Lead-acid battery charger

This battery charger for lead-acid batteries switches of the charge when the battery voltage rises above that of a fully charged battery, which has been used for calibration.

The potential divider incorporating VR_1 must be adjusted so that the op-amp output just becomes high when the calibrating battery is in position, so that when the battery under charge is in place, an increase in its voltage to more than 100mV above that of a fully charged battery turns on the transistor by way of the led and the relay is activated to stop the charge.

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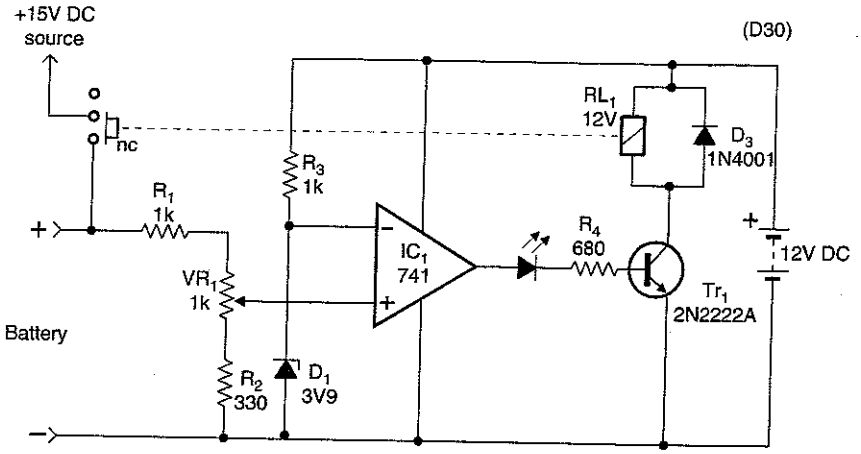

Lead-acid battery charger stops the charge automatically when the battery is fully charged.

Electronic load

There are several methods of testing DC power supplies using variable loads, but they turn out to be unwieldy and difficult to adjust (rheostats), or to need heat sinks and insulation (power transistors). Wirewound resistors suffer from neither defect and can be obtained in metal-clad types with insulation.

Figure 1 shows one method. A fast-switching mosfet with a choke in its drain draws the supply current, dissipation being low in the Class-D operation adopted. Waste power is simply dumped in the resistor, which is of fixed value, the variation being taken care of by varying the pulse width. In testing the circuit, it became clear that the diode is unnecessary, which gives more current from the supply; the choke L_1 may also be left out to leave only the resistor in circuit.

However, it is best to keep the choke as part of a filter using $C_{1,2}$ to smooth the pulses to the supply, as seen in **Fig. 2**. Variable-width pulses come from the 555, which takes its own supply from terminal B or from a secondary winding on the choke via $D_{2,3}$.

Pulse width is varied by P_1 to provide effectively a variable resistive load from around 33Ω to 2.7Ω. Switching frequency, determined by $P_1R_{2,3}C_3$, is about 15-60kHz, the off time of the mosfet being 15µs and the on time variable from 1.5µs to 50µs, so the duty cycle is theoretically 9%-77%, although switching times mean a lower limit of 6%.

The turns ratio of L_1 is such that at least 12V goes to $D_{2,3}$ from the ripple across the primary. Capacitor C2 must withstand the ripple caused by switching and must be a multiple unit. Resistance R_1, which consists of five resistors, is fixed to a 25 by 15cm aluminium sheet and the mosfet is fitted with a 10°C/W heat sink.

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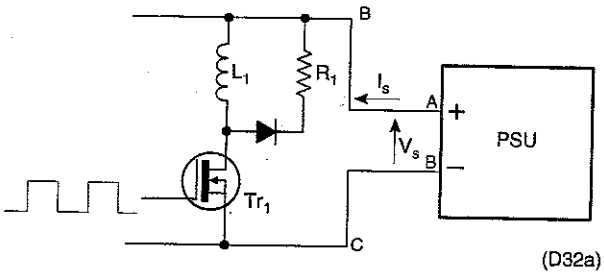

Fig. 1. One way of providing a variable load for power supply testing is to pulse-width modulate a mosfet and dump the power into a fixed resistor.

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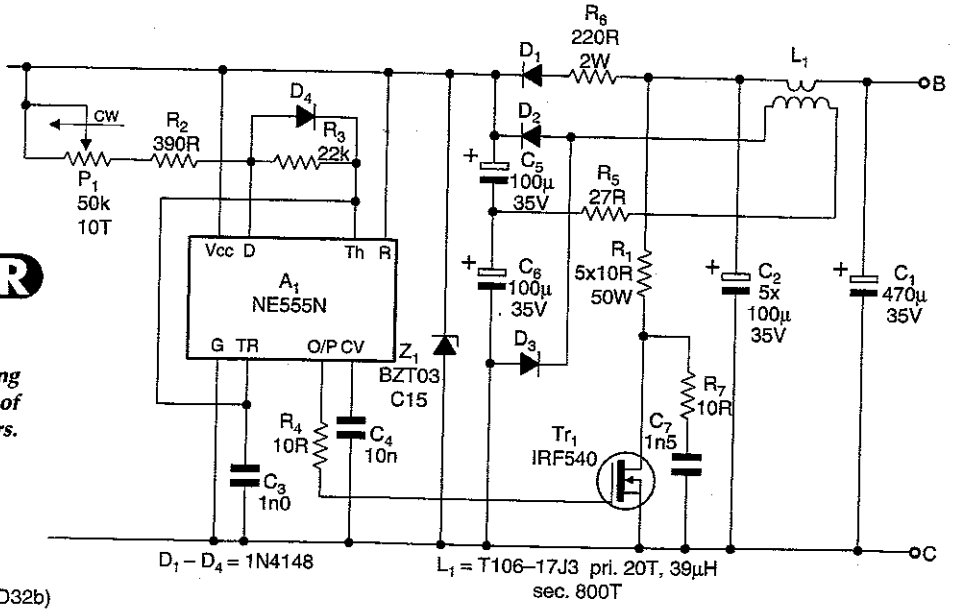

Fig. 2. Variable load for testing power supplies avoids the use of rheostats and power transistors.