HOW THE FETRON WORKS

The FETRON usually contains two JFETs connected in cascode to simulate the actual performance of a pentode or triode vacuum tube. The advantages of this configuration are:

1. The input characteristics are determined by the first device,
2. The plate voltage rating is determined by the second device, and
3. The Miller capacitance is minimized.

Since a screen grid is not needed by a FETRON, some circuits include R/C networks to simulate the equivalent circuit of the screen-plate circuit. A tantalum fuse is connected in the plate circuit to protect other circuit components in case of failure.

Using cascoded JFETs in combination with other elements, any number of different tube types can be simulated. The FETRON is most like a pentode in that the plate current is essentially independent of the plate to cathode voltage. The plate current of a triode, and its transconductance, are very much dependent on the plate to cathode voltage. The FETRON is therefore superior in principle to the triode, and usually provides improvement in circuit performance upon replacement.

However, the proper FETRON must be selected and trimmed for each application, to avoid saturation effects as determined from the load line analysis.

Because of characteristic similarity, a FETRON can very closely simulate the function of a pentode tube. The gain/phase relationships are almost identical for a FETRON and a pentode. However, there are three important circuit improvements obtained with the FETRON. These are:

1. Reduced noise by several dB, and no microphonics,
2. Higher gain which is independent of screen voltage, and;
3. Lower distortion by typically 15dB.

The pentode generates distortion by cross modulation of higher harmonics, a result of its three-halves response relationship. The FETRON, however, is close to being a perfect square law device over most of its usable range, and generates almost no harmonics above the second. The FETRON must also be tailored for pentode operating conditions, but less critically than for the triode.

In general, the choice of FETRON depends on operating voltage and power levels, frequency range and whether an oscillator or an amplifier. Teledyne has analyzed the circuits on most telephone carrier equipment and other instruments such as Hewlett Packard VTVMs. Worst case analyses have been done on the carrier equipment by Teledyne together with different telephone companies. Teledyne has also formalized simple conversion procedures in most cases. The target ground rules for specific applications are:

1. No external components.
2. No re-wiring of equipment.
3. No power supply changes.
4. Plug directly into the tube socket.

These objectives have been achieved in almost every case. They make it easy for you to reap the benefits of the FETRON.

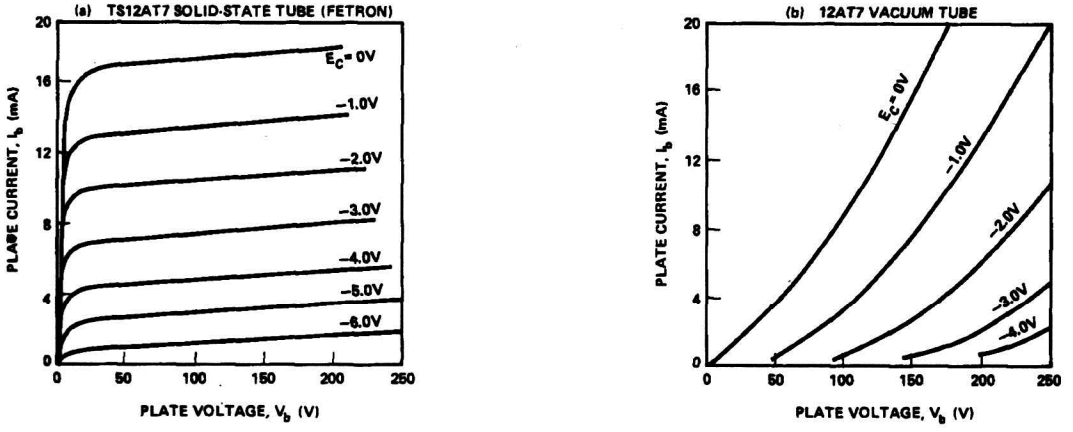

Figure 6. FETRON Compared with Vacuum Triode. The FETRON provides a plate current/voltage characteristic that is superior to the triode. Plate current in the FETRON is virtually independent of plate voltage. The plate current and transconductance of a vacuum triode is very much dependent on plate voltage. For example, with a 240 ohm load, a plate voltage change from 130V to 60V results in a plate current change from 8mA to 2.5mA. The same voltage excursion results in only μA in the FETRON.