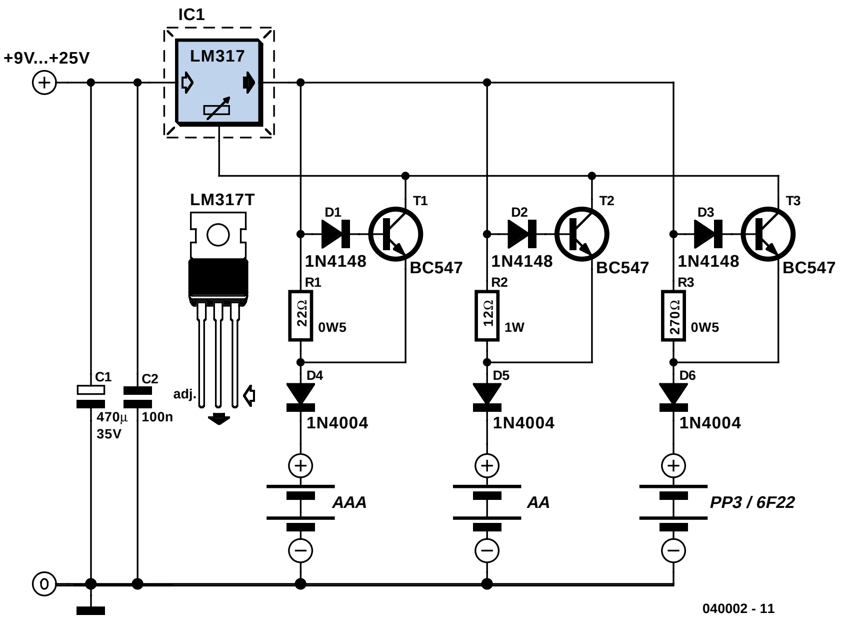
Switchless NiCd/NiMH Charger

Myo Min

This circuit may be used to replace the single current limiting resistor often found in dirt cheap battery chargers. The alternative shown here will eventually pay off because you no longer have to throw away your NiCds after three months or so of maltreatment in the original charger.
The circuit diagram shows an LM317 in constant-current configuration but without the usual fixed or variable resistor at the ADJ pin to determine the amount of output current. Also, there is no switch with an array of different resistors to select the charge currents for three cell or battery types we wish to charge: AAA, AA and PP3 (6F22).
When, for example, an empty AAA cell is connected, the voltage developed across R1 causes T1 to be biased via voltage dropper D1. This results in about 50 μA flowing from the LM317's ADJ pin into the cell, activating the circuit into constant-current mode. D4 is included to prevent the battery being discharged when the charger is switched off or without a supply voltage. The charging current *I* is determined by R1/R3/R3 as in

$$R(n) = (1.25 + V_{sat}) / I$$

where V_{sat} is 0.1 V.



The current should be one tenth of the nominal battery capacity — for example, 170 mA for a 1700-mAh NiCd AA cell.
It should be noted that 'PP3' rechargeable batteries usually contain seven NiCd cells so their nominal voltage is 8.4 V and not 9 V as is often thought.
If relatively high currents are needed, the power dissipation in R1/R2/R3 becomes an issue. As a rule of thumb, the input voltage required by the charger should be greater than three times the cell or battery (pack) voltage. This is necessary to cover the LM317's dropout voltage and the voltage across R(n).
Two final notes: the LM317 should be fitted with a small heat sink. With electrical safety in mind the use of a general-purpose mains adapter with DC output is preferred over a dedicated mains transformer/rectifier combination.

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