The Augetron and Its Applications

By the Technical Staff of Vacuum Science Products, Ltd.

THE Augetron is a multi-stage electron multiplier which has been developed by Vacuum Science Products, Ltd., as a solution of a problem which is confronting valve designers. Modern circuit design requires valves with a high mutual conductance relative to the standing anode current and the conventional valve is limited in this respect both by geometric design and by mechanical considerations.

Augetron multipliers have been designed employing either a thermionic or a photo-electric cathode, as primary emitter, but the present article will be confined to a description of the thermionic type, in some detail, in order to assist readers in the application of these tubes. The general arrangement of electrodes in a six-stage Augetron is illustrated in Fig. 1. It will be seen that the indirectly heated cathode is followed first by a control grid and then by an accelerator plate. This plate is maintained at the same potential as the first secondary cathode. Each secondary cathode is at a potential some 300 volts more positive than the preceding one.

It will be noticed that the position of the final secondary cathode and collector have been interchanged. This arrangement has been adopted since it enables a much higher multiplication factor to be obtained from the final secondary cathode. The construction of the secondary cathodes has already been described and, for the purpose of this explanation, it may be assumed that

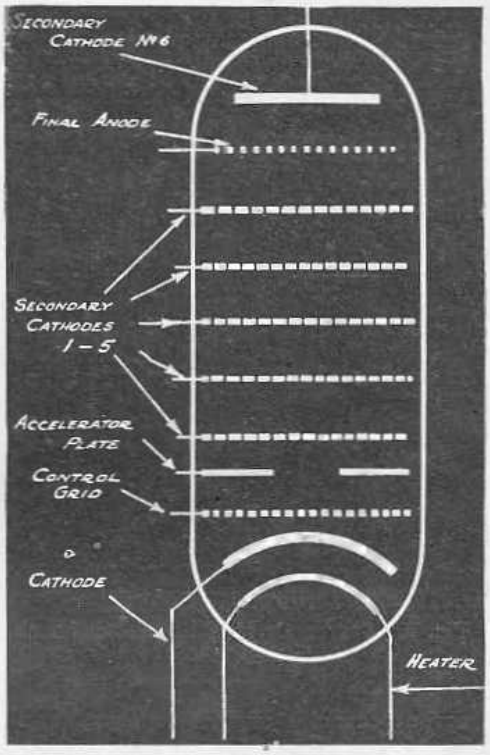
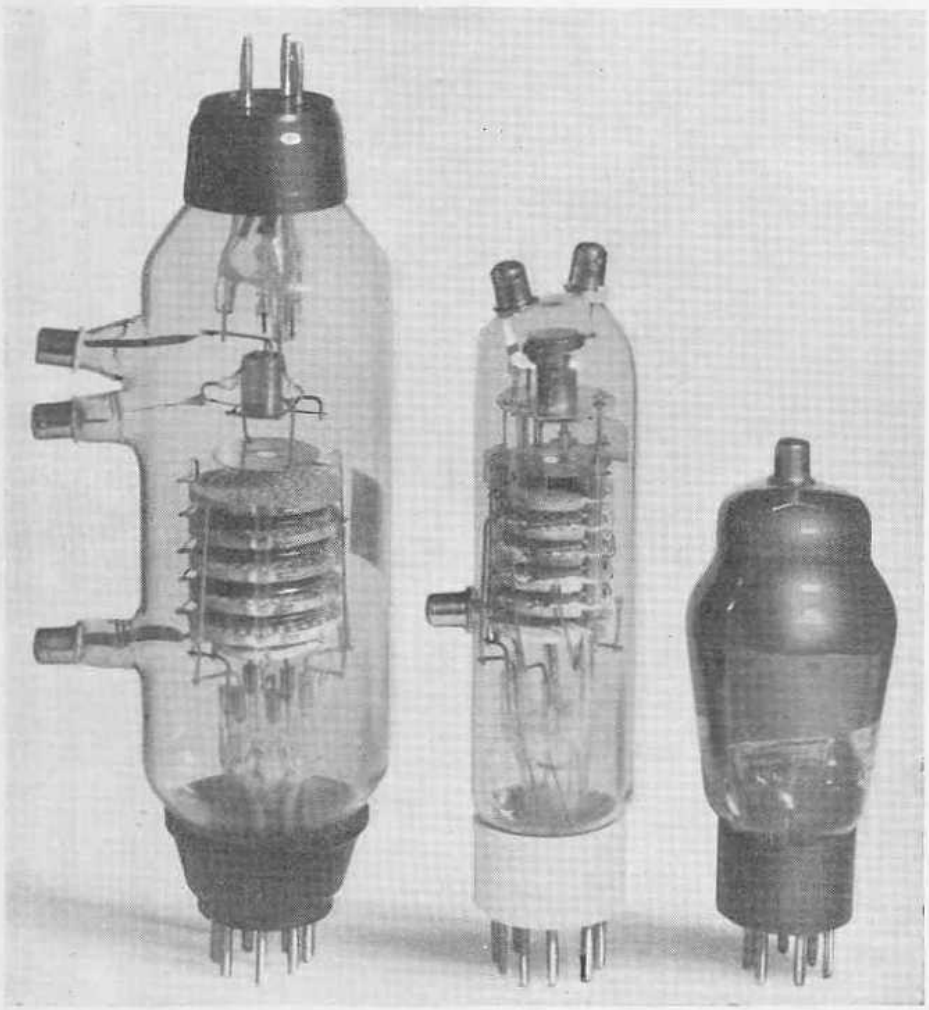


Fig. 1. General arrangement of electrodes in a six-stage Augetron type A206/7.



These photographs show two types of Augetron compared with an ordinary valve.

these plates constitute a system which multiplies the cathode current and the cathode grid slope by a factor of the order of 1,000 times. This current multiplication does not, in itself, yield any increase in voltage amplification and has no direct connection with the stage gain obtainable from the tube.

In the Augetron cathode, currents of the order of 10 microamperes are used. This enables a cathode of much smaller area than usual to be employed, thereby reducing the input capacity and the high-frequency input damping to very low figures. This feature is in itself a very big advantage for high-frequency amplification.

The main functions of the multiplier may best be understood from the curves in Fig. 2. In these primary current and slope are plotted against control grid voltage. In order to obtain a high slope valve of reasonable power dissipation it is necessary to improve the ratio of slope to anode current. It will be seen from the curve that ratios as high as 6 to 1 may be obtained at very low cathode currents.

Now, if these low currents are increased by a linear multiplying device, these ratios will be retained at normal anode currents. The question then arises as to how much multiplication is desirable. This will depend upon the circuit in which the Augetron is to be used. A typical case is that in which an Augetron is required to give as much amplification as possible in a wide band amplifier. In such a circuit the load resistance, and hence the gain, will be dependent upon the