

ratus and the principles of their working—the “how and why.” Having this knowledge, success depends upon watching and doing, or, more simply, “know how” and “do it.”

Therefore, a brief description of the construction of the storage cell, or accumulator, and the principle upon which it works, will be in order. Electric cells, or when combined in any number so as to form a single source called electric batteries, are divided in two great classes:

I. Primary batteries. II. Secondary, or storage batteries.

Primary batteries are generators of electricity through the chemical action which takes place between certain different substances when brought into contact with each other, and independently from any outside electric current. To make this plainer, take the simplest form of a primary cell, a glass beaker filled with water, to which has been added a certain quantity of sulphuric acid, into which a strip of copper and one of zinc has been set, and connect these two metal strips by a copper wire. Immediately a strong chemical action will take place, showing an electric current flowing from the copper strip to the zinc through the conducting wire. The chemical action is as follows: The water is decomposed into hydrogen and oxygen. The hydrogen collecting on the surface of the copper and the oxygen combining with the zinc, forming oxide of zinc, which then combines with the sulphuric acid, forming sulphate of zinc. The principal seat of chemical reaction is at the surface of the zinc, which is consumed by oxidation, while the copper acts as a conductor and is not consumed. Hence, since electric movement is from higher to lower potential, and the same law applies to the energy of chemical reaction, in common with other forms of physical energy, and since the electrical energy of the cell is found to be strictly proportionate to its chemical reaction, it is assumed that the electric current originates at the surface of the zinc and flows through the fluid to the copper.

In the absence of external connection between the metal strips it is evident that the difference of electric potential would immediately become equalized and the current cease, but when they are connected by a conductor the current finds an outlet through the copper and flows back to the zinc through the external circuit; chemical action is thus sustained and the current becomes continuous. The law of the conservation of energy requires the expenditure of energy in one form as a condition of the production of the same amount in another form. Hence, as chemical energy is the only energy expended in the battery, the natural conclusion is that it is the source of the electric energy or current generated.