

keys with a short interval of time between and the electrometer shows the final potential of the condenser. This time interval may be changed at will over a wide range and a series of readings taken for different times of charge or discharge.

Figure 3 shows the result using for $R=100$ ohms. The standard condenser had a capacity of 1 microfarad and the electrometer about .27 microfarads with normal charging.

It will be noticed that the minima are much nearer the mean positions on which would be a logarithmic curve than the maxima, and the curvature is much less also. This is the result of the condenser having different capacities in the different directions.

NON-OSCILLATORY DISCHARGE CURVES

It was easy to obtain charge and discharge curves with the above mentioned chronograph, but the effects of varying resistance and capacity are best seen by plotting the results semi-logarithmically. If the resistance of the electrometer is mainly that of the mercury and acid column in the small tube, the changes will be relatively small when the meniscus is not too near the open end of the tube, but may be large if the meniscus is near the end. In the first case, the discharge curve is represented well by $V=V_0 e^{-\frac{t}{RC}}$ and the semi-logarithmic plot is straight. On the other hand, if the meniscus is near the end the resistance of the column depends on the position of the meniscus, thus on the potential difference V . We may treat the resistance as though made up of two parts, one approximately constant, and the other approximately proportional to V , so $R=aV+b$ and the current at any instant is

$$i = \frac{V}{aV+b} = -\frac{dq}{dt} = -C \frac{dV}{dt}$$

which is satisfied by

$$Ca(V-V_0) + Cb \log \frac{V}{V_0} = -t.$$

Both of these equations are well satisfied by observations taken under the proper circumstances.

Since the capacity increases a little with the increase of potential difference the effect on the discharge curve is of the same general nature as that of the increase in resistance, so all curves plotted as described show a slight curvature.