Solar-powered regulator charges batteries efficiently

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For use with solar panels, this simple and efficient regulator circuit provides an energy-saving solution to charging batteries of the lead-acid type commonly found in automobiles. Not considering the cost of the solar cells, assumed to be at hand for use in other projects, the regulator alone is under $10.

Unlike many other shunt regulators that divert current into a resistor when the battery is fully charged, this circuit opens the charging path so that the resistors can be eliminated. This method is extremely advantageous when solar panels are used, for large resistors would otherwise be required to dissipate the high power levels typically encountered.

When the battery voltage, e_o, is below 13.5 volts (normally the open-circuit potential of a 12-v battery), transistors Q_1, Q_2, and Q_3 turn on and charging current flows from the solar panels as required. The active green light-emitting diode indicates the battery is taking charge.

As e_o approaches the open-circuit voltage, op amp A_{1a} switches Q_1–Q_3 off. This condition is maintained until such time as the battery voltage drops to 13.2 v, whereupon the charge cycle repeats.

If the battery voltage should continue to fall from 13.2 to approximately 11.4 v, indicating a flat battery, A_{1b} switches low, causing a red LED to flash at a rate determined by the astable multivibrator A_{1c}, in this case oscillating at a frequency of 2 hertz. A_{1d} provides a reference of 6 v to maintain the switching points at the 11.4- and the 13.2-v levels.

The circuit will handle currents to 3 amperes. To draw larger currents, it is necessary to increase the base currents of Q_2 and Q_3 so that these transistors will remain in saturation during the charging periods. □

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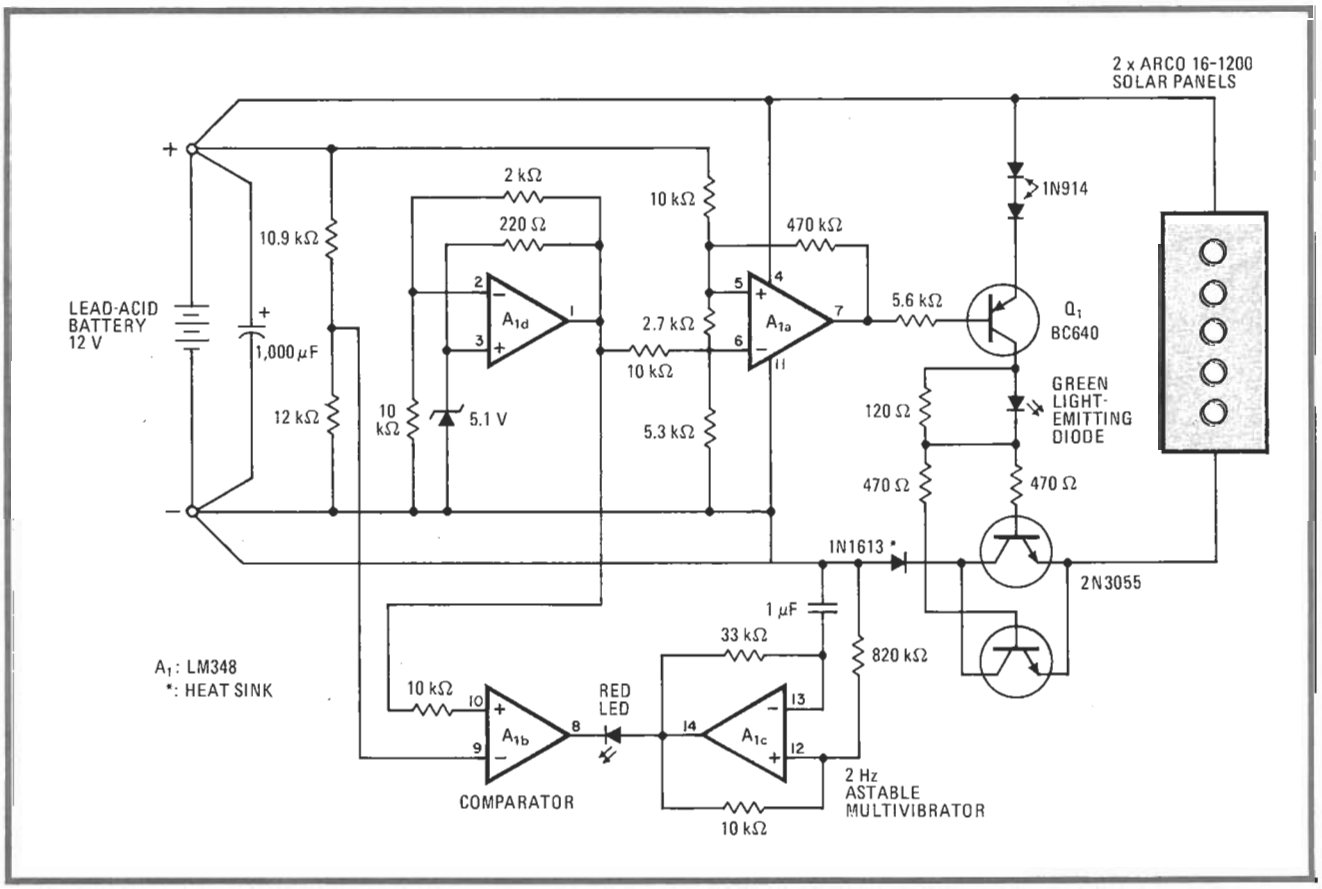

Light charge. Regulator for handling currents produced by solar panels charges lead-acid batteries without wasting excessive power. Circuit cuts off current to battery when its open-circuit voltage is greater than 13.5 V, eliminating need for dissipating power in resistors. Green LED indicates battery is charging. Flashing red LED indicates battery is flat (battery voltage below 11.4 V) and refuses to take charge.