

## Visual Lecture Table Methods for Judging the Degree of Exhaustion of a Vacuum Tube

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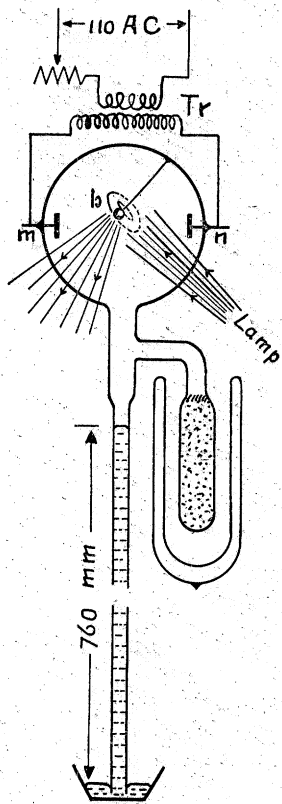


Fig. 1.

The experiment showing the exhaustion of a vessel from atmospheric pressure to, say, 0.001 mm of mercury by means of charcoal and liquid air alone is always interesting and convincing. The degree of exhaustion may be readily shown simultaneously in three separate ways, all *within* the same vessel. These by themselves are *not* new. Two were presented before the Academy by the writer several years ago. The three are:

a) Attach to the discharge vessel a barometric tube set in a dish of mercury, as shown in Fig. 1. As the air is absorbed by the charcoal cooled to the temperature of liquid air the mercury rises in the barometric leg giving a visual indication of the degree of exhaustion.

b) Seal in two electrodes (shown by *m* and *n* in Fig. 1) to which are attached wires from an induction coil, or from the secondary of a small transformer. As the exhaustion proceeds the electric discharge will begin to pass when the Geissler vacuum is reached. This is a very accurate indicator.

c) Mount a small pyrex glass bead delicately on a long slender solid fiber of the same glass within the discharge vessel. When thus mounted (Fig. 1, *b*) the bead will be free to vibrate in any azimuth, and may be set in motion by gently jarring the vessel. When the pressure within is atmospheric the vibrations are soon damped out, however as the pressure is reduced (by the charcoal being cooled to the temperature of liquid air) the vibrations continue for a longer time, and when the vacuum is of the order of 0.001 mm of mercury there is little damping other than that due to the internal

friction of the glass can support. The to and fro motions of the glass bead may be seen more clearly, and made visible to an entire class, by reflection of light from a 60- or 100-watt lamp. The bead being spherical its motion may be seen from any angle. For accuracy this device must be calibrated.

The demonstration consists in operating (a), (b) and (c) simultaneously.