PORTABLE CHARGER

TECHNICAL FIELD

[0001] The present invention relates to a portable charging system.

RELATED ART

[0002] With advancement in electronics and battery technology, our life has become very reliant on portable battery powered electronic devices. This reliance on portable devices in turn required power supply be readily available to charge up these devices wherever we are. There many situations where availability of off-site power supply can determine whether a mission is to be carried out successfully. For examples, disaster relief, off-site monitoring of events, etc. With the high proliferation of mobile communication devices, the need for a remote charging station becomes ever more critical.

[0003] Reference is made to US 7,598,703 B2 entitled "Portable chargers having power factor correction capability for use with electric vehicles". The patent discloses a type of portable chargers with power factor correction capability for use with electric vehicles however, the cited patent is a charger for electric vehicle while our invention is not a charger for electric vehicle. In addition, the cited patent only produces a DC output while our invention produces both DC and AC output.

[0004] Reference is made to US 7,688,027 B2 entitled "Portable battery charger to charge plural batteries". Said document is capable of charging many batteries in a small space and enables efficient attaching and detaching operation of many batteries. However,it emphasizes on the design of the placement for the batteries being charged.

[0005] Reference is made to US 2011/0055037 A1 entitled "Stored energy and charging appliance". Said application discloses systems and methods for storing and providing electrical power, and more particularly to devices for charging battery-

based devices or powering electrical devices via a limited electrical supply. Thus, the main drawback of this application that the disclosed charging system is not portable and is bulky and heavy in weight.

[0006] Thus, there is a need to provide a light weight, easy handling charger system for easy transportation and emergency backup.

SUMMARY

[0007] The present invention provides a portable charger or a portable field charger as illustrated in Figure 1 to 7. Portable charger of present invention comprises of air outlet ducts, a heatsink, a hybrid power system and an air intake fan.

[0008] In alternative embodiments, the invention provides a charger, or a portable charger, or a portable field charger, optionally comprising a Fuel Cell-Battery Hybrid Power System as set forth in Figure 7.

[0009] In alternative embodiments, a charger, or a portable charger, or a portable field charger of the invention, further comprise an electronic system comprising a three in one (3-in-1) high precision voltage measurement ,smart microcontroller and power distribution module to efficiently regulate and control the output voltages in accordance to rapidly changing load demands.

[0010] In another embodiment, the invention provides a Hybrid Power System as set forth in Figure 6. In alternative embodiments, the invention provides a Fuel Cell-Battery Hybrid Power System as set forth in Figure 7.

[0011] In an alternative embodiments, the at least one integrated fan system comprises an air outlet is situated at the upper end of the heat sink part and at opposite end to the integrated fan system such that the exhaust hot air is forced to move over a wide area of the heat sink, further enhancing effective heat removal.

[0012] In alternative embodiments, the charger, or a portable charger, or a portable field charger of the invention, further comprise an integrated two-way (2 way) valve to equalize pressure fluctuations caused by operating the invention in different environmental conditions such as differing altitudes.

[0013] In an alternative embodiment, the charger, or a portable charger, or a portable field charger of the invention, further comprise an intuitive interface, wherein optionally all user interfaces are located at the front panel, and optionally the recharging port is located at the rear, and optionally can further comprise a built-in light-emitting diode (LED) display, or equivalent, to show the battery status.

[0014] In an alternative embodiment, the heat sink is integrated at the back panel of the charger, away from users, to allow heat to be effectively dissipated and not affect users' handling and optionally the integrated heatsink comprises an internal heat sink and air cooling mechanism connected to the external heat sink, and optionally can further comprise a large heat sink panel to avoid the need for a cooling fan and to optionally allow the electronics to be sealed and waterproofed.

[0015] In an another alternative embodiments, the charger, or the portable charger, or the portable field charger of the invention, further comprise a handlebar on the top face, or a handlebar on the side face, or comprising biaxial handlebars on both the top and side face.

[0016] The details of one or more embodiments of the invention are set forth in the accompanying drawings and the description below. Other features, objects, and advantages of the invention will be apparent from the description and drawings, and from the claims.

[0017] All publications, patents, patent applications cited herein are hereby expressly incorporated by reference for all purposes.

BRIEF DESCRIPTION OF DRAWINGS

[0018] FIG 1: shows an overview of portable charger comprising an electric system shaped in a jerry can.

FIG2: shows various component of the portable charger.

FIG3: shows various component of portable charger from a different view.

FIG4: shows enlarged view of portable charger.

FIG5: shows a portable charger with biaxial handlebar.

FIG 6: shows a hybrid power system/configuration.

FIG 7: shows a fuel cell battery hybrid power system.

DETAILED DESCRIPTION

[0019] Portable chargers and portable field chargers shaped in a jerry can as illustrated in Figures 1 to 7 is described herein. Particularly, the portable chargers and portable field chargers of the invention are designed for outfield or outdoor use or deployment.

[0020] The invention provides portable chargers and portable field chargers that is lightweight, high power, rugged and/or built for easy handling. Devices that can be charged using this portable charger include electrically operated equipment such as portable electronic device, battery pack, light, laptop, DC/AC inverter.

[0021] The portable charger and portable field charger of present invention comprises a simple user interface, a 240VAC output, dual USB outputs and a single 24Vdc compatible with most outdoor equipment charging needs. In alternative embodiments the invention is ideal for military deployment, recreational off-grid power supply, emergency backup and disaster relief operation.

[0022] Various components of portable charger are as follows:

1. Embbeded air outlet duct, concealed inside ceiling of product for capturing and channelling heated air.
2. Concealed air outlet, not easily noticed during normal operation, facing

downwards to prevent water ingress from light rain and mild water splashes during normal used when seated in upright position.

3. Heatsink, flushed to housing, with fins matching outlet duct, (1) , acting as air outlet guide.

4. Concealed air intake grill, not easily noticed during normal operation, facing downwards to prevent water ingress from light rain and mild water splashes during normal used when seated in upright position.

5. Air intake duct shaped and sized for similar cross-sectional area as air intake grill, (4), air flow to intake fan, (8).

6. Integrated electronics.

7. Integrated battery pack.

8. Air intake fan.

9. Air flow outlet direction.

10. Biaxial handle bar.

Various components of portable charger are described in details :

[0023] a. Electric system shaped in a jerry can

In alternative embodiments, the invention provides portable chargers and portable field chargers shaped in or as a jerry can, or shaped approximately as a jerry can. Jerry cans have been widely used for transportation of gas, water and other liquids. The concept of designing an electric system shaped in a jerry allows the product to be easily transported in existing infrastructure, in particular military vehicles, simplifying logistic complexity. The invention can also be easily recharged from military trucks and transporters. Figure 1 illustrates an exemplary portable charger or portable field charger of the invention comprising an electric system shaped in a jerry can.

[0024] b. Biaxial handlebars on the top and side

In alternative embodiments, portable chargers or portable field chargers of the invention comprise biaxial handlebars on both the top and side face to e.g., facilitate ease of handling. A carrying option is also flexible as it can be ergonomically carried by one to two men, e.g. in two perpendicular axes. This innovative biaxial design enables easy mounting and dismounting on a vehicle. Figure 5 illustrates an

exemplary portable charger or portable field charger of the invention comprising biaxial handlebars (10). Typical jerry cans only have handlebars at the top.

[0025] c. Rugged interface

In alternative embodiments, portable chargers or portable field chargers of the invention comprise connectors flushed to the edge to protect and prevent mishandling or accidental damage. In alternative embodiments, atleast one of the connectors are flushed to the edge to protect and prevent mishandling or accidental damage.

[0026] d.Heat sink

In alternative embodiments, portable chargers or portable field chargers of the invention comprise at least one integrated heat sink at the back panel, away from users. This embodiment allows heat to be effectively dissipated and not affect users' handling. In alternative embodiments the integrated heatsink comprises an internal heat sink and air cooling mechanism connected to the external heat sink. In alternative embodiments a large heat sink panel avoids the need for a cooling fan and allows the electronics to be sealed and waterproofed. Figure 2 illustrates an alternative embodiment comprising an integrated heat sink.

[0027] e. All-in-one user interface panel

In alternative embodiments, portable chargers or portable field chargers of the invention comprise an intuitive interface whereby all user interfaces are located at the front panel while the recharging port is located at the rear. This embodiment can also have a simple built-in light-emitting diode (LED) display, or equivalent, to show the battery status

[0028] f.Integrated 2 way valve

In alternative embodiments, portable chargers or portable field chargers of the invention are equipped with an integrated two-way (2 way) valve to equalize pressure fluctuations caused by operating the invention in different environmental conditions such as differing altitudes. For example, in the absence of the 2 way valve, when the invention is in operation at high altitude such as in high mountainous

terrains, the internal pressure can exceed the external pressure, leading to casing deformity and degraded operational performance.

[0029] g. Integrated Power distribution module with an innovative control architecture

In alternative embodiments, portable chargers or portable field chargers of the invention comprise an electronic system comprising a three in one (3-in-1) high precision voltage measurement , smart microcontroller and power distribution module to efficiently regulate and control the output voltages in accordance to rapidly changing load demands. The high precision voltage measurement system detects minute changes in the load voltages due to varying load demands, process the information and output the correction signals rapidly with a high performance microcontroller. This innovative control architecture facilitates the ease of determination of power distribution and safety management.

[0030] h.Hybrid power configuration/system

In alternative embodiments, chargers of the invention comprise a battery-battery hybrid configuration/system to match and optimize power and energy demands using an integrated power distribution and innovative control architecture, thereby reducing the cost and complexity of large format lithium battery. Figure 6 schematically illustrates an alternative embodiment comprising a hybrid battery bank operably linked to a controller with control algorithms and a field pack output unit that comprises a plurality of DC-AC and DC-DC outputs, e.g. as illustrated in Figure 6. In the embodiment illustrated in Figure 6, the field pack output unit is operatively linked to a dynamic load and a precision measurement module, e.g. as illustrated in Figure 6. In alternative embodiments the precision measurement module is a high precision measurement module, and this can be operatively linked to a smart controller with control algorithms.

[0031] i.Fuel Cell-Battery Hybrid Power System

In alternative embodiments, chargers of the invention comprise a hydrogen fuel cell comprising a battery hybrid power configuration to meet long duration power demands as well as heavy power demands. Fuel cells can offer exceptionally quiet operation, highly efficient use of the fuel energy, and a high energy storage density

compared to batteries; leading to much longer discharge time. By using a low power fuel cell to charge the battery and provide nominal load demands, the hybridization extends the operating lifetime of the stack and battery. The hybrid configuration also increases the overall system efficiency by limiting the operation of the fuel cell at above 0.7v/cell.

[0032] In alternative embodiments the hybrid battery is configured to only provide instantaneous power and peak requirements. The smart controller can sense and optimally switch between the two power sources to meet the load demand. The degree of hybrid can depend on the load requirements and can be adjusted to maximize runtime and lifetime.

[0033] For example, Figure 7 schematically illustrates an exemplary fuel cell hybrid power system of the invention comprising a fuel cell operatively linked to a battery pack, which both are operatively linked to an output unit. In alternative embodiments the output unit comprises a plurality of DC-AC and DC-DC outputs, e.g. as illustrated in Figure 7. These outputs can be operatively linked to dynamic loads, e.g. as illustrated in Figure 7.

[0034] j. Air intake fans for Cooling

In alternative embodiments, chargers of the invention comprise at least one air intake fan for effective and efficient removal of heat generated by the various power components residing within the jerry can. The air intake fan as shown in figure 4 is integrated in the system enabling the invention to operate effectively at heavy loads for long duration over a wide range of ambient temperature and humidity conditions. The integrated fan system also increases the operation life span of the various power components thereby increasing the invention overall operational lifetime. The design of the integrated fan system minimizes water and dust intrusion as the air inlet to the integrated fan is positioned facing downwards while the air duct is extended, elongated and curved upwards towards the fan. In alternative embodiments the air outlet is situated at the upper end of the heat sink part and at opposite end to the integrated fan system such that the exhaust hot air is forced to move over a wide area of the heat sink, further enhancing effective heat removal.

[0035] A number of embodiments of the invention have been described. Nevertheless, it can be understood that various modifications may be made without departing from the spirit and scope of the invention. Accordingly, other embodiments are within the scope of the following claims.

[0036] The term "smart microcontroller", "controller" and "control architecture" are interchangeable and refer to the same component here. "Smart microcontroller" has the following features:

1. Automatic protection.
2. Single button with multiple functions (ON/OFF controlling, State checking).
3. Status indicator.
4. Automatic charging and discharging mode detection.
5. Energy management to reduce power consumption of the controller.

[0037] The microcontroller further includes a battery Management system (BMS) and an inverter. A battery management system (BMS) is an electronic system that manages a rechargeable battery (cell or battery pack), such as by monitoring its state, calculating secondary data, reporting that data, protecting the battery, controlling its environment, and / or balancing it. BMS further provides following :

1. All the safety protections against various conditions which includes: Over Voltage Protection, Low Voltage Protection, Over Current Protection, Short Circuit Protection and Over Temperature Protection.
2. Battery State Prediction with Self-correction function to prevent the drift of the sensor.
3. Multi Function of single button (ON/OFF Switch, State Check) is simple and easy to use.
4. Power saving function to reduce the power consumption of the controller.
5. Automatic detection of charger connection and automatic working state switching.
6. Automatic protection of unpredictable disconnection and charger failure during the charging process.
7. Automatic temperature control.
8. Automatic power range selection for different charging sources.
9. Fault indications

[0038] Inverter

1. All the safety protections against various conditions which includes: Over Voltage Protection, Low Voltage Protection and Over Current Protection.
2. Standard interface to connect to any master controller (BMS Card).
3. USART Communication with PC
4. Fault indications (for display and control)

[0039] There has thus been shown and described portable charger using the same which fulfills all the objects and advantages sought therefore. Many changes, modifications, variations and other uses and applications of the subject invention will, however, become apparent to those skilled in the art after considering this specification and the accompanying drawings which disclose the preferred embodiments thereof. All such changes, modifications, variations and other uses and applications which do not depart from the spirit and scope of the invention are deemed to be covered by the invention, which is to be limited only by the claims which follow.

[0040] Although the invention has been described in detail for the purpose of illustration based on what is currently considered to be the most practical and preferred embodiments, it is to be understood that such detail is solely for that purpose and that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover modifications and equivalent arrangements that are within the spirit and scope of the appended claims. For example, it is to be understood that the present invention contemplates that, to the extent possible, one or more features of any embodiment can be combined with one or more features of any other embodiment.

[0041] **Advantages of present invention:**

1/ Light weight.
2/ High power density.
3/ Portable field charger.
4/ Integrated fan system and integrated heat sink that enhances effective heat removal.

5/ 2-way valve to equalize pressure fluctuations enable charger operation in differing altittudes.

6/ Charger is shaped like a jerry can thereby enabling easy transportation in existing Infra structure and simplifying logistic complexity.

7/ The biaxial handlebars enable easy mounting and dismounting on a vehicle.

8/ The charger has a ruggged interface to protect and prevent mishandling or accidental damage.

WHAT IS CLAIMED IS:

1. A light weight, high power portable charger comprising (a) atleast an air outlet duct; (b) atleast one heat sink; (c) an air intake duct; (d) a hybrid power system; and (d) an integrated power distribution module with a controller wherein said air outlet duct is arranged at an upper end of the heat sink; wherein heat sink is integrated at the back panel, away from users and wherein the hybrid power system uses the integrated power distribution module to regulate and control the output voltages and safety management of the portable charger.

2. The portable charger as claimed in claim1, further comprises of atleast one integrated fan system wherein said fan system comprises of an air outlet situated at the upper end of the heat sink and at opposite end to the integrated fan system such that the exhaust hot air is forced to move over a wide area of the heat sink, enhancing effective heat removal.

3. The portable charger as claimed in claim 1, wherein the integrated power distribution module consist of a voltage measurement, a microcontroller and a power distribution module to regulate and control output voltages with respect to rapidly changing load demand.

4. The portable charger as claimed in claim 1, further comprises of an integrated two-way valve to equalize pressure fluctuations caused.

5. The portable charger as claimed in claim 1, wherein the heat sink comprises an internal heat sink and air cooling mechanism connected to the external heat sink.

6. The portable charger as claimed in claim 4, optionally comprises a large heat sink panel to avoid the need for a cooling fan.

7. The portable charger as claimed in claim 1, further comprises of a fuel cell battery hybrid power system comprising a fuel cell operatively linked to a battery pack.

8. The portable charger as claimed in claim 1, wherein said charger is in the shape of a jerry can.

5