Pulsed low-power source energizes solenoids and relays

by Tom Rogers
United Telecommunications Inc., Shawnee Mission, Kan.

Simultaneously activating the track switches of a model railroad from just its standard low-voltage power supply is a neat hobbyist's trick. But the circuit that makes it possible also can serve in any application where low-power sources must supply tremendous currents for activating mechanical-latch solenoids and relay coils. The circuit stores the source's energy and releases it in a burst through those devices.

The source—in this case a 20-volt supply—is stored on a capacitor and then discharged instantaneously through a low-resistance inductor. The unit's operation is analogous to that of a strobe circuit, where a blinding light is produced by storing a small voltage on a capacitor and quickly discharging it to form a pulse of energy.

The supply typically provides only 6 volt-amperes—barely enough to supply the required current to one switch, and certainly not enough to operate larger switches. But, with capacitor C_1 included as shown in the figure, large currents may be produced. The 20-v ac or dc input from the accessory terminals of the power supply charges C_1 through lamp L_1 and diode D_1 in the half-wave rectifier circuit.

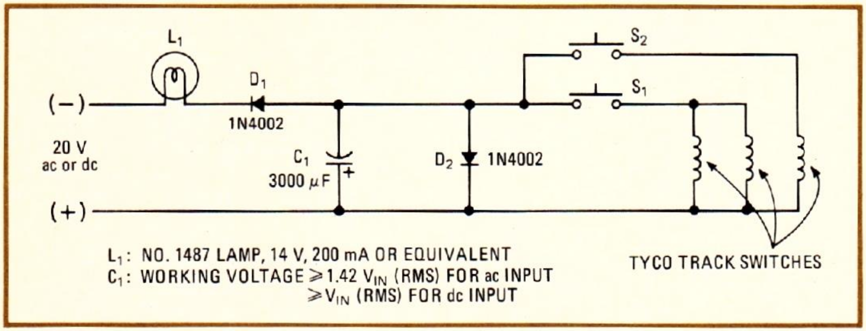
The lamp resistance limits the charging current to approximately 120 milliamperes and is also used as a charging indicator. When the capacitor voltage is approximately equal to the peak value of the input voltage, the lamp is extinguished. The energy stored in the capacitor at this time is about 3.5 joules.

One of the external momentary-contact push buttons may now be depressed. The capacitor will discharge through the appropriate low-resistance relay coil. The instantaneous current through the coil will be very great for a few microseconds, enough to switch the relay but not long enough to damage its coil. Diode D_2 provides protection for the capacitor by preventing the coil's counter-electromotive force from appearing across it.

The energy stored by the capacitor may, of course, be increased by raising the value of capacitance or input voltage ($E = CV^2$). The current produced as the capacitor discharges will be directly proportional to the energy stored.

Recharging the capacitor is accomplished in three seconds or so. Charging currents, and thus charging times, are easily changed by substitution of appropriately rated lamps for the one used in this circuit. If the charging current is kept low enough, other devices connected to the power supply will not be affected by this circuit's operation.

The circuit also suits applications where it is necessary



High-current pulser. Energy in low-power source is stored on capacitor, then released to provide latch-type relays with high-current pulse. Lamp is charging indicator and limits current to relays in applications where small continuous current is necessary.

to keep the external switches closed after the initial switching pulse has been applied. The holding current will be much less than the initial current, and the current supplied continuously will be a function of the lamp, coil, and diode (forward) resistances. The limited current should not overheat the transformer or the coil might be damaged. Holding currents for the particular solenoid can be supplied by the manufacturer. □