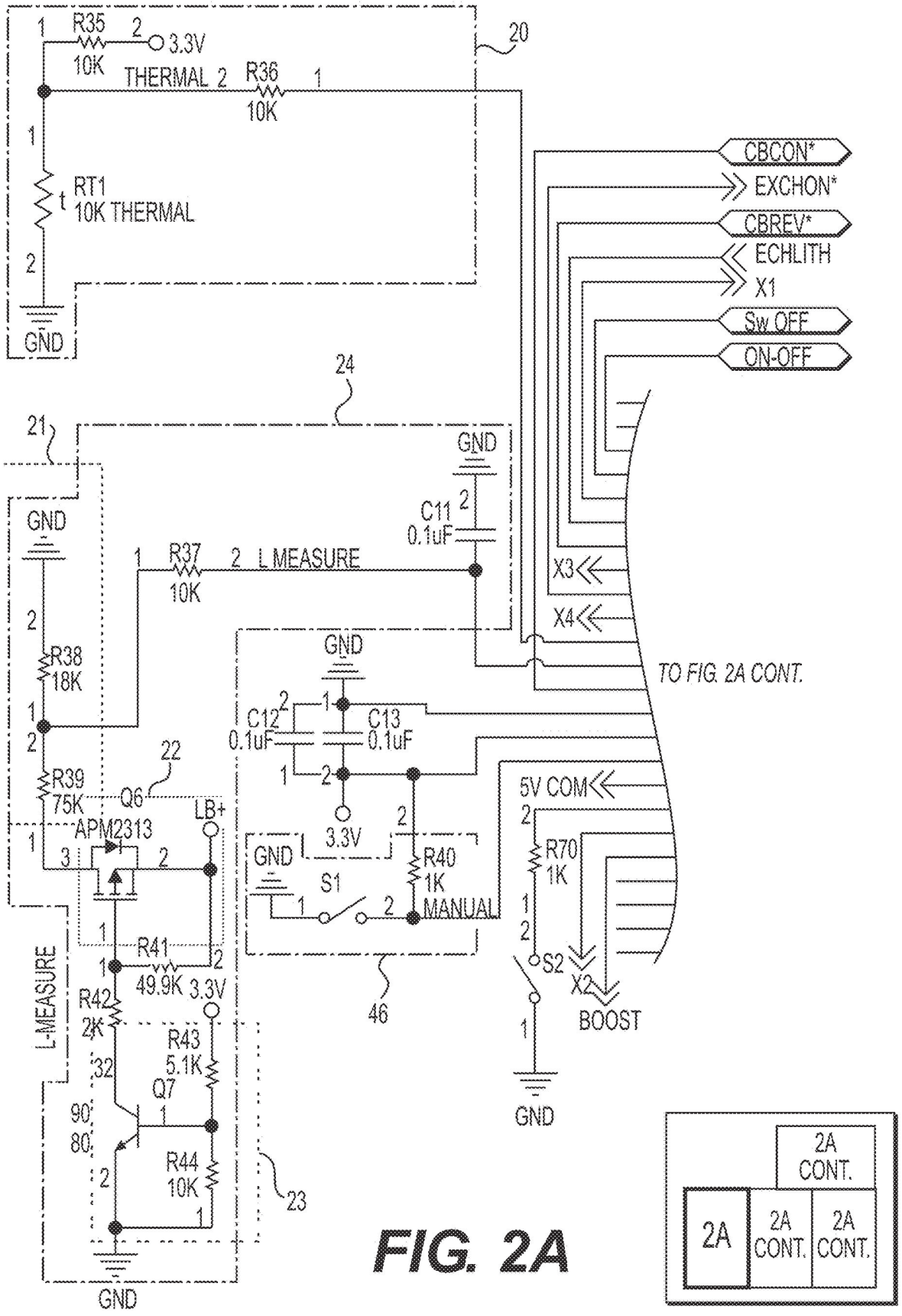


FIG. 2A

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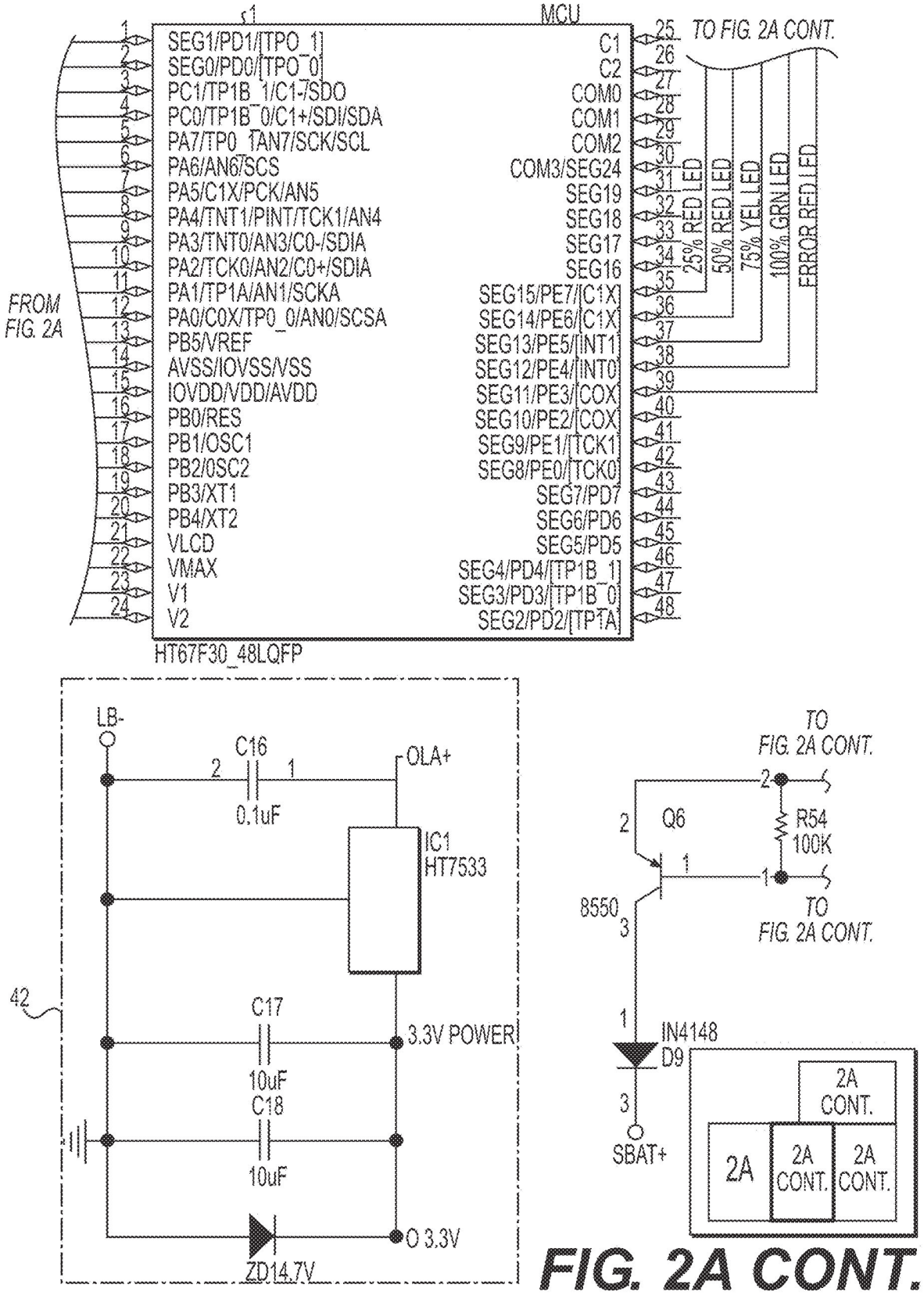


FIG. 2A CONT.

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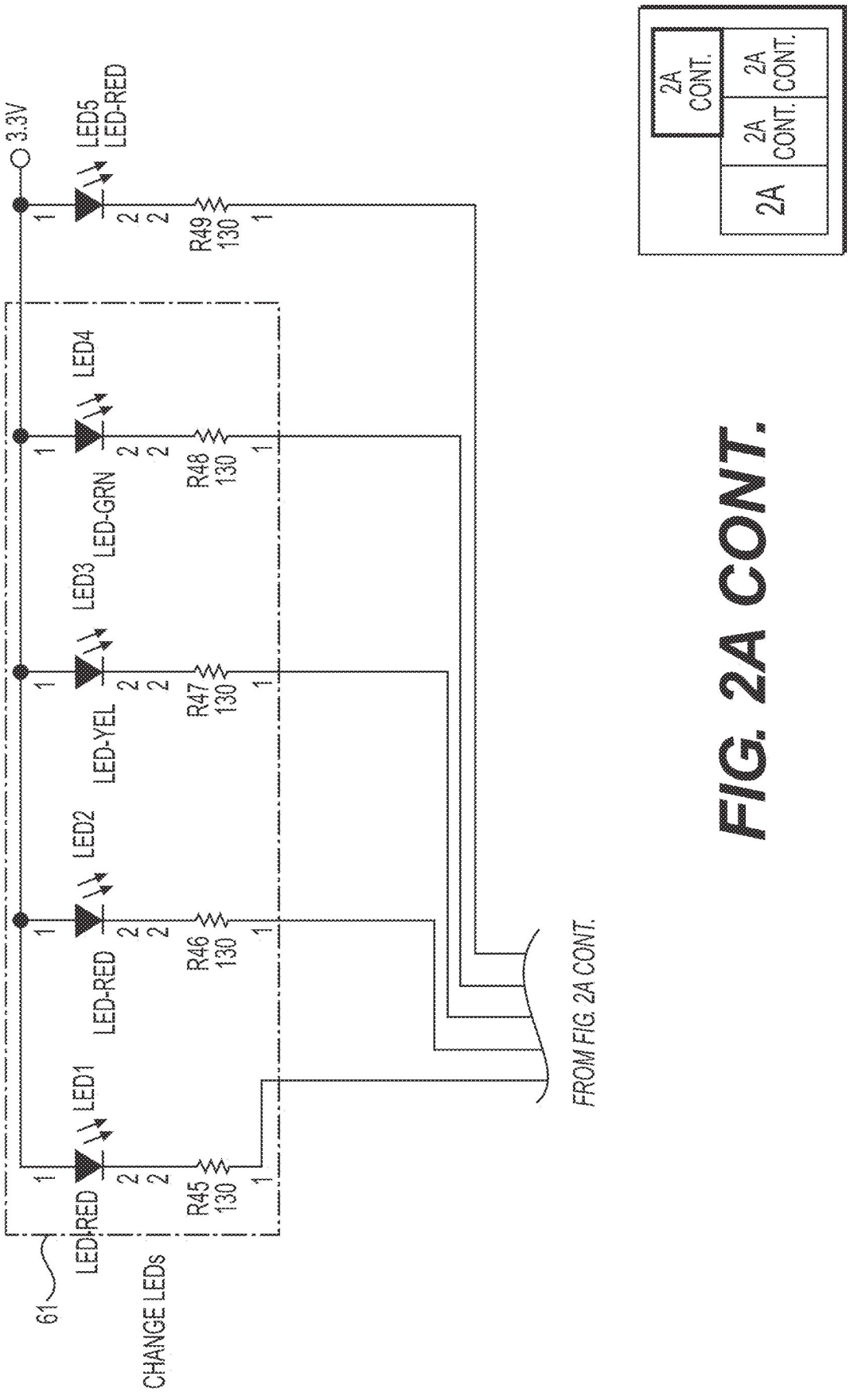


FIG. 2A CONT.

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Petitioner ADC (IPR2024-00671)

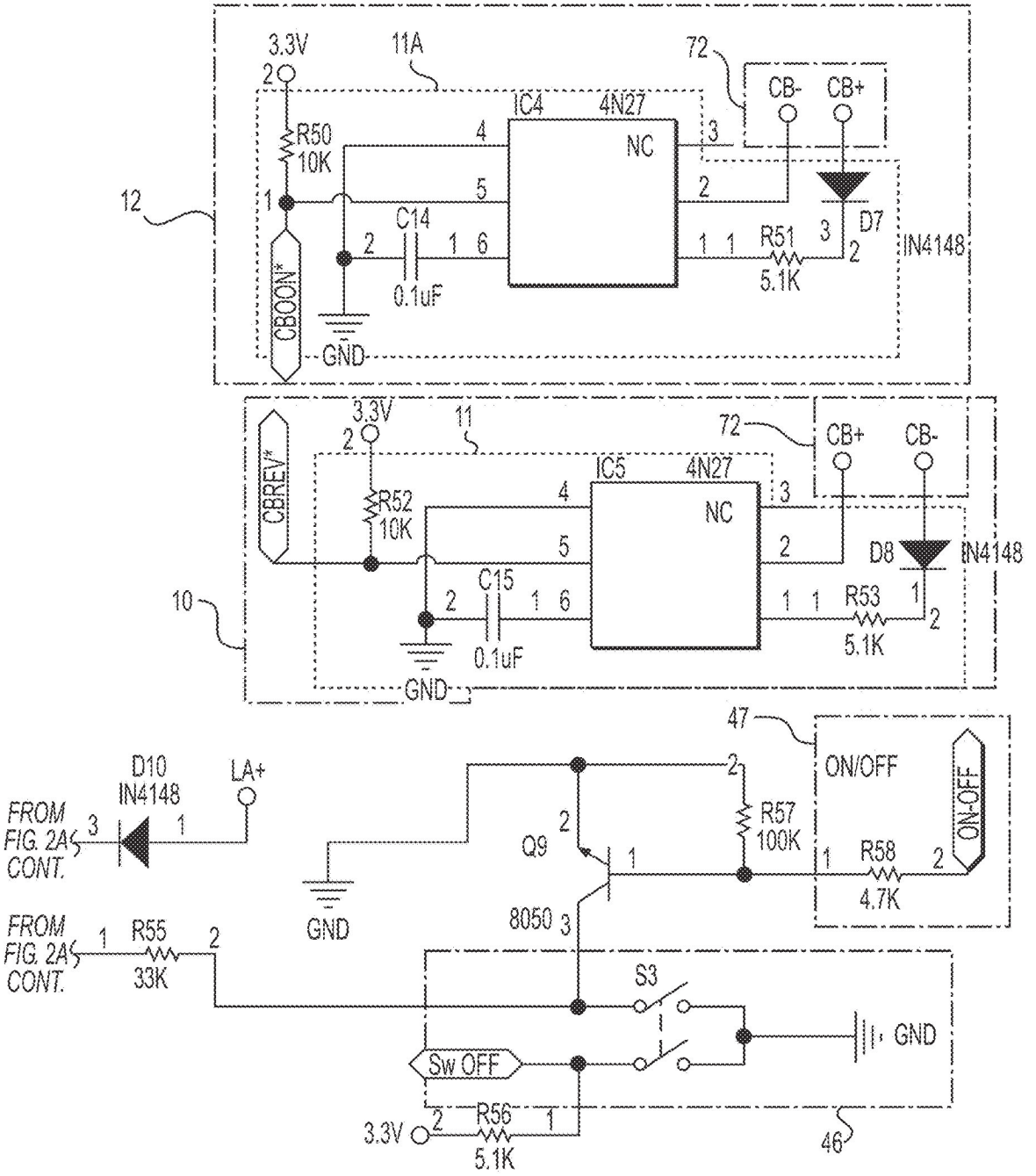


FIG. 2A CONT.

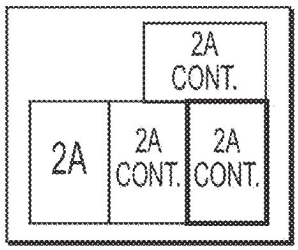


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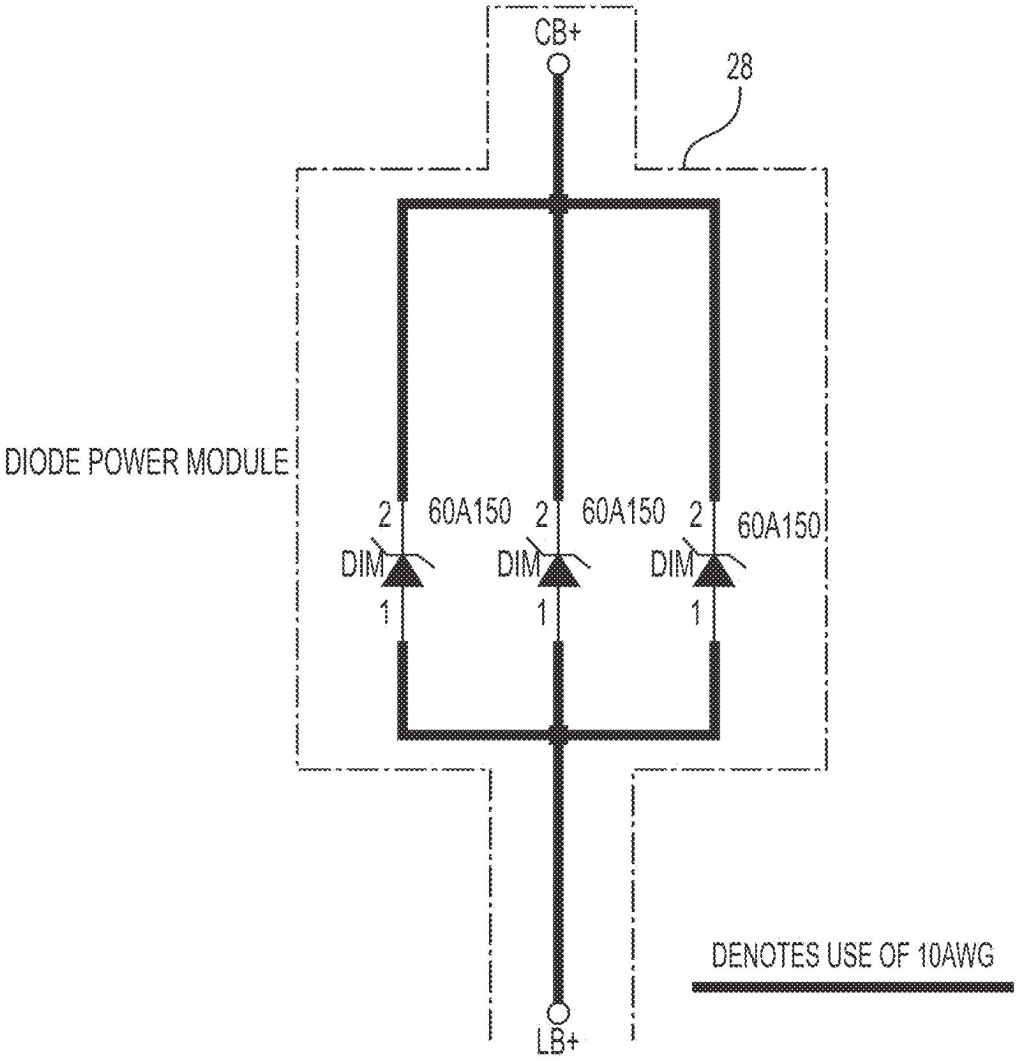


FIG. 2B

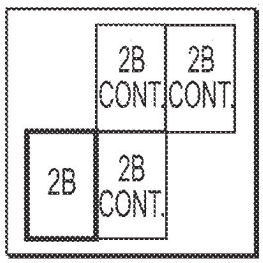


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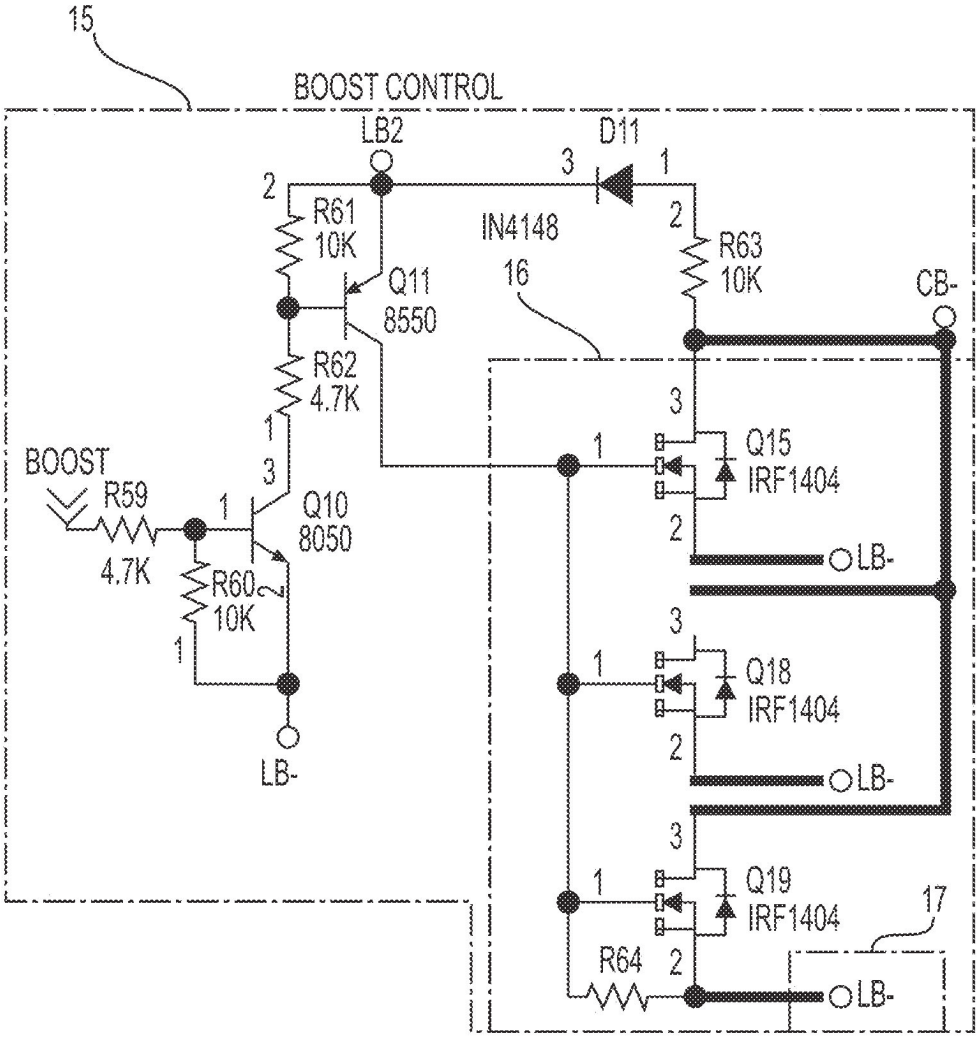


FIG. 2B CONT.

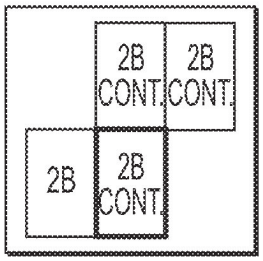


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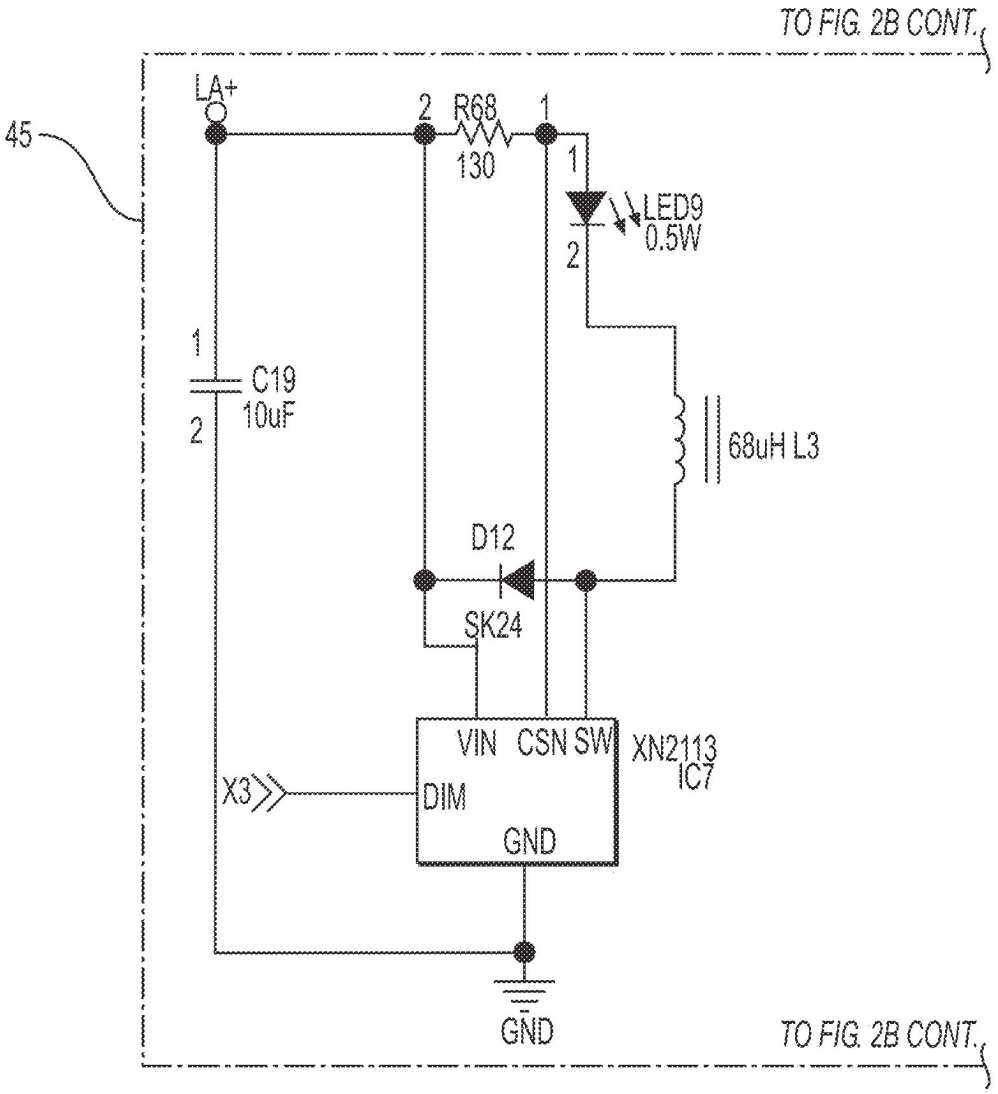


FIG. 2B CONT.

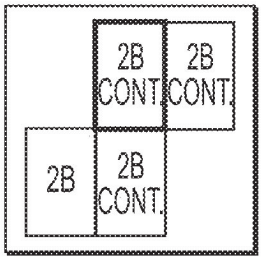


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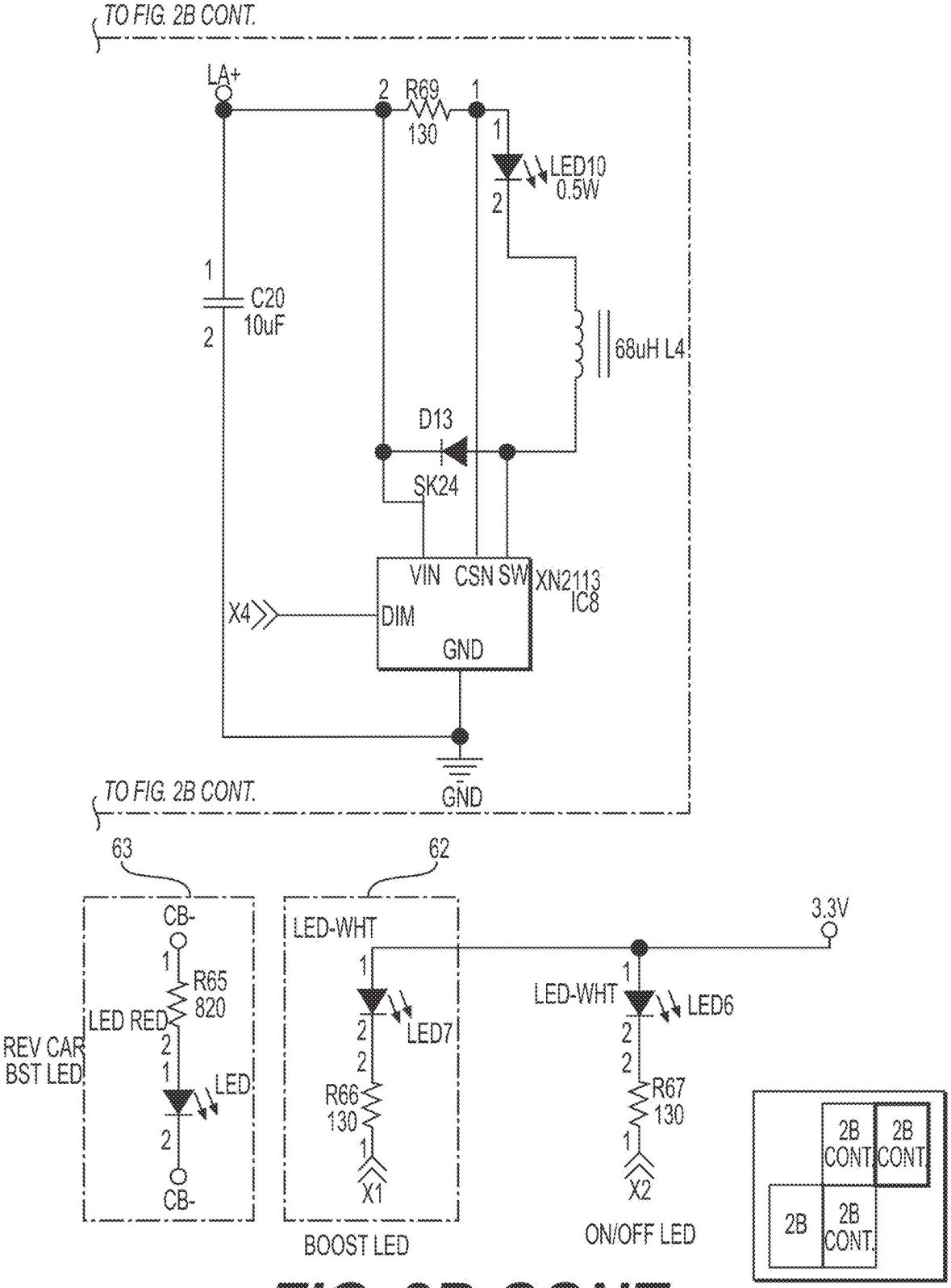
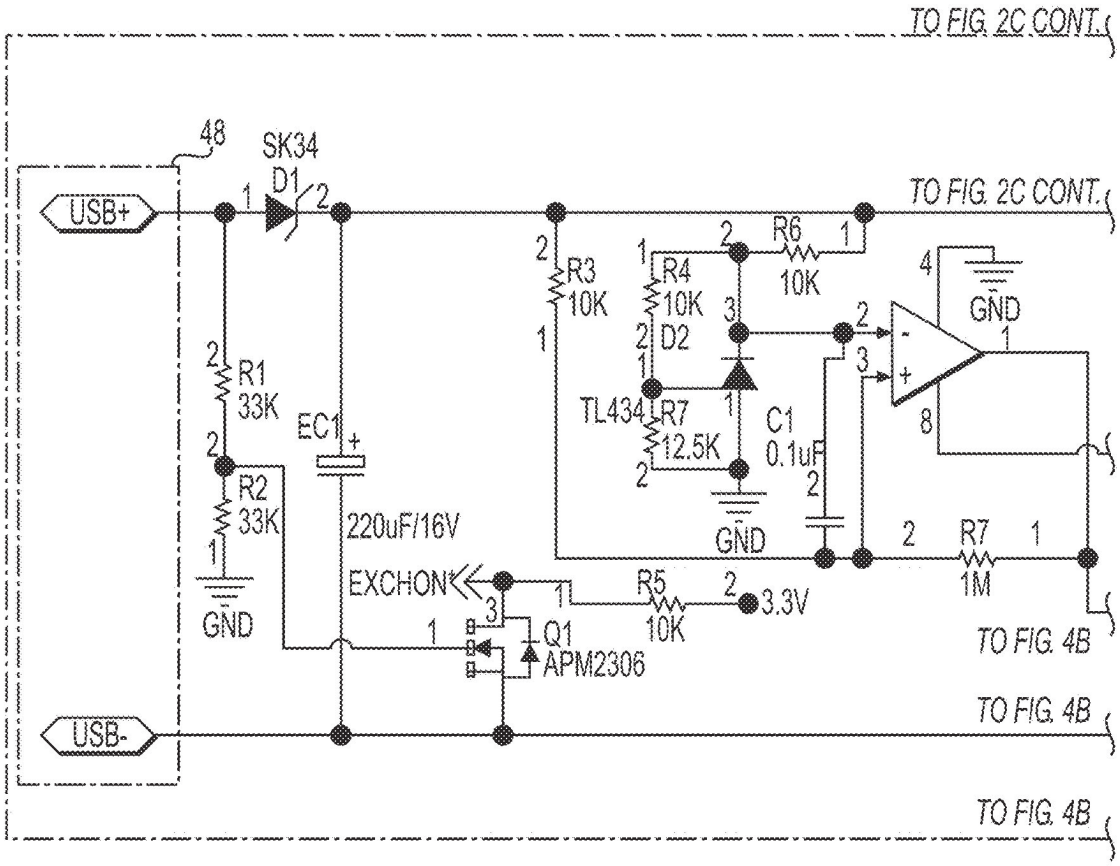


FIG. 2B CONT.

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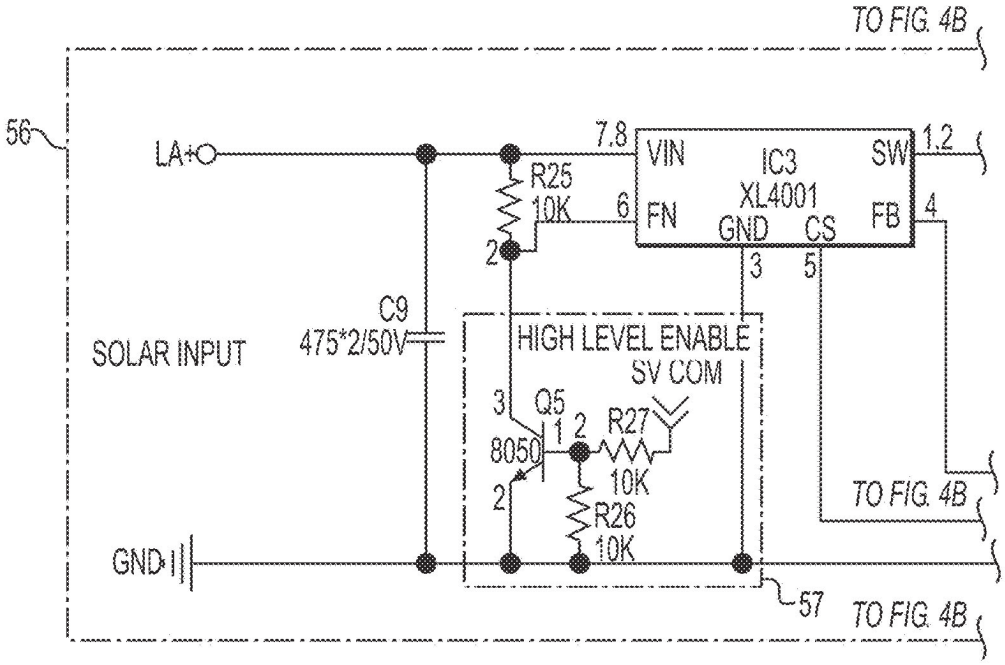


FIG. 2C

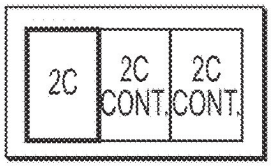


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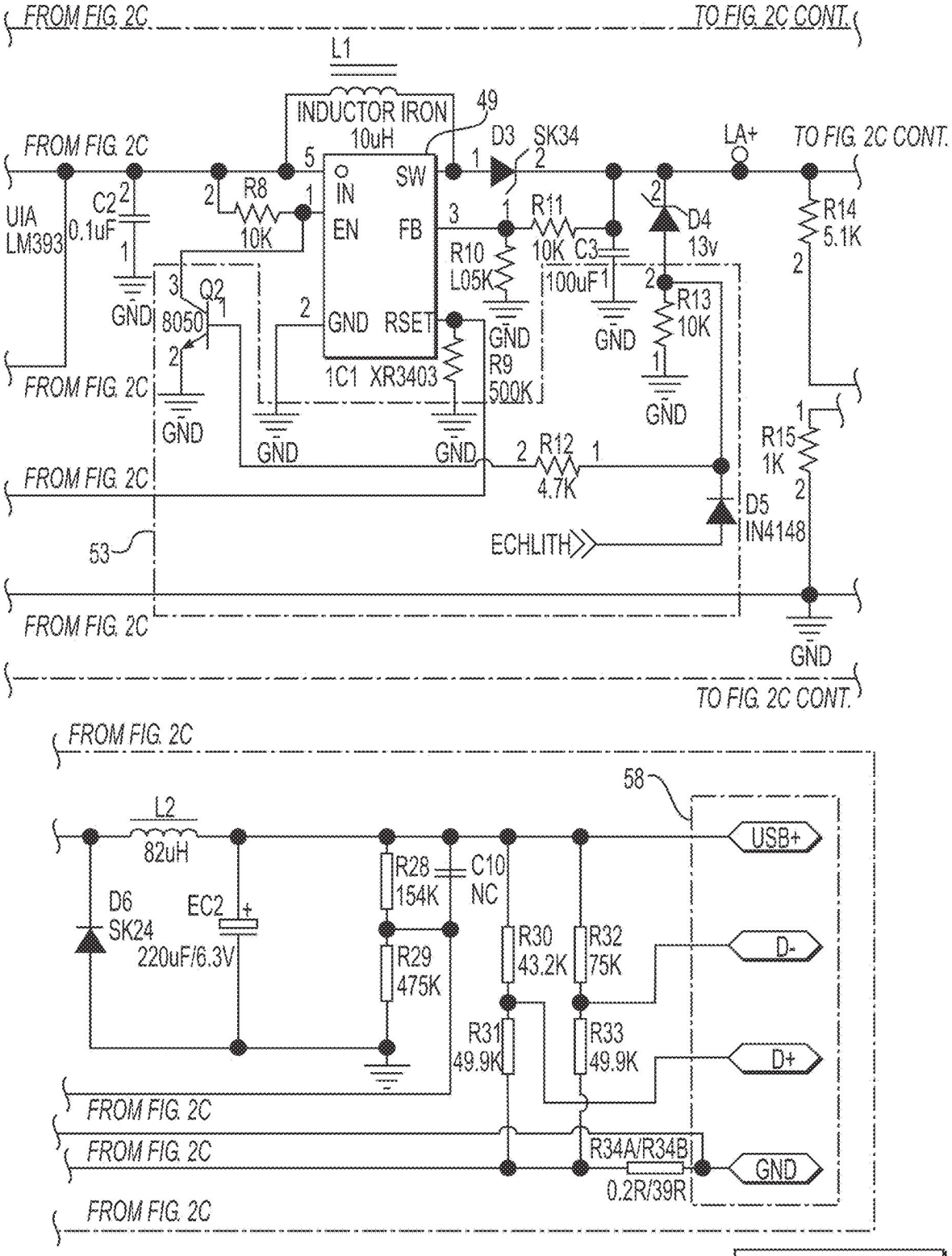


FIG. 2C CONT.

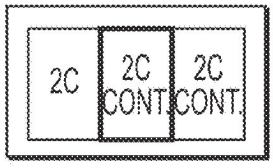


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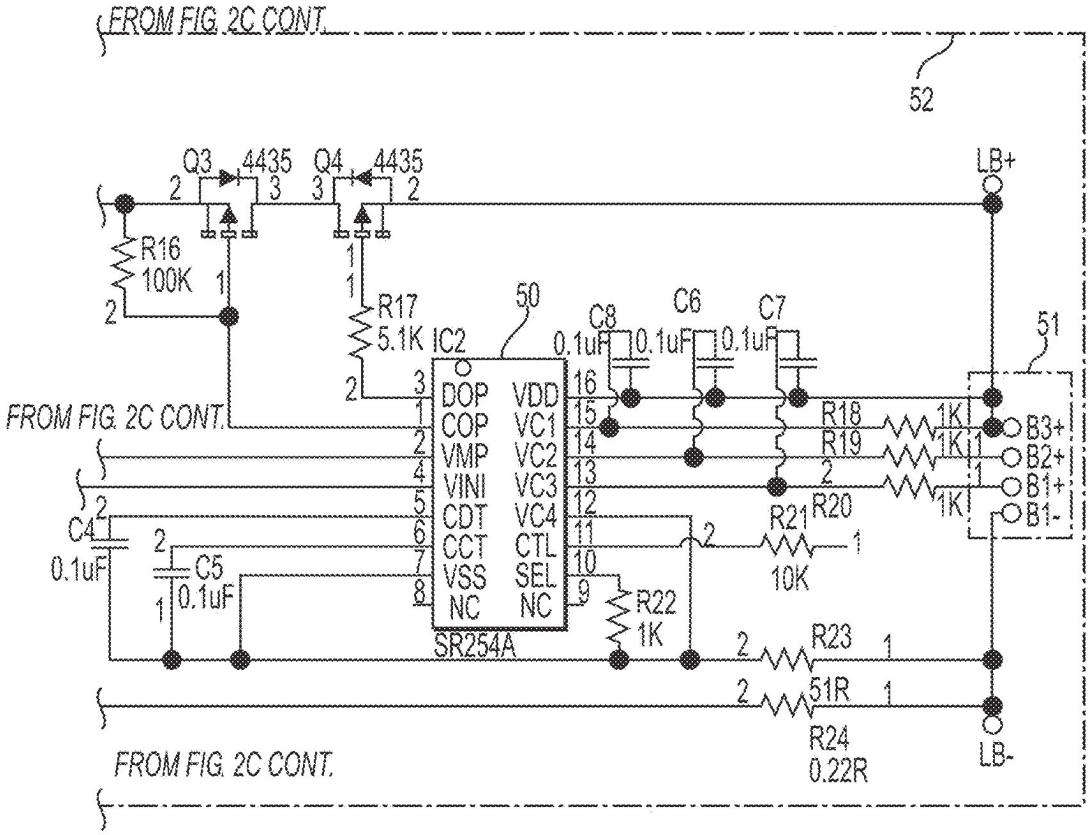


FIG. 2C CONT.

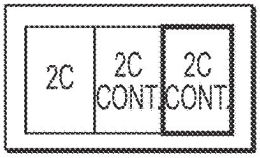


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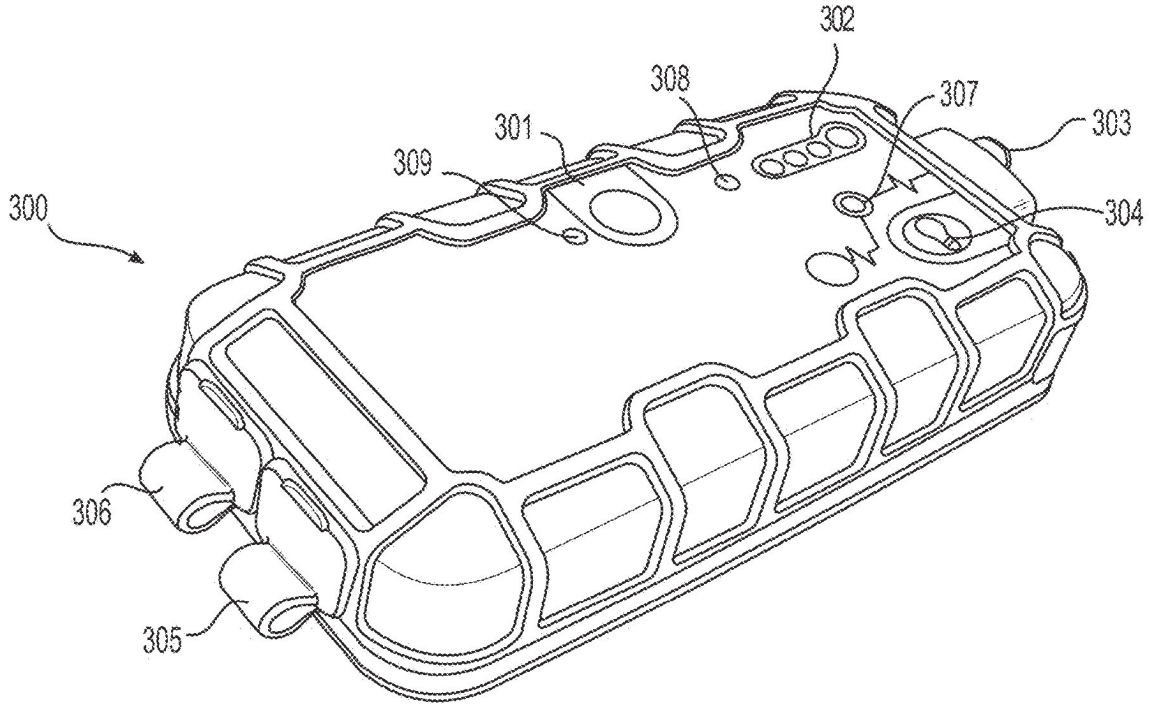


FIG. 3

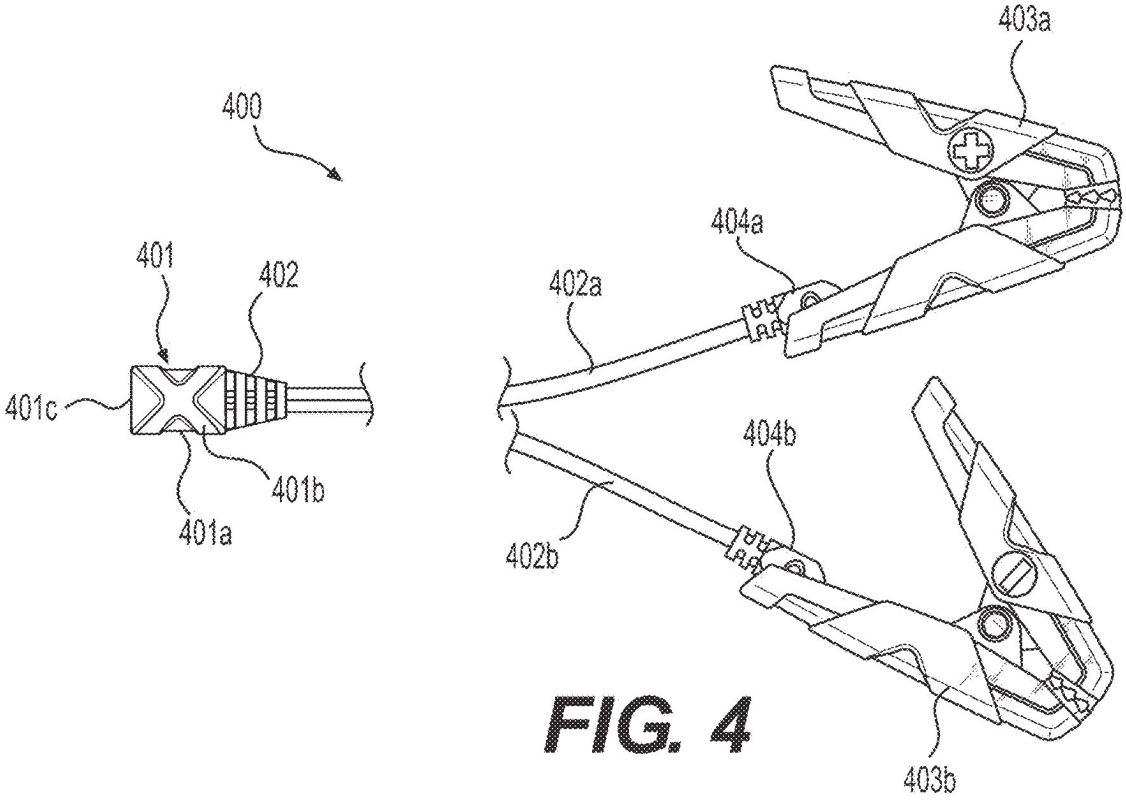


FIG. 4

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JUMP STARTING DEVICE WITH USB

FIELD OF THE INVENTION

The present invention relates generally to apparatus for jump-starting a vehicle having a depleted or discharged battery.

BACKGROUND TO THE INVENTION

Prior art devices are known for jump-starting a vehicle, which provide either a pair of electrical connector cables that connect a fully-charged battery of another vehicle to the engine start circuit of the dead battery vehicle, or portable booster devices which include a fully-charged battery which can be connected in circuit with the vehicle's engine starter through a pair of cables.

Problems with the prior art arose when either the jumper terminals or clamps of the cables were inadvertently brought into contact with each other while the other ends were connected to a charged battery, or when the positive and negative terminals were connected to the opposite polarity terminals in the vehicle to be jumped, thereby causing a short circuit resulting in sparking and potential damage to batteries and/or bodily injury.

Various attempts to eliminate these problems have been made in the prior art. U.S. Pat. No. 6,212,054 issued Apr. 3, 2001, discloses a battery booster pack that is polarity sensitive and can detect proper and improper connections before providing a path for electric current flow. The device uses a set of LEDs connected to optical couplers oriented by a control circuit. The control circuit controls a solenoid assembly controlling the path of power current. The control circuit causes power current to flow through the solenoid assembly only if the points of contact of booster cable clamp connections have been properly made.

U.S. Pat. No. 6,632,103 issued Oct. 14, 2003, discloses an adaptive booster cable connected with two pairs of clips, wherein the two pairs of clips are respectively attached to two batteries to transmit power from one battery to the other battery. The adaptive booster cable includes a polarity detecting unit connected to each clip, a switching unit and a current detecting unit both provided between the two pairs of clips. After the polarity of each clip is sensed by the polarity detecting unit, the switching unit generates a proper connection between the two batteries. Therefore, the positive and negative terminals of the two batteries are correctly connected based on the detected result of the polarity detecting unit.

U.S. Pat. No. 8,493,021 issued Jul. 23, 2013, discloses apparatus that monitors the voltage of the battery of a vehicle to be jump started and the current delivered by the jump starter batteries to determine if a proper connection has been established and to provide fault monitoring. Only if the proper polarity is detected can the system operate. The voltage is monitored to determine open circuit, disconnected conductive clamps, shunt cable fault, and solenoid fault conditions. The current through the shunt cable is monitored to determine if there is a battery explosion risk, and for excessive current conditions presenting an overheating condition, which may result in fire. The system includes an internal battery to provide the power to the battery of the vehicle to be jump started. Once the vehicle is started, the unit automatically electrically disconnects from the vehicle's battery.

U.S. Pat. No. 5,189,359 issued Feb. 23, 1993, discloses a jumper cable device having two bridge rectifiers for developing a reference voltage, a four-input decoder for determining which terminals are to be connected based on a comparison of the voltage at each of the four terminals to the reference voltage, and a pair of relays for effecting the correct connection depending on the determination of the decoder. No connection will be made unless only one terminal of each battery has a higher voltage than the reference voltage, indicating "positive" terminals, and one has a lower voltage than the reference voltage, indicating "negative" terminals, and that, therefore, the two high voltage terminals may be connected and the two lower voltage terminals may be connected. Current flows once the appropriate relay device is closed. The relay device is preferably a MOSFET combined with a series array of photodiodes that develop MOSFET gate-closing potential when the decoder output causes an LED to light.

U.S. Pat. No. 5,795,182 issued Aug. 18, 1998, discloses a polarity independent set of battery jumper cables for jumping a first battery to a second battery. The apparatus includes a relative polarity detector for detecting whether two batteries are configured cross or parallel. A three-position high current capacity crossbar pivot switch is responsive to the relative polarity detector for automatically connecting the plus terminals of the two batteries together and the minus terminals of the two batteries together regardless of whether the configuration detected is cross or parallel, and an undercurrent detector and a delay circuit for returning the device to its ready and unconnected state after the device has been disconnected from one of the batteries. The crossbar pivot switch includes two pairs of contacts, and a pivot arm that pivots about two separate points to ensure full electrical contact between the pairs of contacts. The invention can also be used to produce a battery charger that may be connected to a battery without regard to the polarity of the battery.

U.S. Pat. No. 6,262,492 issued Jul. 17, 2001, discloses a car battery jumper cable for accurately coupling an effective power source to a failed or not charged battery, which includes a relay switching circuit connected to the power source and the battery by two current conductor pairs. First and second voltage polarity recognition circuits are respectively connected to the power source and the battery by a respective voltage conductor pair to recognize the polarity of the power source and the battery. A logic recognition circuit produces a control signal subject to the polarity of the power source and the battery, and a driving circuit controlled by the control signal from the logic recognition circuit drives the relay switching circuit, enabling the two poles of the power source to be accurately coupled to the two poles of the battery.

U.S. Pat. No. 5,635,817 issued Jun. 3, 1997, discloses a vehicle battery charging device that includes a control housing having cables including a current limiting device to prevent exceeding of a predetermined maximum charging current of about 40 to 60 amps. The control housing includes a polarity detecting device to verify the correct polarity of the connection of the terminals of the two batteries and to electrically disconnect the two batteries if there is an incorrect polarity.

U.S. Pat. No. 8,199,024 issued Jun. 12, 2012, discloses a safety circuit in a low-voltage connecting system that leaves the two low-voltage systems disconnected until it determines that it is safe to make a connection. When the safety circuit determines that no unsafe conditions exist and that it is safe to connect the two low-voltage systems, the safety circuit may connect the two systems by way of a "soft start" that provides a connection between the two systems over a period of time that reduces or prevents inductive voltage

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spikes on one or more of the low-voltage systems. When one of the low-voltage systems has a completely-discharged battery incorporated into it, a method is used for detection of proper polarity of the connections between the low-voltage systems. The polarity of the discharged battery is determined by passing one or more test currents through it and determining whether a corresponding voltage rise is observed.

U.S. Pat. No. 5,793,185 issued Aug. 11, 1998, discloses a handheld jump starter having control components and circuits to prevent overcharging and incorrect connection to batteries.

While the prior art attempted solutions to the abovementioned problems as discussed above, each of the prior art solutions suffers from other shortcomings, either in complexity, cost or potential for malfunction. Accordingly, there exists a need in the art for further improvements to vehicle jump start devices.

SUMMARY OF THE INVENTION

In accordance with an aspect of the invention, an apparatus is provided for jump starting a vehicle engine, comprising: an internal power supply; an output port having positive and negative polarity outputs; a vehicle battery isolation sensor connected in circuit with said positive and negative polarity outputs, configured to detect presence of a vehicle battery connected between said positive and negative polarity outputs; a reverse polarity sensor connected in circuit with said positive and negative polarity outputs, configured to detect polarity of a vehicle battery connected between said positive and negative polarity outputs and to provide an output signal indicating whether positive and negative terminals of said vehicle battery are properly connected with said positive and negative polarity outputs of said output port; a power switch connected between said internal power supply and said output port; and a microcontroller configured to receive input signals from said vehicle isolation sensor and said reverse polarity sensor, and to provide an output signal to said power switch, such that said power switch is turned on to cause said internal power supply to be connected to said output port in response to signals from said sensors indicating the presence of a vehicle battery at said output port and proper polarity connection of positive and negative terminals of said vehicle battery with said positive and negative polarity outputs, and is not turned on when signals from said sensors indicate either the absence of a vehicle battery at said output port or improper polarity connection of positive and negative terminals of said vehicle battery with said positive and negative polarity outputs.

In accordance with an embodiment of the invention, the internal power supply is a rechargeable lithium ion battery pack.

A jumper cable device may also be provided, having a plug configured to plug into said output port; a pair of cables integrated with the plug at one respective end thereof; said pair of cables being configured to be separately connected to terminals of a battery at another respective end thereof.

Comprises/comprising and grammatical variations thereof when used in this specification are to be taken to specify the presence of stated features, integers, steps or components or groups thereof, but do not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a functional block diagram of a handheld vehicle battery boost apparatus in accordance with one aspect of the present invention;

FIGS. **2**A-**2**C are schematic circuit diagrams of an example embodiment of a handheld vehicle battery boost apparatus in accordance with an aspect of the invention;

FIG. **3** is a perspective view of a handheld jump starter booster device in accordance with one example embodiment of the invention; and

FIG. **4** is a plan view of a jumper cable usable with the handheld jump starter booster device in accordance with another aspect of the invention.

DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** is a functional block diagram of a handheld battery booster according to one aspect of the invention. At 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. In one example embodiment, a high-surge lithium polymer battery pack includes three 3.7V, 2666 mAh lithium polymer batteries in a 3S1P configuration. The resulting battery pack provides 11.1V, 2666 Ah (8000 Ah at 3.7V, 29.6 Wh). Continuous discharge current is 25C (or 200 amps), and burst discharge current is 50C (or 400 amps). The maximum charging current of the battery pack is 8000 mA (8 amps).

A programmable microcontroller unit (MCU) **1** receives various inputs and produces informational as well as control outputs. The programmable MCU **1** further provides flexibility to the system by allowing updates in functionality and system parameters, without requiring any change in hardware. According to one example embodiment, an 8 bit microcontroller with 2K×15 bits of flash memory is used to control the system. One such microcontroller is the HT67F30, which is commercially available from Holtek Semiconductor Inc.

A car battery reverse sensor **10** monitors the polarity of the vehicle battery **72** when the handheld battery booster device is connected to the vehicle's electric system. As explained below, the booster device prevents 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. A car battery isolation sensor **12** detects whether or not a vehicle battery **72** is connected to the booster device, and prevents the lithium battery pack from being connected to the output terminals of the booster device unless there is a good (e.g. chargeable) battery connected to the output terminals.

A smart switch FET circuit **15** electrically switches the handheld battery booster lithium battery to the vehicle's electric system only when the vehicle battery is determined by the MCU **1** to be present (in response to a detection signal provided by isolation sensor **12**) and connected with the correct polarity (in response to a detection signal provided by reverse sensor **10**). A lithium battery temperature sensor **20** monitors the temperature of the lithium battery pack **32** to detect overheating due to high ambient temperature conditions and overextended current draw during jump starting. A lithium battery voltage measurement circuit **24** monitors the voltage of the lithium battery pack **32** to prevent the voltage potential from rising too high during a charging operation and from dropping too low during a discharge operation.

Lithium battery back-charge protection diodes **28** prevent any charge current being delivered to the vehicle battery **72** from flowing back to the lithium battery pack **32** from the vehicle's electrical system. Flashlight LED circuit **36** is

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provided to furnish a flashlight function for enhancing light under a vehicle's hood in dark conditions, as well as providing SOS and strobe lighting functions for safety purposes when a vehicle may be disabled in a potentially dangerous location. Voltage regulator **42** provides regulation of internal operating voltage for the microcontroller and sensors. On/Off manual mode and flashlight switches **46** allow the user to control power-on for the handheld battery booster device, to control manual override operation if the vehicle has no battery, and to control the flashlight function. The manual button functions only when the booster device is powered on. This button allows 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. When the user presses and holds the manual override button for a predetermined period time (such as three seconds) to prevent inadvertent actuation of the manual mode, the internal lithium ion battery power is switched to the vehicle battery connect port. The only exception to the manual override is if the car battery is connected in reverse. If the car battery is connected in reverse, the internal lithium battery power shall never be switched to the vehicle battery connect port.

USB charge circuit **52** converts power from any USB charger power source, to charge voltage and current for charging the lithium battery pack **32**. USB output **56** provides a USB portable charger for charging smartphones, tablets, and other rechargeable electronic devices. Operation indicator LEDs **60** provide visual indication of lithium battery capacity status as well as an indication of smart switch activation status (indicating that power is being provided to the vehicle's electrical system).

Detailed operation of the handheld booster device will now be described with reference to the schematic diagrams of FIGS. **2**A-**2**C. As shown in FIG. **2**A, the microcontroller unit **1** is the center of all inputs and outputs. The reverse battery sensor **10** comprises an optically coupled isolator phototransistor (4N27) connected to the terminals of vehicle battery **72** at input pins **1** and **2** with a diode D**8** in the lead conductor of pin **1** (associated with the negative terminal CB−), such that if the battery **72** is connected to the terminals of the booster device with the correct polarity, the optocoupler LED **11** will not conduct current, and is therefore turned off, providing a "1" or high output signal to the MCU **1**. The car battery isolation sensor **12** comprises an optically coupled isolator phototransistor (4N27) connected to the terminals of vehicle battery **72** at input pins **1** and **2** with a diode D**7** in the lead conductor of pin **1** (associated with the positive terminal CB+), such that if the battery **72** is connected to the terminals of the booster device with the correct polarity, the optocoupler LED **11**A will conduct current, and is therefore turned on, providing a "0" or low output signal to the MCU, indicating the presence of a battery across the jumper output terminals of the handheld booster device.

If the car battery **72** is connected to the handheld booster device with reverse polarity, the optocoupler LED **11** of the reverse sensor **10** will conduct current, providing a "0" or low signal to microcontroller unit **1**. Further, if no battery is connected to the handheld booster device, the optocoupler LED **11**A of the isolation sensor **12** will not conduct current, and is therefore turned off, providing a "1" or high output signal to the MCU, indicating the absence of any battery connected to the handheld booster device. 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 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.

As shown in FIG. **2**B, the FET smart switch **15** is driven by an output of the microcontroller **1**. The FET smart switch **15** includes three FETs (Q**15**, Q**18**, and Q**19**) in parallel, which spreads the distribution of power from the lithium battery pack over the FETs. When that microcontroller output is driven to a logic low, FETs **16** are all in a high resistance state, therefore not allowing current to flow from the internal lithium battery negative contact **17** to the car battery **72** negative contact. When the microcontroller output is driven to a logic high, the FETs **16** (Q**15**, Q**18**, and Q**19**) are in a low resistant state, allowing current to flow freely from the internal lithium battery pack negative contact **17** (LB−) to the car battery **72** negative contact (CB−). In this way, the microcontroller software controls the connection of the internal lithium battery pack **32** to the vehicle battery **72** for jumpstarting the car engine.

Referring back to FIG. **2**A, the internal lithium battery pack voltage can be accurately measured using circuit **24** and one of the analog-to-digital inputs of the microcontroller **1**. Circuit **24** is designed to sense when the main 3.3V regulator **42** voltage is on, and to turn on transistor **23** when the voltage of regulator **42** is on. When transistor **23** is conducting, it turns on FET **22**, thereby providing positive contact (LB+) of the internal lithium battery a conductive path to voltage divider **21** allowing a lower voltage range to be brought to the microcontroller to be read. Using this input, the microcontroller software can determine if the lithium battery voltage is too low during discharge operation or too high during charge operation, and take appropriate action to prevent damage to electronic components.

Still referring to FIG. **2**A, the temperature of the internal lithium battery pack **32** can be accurately measured by two negative temperature coefficient (NTC) devices **20**. These are devices that reduce their resistance when their temperature rises. The circuit is a voltage divider that brings the result to two analog-to-digital (A/D) inputs on the microcontroller **1**. The microcontroller software can then determine when the internal lithium battery is too hot to allow jumpstarting, adding safety to the design.

The main voltage regulator circuit **42** is designed to convert internal lithium battery voltage to a regulated 3.3 volts that is utilized by the microcontroller **1** as well as by other components of the booster device for internal operating power. Three lithium battery back charge protection diodes **28** (see FIG. **2**B) are in place to allow current to flow only from the internal lithium battery pack **32** to the car battery **72**, and not from the car battery to the internal lithium battery. In this way, if the car electrical system is charging from its alternator, it cannot back-charge (and thereby damage) the internal lithium battery, providing another level of safety.

The main power on switch **46** (FIG. **2**A) is a combination that allows for double pole, double throw operation so that with one push, the product can be turned on if it is in the off state, or turned off if it is in the on state. This circuit also uses a microcontroller output **47** to "keep alive" the power when it is activated by the on switch. When the switch is pressed the microcontroller turns this output to a high logic level to keep power on when the switch is released. In this way, the microcontroller maintains control of when the power is turned off when the on/off switch is activated again or when the lithium battery voltage is getting too low. The micro-

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controller software also includes a timer that turns the power off after a predefined period of time, (such as, e.g. 8 hours) if not used.

The flashlight LED circuit **45** shown in FIG. **2**B controls the operation of flashlight LEDs. Two outputs from the microcontroller **1** are dedicated to two separate LEDs. Thus, the LEDs can be independently software-controlled for strobe and SOS patterns, providing yet another safety feature to the booster device. LED indicators provide the feedback the operator needs to understand what is happening with the product. Four separate LEDs **61** (FIG. **2**A) are controlled by corresponding individual outputs of microcontroller **1** to provide indication of the remaining capacity of the internal lithium battery. These LEDs are controlled in a "fuel gauge" type format with 25%, 50%, 75% and 100% (red, red, yellow, green) capacity indications. An LED indicator **63** (FIG. **2**B) provides a visual warning to the user when the vehicle battery **72** has been connected in reverse polarity. "Boost" and on/off LEDs **62** provide visual indications when the booster device is provide jump-start power, and when the booster device is turned on, respectively.

A USB output **56** circuit (FIG. **2**C) is included to provide a USB output for charging portable electronic devices such as smartphones from the internal lithium battery pack **32**. Control circuit **57** from the microcontroller **1** allows the USB Out **56** to be turned on and off by software control to prevent the internal lithium battery getting too low in capacity. The USB output is brought to the outside of the device on a standard USB connector **58**, which includes the standard voltage divider required for enabling charge to certain smartphones that require it.

The USB charge circuit **52** allows the internal lithium battery pack **32** to be charged using a standard USB charger. This charge input uses a standard micro-USB connector **48** allowing standard cables to be used. The 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**. The DC-DC converter **49** can be turned on and off via circuit **53** by an output from the microcontroller **1**.

In this way, the microcontroller software can turn the charge off if the battery voltage is measured to be too high by the A/D input **22**. Additional safety is provided for helping to eliminate overcharge to the internal lithium battery using a lithium battery charge controller **50** that provides charge balance to the internal lithium battery cells **51**. This controller also provides safety redundancy for eliminating over discharge of the internal lithium battery.

FIG. **3** is a perspective view of a handheld device **300** in accordance with an exemplary embodiment of the invention. **301** is a power on switch. **302** shows the LED "fuel gauge" indicators **61**. **303** shows a 12 volt output port connectable to a cable device **400**, described further below. **304** shows a flashlight control switch for activating flashlight LEDs **45**. **305** is a USB input port for charging the internal lithium battery, and **306** is a USB output port for providing charge from the lithium battery to other portable devices such as smartphones, tablets, music players, etc. **307** is a "boost on" indicator showing that power is being provided to the 12V output port. **308** is a "reverse" indicator showing that the vehicle battery is improperly connected with respect to polarity. **309** is a "power on" indicator showing that the device is powered up for operation.

FIG. **4** shows a jumper cable device **400** specifically designed for use with the handheld device **300**. Device **400** has a plug **401** configured to plug into 12 volt output port **303** of the handheld device **300**. A pair of cables **402***a* and **402***b* are integrated with the plug **401**, and are respectively connected to battery terminal clamps **403***a* and **403***b* via ring terminals **404***a* and **404***b*. The port **303** and plug **401** may be dimensioned so that the plug **401** will only fit into the port **303** in a specific orientation, thus ensuring that clamp **403***a* will correspond to positive polarity, and clamp **403***b* will correspond to negative polarity, as indicated thereon. Additionally, the ring terminals **404***a* and **404***b* may be disconnected from the clamps and connected directly to the terminals of a vehicle battery. This feature may be useful, for example, to permanently attach the cables **302***a*-**302***b* to the battery of a vehicle. In the event that the battery voltage becomes depleted, the handheld booster device **300** could be properly connected to the battery very simply by plugging in the plug **401** to the port **303**.

The invention having been thus described, it will be apparent to those skilled in the art that the same may be varied in many ways without departing from the spirit or scope of the invention. Any and all such variations are intended to be encompassed within the scope of the following claims.

The invention claimed is:

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

a power supply;

a positive battery connector for electrically connecting the jump starting device to the positive battery terminal of the depleted or discharged battery;

a negative battery connector for electrically connecting the jump starting device to the negative battery terminal of the depleted or discharged battery;

a power switch or switch circuit connected in circuit with the power supply and the positive and negative battery connectors, the power switch or switch circuit configured to switch power on from the power supply to boost or charge the depleted or discharged battery when connected between the positive and negative battery connectors;

a USB input connector; and

a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit comprising a DC-DC converter configured to upconvert voltage from the USB input connector to the power supply.

2. The device according to claim **1**, wherein the power switch or switch circuit is controlled to turn on power to the depleted or discharged battery only when the jump starting device is connected with correct polarity to the depleted or discharged battery.

3. The device according to claim **1**, wherein the power supply is an internal power supply.

4. The device according to claim **1**, wherein the USB charging circuit and power supply are located within the jump starting device.

5. The device according to claim **4**, wherein the DC-DC converter is one or more DC-DC converters.

6. The device according to claim **1**, wherein the DC-DC converter is configured to convert about 5 VDC from the USB input connector to at least 11.1 VDC for the power supply when an active USB power source is connected to the USB input connector.

7. The device according to claim **6**, wherein the USB charger power source is a USB charger, and the USB charging circuit is configured to convert power from the

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USB charger to charge voltage and current for supplying power or charging the power supply.

8. The device according to claim **6**, wherein the USB charging source is a USB charger.

9. The device according to claim **8**, wherein the USB charger is a standard USB charger.

10. The device according to claim **1**, wherein the DC-DC converter is configured to be turned on and off via a circuit by an output from a microcontroller.

11. The device according to claim **10**, wherein the power supply is a rechargeable battery, and wherein the microcontroller software can turn charge off if the rechargeable battery voltage is measured to be too high by an A/D input.

12. The device according to claim **11**, wherein the rechargeable battery is a rechargeable lithium battery, and further comprising a rechargeable lithium battery charge controller configured to provide charge balance to internal lithium battery cells of the rechargeable lithium battery.

13. The device according to claim **12**, wherein the rechargeable lithium battery charge controller is also configured to provide safety redundancy for eliminating over discharge of the rechargeable lithium battery.

14. The device according to claim **1**, wherein the USB input connector is a micro-USB connector.

15. The device according to claim **1**, further comprising a USB output connector for providing a power output from the power supply to a USB-chargeable device.

16. The device according to claim **15**, wherein the USB output connector at least partially defines a USB output port.

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

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

19. The device according to claim **17**, wherein the USB output connector and the USB output circuit define a USB output port.

20. The device according to claim **19**, wherein the USB output port is configured to provide a portable charger for charging smartphones, tablets, music players, and other rechargeable electronic devices.

21. The device according to claim **19**, wherein the USB output port is accessible from outside of the jump charge device using the USB output connector.

22. The device according to claim **21**, wherein the USB connector includes a voltage divider configured to enable charge to certain smartphones that require the voltage divider.

23. The device according to claim **1**, wherein the power supply is a rechargeable battery disposed within the jump starting device.

24. The device according to claim **1**, wherein the power switch or switch circuit comprises at least one power switch or switch circuit configured to turn power on from the power supply to the depleted or discharged battery when connected to the positive and negative battery connectors.

25. The device according to claim **24**, wherein the power switch or switch circuit comprises one or more sensors configured to detect whether the positive and negative battery connectors are properly connected to the depleted or discharged battery prior to switching on the power switch or switch circuit.

26. The device according to claim **25**, wherein the power switch or switch circuit is configured to detect presence of the depleted or discharged battery when connected between the positive and negative battery connectors.

27. The device according to claim **25**, wherein the power switch or switch circuit is configured to detect polarity of the depleted or discharged battery when connected between the positive and negative battery connectors.

28. The device according to claim **25**, wherein the power switch or switch circuit is configured to detect presence of the depleted or discharged battery when connected between the positive and negative battery connectors, and configured to detect polarity of the depleted or discharged battery when connected between the positive and negative battery connectors,

wherein the power switch or switch circuit switches on the power supply to connect the power supply to the depleted or discharged battery only when the depleted or discharged battery is present when connected between the positive and negative battery connectors and the depleted or discharged battery is connected with correct polarity between the positive and negative battery terminals.

29. The device according to claim **24**, wherein the power switch or switch circuit comprises a microcontroller configured for providing an output controlling the power switch or switch circuit.

30. The device according to claim **29**, wherein the microcontroller receives input from one or more sensors configured to detect presence of the depleted or discharged battery when connected between the positive and negative battery connectors, and to detect polarity of the depleted or discharged battery when connected between the positive and negative battery connectors.

31. The device according to claim **30**, wherein the one or more sensors includes one sensor configured to detect presence of the depleted or discharged battery when connected between the positive and negative battery connectors, and another sensor configured to detect polarity of the depleted or discharged battery when connected between the positive and negative battery connectors.

32. The device according to claim **31**, wherein the one or more sensors is one or more sensing circuits.

33. The device according to claim **30**, wherein the one or more sensors is a presence sensor configured for detecting presence of the depleted or discharged battery when connected between the positive and negative battery connectors, and a reverse polarity sensor configured to detect polarity of a connection of the positive and negative battery connectors of the jump starting device with the depleted or discharge battery.

34. The device according to claim **33**, wherein the presence sensor and the reverse polarity sensor comprise optically coupled isolator phototransistors.

35. The device according to claim **33**, further comprising a manual override switch configured to activate a manual override mode to enable a user to connect jump start power to the positive and negative battery connectors when the one sensor configured for detecting presence of the depleted or discharged battery is unable to detect presence of the depleted or discharged battery.

36. The device according to claim **35**, wherein the microcontroller is configured to detect actuation of the manual override switch for at least a predetermined period of time before activation of the manual override mode.

37. The device according to claim **29**, wherein the microcontroller switches the power switch or switch circuit on to

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provide power from the power supply to the depleted or discharged battery only when the depleted or discharged battery is determined by the microcontroller to be present and connected with correct polarity to the positive and negative battery connectors.

38. The device according to claim **29**, wherein the microcontroller is a programmable microcontroller configured to allow updates in functionality and system parameters.

39. The device according to claim **38**, wherein the programmable microcontroller comprises a memory.

40. The device according to claim **29**, further comprising a temperature sensor configured to detect temperature of the power supply and to provide a temperature signal to the microcontroller.

41. The device according to claim **29**, further comprising a voltage measurement circuit configured to measure output voltage of the power supply and to provide a voltage measurement signal to the microcontroller.

42. The device according to claim **1**, wherein the positive battery connector comprises a positive battery cable, and the negative battery connector comprises a negative battery cable.

43. The device according to claim **42**, wherein the positive battery cable comprises a positive battery clamp and the negative battery cable comprises a negative battery clamp.

44. The device according to claim **1**, wherein said power switch or switch circuit comprises a plurality of FETs in parallel.

45. The device according to claim **1**, further comprising a plurality of power diodes coupled between the positive and negative battery connectors and the power supply to prevent back-charging of the power supply from an electrical system connected to the depleted or discharged battery.

46. The device according to claim **1**, further comprising an output port providing positive and negative polarity outputs to the positive and negative battery connectors.

47. The device according to claim **1**, further comprising a voltage regulator configured to convert output voltage of the power supply to a voltage level appropriate to provide operating power to internal components of the device.

48. The device according to claim **1**, wherein the positive and negative battery connectors are defined by a jumper cable device including a plug configured to plug into an output port of the jump starting device, a pair of cables integrated with the plug at one respective end of the pair of cables and being configured to be connected to positive and negative battery terminals of the depleted or discharged battery at an opposite end of the pair of cables.

49. The device according to claim **48**, wherein the output port and the plug are dimensioned so that the plug will fit into the output port only in one specific orientation.

50. The device according to claim **1**, wherein the power switch or switch circuit is configured to switch power on only when the jump starting device is properly connected to the depleted or discharged battery.

51. The device according to claim **1**, wherein the power supply is a rechargeable lithium battery pack.

52. The device according to claim **18**, wherein the rechargeable lithium battery pack is an internal power supply.

53. The device according to claim **18**, wherein the USB charge circuit is configured to convert power from a USB charger power source, to charge voltage and current suitable for charging the rechargeable lithium battery pack.

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

55. The device according to claim **51**, further comprising a fuel gauge LEDS for indicating a charge level of the rechargeable lithium battery pack.

56. The device according to claim **1**, wherein the power switch or switch circuit is a smart switch, or comprises a smart switch.

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

a power supply;

a positive battery connector for electrically connecting the jump starting starter device to the positive battery terminal of the depleted or discharged battery;

a negative battery connector for electrically connecting the jump starting starter device to the negative battery terminal of the depleted or discharged battery;

a power switch or switch circuit in circuit with the power supply and the positive and negative battery connectors, the power switch or switch circuit configured to switch power on from the power supply to boost or charge the depleted or discharged battery when connected between the positive and negative battery connectors;

a USB input connector;

a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit configured to up-convert voltage from a USB charger power source connected to the USB input connector to the power supply using a DC-DC converter;

a USB output connector; and

a USB output circuit electrically connecting the power supply to the USB output connector.

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