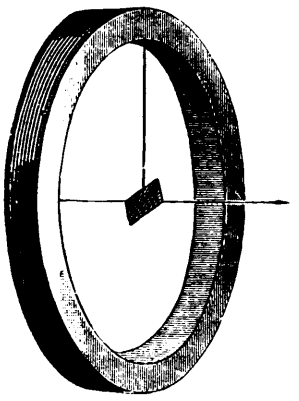

FIG. 1.—PRINCIPLE OF TANGENT GALVANOMETER.

adjusted at any angle or raised or lowered. This magnet serves as an artificial meridian when the galvanometer is used for ordinary work. When it is used as a tangent galvanometer the magnet is removed.

The tangent galvanometer must be arranged with the coil and the needle in the magnetic meridian, and its adjustment must be such that a current which produces a certain deflection of the needle in one direction will, when reversed, produce a like deflection in the opposite direction. The angle of maximum sensitiveness in the tangent galvanometer is 45°; therefore, when it is possible to do so, the current should be arranged to produce a deflection approximating 45°.

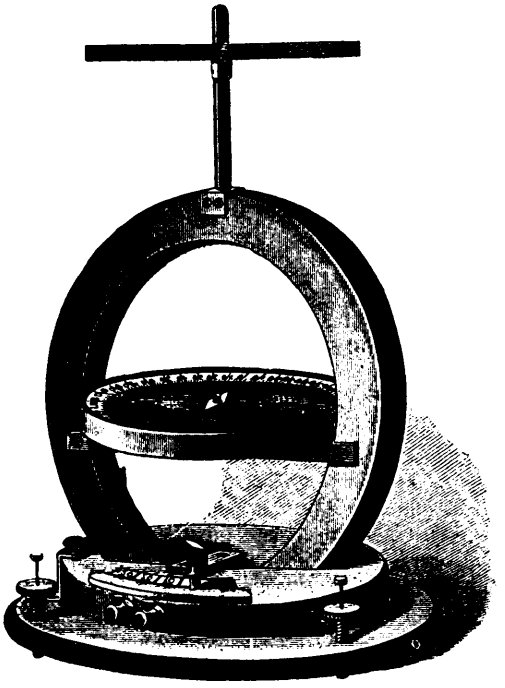

FIG. 2.—TANGENT GALVANOMETER.

The resistance of a battery may be ascertained by means of the tangent galvanometer as follows: The battery is connected with the galvanometer, and the deflection of the needle is noted; then a variable resistance is introduced and adjusted until there is a deflection, the tangent of the angle of which is equal to one-half the tangent of the angle of the first deflection. The resistance thus introduced is equal to that of the battery and galvanometer. Take from this quantity the resistance of the galvanometer and the remainder will be the resistance of the battery.

For example, when a battery placed in circuit with a tangent galvanometer produces a deflection of 48″, the tangent * of that angle being 1·111, half of this quantity would be 0·555, which is very nearly the tangent of the angle of 29°; therefore, resistance is introduced until the needle falls back to 29°. Assuming this resistance to be 15 ohms, and the resistance of the galvanometer to be 10 ohms, the galvanometer resistance deducted from the resistance introduced leaves 5 ohms, which is the resistance of the battery.

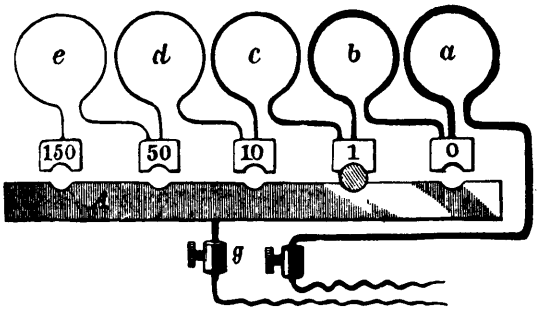

FIG. 3.—ARRANGEMENT OF SWITCH CONNECTIONS.

To measure the electromotive force of a battery a standard cell is necessary. A Daniell or gravity cell, having an E. M. F. of 1·079 volts, is commonly used. This is connected with the tangent galvanometer, and the deflection and total resistance in the circuit, which must be high, is noted. The standard battery is then removed and the one to be measured is inserted in its place, and the resistance of the circuit is adjusted until the deflection of the galvanometer needle is the same as in the first case. It now becomes a matter of simple proportion, which is as follows:—

E. M. F. of standard battery.	:	F. M. F. of battery being measured.	:	:	Total resistance in first case.	:	Total resistance in second case.

Assuming the resistance in the first case to have been 2,500 ohms, and that in the second case 2,000 ohms, the proportion would stand thus:—

1,079	:	Unknown E. M. F.	:	:	2,500	:	2,000

or as 5 to 4. The E. M. F. of the battery measured is therefore 0·8632 volt.

A convenient arrangement of the tangent galvanometer scale is to have one side of the scale divided into degrees, the other side being arranged according to the tangent principle, so that the reading will be direct and reference to the table of tangents will be avoided.

The simplest method of measuring resistance is that known as the substitution method, in which the unknown resistance and a galvanometer are placed in the circuit of the battery; the deflection of the galvanometer needle is noted. A variable known resistance is then substituted for the unknown

* A table of natural tangents may be found in almost any engineer's hand book.