applied voltages we have:—

$$Ia = \frac{K}{Ra}\left(\frac{2}{\pi}\hat{\varepsilon} + \frac{2}{\pi}\mu\hat{\varepsilon}_g\right)$$

Let ϵ_{RMS} be the RMS value of the applied A.C. (at would be the normal measurement of applied A.C. volts) and let represent the average value of the half wave rectified applied grid volts (as read on an ordinary moving coil D.C. voltmeter) then:—

$$Ia = \frac{K}{Ra}\left(\frac{2\,\varepsilon_{RMS}}{\cdot 707 \times \pi} + \frac{2\mu\,\varepsilon_{DC}}{\cdot 318\,\pi}\right)$$

$$= \frac{K}{Ra}\left(\frac{\varepsilon_{RMS}}{1\cdot 1} + 2\mu\,\varepsilon_{DC}\right)$$

Thus, remembering that current only flows in the anode circuit on alternate (positive) half cycles of anode voltage, we have:—

$$Ia = \frac{K}{2Ra}\left(\frac{\varepsilon_{RMS}}{1\cdot 1} + 2\mu\,\varepsilon_{DC}\right)$$

This can be written:—

$$Ia = \frac{K}{2}\cdot\frac{(\varepsilon_{RMS} \times \frac{1}{1\cdot 1} + \mu\,\varepsilon_{DC} \times 2)}{Ra}$$

This is obviously of the form of the general characteristic:—

$$Ia = \frac{K(Va + \mu Vg)}{Ra}$$

It is thus clear that with an RMS value of applied anode (and/or screen) voltage equal to 1.1 × Va (D.C.) and a mean value of half-wave rectified bias voltage equal to .5 × Vg (D.C.) where Va (D.C.) and Va (D.C.) are the required D.C. testing voltages, then the valve will give a mean value of D.C. anode current (as read on an ordinary D.C. moving coil meter) equal to precisely one half the anode current that the valve would take under D.C. conditions. Therefore, by scaling the meter in milliamps by a multiplying factor of twice its actual reading, and by applying the equivalent anode (or screen) voltages and grid voltage, as described above, the meter will be direct reading in anode current for the valve and this relationship will hold over the whole of the characteristic in question. Further, by changing the grid voltage in the above relationship at any point on the characteristic, the change in anode current for a given change in grid voltage will bear the same relationship to the mutual conductance of the valve and the change in anode current as measured on the meter will thus be a direct measure of the valves mutual conductance at any point on its characteristic.

The above relationship has, for the sake of simplicity, been calculated for a triode valve, but similar relationships exist in the case of a multi-electrode valve. For instance, a screen grid valve or pentode in which positive D.C. volts are normally applied to the screen as well as the anode has the general expression:—

$$Ia = f(Va + \mu(a/s)Vs + \mu(a/g)Vg$$

and would obviously have a sinusoidal voltage applied to its anode whose RMS value is equal to 1.1 × the rated anode voltage, a sinusoidal voltage in phase with the anode voltage applied to the screen and of an RMS value equal to 1.1 × the rated positive D.C. screen voltage and a counter-phase half-wave rectified sinusoidal voltage applied to the grid, the mean value of which is .5 × the negative D.C. bias voltage. Under these conditions the equivalent mean measured D.C. anode or screen current would be half the D.C. anode or screen current obtained if the valve were working under full D.C. conditions. Anode and screen mutual characteristics can thus be plotted.

Similarly, for other multi-electrode valves employing electrodes normally subject to positive voltages on the current carrying electrodes (anodes, screens and so forth) and negative voltage on the normally non-current carrying electrodes (signal grids, suppressor grids and so forth) the stated relationships for applied in phase sinusoidal voltages to the anodes and screens and applied counter-phase half-wave rectified voltages to the grids and suppressor grids holds throughout, the mean D.C. anode current always being one half the D.C. current obtained under full D.C. conditions.

It must be understood that whilst the above general relationships have been worked out for an ideal characteristic without curvature, they give substantially correct results even when the characteristic curvature is taken into account. Minor modifications of the multiplying factors for anode and grid voltages can be introduced to correct small errors due to the curvature without departing from the scope of the present invention.

The apparatus for testing valves according to the present invention comprises one or more transformers adapted to provide the required A.C. voltages, a half-wave rectifier to remove the unwanted positive half-wave of the A.C. voltage applied to