tubes such as the 1A7, 1U5, etc., which require 1.4 volts. As shown, the circuit would be unlikely to protect 1.1-volt tubes as mentioned. If protection of these tube types is required, remove one of the diodes and reduce the input voltage accordingly.

Antique Radio is the first column I turn to each month—keep the great stories coming!

C.R. ZINCK
Halifax, Nova Scotia
Canada B3N 1Y9

AUTOMOTIVE ALTERNATORS

I found Gary Eggleston's article, "Fighting Interference" (**Popular Electronics**, August 1993) to be a good overview on EMI. He offered practical solutions to making equipment less susceptible to interference. However, his article contains one error in the description of the automotive alternator.

The article states that slip rings connect the rectifying diodes to the coils of the rotating armature. Actually, the rotating element of the alternator is the field. The stator is the armature and it contains the diodes that are directly connected to its AC windings. The current for the field is supplied via the voltage regulator from the battery contacts of the ignition switch. The voltage regulator, which is often contained in the alternator housing, monitors the battery voltage and supplies excitation current to the rotor field through the slip rings. The regulator adjusts the excitation current with the varying electrical load and engine speed to the value required to maintain a constant battery-charging voltage (around 14 VDC). The voltage is varied with temperature, however, to provide more charging current during cold weather.

The description in the article more resembles that of the old-style automotive generator. The rotating element of the generator is the armature, and the stator is the field. The generator-voltage regulator provides excitation current to the stator field, and battery-charging current is obtained from the rotor armature via brushes that ride on a segmented commutator. "Rectification" is obtained by rapidly switching the polarity of the generator armature winding with the brushes so that a DC output current results. Because the alternator is a more efficient machine than the generator, charging current can be obtained at a lower engine RPM. Generators were sometimes unable to charge the battery at idle speed, which is one of the reasons why the generator is no longer widely used.

The brushes in an alternator also last much longer than the brushes in a generator, for three reasons. First, the alternator brushes only carry the field current (less than 10 amps), while the generator brushes must carry the entire output current (50 to 100 amps, depending on the generator rating). Second, the alternator slip-ring surface is a smooth continuous band, while the generator commutator is segmented, causing more mechanical wear. Finally, the generator brushes have to continuously switch the polarity of the highly inductive output windings to obtain the DC charging current. This causes high-temperature arcing, which adds to the brush wear.

C.H.
Tinton Falls, NJ

FUEL MISER STATS

I've built three Fuel Misers using the information that appeared in the March 1993 issue of **Popular Electronics**. Two are installed on gas furnaces (one older, one fairly new) and the third on a brand-new electric furnace. The first board was hard-wired, the second etched by hand, and the third etched using the photocopy method. All three are working with furnace fans on continuously. The two gas furnaces are operating at 40%, and the electric had to settle for 70%. We started, as