(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
27 April 2017 (27.04.2017)

WIPO | PCT

(10) International Publication Number
WO 2017/066916 Al

(51) International Patent Classification:
H02J 7/00 (2006.01)

(21) International Application Number:
PCT/CN20 15/092250

(22) International Filing Date:
20 October 2015 (20.10.201 5)

(25) Filing Language: English

(26) Publication Language: English

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available):* AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available):* ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

WO 2017/066916 A1

(54) Title: START-UP POWER SOURCES, IN PARTICULAR FOR VEHICLE BATTERY CHARGING

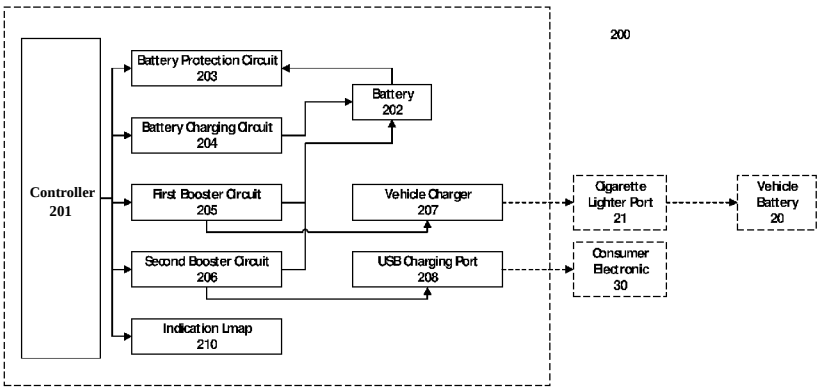

Fig. 3

(57) Abstract: Start-up power sources, in particular for charging a vehicle battery, can be provided in various embodiments of this disclosure. The start-up power sources can directly engage with the cigarette lighter port without the usage of any clip cords, thereby greatly reducing a risk of electric spark when connecting the start-up power source with the vehicle battery.

START-UP POWER SOURCES, IN PARTICULAR FOR VEHICLE BATTERY CHARGING

TECHNICAL FIELD

This disclosure generally relates to portable power bank, and particularly to start-up power sources for vehicle battery charging.

BACKGROUND

Vehicles are often supported by an internal battery having energy storage, where large current of substantially 100-300A from the internal battery are required for starting the vehicles. During daily usage, however, a vehicle owner may forget to turn off an air conditioner, a vehicle light or any other electrical device after a motor of the vehicle stops working. This can lead to a depleted condition for the vehicle battery, and thus the vehicle cannot be started next time due to no power supply from the vehicle battery.

In this situation, a trailer or road-side service was involved in the past, which would cause too high cost. In order to greatly lower down the cost, jump starters with build-in battery are adopted; the jump starter can replace the vehicle battery after it is connected to the vehicle, and the jump starter can directly power a motor of the vehicle so as to start the vehicle. Some existing jump starters are connected to the vehicle through clip cords; besides, it is needed to open an engine hood of the vehicle and remove a protection casing of the vehicle battery when using those jump starters to power the vehicle. In this way, it is too inconvenient to operate those jump starters, and there is great risk of short circuit or electrical spark when connecting the jump starters by virtue of the clip cords.

SUMMARY OF THIS DISCLOSURE

In one aspect, a start-up power source can be provided to charge a vehicle battery through a cigarette lighter port. The start-up power source can include a controller, a battery for providing power supply to the vehicle battery, a battery charging circuit for recharging the battery; a first booster circuit for boosting the power supply from the battery to a first target voltage, and a vehicle charger for connecting to the cigarette lighter port to charge the vehicle battery by the first target voltage. The connection between the start-up power source and the vehicle battery can be enabled by the cigarette lighter port without any clip cords, thus greatly improving operation convenience and reducing risk of electrical spark.

In some embodiments, the first booster circuit may boost the power supply through a synchronous rectification way, such that an efficiency of converting power storage of the battery to that of the vehicle battery can be improved.

In some embodiments, the battery charging circuit may recharge the battery through a multi-stage recharge way so as to prolong a service life of the battery. The multi-stage recharge way may be correlated to a voltage of the battery.

In some embodiments, the start-up power source may further include a USB charging port capable of being connected to a consumer electronic. When the start-up power source is not engaged with the cigarette lighter port, the start-up power source can act as a power bank to provide the power supply to the consumer electronic.

In still another aspect, a start-up power source can be provided, which may use one or more batteries for charging a storage battery of a vehicle or a consumer electronic. The start-up power source can include a controller, a first booster circuit, a second booster circuit and an output port for selectively connecting to the storage battery of the vehicle or the consumer electronics. The first booster circuit can operate for boosting a power supply provided by the one or more batteries to a first target voltage, and the second booster circuit can operate for boosting a power supply provided by the one or more batteries to a second target voltage. The first booster circuit and the second booster circuit can be selected by the controller to be connected to the output port. When the first booster circuit is connected to the output port, the storage battery can be charged by the first target voltage; when the second booster circuit is connected to the output port, the second target voltage can be applied to the consumer electronic. The output port can be configured to be plugged in a cigarette lighter port of the vehicle, so as to charge the storage battery via the cigarette lighter port.

BRIEF DESCRIPTION OF THE DRAWINGS

Following detailed descriptions of respective embodiments in this disclosure can be understood better when combining with these figures, in which the same structure is represented by the same reference sign. In the figures:

Figure 1 is a schematic diagram for a start-up power source according to a first embodiment of this disclosure;

Figure 2a is a circuit diagram for a battery protection circuit according to an embodiment of this disclosure;

Figure 2b is a circuit diagram for a battery charging circuit according to an embodiment of this disclosure;

Figure 3 is a schematic diagram for a start-up power source according to a second embodiment of this disclosure; and

Figure 4 is a schematic diagram illustrating structural configurations for start-up power sources in this disclosure.

DETAILED DESCRIPTION

Below this disclosure is described in detail with reference to various embodiments and accompanying drawings. Here, those embodiments and figures are used to explain this disclosure, rather than limiting any protection scope of this disclosure.

Start-up power sources, which can have high working efficiency and/or operation convenience, can be provided in various embodiments of this disclosure. The start-up power sources can connect with a vehicle battery via an inherent cigarette lighter port of a vehicle; that is, the start-up power source can directly engage with the cigarette lighter port without the usage of any clip cords. In this way, it becomes very convenient to operate the start-up power source when the vehicle battery is depleted. Also, after the start-up power source is connected to the vehicle battery, the start-up power source can charge the vehicle battery rather than powering a motor of the vehicle. At this point, a risk of electric spark during the usage of the start-up power source can be reduced greatly.

Figure 1 shows a start-up power source 100 with built-in battery unit in a first embodiment of this disclosure, where the start-up power source 100 can charge a vehicle battery 20 and/or a consumer electronic 30 using power storage of the battery unit. The start-up power source 100 can include a controller 11, a battery unit, a battery charging circuit 14, a first booster circuit 15 and a vehicle charger 16. The controller 11 can enable various control functions within the start-up power source 100; for example, the controller 11 can protect the start-up power source 100 from risks of over-discharge, short-circuit, over-current and/or over-shoot. The battery unit, the battery charging circuit 14, the first booster circuit 15 and the vehicle charger 16 can be controlled by the controller 11 to charge the vehicle battery 20.

The battery unit can have power storage to provide power supply to the vehicle battery 20. When the start-up power source 100 is connected to the vehicle battery through the cigarette lighter port 21, electrical power can be transmitted from the battery unit to the vehicle battery 20. The battery unit can include a battery 12 and a corresponding battery protection circuit 13, where the battery protection circuit 13 can protect the battery 12 from over-current, over-voltage and/or over-discharge and so on. Various batteries can be used as the built-in battery 12, and a protection circuit respectively adapted to different batteries should be applied correspondingly. In an example, a lithium battery can be used as the battery 12, and the battery protection circuit

13 corresponding to the lithium battery can be formed by a protection integrated chip (IC) (such as, an IC DW01) and high power MOSFETs.

In various embodiments of this disclosure, the battery protection circuit 13 can monitor the battery 12 through detecting voltage and/or current of the battery 12. A voltage detection result and/or a current detection result can then be obtained by the battery protection circuit 13. The battery protection circuit 13 can be connected with the controller 11 so that the voltage detection result and/or the current detection result can be communicated to the controller 11. After that, the battery charging circuit 14 can be controlled to recharge the battery 12 according to the voltage detection result, and/or the battery 12 is controlled to charge the vehicle battery 20 according to the voltage detection result or the current detection result.

In an example, a voltage high limit, a voltage low limit, a working voltage range and a current high limit can be preset for the battery 12, so that the corresponding battery protection circuit 13 can protect the battery 12 by comparing the voltage detection result and/or the current detection result with those preset limits. For example, when the voltage of the battery 12 is detected to exceed the voltage high limit, the battery charging circuit 14 may be switched off to stop recharging the battery 12, so that the battery 12 can be prevented from over-voltage; when the voltage of the battery 12 is lower than the voltage low limit, or when a discharging current of the battery 12 is larger than the current high limit, the battery 12 may be controlled to stop charging the vehicle battery 20 to avoid over-discharge (i.e., stopping outputting the power supply to the vehicle battery); when the voltage of the battery 12 falls within the working voltage range, the battery 12 can charge the vehicle battery 20 while the battery 12 can be recharged by the battery charging circuit 14. Other voltage limits and/or current limits can also be preset in the start-up power source 100.

Figure 2a shows a circuit diagram for a specific battery protection circuit 13 corresponding to the lithium battery. The battery protection circuit 13 can include a processing chip 131 (e.g., DW01), a charging MOSFET 132 and a discharging MOSFET 133. A pin 1 and a pin 3 of the processing chip 131 respectively connect with the discharging MOSFET 133 and the charging MOSFET 132. Pins 5, 6 of the processor chip 131 can detect the voltage of the battery 12, and a pin 2 of the processor chip 131 can detect the discharging current of the battery 12. When the voltage of the battery 12 is detected to be too large, the charging MOSFET 132 can be switched off by disconnecting the pin 3 of the processing chip 131. When the voltage of the battery 12 is detected to be too small, or the discharging current of the battery 12 is too high, the discharging MOSFET 133 can be switched off by disconnecting the pin 1 of the processing chip 131.

The battery charging circuit 14, which is used for recharging the battery 12 of the battery unit 14, can include a power input port 141, a power output port 142 and a recharging control port 143. The power input port 141 is capable of being connected to commercial power, an external storage battery or a motor of the vehicle, such that the battery charging circuit 14 can

recharge the battery 12 using the electrical power from the commercial power, another storage battery or the motor of the vehicle. The power output port 142 is connected with the battery 12 for power transmission. The recharging control port 143 is connected with the controller 11 to receive recharging control signals from the controller 11, such that the battery 12 can be prevented from over-voltage by the battery charging circuit 14.

In order to prolong a service life of the battery 12, a multi-stage recharging way can be used by the battery charging circuit 14 to recharge the battery 12. The multi-stage recharging way can mean that, the battery 12 is recharged using varied current during a complete recharging process. In an embodiment, the multi-stage recharging way can include a trickle charging mode, a constant-current charging mode and a constant-voltage charging mode. Those three charging modes can be correlated to a voltage of the battery 12 that is being recharged. That is, those three charging modes may be selected according to the voltage of the battery 12. Specifically, proposed a second recharging current for the battery 12 is N A under the constant-current charging mode, a first recharging current under the trickle charging mode can be substantially one tenth of the second recharging mode (i.e., N/10 A), while a third recharging current under the constant-voltage charging mode can gradually decrease until it becomes smaller than one tenth of the second recharging mode (i.e., <N/10 A).

The battery charging circuit 14 can be arranged with multiple threshold voltages, and those three charging modes can be selected by comparing the detected voltage of the battery with the multiple threshold voltages. In an example, a first threshold voltage and a second threshold voltage may be preset for the battery charging circuit 14, where the first threshold voltage is set to be smaller than the second threshold voltage. When the voltage of the battery 12 is lower than the first threshold voltage, the battery charging circuit 14 may recharge the battery 12 through the trickle charging mode. When the voltage of the battery 12 is between the first threshold voltage and the second threshold voltage, the battery charging circuit 14 may recharge the battery 12 through the constant-current charging mode. When the voltage of the battery 12 is greater than the second threshold voltage, the battery charging circuit 14 may recharge the battery 12 through the constant-voltage charging mode. Using the above-described recharging way, the battery can be better protected to have a prolonged service life.

A processing chip, such as EUP8027 can be used in the battery charging circuit 14 to achieve the multi-stage recharging way. Parameters and/or peripheral circuits of an integrated chip can be adjusted or designed to recharge the battery 12 using different charging modes according to different voltages of the battery 12. It is also mentioned that one or more MOSFETs can be used in the battery charging circuit 14 to achieve synchronous rectification during the battery recharging process. The synchronous rectification can enhance the efficiency to recharge the battery 12 by the battery charging circuit 14. In this way, the start-up power source 100 can restore more quickly. A specific battery charging circuit is shown in Figure 2b, where this circuit

can recharge the battery 12 while prolonging the service life of the battery 12. A pin 7 of the processing chip may receive the detected voltage of the battery 12 to regulate its charging mode during the complete recharging process. A pin 5 of the processing chip can communicate with the controller, such that it can stop recharging the battery 12 to protect the battery 12 when there is over-voltage problem in the start-up power source.

The first booster circuit 15 can be configured to boost the power supply from the battery 12 to a first target voltage that will be applied to the vehicle battery 20 via the cigarette lighter port 21. Here, an output voltage from the battery 12 can be amplified to meet the demand of the vehicle battery 20. Specifically, the first booster circuit 15 can be formed by a DC-DC converter together with one or more MOSFETs, where the one or more MOSFETs can enable synchronous rectification when amplifying the output voltage of the battery 12. Compared with asynchronous boosting operation (which has a conversion efficiency of at most 85%), the first booster circuit 15 by virtue of synchronous rectification can achieve a higher efficiency (which is greater than substantially 90%) of converting power storage of the battery 12 to that of the vehicle battery 20, in particular when the battery 12 can only provide a low voltage.

The first target voltage obtained through DC-DC conversion of the first booster circuit 15 can then be outputted to charge the vehicle battery 20. The first booster circuit 15 can connect to the vehicle charger 16, so that an output voltage of the first booster circuit 15 can be applied to the vehicle battery 20 through the vehicle charger 16 and the cigarette lighter port 21.

Figure 3 shows another start-up power source 200 according to an embodiment of this disclosure. The start-up power source 200 can include a controller 201, a battery 202, a battery protection circuit 203, a battery charging circuit 204, a first booster circuit 205, a second booster circuit 206 and an output port. The controller 201, the battery 202, the protection circuit 203, the battery charging circuit 204 and the first booster circuit 205 can be the same as those in the start-up power source 100 in Figure 1.

The output port of the start-up power source 200 can include a vehicle charger 207 and a USB charging port 208. The vehicle charger 207 may couple to both the first booster circuit 205 and the cigarette lighter port 20 of the vehicle so as to establish the electrical connection between the start-up power source 200 and the vehicle battery 20. The USB charging port 208 may be separately arranged with respect to the vehicle charger 207, where one end of the USB charging port 208 may couple to the second booster circuit 206, and the other end of the USB charging port 208 may couple to a consumer electronic 30. Under this configuration, the start-up power source 200 can electrically connect with the consumer electronic 30 so as to charge the consumer electronic 30.

Here, different voltages can be outputted from the start-up power source 200 when the start-up power source 200 is connected to the vehicle battery 20 and the consumer electronic 30. When the vehicle charger 207 is enabled/activated, the first booster circuit 205 can boost the

output voltage of the battery 12 to a first target voltage, such as about 15 V, that is adapted to a capacity of the vehicle battery 20. Alternatively, when the USB charging port 208 is enabled/activated by plugging in the USB wire, the second booster circuit 206 may generate a second target voltage adapted to the consumer electronic 30.

Moreover, the second booster circuit 206 can be regulated to output different target voltages when the consumer electronic 30 supporting one or more charging protocols is coupled to the USB charging port 208. Correspondingly, the output voltage of the second booster circuit 206 can be regulated according to one or more charging protocols supported by the consumer electronic 30.

In an example, a mobile phone supporting a protocol of "Quick Charge 2.0" can be connected with the start-up power source 200 through the USB charging port 208. The person skilled in the art can understand that, the Quick Charge 2.0 Protocol can enable quicker charging operation for the mobile telephone. In this case, after this mobile phone is coupled to the USB charging port 208, the second target voltage of about 6V can first be outputted to the mobile phone in a default condition. However, when the start-up power source 200 communicates with mobile phone under the Quick Charge 2.0 Protocol, the second booster circuit 206 may change its output voltage into about 9V, so that the mobile phone can be charged faster.

The first and the second booster circuits 205 and 206 can be selectively enabled within the start-up power source 200. In an example, when either of the vehicle charger 207 and the USB charging port 208 is activated, the first booster circuit 205 and the second booster circuit 206 can be correspondingly activated in an automatic mode. Alternatively, a switch can be further arranged within the start-up power source 200. The start-up power source 200 can be set to charge the vehicle battery 20 or the consumer electronic 30.

As shown in Figure 4, there can be three configurations for the output port of the start-up power source. In a first example, the vehicle charger 207 and the USB charging port 208 can be integrated with a main body of the start-up power source 200. That is, the vehicle charger 207 and the USB charging port 208 can be fixedly arranged on the main body of the start-up power source 200 to form a singular integrated device. In a second example, the USB charging port 208 can be arranged on the main body of the start-up power source 200, while the vehicle charger 207 can be in removable connection with the main body of the start-up power source 200. In this case, one end of the vehicle charger 207 can connect to the cigarette lighter port 21 of the vehicle, and its other end can connect to the USB charging port 208 through a USB wire. In a third example, the vehicle charge 207 and the main body of the start-up power source 200 can also form a two-module part as that in the second example. The difference lies in that the USB wire is built-in for coupling the vehicle charger 207 and the main body of the start-up power source 200, and it is needed to pull the USB wire out of the start-up power source 200 before coupling the vehicle charger 207. In some other examples not shown in figures, the main body of the start-up

power source 200 can be provided with a universal adapter, while the vehicle charger, the USB wire, or any other plug can be coupled to the universal adapter to be charged by the start-up power source.

The start-up power sources 100 and 200 can further include multiple indication lamps 210 for indicating at least one of following situations: an operation state of the start-up power source, and a battery capacity of the battery unit. For example, an indication lamp can be lighted to represent the start-up power source is charging the vehicle battery 20 and there is still enough energy storage for the battery to charge the vehicle battery 20. For example, an indication lamp can be lighted to represent the built-in battery of the start-up power source is being recharged. Different combinations of the indication lamps can be used to indicate the state of the start-up power source. The person skilled in the art can consider many combinations, while all these combinations should be included within the scope of this disclosure.

The above-described embodiments can provide the jump starts that can directly charge the vehicle battery through the cigarette lighter port of the vehicle. As such, the start-up power sources in this disclosure can realize convenient operation and reduce the risk of electric spark when using the start-up power source to charge a depleted vehicle battery.

The start-up power sources of this disclosure can operate as follows:

after the vehicle battery is depleted, the start-up power source can be directly plugged into the cigarette lighter port, and a start button can be pressed down so that the start-up power source can start to charge the vehicle battery; when the vehicle battery has been charged for 5-10 minutes, its energy storage can be enough to start the vehicle; once the vehicle is successfully started, the start-up power source can stop outputting the power supply and it can be removed from the cigarette lighter port;

when the start-up power source does not charge the vehicle battery, the consumer electronic can directly couple to the USB charging port; the start-up power source will begin to charge the consumer electronic when detecting the electrical connection on the USB charging port;

anytime the start-up power source detects a low voltage of its battery, it may stop outputting the power supply, and may even send out an alarm.

This written description uses examples to disclose the invention, including the best mode, and also to enable any person skilled in the art to make and use the invention. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal language of the claims.

Many other changes and modifications may be made to this disclosure without departing from the spirit thereof. The scope of these and other changes will become apparent from the appended claims.

CLAIMS

What is claimed is:

1. A start-up power source capable of charging a vehicle battery through a cigarette lighter port, comprising:

a controller;

a battery for providing power supply to the vehicle battery;

a first booster circuit for boosting the power supply from the battery to a first target voltage; and

a vehicle charger for connecting to the cigarette lighter port to charge the vehicle battery by the first target voltage.

2. The start-up power source of claim 1, further comprising a battery protection circuit corresponding to the battery; the battery protection circuit is connected between the battery and the controller.

3. The start-up power source of claim 2, wherein the battery protection circuit monitors the battery through detecting voltage and/or discharging current of the battery, and a voltage detection result and/or a current detection result are/is communicated from the battery protection circuit to the controller.

4. The start-up power source of claim 3, wherein the battery charging circuit is controlled to recharge the battery according to the voltage detection result, and/or the battery is controlled to output the power supply according to the voltage detection result or the current detection result.

5. The start-up power source of claim 2, wherein the battery protection circuit comprises a processing chip, a charging MOSFET and a discharging MOSFET; the processing chip samples voltage of the battery and/or discharging current of the battery; the charging MOSFET is controlled to be switched on or off by the controller according to the voltage of the battery, and the discharging MOSFET is controlled to be switched on or off according to the voltage of the battery or the discharging current of the battery.

6. The start-up power source of claim 1, furthering comprising a battery charging circuit for recharging the battery; the battering charging circuit comprises a power input port for receiving electrical energy, a power output port for outputting the electrical energy to the battery, and a recharging control port configured to receive recharging control signals from the controller.

The start-up power source of claim 6, wherein the battery charging circuit recharges the battery through a multi-stage recharging way; the multi-stage recharging way is comprised of a trickle charging mode, a constant-current charging mode and a constant-voltage charging mode, and said three charging modes are selected according to a voltage of the battery.

8. The start-up power source of claim 7, wherein the multi-stage recharging way comprises:

recharging the battery via the trickle charging mode when the voltage of the battery is lower than a first threshold voltage;

recharging the battery via the constant-current charging mode when the voltage of the battery is between the first threshold voltage and a second threshold voltage; and

recharging the battery via the constant-voltage charging mode when the voltage of the battery is greater than the second threshold voltage;

wherein the first threshold voltage is smaller than the second threshold voltage.

9. The start-up power source of claim 6, wherein the power input port of the battery charging circuit is capable of being connected to commercial power, an external storage battery or a motor for driving the vehicle battery.

10. The start-up power source of claim 1, further comprising a USB charging port capable of being connected to a consumer electronic and a second booster circuit connecting to the USB charging port; when the USB charging port is enabled by a connected consumer electronic, the second booster circuit boosts the power supply from the battery to a second target voltage, and the consumer electronic is charged by the second target voltage.

11. The start-up power source of claim 10, wherein the start-up power source comprises a main body, and the vehicle charger and the USB charging port are fixed arranged on the main body of the start-up power source to form an integrated structure.

12. The start-up power source of claim 1, wherein the start-up power source comprises a main body, and the vehicle charger is in a removable connection with the main body of the start-up power source.

13. The start-up power source of claim 1, wherein the first booster circuit boosts the power supply through synchronous rectification to improve an efficiency of converting power storage of the battery to that of the vehicle battery.

14. The start-up power source of claim 1, further comprising multiple indication lamps for indicating at least one of following situations: an operation state of the start-up power source, and a battery capacity of the battery.

15. A start-up power source with one or more batteries, comprising:

a controller;

a first booster circuit for boosting a power supply provided by the one or more batteries to a first target voltage;

a second booster circuit for boosting a power supply provided by the one or more batteries to a second target voltage; and

an output port for selectively connecting to a storage battery of a vehicle or a consumer electronics;

wherein the first booster circuit and the second booster circuit are selected by the controller to be connected to the output port; when the first booster circuit is connected to the output port, the storage battery is charged by the first target voltage; when the second booster circuit is connected to the output port, the second target voltage is applied to the consumer electronic;

wherein the output port is configured to be plugged in a cigarette lighter port of the vehicle, so as to charge the storage battery via the cigarette lighter port.

16. The start-up power source of claim 15, wherein the output port comprises a vehicle charger that is capable of being engaged with the cigarette lighter port, and a USB charging port that connects with the consumer electronic through a USB wire.

17. The start-up power source of claim 15, wherein the one or more batteries is removable from the start-up power source.

18. The start-up power source of claim 15, wherein the one or more batteries is fixedly arranged within the start-up power source; the start-up power source further comprises a battery charging circuit for recharging the one or more batteries;

wherein the battery is recharged by the battery charging circuit via a trickle charging mode when a voltage of the battery is lower than a first threshold voltage; the battery is recharged by the battery charging circuit via a constant-current charging mode when a voltage of the battery is between the first threshold voltage and a second threshold voltage; and the battery is recharged by the battery charging circuit via a constant-voltage charging mode when a voltage of the battery is greater than the second threshold voltage; the first threshold voltage is smaller than the second threshold voltage.

iy. The start-up power source of claim 15, furthering comprising a battery protection circuit connected between the one or more batteries and the controller; the battery protection circuit monitors the one or more batteries through detecting voltage and/or discharging current of the one or more batteries, and a voltage detection result and/or a current detection result are/is communicated from the battery protection circuit to the controller.

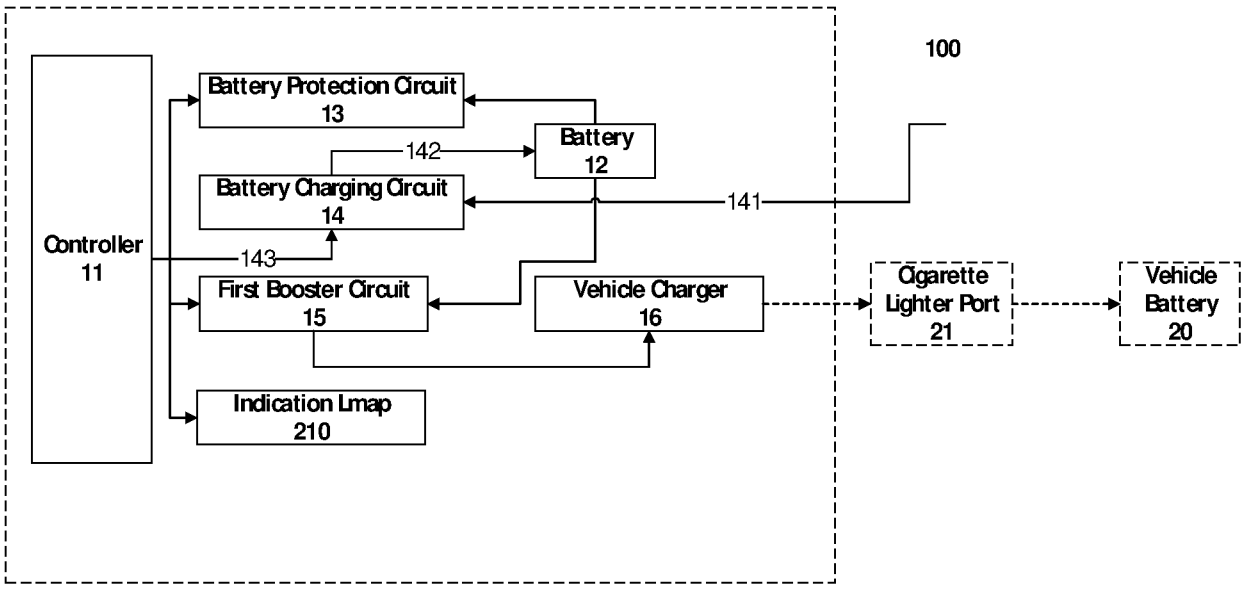
100
Controller
11
Battery Protection Circuit
13
Battery
12
142
Battery Charging Circuit
14
141
143
First Booster Circuit
15
Vehicle Charger
16
Cigarette
Lighter Port
21
Vehicle
Battery
20
Indication Lmap
210

Fig. 1

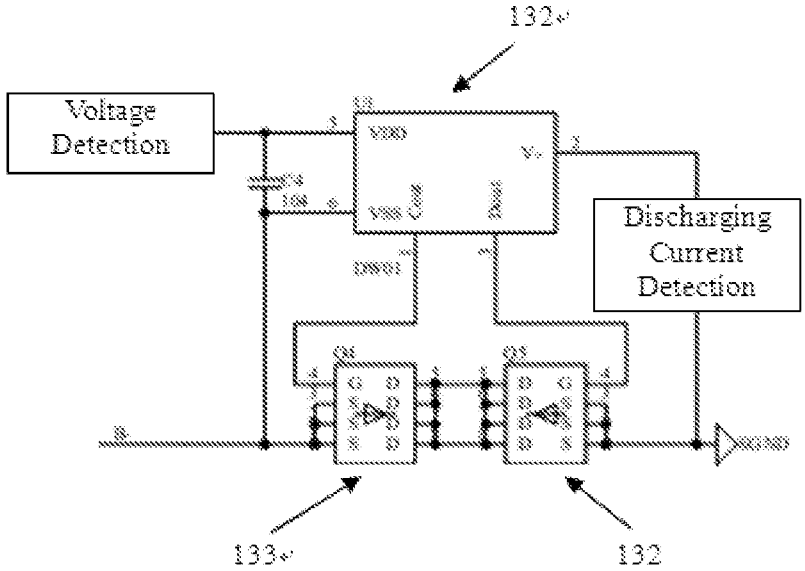
132
Voltage
Detection
Discharging
Current
Detection
133
132

Fig. 2a

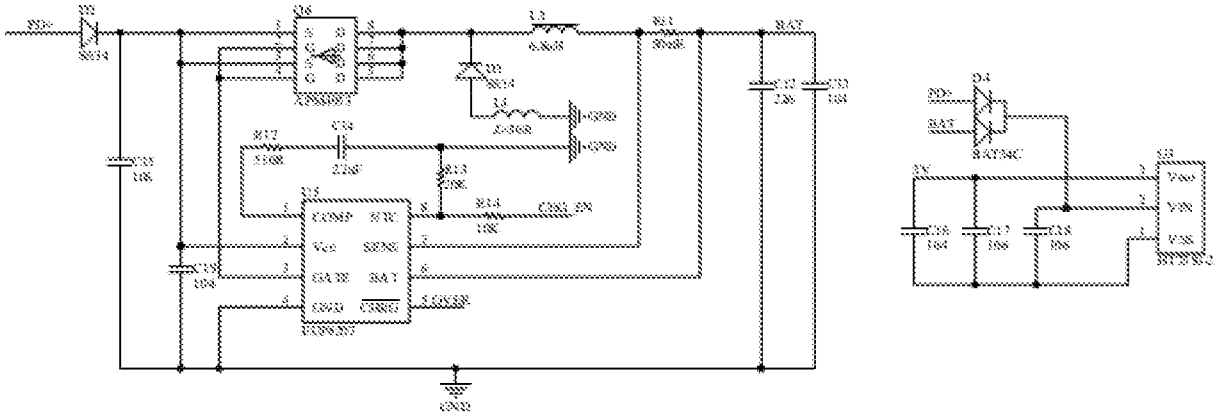

Fig. 2b

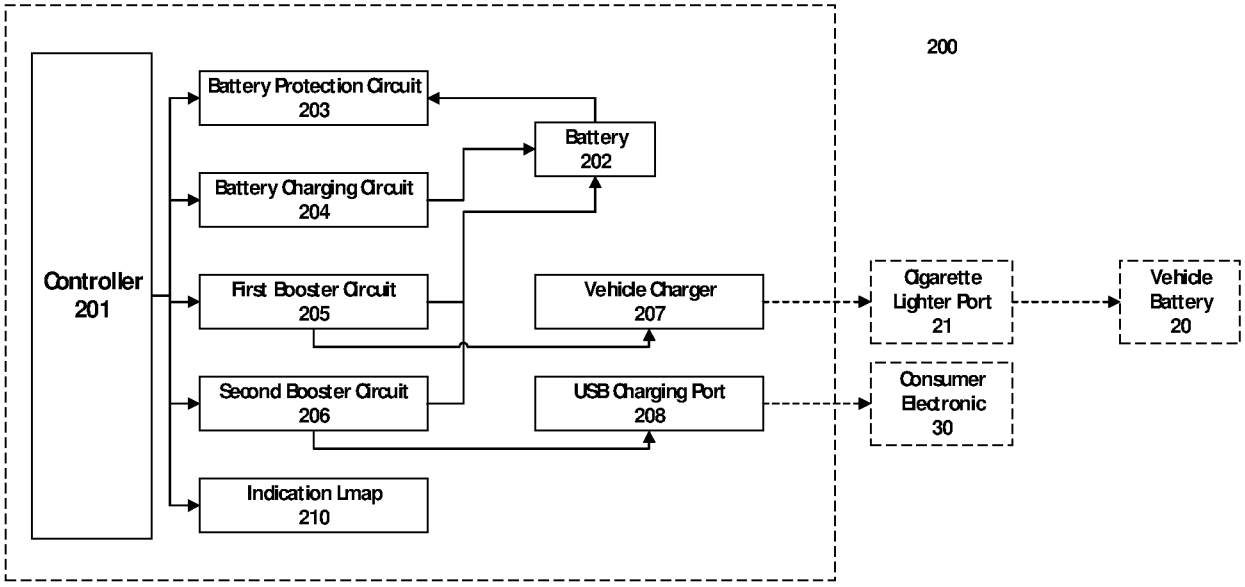
200
Controller
201
Battery Protection Circuit
203
Battery
202
Battery Charging Circuit
204
First Booster Circuit
205
Vehicle Charger
207
Second Booster Circuit
206
USB Charging Port
208
Indication Lmap
210
Cigarette
Lighter Port
21
Vehicle
Battery
20
Consumer
Electronic
30

Fig. 3

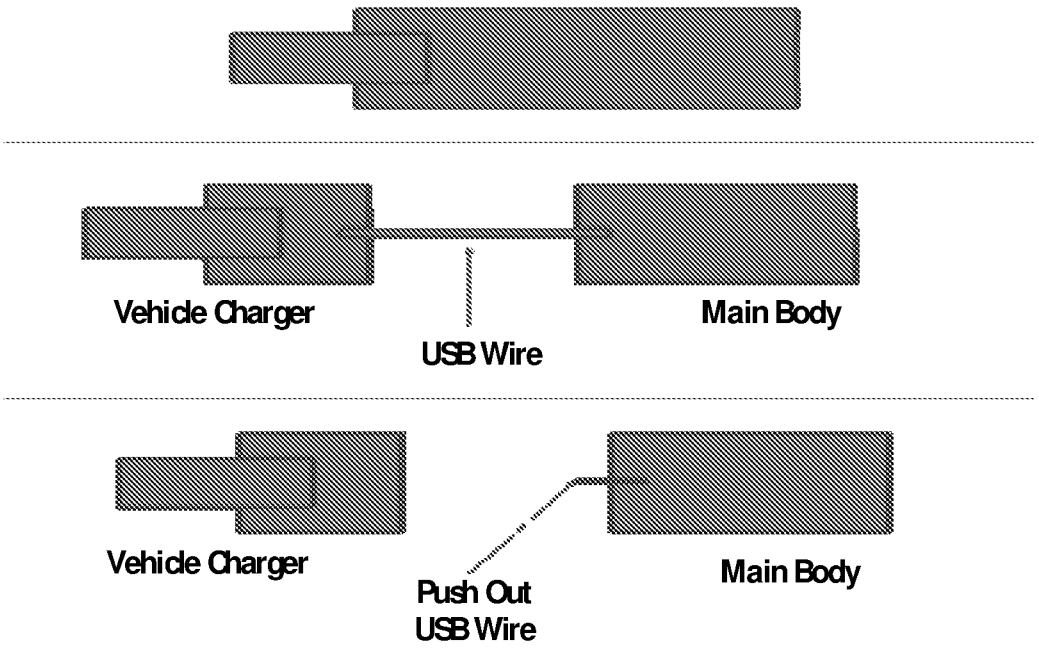
Vehicle Charger
USB Wire
Main Body
Vehicle Charger
Push Out
USB Wire
Main Body

Fig. 4

INTERNATIONAL SEARCH REPORT

Intemational application No.

PCT/CN2015/092250

A. CLASSIFICATION OF SUBJECT MATTER

H02J 7/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H02J,; B60R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC,WPI,CNPAT,CNKI:vehicle,car,charg+,start+,cigarettew lighter,battery

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 104617608 A (SHENZHEN DBK ELECTRONICS CO., LTD.) 13 May 2015 (2015-05-13) description paragraphs 0018-0025, figures 1-6	1-6,9-17,19
Y	CN 104617608 A (SHENZHEN DBK ELECTRONICS CO., LTD.) 13 May 2015 (2015-05-13) description paragraphs 0018-0025, figures 1-6	7-8,18
Y	CN 102623768 A (QINGDAO HISENSE MOBILE COMMUNICATION TEC.) 01 August 2012 (2012-08-01) description paragraphs 0023-0031	7-8,18
X	US 5637978 A (KENDRICK PROD. CORP.) 10 June 1997 (1997-06-10) description column 5, line 30-column 5, line 59, figures 1-2	1,14
X	TW 1246243 B (JIAN HUNG CO., LTD.) 21 December 2005 (2005-12-21) description pages 5-10, figures 1-6	1,14
E	CN 105150963 A (DONGGUAN LARGE ELECTRONICS CO., LTD.) 16 December 2015 (2015-12-16) description paragraphs 0041-0070, figures 1-7	1-4,6,14

[✓] Further documents are listed in the continuation of Box C. [✓] See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 June 2016	**21 July 2016**
Name and mailing address of the ISA/CN **STATE INTELLECTUAL PROPERTY OFFICE OF THE P.R.CHINA** **6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088, China** Facsimile No. **(86-10)62019451**	Authorized officer **ZHOU,Xuan** Telephone No. **(86-10)010-6241 3214**

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	CN 204978506 U (DONGGUAN LARGE ELECTRONICS CO., LTD.) 20 January 2016 (2016-01-20) description paragraphs 0041-0070, figures 1-7	1-4,6,14
A	CN 104979861 A (C-TECH UNITED CORP.) 14 October 2015 (2015-10-14) the whole document	1-19
A	CN 104917236 A (DONGGUAN GREENWAY BATTERY CO., LTD.) 16 September 2015 (2015-09-16) the whole document	1-19
A	CN 203674766 U (WANG, DONGHAI) 25 June 2014 (2014-06-25) the whole document	1-19

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2015/092250

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
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CN 102623768 A	01 August 2012	CN 102623768 B	27 August 2014
		WO 2013143398 A1	03 October 2013
US 5637978 A	10 June 1997	None	
TW 1246243 B	21 December 2005	TW 200536232 A	01 November 2005
CN 105150963 A	16 December 2015	None	
CN 204978506 U	20 January 2016	None	
CN 104979861 A	14 October 2015	None	
CN 104917236 A	16 September 2015	None	
CN 203674766 U	25 June 2014	None	