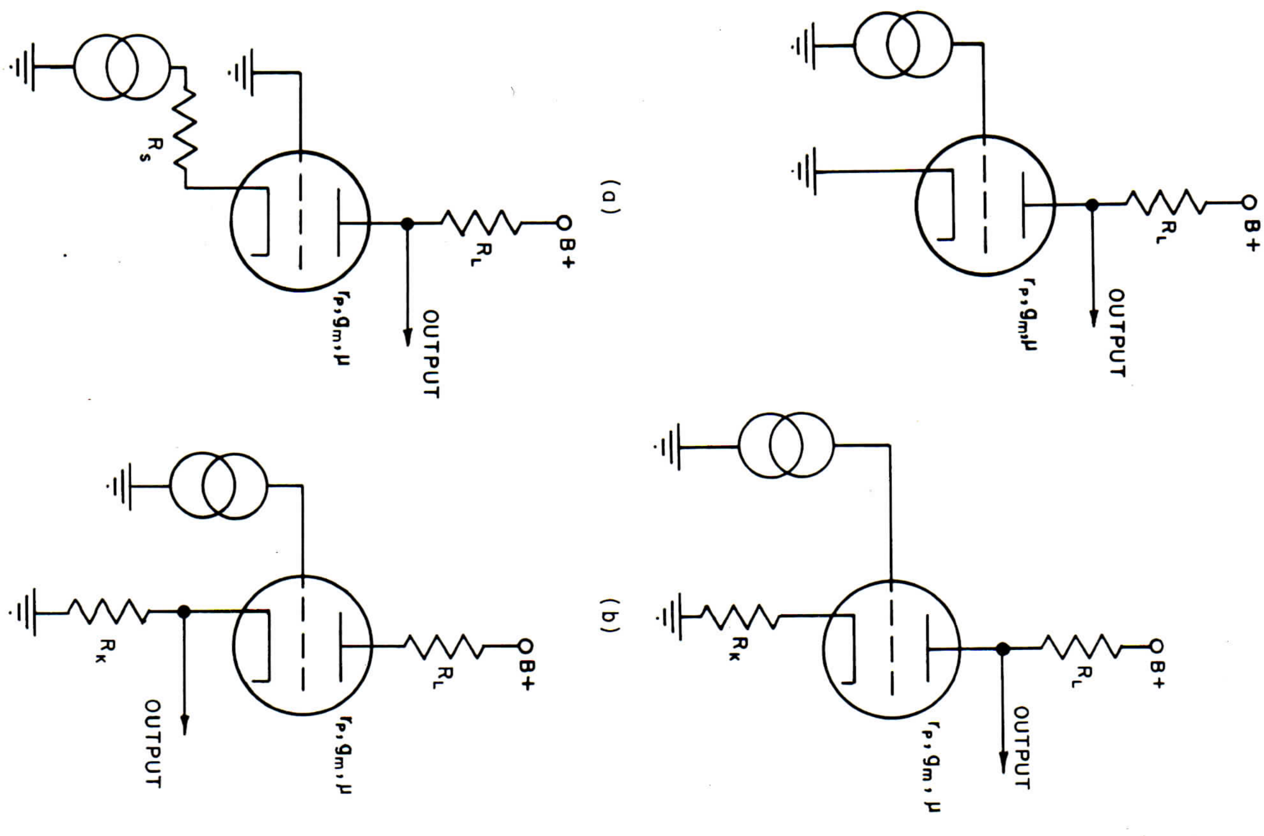

FIG. 1. (a) Basic amplifier, $R_K = 0$; (b) basic amplifier, $R_K \neq 0$; (c) grounded-grid amplifier; (d) cathode follower.

TABLE I. Characteristics of Basic Triode Amplifiers[a]

Circuit	Voltage gain: Exact	Voltage gain: Approximate[b]	Input impedance: Exact	Input impedance: Approximate[b]	Output impedance: Exact[c]	Output impedance: Approximate[b]
Grounded cathode $R_K = 0$	$\frac{\mu R_L}{R_L + r_p}$	$g_m R_L$	—	∞	$R_L \parallel r_p$	R_L
Grounded cathode $R_K \neq 0$	$\frac{\mu R_L}{R_L + r_p + R_K(\mu + 1)}$	$\frac{g_m R_L}{1 + g_m R_K}$	—	∞	$R_L \parallel [r_p + R_K(\mu + 1)]$	R_L
Grounded grid	$\frac{R_L(\mu + 1)}{R_L + r_p + R_s(\mu + 1)}$	$\frac{g_m R_L}{1 + g_m R_s}$	$\frac{r_p + R_L}{\mu + 1}$	$\frac{1}{g_m}$	$R_L \parallel [r_p + R_s(\mu + 1)]$	R_L
Cathode follower[d]	$\frac{\mu R_K}{R_L + r_p + R_K(\mu + 1)}$	$\frac{g_m R_k}{1 + g_m R_K}$	—	∞	$R_K \parallel \frac{r_p + R_L}{\mu + 1}$	$R_K \parallel \frac{1}{g_m}$

[a] These formulations are for the circuit of Fig. 1. They are valid for signals small enough so that r_p and g_m are essentially constant, and for frequencies low enough so that capacitance effects are negligible. They apply to pentodes if the screen grid and suppressor grid are bypassed to cathode.

[b] Approximate forms are valid if $R_L \ll r_p$ and $\mu \gg 1$.

[c] The sign $\parallel$ is used to mean "paralleled with."

[d] A cathode follower with a gain very close to unity and an output impedance of a few ohms is obtained if the cathode resistance is replaced by a second tube. Its grid is capacitively coupled to the plate of the cathode follower which is returned to the supply through a load of several kΩ. For an analysis of this "stacked" or "White" cathode follower, see M. Brown, *Rev. Sci. Instr.* **31**, 403 (1960); for further refinements see P. L. Read, *Rev. Sci. Instr.* **31**, 979 (1960).