

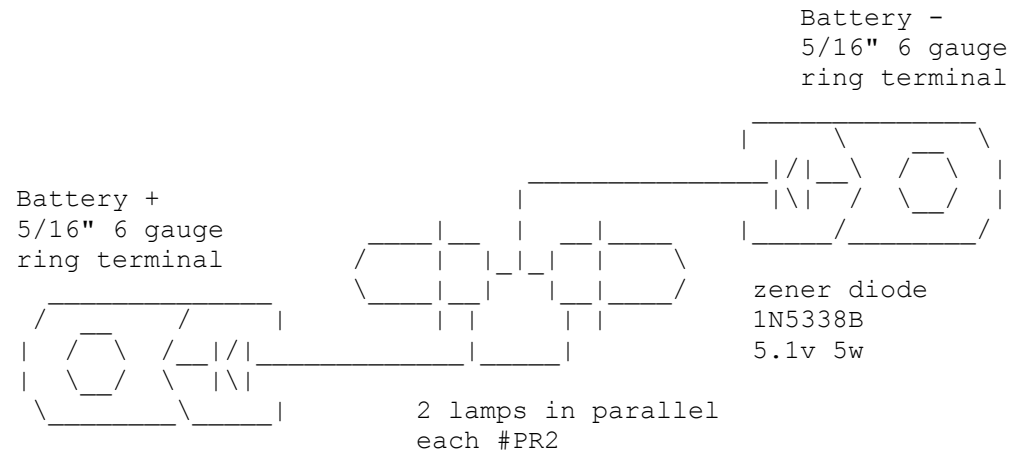
Zener-lamp regulator

Lee Hart wrote on 2/26/03:

Here is a design I have been playing with for about a year. I have two working systems installed, and while not as aggressive as a full-blown [Battery Management System](#), it does most of the job and at very low cost.

Battery regulators

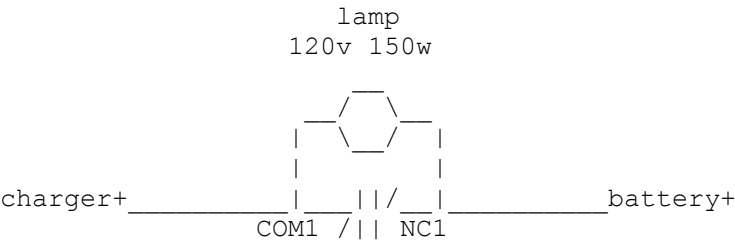
Here is the wiring diagram of the battery regulators:

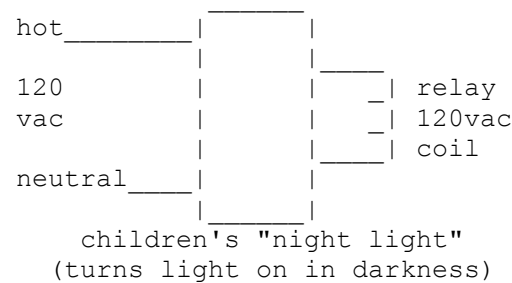


Charge Current Limiter

One simple way to force a charger to limit its output current is to put some resistance in series with its output. A light bulb is a good way to do this, because it acts like a crude constant-current source. The current only changes about 2:1 for a 10:1 change in voltage. For example, an ordinary 120vac 150w light bulb draws $150\text{w} / 120\text{v} = 1.25$ amps at 120v, and about half this or 0.625 amps at 12v.

Wiring diagram:





Parts list:

- 1 - 120v 150 watt light bulb and socket (choose wattage for desired limiting current)
- 1 - relay, SPDT contacts to match charger max amps and volts, 120vac coil (for example, Potter & Brumfield T92 series, DPDT 30a 240vac contacts, 120vac coil, Mouser 655-T92P11A22-120, \$10.50)
- 1 - children's night light with photocell that turns it off when it senses light. Replace its lamp with the relay coil

Locate the night light inside the battery box where its photocell gets exposed to light from any of the battery sensors. When no light is detected, the relay coil is off, so its normally-closed contacts short the light bulb and the charger delivers full power to the batteries. When the first battery regulator lights, it pulls in the relay, which opens the contacts and puts the light bulb in series with the charger, limiting its current.

Usage

Add my zener lamp regulators across each battery.

Add a timer to turn off the charger after a set time. I like the Intermatic mechanical timers that you can set for 0-12 hours with a knob; they count down and turn off (\$15-\$20).

Next time you charge, watch the lamps on the regulators. When the first one comes on, set the timer to only run another hour or so. If the pack is out of balance, you'll probably find that after an hour, only a few lamps are on.

Do the same thing for the next few charge cycles. Each time, you'll find that more lamps will be on after that final 1 hour of charging, as the batteries get pushed closer to balance. After a while, the last lamp should just be starting to light at the end.

for a specific time (like 5 hours) right at the beginning, and will automatically get that 1 hour extra charging time alf you have a fairly consistent driving cycle (say 10 amphours/day), you'll find you can set the timerfter the regulators light up.

If your cycle isn't that consistent, you'll have to figure out by trial and error how much charge time to select for each depth of discharge.

You can automate this process by adding a light sensor and high/low relay.