ever, the RC network is omitted. If needed, a capacitor is added to provide the necessary frequency response. Characteristics of a properly trimmed TS6AK5 Fetron and the tube it replaces are listed in Table 1. Heater voltage is not specified, because those pins are not connected in the Fetron.

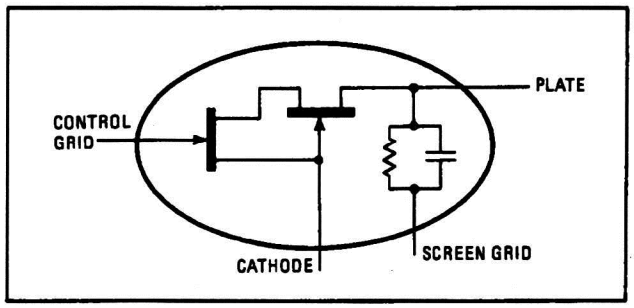
Note the great increases in amplification factor and plate resistance when Fetrons are used. The effect of these differences on the circuit is greatly improved sensitivity—about 4 to 5 decibels—resulting from the higher $m\mu$, lower noise, and low distortion.

Triode simulation

The Fetron will also perform well if configured as a triode, for the three electrodes of a single JFET directly simulate the latter's grid, cathode, and anode. But the JFET's much higher output impedance (hence higher gain) could cause an amplifier circuit to oscillate. Usually, however, the load resistance of a circuit is much smaller than r_p of the Fetron, and there is no problem.

The first Fetron triodes made were equivalents of the 12AT7 and Western Electric's 407 version, which has a 20-volt heater and slightly different pin-out. These Fetrons operate as twin triodes. Figure 7 and Table 2 show their characteristics compared to a single triode. Although the Fetron's transconductance is significantly lower (each of the triodes is a single high-voltage FET), its transconductance is the same as that of the twin triode being replaced. And the design equations given for pentode amplifiers also apply to the triode version.

True, the Fetron output characteristics approximates a pentode's, not a triode's. But it can be used to replace a twin triode—the more common triode application because two of the small inexpensive devices go easily into one glass tube envelope. It's generally not as good an electronic device as a pentode, though many circuit designers use them in cascode to get lower noise than obtainable with a pentode. Now, the Fetron triode upgrades typical circuit performance because of its excellent square-law characteristics throughout the control voltage range. Power supply regulation can also be relaxed—triodes normally require well-regulated power supplies, because triode operating current depends on operating plate voltage, whereas the Fetron's does not (see Fig. 7a).



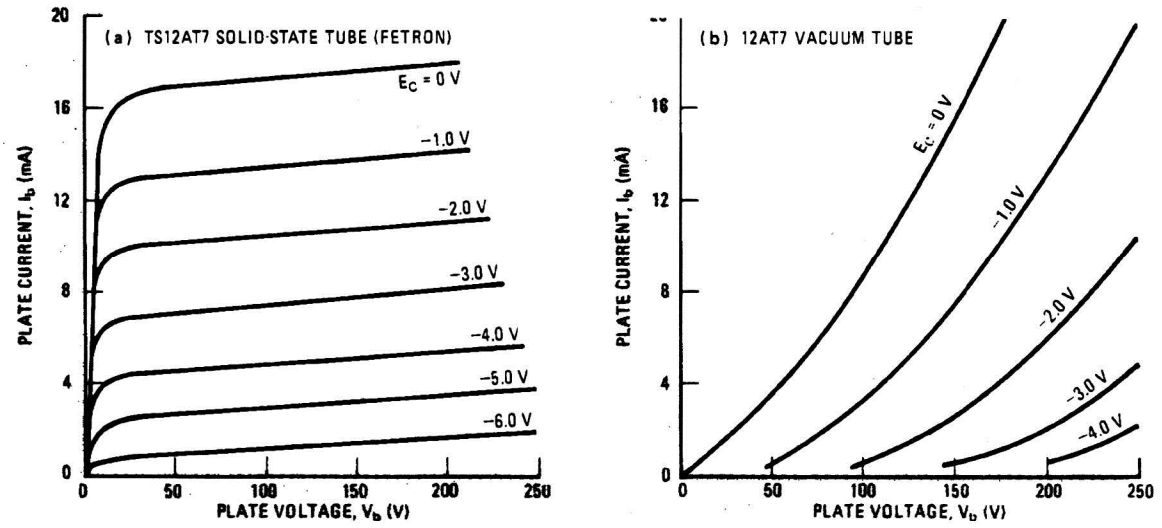
6. Farflung net. This oscillator network is used when Fetrons replace a pentode oscillator. The resistor and/or resistor-capacitor combination simulates screen-grid action. The network is included within the header, permitting 1:1 replacement.

It's dependable

Besides replacing pentode and triode tubes, the Fetron gets higher marks in reliability than either. A high-reliability tube has a life expectance of 5×10^4 hours (63% failure point). Preliminary data from burn-in and accelerated life tests on 1,000 Fetrons indicates a life expectancy of 3×10^6 hours, or 300 years. Of the 1,000 in the sample, 787 were screened by the type of power burn-in tests generally given high-reliability tubes, and were operated for 20 hours at twice normal dissipation (1,760 milliwatts). The failure rate, or dropout, was only 3.5%, a small fraction of the tube screening dropout rate.

In addition, some 2,500 Fetrons have been shipped to telephone companies for evaluation and trial applications. Many have been in use for as long as eight months, and to date, failures or degradations reported have been statistically unimportant.

Finally, another group was put in a 170° C oven and



7. Just like a triode. Although the characteristics of a Fetron are different from those of a typical triode, they are similar to those of a triode pair and can be used wherever twin triodes are used. In fact, Fetrons were first designed to replace Western Electric's 407 twin triode.