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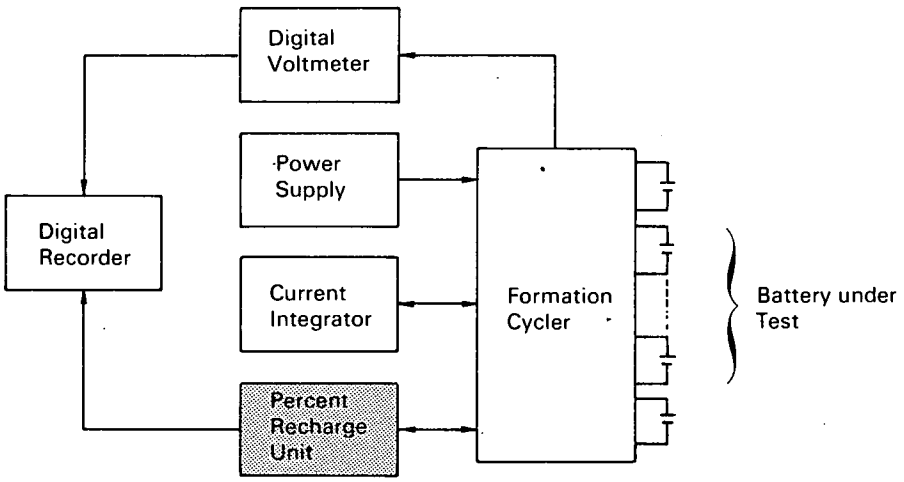
NASA TECH BRIEF

Recharge Unit Provides for Optimum Recharging of Battery Cells



Since the voltage slope of a rechargeable battery is very small near the upper preset voltage limit, voltage sensing is not the ideal way of determining when charging of individual cells in the battery should be cut off. A "percent recharge unit," which has been developed, permits each cell of a rechargeable battery to be charged to a preset percentage value of the discharge ampere-hour capacity of the cell. This preset percentage value is set on the front panel and has a range of 100 percent to 199 percent in 1-percent increments. This unit operates in conjunction with an automatic formation cycler, a current integrator, a digital recorder, a digital voltmeter, and a power supply for battery charging. The entire system automatically monitors and controls a rechargeable battery subjected to charge–discharge cycling tests. Without the percent recharge unit in the system, the formation cycler would monitor the voltage of each cell in the battery and automatically remove a cell from the battery when its voltage reached an upper preset limit during charge or a lower preset limit during discharge.

With the percent recharge unit in the system, the process begins by connecting a fully charged battery (containing up to 20 cells) to the formation cycler. The fully charged battery is discharged into an internal load in the formation cycler, with the current time integrator monitoring the ampere-hour discharge capacity. During this discharge mode, pulses which are generated by the current integrator are counted by 20 discharge counters located within the percent recharge unit. Each cell of the battery has its own discharge counter. When a cell is removed from the battery by the formation cycler because of a low preset voltage limit, the cell control relay located in the formation cycler applies an inhibit level to the cell counter gate, preventing the integrator pulses from being applied to the discharge counter representing that cell. Therefore, at the end of the battery discharge cycle the digital information stored in each of the 20 discharge counters represents the discharge

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ampere-hour capacity of each of the corresponding battery cells.

During the battery charge mode, pulses from the current integrator are applied to a single charge counter within the percent recharge unit. Therefore, the digital information in this charge counter represents the ampere-hour charge applied to the battery. The percent recharge unit sequentially multiplies the ampere-hour discharge capacity stored in each cell counter by the percentage value set on the front panel and compares this product to the ampere-hour value accumulated in the charge counter. If this product is equal to or less than the value in the charge counter, a signal is sent to the formation cycler which causes it to bypass that cell. Cell identification, voltage, and ampere-hour capacity are recorded by the printer each time a cell is removed from the battery.

Note:

Complete details may be obtained from:
Technology Utilization Officer
Goddard Space Flight Center
Greenbelt, Maryland 20771
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Patent status:

No patent action is contemplated by NASA

Source: D. Baer and F. E. Ford
(GSC-10688)