

source. A rectifier circuit is connected between the transformer and the output circuit, the rectifier circuit including a two diode rectifying circuit for producing a full wave voltage output positive pulse having an RF content.

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**BATTERY CHARGING METHOD WITH
STEPPED CURRENT PROFILE WITH
OPERATING PARAMETER
COMPENSATION AND ASSOCIATED
CHARGER**

Rose Stephen D; Cates Joseph A; Rose Jeffrey A
Irvine, KY, UNITED STATES assigned to Premier
Engineered Products Inc

A method and apparatus is provided to charge a battery including a DC charge current supply having a variable output. The charging current is varied in accordance with several sensed parameters in the circuit so that battery voltage is accurately controlled. Initially, constant charging current is applied, and upon detecting that battery voltage increases to the gassing voltage, an incremental step reduction in charging current is triggered. The step reduction causes a decrease in battery voltage, dropping it below the gassing voltage. The step reduced charging current is then applied to increase battery voltage back up to the gassing voltage, thereby triggering another step reduction in charging current. This process is repeated multiple times providing a stepped current profile, i.e., each battery voltage increase to the gassing voltage triggering a step reduction in charging current, and in turn a corresponding voltage reduction. The battery voltage, with the alternating increases and decreases, is thus defined by a saw-tooth profile with peaks at the gassing voltage. When the charging current is finally reduced to a minimum level, the sensed battery voltage triggers a termination of the stepped current reduction. Upon the battery reaching full charge, the application of charging current is terminated. In the alternative embodiment, the slope of the voltage curve is detected and analyzed to control a step up profile of the current during the initial phase of charging. The rising temperature of the battery controls a decrease in the gassing or target voltage.

5635813

**ELECTRONIC APPARATUS, BATTERY
MANAGEMENT SYSTEM, AND BATTERY
MANAGEMENT METHOD**

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JAPAN assigned to Mitsubishi Denki Kabushiki Kaisha

Methods and apparatus to enable electronic apparatuses to display the remaining power of exchangeable batteries at any given time. A battery pack having a battery and an ID generator is attached to an electronic apparatus. The accumulated consumption hours of the battery is stored in a battery information memory for each battery ID. A remaining power detector determines the remaining battery power on the basis of the accumulated consumption hours and displays it on a display unit. Because the remaining battery power is determined based on the consumption hours of a battery, the running hours of a battery can be displayed at any given time.

5635816

**METHOD AND APPARATUS FOR
CONTROLLING BATTERY CHARGING
CURRENT**

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UNITED STATES assigned to Morningstar Corporation

An automatic photovoltaic controller provides a fixed frequency, pulse width modulated charging current to charge and regulate a battery, the duty cycle of the charging current being controlled by the difference between the sensed battery voltage and a desired regulated voltage. Modulation is achieved by controlling the on and off states of plural parallel-connected FET switches placed in series between the photovoltaic array and the battery. The duty cycle is adjustable in discrete steps over the entire range of 0% to 100% and is updated numerous times per second with new battery voltage measurements to provide highly accurate regulation. The charge current pulse rise time is selected to match the response time of the photovoltaic array. The fixed frequency of the charge current is within the preferred range of 100 Hz to 600 Hz to provide sufficient time for the chemical reaction within the battery cells to be