The Storage Battery and its Uses.

The advances made in Electrical Science within the last half century have surpassed the prophecies of the most liberal; and this is especially true in the production of strong electric currents for immediate consumption. But the means of storing such currents have been limited. However, within the last ten years such suggestions and improvements have been made as to render such a thing both possible and practical. We will attempt to give in the following a brief account of the earlier discoveries with their subsequent improvements, and to show how they are practically valuable.

It has been observed that when two platinum plates are disconnected from a battery and put in circuit with a galvanometer that the presence of an electric current is indicated, flowing in the opposite direction from that in the battery. This phenomenon was studied by scientists living in the early part of the present century. Their explanation was that Oxygen had been condensed on the positive plate and Hydrogen on the surface of the negative. The resuet of this was to produce two electromotors, developing a current opposed to the direction of the original one. This current was called a secondary current.

The discovery of the cause of this very interesting action caused inventors and men working in experimental science to attempt the perfection of some apparatus by which the secondary current might be utilized. Probably the first attempt of this kind was made by Ritter, in 1806. His battery was constructed with pieces of gold, separated by cloths moistened with salt water. after being connected with a primary battery for a few minutes a secondary current was produced. For any practical purpose this battery would be excluded because of the cost of manufacture. For a considerable time after this no development was made worthy of mention. However in 1859 Planté began an elaborate research upon the secondary action. Instead of using gold he experimented with less costly metals. By making repeated attempts to construct a battery of considerable power, Planté's work resueted in a battery made of two rolls of sheet lead, separated by a strip of insulating; this being immersed in a ten per cent solution of sulphuric acid.

This battery has been the basis upon which all others, of late years, have been built. When scientists were made familiar with the fact that it was possible to store electricity, there were numerous batteries made, and improvements suggested which had no value whatever. The failure of the many would-be scientists to produce the great results anticipated in their suggestions threw an effective damper on the work for about 20 years. There were a few who did not give up the idea of the storage battery so readily, but in a quiet way continued their investigations until their co-workers were astonished at their success. Faure deserves credit for a large share of this work. The great objection to Planté's battery was the long time required to "form" it, the action of the current on the lead being very slow. Faure's improvement consisted in the use of a paste composed of red lead, for covering the heretofore solid plates. Upon passing the current the minium or red lead was reduced to metallic lead on one plate and oxidized to the peroxide on the other. †The improved battery thus requiring but a few hours in charging, while the old form required about three months for a full formation. Such an improvement as this made the practical use of the storage battery more apparent. A new interest was taken in the work and our modern scientific men have undertaken it with some success.

There are a variety of patterns to be found in these storage batteries or accumulators. The majority of them however agree in the use of lead plates and sulphuric acid. In many cases the plates are roughened like a file, or even corrugated that they may present a greater surface to be acted upon by the acid. In the manner of connecting and in the insulating material employed there is great diversity, as well as in the size. A battery requiring from 15 to 30 amperes current to charge it occupies about a cubic foot of space and weighs about 130 pounds. As to cost they vary from $17.50

for the largest size to about $4.00 for one weighing only 3 pounds. The electromotive force of all standard cells is very close to 2 volts.

The operation of charging is quite an important one, and to obtain the best results requires considerable skill. One way of charging and one which may be used with success where the work is on a small scale is by the use of primary batteries. The number of such batteries required depends upon the electromotive force and flow from the primary and the capacity of the secondary battery to be charged. To use these batteries for charging large plants would prove very expensive, so that ordinarily a current from an incandescent lamp circuit or directly from a shunt wound dynamo is used. It must be remembered that at least 20% more current must be put in than is taken out, on account of the loss due to chemical action. All that is necessary to discharge the battery is to connect the poles with the motor.

We have followed briefly the formation of storage batteries, assuming that they possessed advantages not to be found to the same extent in any other contrivance. We may now consider what some of these advantages are. In many cases in which a strong current is required, it can be furnished more profitably, directly from a dynamo electrical machine. It may often happen in large mills that there is some power that would be lost entirely were it not for the use of the storage. Where a large plant of intricate machinery is necessary to produce a current, accidents often happen which delay work very much. By passing such a current through storage batteries the machinery might break and yet a continuous and regular current be supplied. Cases often occur in which the available power is weak but continuous. In such a case, if by some arrangement the power could be transformed into electrical energy and this stored, a large saving might be made.

As with almost all other apparatus for storing energy there are disadvantages to the accumulators. They may be stated briefly as follows: the great weight, due to the use of lead plates; the cost of manufacture; the local action caused by impurities in the lead; and the difficulty of charging them without the use of costly machinery. There is no doubt that a part of these difficulties are sure to be surmounted by the work of inventors.

Let us next inquire into the practical uses made of the storage battery. Its uses are almost endless, and it is serviceable for every application of the electric current. Electric lighting may be accomplished by this means where otherwise it would be out of the question. Not only that, but the failure of light furnished by storage batteries is next to impossible. The cause of the majority of accidents in an electrical plant, is the slipping or breaking of some belt, or the heating of some bearing, all of which could be repaired in 30 minutes; and yet causes all operations depending on the light to cease. Often this would result in a serious loss to the consumers of the light, as in the failure during a lecture, a sermon, or a performance at a theatre.

Again in most workshops and factories there is surplus horsepower or two which could be used to advantage if employed to drive a small dynamo and the current therefrom stored. The ease with which the batteries can be transported would make them useful for lighting in this case. It has been claimed that by the use of a current from a storage battery for Electro-plating, much better results were obtained than if the current was furnished direct from the dynamo. However they have not been sufficiently employed for this purpose to make the statement generally applicable.

An attempt was made in 1882 by a New York firm to utilize the storage battery in the propulsion of a steam launch. The average speed attained was 8 miles per hour, and the advantages were in employing one less man, in being free from smoke, smell, heat and dust, and in having more available passenger room.

Probably nothing has done more to bring the storage battery before the public than its use in connection with street-railways. Some very interesting and favorable experiments have been made within the last two or three years to show that such a use was possible. As in the overhead wire system a motor is placed on the trucks of the car, and the current is furnished by ~~by~~ batteries. The cells are charged at the power house and when ready for use are pushed under the seats from the outside of the car, and connected to the motor. Thus they occupy a space that would not be utilized in any other system. Estimates have been made showing the relative cost of construction of the various systems of street railway. We quote from good authority the following figures.

"A comparative statement of the cost of construction of a ten mile road complete with fifteen cars would stand probably as follows:

<u>Cable System</u>

Cost of cable construction	$700,000.
Cost of power plant	125,000
Cost of cars	15,000
	$840000

Electrical Over-head Wire System

Cost of road bed	$70,000
Cost of wiring	30,000
Cost of cars	60,000
Cost of power plant	30,000
	$190,000

Storage Battery System

Cost of road bed	$70,000
Cost of cars	75,000
Cost of power plant	30,000
	$175,000

These figures would show that the last named is not only pratical but above all others desirable.

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