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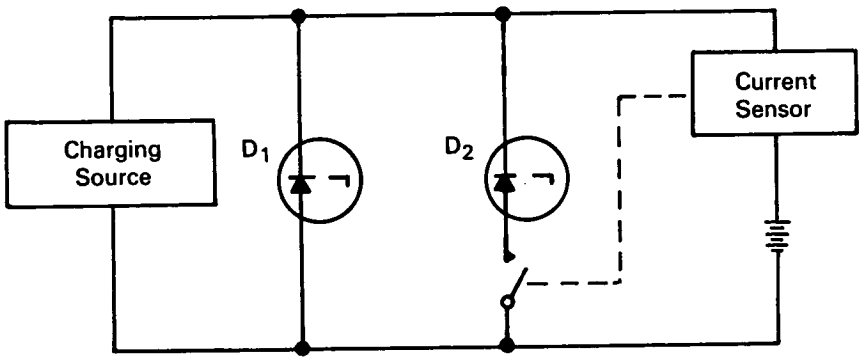
Brief 66-10492

NASA TECH BRIEF

Circuit Prevents Overcharging of Secondary Cell Batteries



The problem:

To design a circuit that will prevent any cell, such as a sealed silver–cadmium or silver–zinc cell, in a series battery from overcharging, with consequent internal gas buildup. The resulting pressure can cause a sealed cell to leak electrolyte and thereby lead to failure of the entire battery.

While it is relatively simple to limit the charging voltage on a single cell, it is difficult to limit the charging voltage on each cell of a number connected in series. When charging voltage is applied to a battery, varying potential differences will occur across the individual cells. This cell unbalance may lead to overcharging of one or more cells of a series. Systems which have attempted to solve this problem by first charging at a high current and then at a trickle rate have not been entirely satisfactory. These systems only allow a longer time before overcharging can occur.

The solution:

A circuit that detects the battery charging current and reduces the charging voltage to the open-circuit voltage of the battery when this current falls to a predetermined value. The voltage control depends on the experimentally observed fact that the charging current falls significantly when the battery nears its fully charged state.

How it's done:

The circuit includes a current sensor connected in series with the battery to be charged and a voltage regulator connected in parallel with this series combination. The regulator consists of two parallel-connected zener diodes, D_1 and D_2. Diode D_2, which has a lower breakdown voltage than D_1, is connected in series with a switch.

In operation, the charging source applies a voltage at the breakdown value of D_1. As the battery approaches its fully charged state, the current drops. The current sensor detects this current drop and closes the switch. This closure provides a parallel path through D_2. The breakdown voltage of D_2 is chosen so as to maintain the battery at its open-circuit value. Hence, this second path drops the applied voltage and thereby prevents the overcharge of the battery.

(continued overleaf)

Notes:

1. Various types of current sensor and voltage regulator can be used to prevent overcharging of a battery of secondary cells in accordance with the principle of dropping the charging voltage when the charging current falls to a predetermined value.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland 20771
   Reference: B66-10492

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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