

Cancellation by a Series Triode.—In the circuit of Fig. 11-46, the plate resistor for the amplifier (lower) tube comprises a circuit resembling the constant-current device of Fig. 11-18 except that the voltage E is omitted. Thus this is not a constant-current device but is simply the equivalent of a resistor whose upper end is attached to E_{pp} and whose value is $r_p + (\mu + 1)R$ [Eq. (23)]. Thus from Eq. (7), if the two triodes are similar,

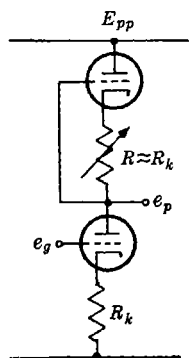


FIG. 11-46.—Cancellation of E_f variation with a series triode.

$$e_p = \frac{\frac{r_p + (\mu + 1)R_k}{r_p + (\mu + 1)R} E_{pp} - \mu e_g}{1 + \frac{r_p + (\mu + 1)R_k}{r_p + (\mu + 1)R}} \quad (90)$$

If the two cathodes respond equally to a change of heater voltage, R should equal R_k for cancellation of the effect.¹ With e_g fixed, a given increase of E_h causes a certain small increase of current; but since this increase is the same in both tubes, the grid biases change identically. Therefore, the two plate-to-cathode voltages suffer no change, and e_p remains constant. If $R_k = R$, Eq. (90) becomes

$$e_p = \frac{E_{pp}}{2} - \frac{\mu e_g}{2} \quad (91)$$

Thus, when e_g is zero, the output voltage is half the plate-supply potential (as is already apparent by symmetry), and the gain is $\mu/2$. The output voltage is linear with respect to e_g because r_p does not appear in Eq. (91). Of course, the two r_p 's were assumed equal, but this assumption is not far in error, as the currents in the two tubes are equal.

The output impedance, from Eq. (11), is (if $R_k = R$)

$$Z_p = \frac{r_p + (\mu + 1)R_k}{2} \quad (92)$$

If the two cathodes have different heater-voltage characteristics, either R or R_k may be adjusted until cancellation is obtained. This adjustment will not usually change the gain from $\mu/2$ by more than 5 per cent.

Cancellation by Means of a D-c Potential Proportional to Heater Voltage. If the d-c load on the power supply is fairly constant, its unregulated output will vary in proportion with the a-c line voltage and therefore with E_h . Thus this output may be employed in some way to offset the

¹ Maurice Artzt, "Survey of D-c Amplifiers," *Electronics*, August, 1945.