

now in use do not interpose a resistance of more than about 500 ohms, which is much less than the resistance of the body, hence when these instruments are used a commutator is also used to prevent a shock to the nervous system when the current is applied or removed.*

3. In the means and methods of applying the electric current improvement has been made in two directions. Firstly, by increasing the size of the electrodes; and secondly, by making the electrodes so that they may be more accurately adapted to the surface. For instance, in applying the galvanic current to the head, instead of using an electrode only 1 or 2 inches in diameter, a concave electrode is used, large enough to cover the whole of the upper part of the head, while the other electrode called the "indifferent electrode," also large, is placed either on the sternum or on the spine. By this means strong currents can be applied with greater safety and less discomfort than formerly. Again in passing strong currents through the uterus, as, for instance, in the Apostoli treatment of fibroids, the abdominal or indifferent electrode is very large, and is constructed with a view to adapting itself accurately to the unevenness of the surface. The large electrode distributes the current over a large surface and permits the passage of very strong currents without pain or vesication, and moreover, so reduces the resistance of the circuit that currents may be used of a strength far beyond any current strength attainable with ordinary electrodes. The abdominal electrode now on the table is one devised by Dr. Martin, of Chicago. It is a metal disc about 9 inches in diameter, concave-convex, and covered with animal parchment. The space between the concavity of the metal and the parchment is filled with a solution of salt in water.

This communication will perhaps be less incomplete if it includes some reference to the batteries now in use. For stationary or Cabinet batteries there are two forms of cells in use, viz., the gravity or telegraph battery, and the Leclanchè or telephone transmitter battery. Of these the Leclanchè is to be preferred, as there is no local action in the cell when the battery is not in use, and it is, moreover, much more cleanly than the gravity or Daniel cell (of which it is a modification.)

*The resistance of the body varies from 1000 ohms to 5000 ohms, according to the moisture of the skin, and the part of the body operated upon.

The stationary batteries are placed in a closet or in a cellar from which wires are conveyed to the consulting room. The cells of the Cabinet battery are placed in a cabinet or office desk, on the top of which stands the milliampère meter, rheostat, &c.

Among the portable batteries are the following, namely: 1, the small Leclanchè cell; 2, the chloride of silver cell; and 3, the zinc carbon cell. All of these batteries are in use for ordinary electro-therapeutic purposes; and, so far as the electric current is concerned one battery answers the purpose as well as another. There is this difference, however: the gravity cell and the chloride of silver cell have a comparatively low electro-motive force, and when either of these batteries is used it is necessary to use a larger number of cells than when the Leclanchè or when the zinc carbon batteries are used. The electro-motive force of the gravity and the silver cell is about 1 volt per cell, that of the Leclanchè, about $1\frac{1}{2}$, and that of the zinc carbon, about $1\frac{3}{4}$ volts. Hence, if in a given case, we require an electro-motive force of say 30 volts, 17 cells of zinc carbon battery would be used, 20 cells of the Leclanchè, and 30 cells of the gravity or of the chloride of silver battery would be used. Large cells maintain their strength longer than small cells, but the electro-motive force is no greater, that is, if we take two cells of the same kind, say a large Leclanchè, such as is used with the telephone transmitter, and a small Leclanchè, such as is used in the portable batteries, the electro-motive force of the latter is exactly the same as that of the former, and, while it lasts, it is quite as efficient.

When, however, the battery is for electrolytic purposes, the case is very different; in this case we require a battery with large cells, or what is practically the same thing, a battery with low internal resistance. Either the zinc carbon or the large Leclanchè cells may be used for this purpose. The zinc carbon battery has the advantage of being portable and moreover it maintains its strength much longer than the Leclanchè, nor does it become polarized, when in use, as readily as the latter.

This may be demonstrated in the following manner:—Connect a large Leclanchè cell with a faradic coil. The vibrator will act vigorously possibly for five minutes, when its strength will be perceptibly weakened and in about ten minutes it will fail to operate the vibrator,—whereas a small