tions to the free passage of the current—these are classed under the name of *Resistance*, usually divided into two, *internal* and *external*. *Internal resistance* is that offered by the liquid between the plates, i.e. such resistances as occur in the cell; whereas, *external resistance* is that which occurs without the cell, i.e. in the conductors, electrodes, body, etc.

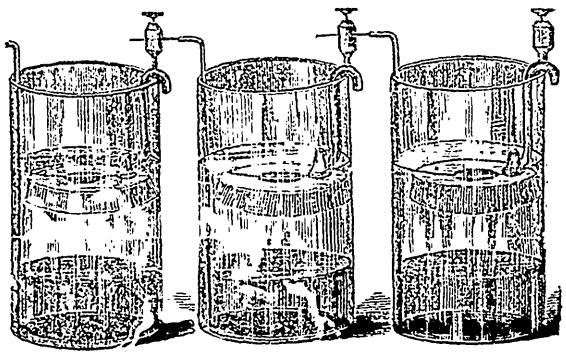
It has been experimentally determined that the quantity of electricity developed by any combination is *directly proportioned* to the electro-motor force and *inversely proportioned* to the resistances to be overcome. As these quantities were always constant for the same combination Ohm expressed the mutual action of the electro-motor forces and resistances of any circuit in the form of a fraction thus:

$$\frac{E}{R+r}=A,$$ where E = electro-motor force, R = internal resistance, and r = external resistance. The unit of electro-motor force as stated above is one volt, the unit of resistance named after Ohm is one *Ohm*, which is equal to the resistance a current encounters in traversing 100 metres of telegraph wire of a certain standard size. The A indicated above is evidently what remains of the current after it has overcome all resistance, and this is taken as the measure of *intensity* (i. e., capacity to overcome resistance), of the current. Using the units *volt*, and *ohm* for numerator and denominator respectively of the fraction, A becomes the unit of intensity or *ampère*.* To state this as clearly as possible, the ampère represents the electricity generated by the unit of electro-motor force, the volt, working through a unit of resistance, the ohm, for a unit of time: this has been experimentally determined to be practically the amount generated by Daniel's cell, with poles connected with 100 metres of wire, working for one second.

Thus it is seen that the current measurer indicates the amount of electricity after all resistances have been overcome, and this explains how, in using the milliampère metre* (1 100oth of an ampère) which measures the intensity, we are always able to give the same dose, as the metre does not begin to register until all resistance has been overcome; therefore, if in one case there are three inches of tissue interposed and 15 milliampères be given, and in another, with two inches of tissue, 15 be given, there is the same amount of acting current passing in both instances; and, this, also explains the manner in which the amount of current can be so easily regulated by a *rheostat*,* as by it varying amounts of resistance can be readily interposed, and the amount of working current augmented or decreased at will. When everything is best arranged for the production of a current, the exciting fluid is decomposed and its component parts are separated either to combine with one of the plates, or to be freed at the other; now if one of the parts which should usually be freed, e.g. H, was to collect at the negative plate it would produce a local action giving a counteracting current which would interfere with the main current. Any such interference, by the collection of components of the liquid at the negative plates, such as H in some batteries, chrome alum in zinc carbon batteries, etc., is known by the inappropriate term of *polarisation*.

Having considered some of the more theoretical portions of the subject and having always in view in speaking of a cell the simple zinc and platinum plates in some dilute acid, it is necessary now to consider those forms of cells which are most used in practice.

The Gravity Cell.—This cell is a modification of the old Daniel cell. Instead of having a porous cup to prevent mixing of the solutions, the zinc plate is superposed over the copper, and



Martin, Tom, & Co.

the solution of zinc sulphate which forms around the zinc plate remains above the copper sulphate solution from difference in specific gravity. The exciting fluid is a solution of sulphate of copper; this is decomposed, liberating sulphuric acid, which

*The asterisks above refer to Dr. Rosebrugh's article in MEDICAL SCIENCE, Vol. 1, No. 2, Pg. 31.