

produced in accordance with the charging limit time, and a battery charging member.

**5635842**

**METHOD OF ESTIMATING RESIDUAL CAPACITY OF BATTERY**

Yokoo Masahide; Nagano Masao; Takemoto Hideharu Saitama ken, JAPAN assigned to Honda Giken Kogyo Kabushiki Kaisha

In estimating the residual capacity of a battery according to the maximum output estimating process, a reference point is established in advance at the intersection of a plurality of current/voltage characteristic linear curves corresponding to various residual capacities of the battery or in an area in the vicinity of the intersections of the curves. A current/voltage characteristic linear curve is determined so as to pass through the reference point and a measured operating point of the battery which corresponds to the present discharging current and output voltage values measured when the battery is discharged. Then, a maximum transfer power value of the battery is determined from the current/voltage characteristic linear curve thus determined, and the present residual capacity of the battery is estimated from the maximum transfer power value.

**5637979**

**RECHARGEABLE BATTERY CHARGING METHOD AND APPARATUS**

Tamai Mikitak; Ohira Takahar Sumoto, JAPAN assigned to Sanyo Electric Co Ltd

A plurality of series connected rechargeable batteries are charged by detecting battery voltages and controlling charging current. Normal charging is performed until any one battery voltage reaches a prescribed voltage. After any one battery voltage reaches the prescribed voltage, all batteries are charged such that a charging current is controlled to keep each battery voltage from exceeding the prescribed voltage.

**5637980**

**BATTERY CHARGING/DISCHARGING SWITCHING CONTROL PROTECTIVE CIRCUIT**

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A battery charging/discharging switching control protective circuit including a charging discharging loop, a constant current control circuit connected to the input terminal of the charging discharging loop, a microprocessor control circuit, a time series control circuit with its input terminal connected to the microprocessor control circuit and its output terminal connected to the switch of the charging discharging loop and the switches of the constant current control circuit, the time series control circuit being controlled by the microprocessor control circuit to control the transistor of the charging discharging loop in charging or discharging the battery at a constant current value, and to control the switches of the charging discharging loop in turning off the transistor at the beginning or the end of the charging or discharging operation, so as to prevent the occurrence of electric arc, sparks, transient electric current and voltage during the switching of the switches of the charging discharging loop.

**5637981**

**METHOD FOR CHARGING A SECONDARY BATTERY AND CHARGER USED THEREFOR USING CONSTANT CURRENT AND CONSTANT VOLTAGE**

Nagai Tamimi; Akiho Hitoshi Kanagawa, JAPAN assigned to Sony Corporation

A secondary battery charging method and a charger used therefor, in which the method uses a constant current and a constant voltage such that the secondary battery is first charged with the constant current until the terminal voltage of the battery becomes a reference voltage higher than the full charging voltage for the battery and then further charged with the constant voltage which is equal to the full charging voltage. These two charging operations are switched by using various kinds of detection and control circuits, so that the secondary battery is properly charged in a short time. Further, the