

Cathode-ray Oscilloscope Circuit for Obtaining Amplifier-tube Characteristic Curves

THIS circuit provides a family of curves of plate current versus plate voltage for various equally spaced grid voltages in multielement amplifier tubes. As the desired curve has plate voltage for its abscissa and plate current for its ordinate, one of the horizontal deflection plates of the cathode-ray tube is connected to the cathode of the tube under test (T_1) and the other to the anode. The vertical deflection plates are connected across a resistor R_1 to receive a voltage proportional to the plate current. Then an alternating voltage of any wave form and frequency may be applied to T_1 and R_1 in series and the spot will move always along the curve of plate current versus plate voltage. During each negative half cycle the spot remains stationary at the origin.

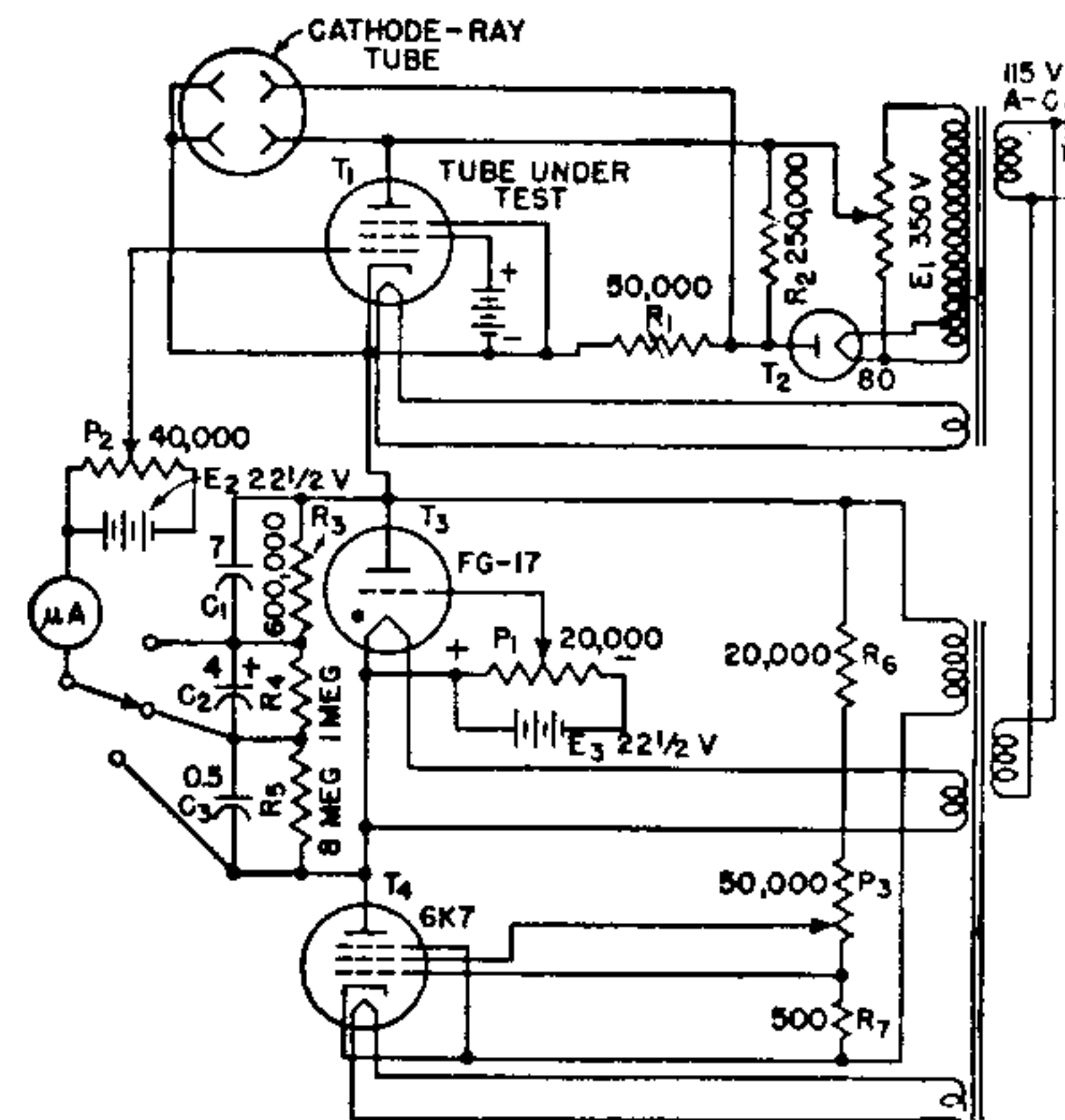
To trace a complete family of curves for various grid voltages, the grid voltage must be held constant during positive half cycles while the spot is moving and changed by a fixed increment during negative half cycles. This is accomplished by charging the capacitor chain $C_1C_2C_3$

through the pentode T_4 in steps and by finally discharging it through the thyatron T_3 . $C_1C_2C_3$ is charged in steps due to the fact that the pentode T_4 has an alternating voltage on its screen and control grids, and hence conducts only during alternate half cycles.

The voltage E_5 is phased with respect to E_1 so as to make T_4 conduct during negative half cycles of E_1 . Since the current passed by T_4 is substantially independent of its plate voltage, so long as it exceeds the screen voltage, the increments of charge applied to $C_1C_2C_3$ are equal. The amount of the increment depends upon the setting of the screen potentiometer P_3 . When the voltage on $C_1C_2C_3$ reaches a value determined by the setting of P_1 , the thyatron fires and discharges $C_1C_2C_3$.

Three capacitors ($C_1C_2C_3$) instead of one provide three ranges of maximum bias voltage. Resistors R_1 , R_2 , and R_3 permit a reasonable grid-leakage current to flow in the tube under test. Potentiometer P_2 across battery E_2 permits adjustment of the minimum bias to zero,

which it would otherwise not be, since the thyatron may discharge the capacitors to almost any voltage, depending upon the



circuit constants. The microammeter in the grid circuit of the tube under test facilitates the adjustment of P_2 .