SCIENCE

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ELECTRIC ACCUMULATORS.

THE world moves slowly, — faster, perhaps, than formerly, — but still the movement is well ordered and regular, new things not jumping into existence fully developed and ready for their most advantageous use.

All this is true of the accumulators or storage-batteries for electricity, about which the public has heard for a number of years. The principle on which they are based is an old one. That an electric current, in passing through many chemical solutions, would decompose them, is a fact shown in every school in the land. That when the battery sending the current is removed, and the wires entering the solution joined, a current can be detected in these wires opposite in direction to the original current, is also known. The decomposing apparatus shows itself as a storage-battery from which, to all intents and purposes, electricity runs out again when the experiment of electrolysis is over. What those interested in storage-batteries have been doing is to make this effect of commercial value.

But why should this effect be of commercial value at all? Why not use the current from the primary battery itself, and not first store up its electricity? The answer to these questions is well given in a paper by George B. Prescott, jun., read at a meeting of the American Institute of Electrical Engineers on Oct. 29.

There are in use electrical systems for lighting purposes; and, as every one knows, these are mainly of service after the sun goes down, and then they are called on for a maximum service for a short time, which is followed by a smaller demand during the rest of the night. It is patent that such a method of production cannot be economical, for the plant must be idle, or working to but a fraction of its capacity, most of the time. The accumulator comes in as a storehouse; so that the dynamos may be run at an even rate of production, and any spare electricity stored till the extra demand has to be met.

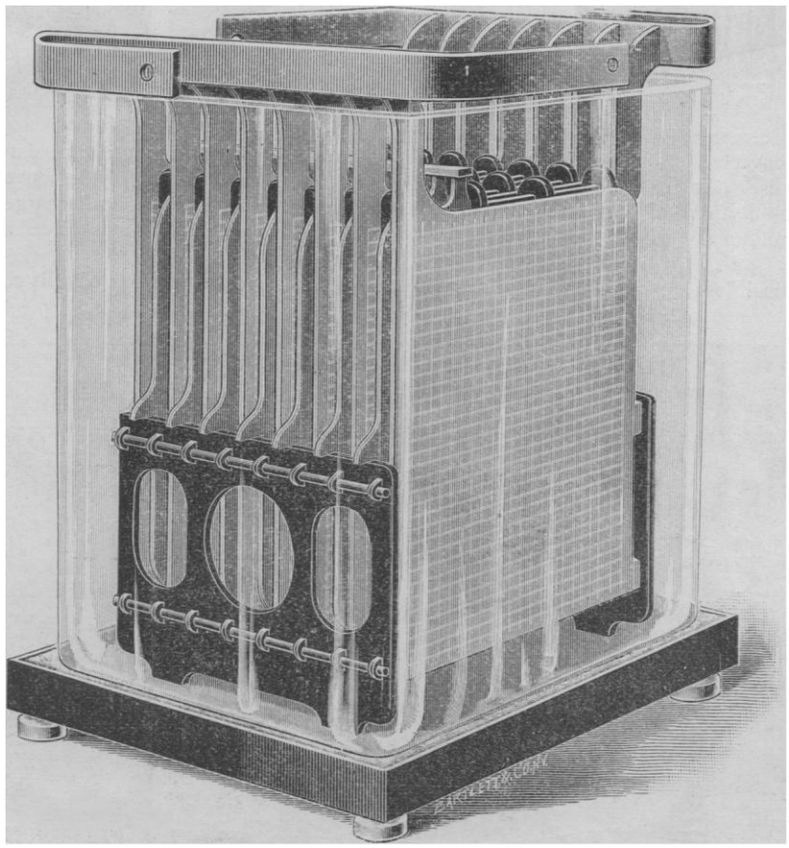

FIG. 1. — ELECTRICAL ACCUMULATOR COMPANY'S STORAGE-BATTERY.

There is a field, then, in which accumulators may play an important part, not in competition with the direct application of the current from the dynamo, but standing to the electric-light systems very much as gasometers do to gas-works. The demand for light during the day is not *nil*, yet it is so small that few electric-light companies are justified in running their dynamos the twenty-four hours through. But it is calculated that there will be ample surplus of current to charge the necessary storage-batteries if the

dynamos are started at 2 P.M. and work till midnight, — a working day of ten hours, — thus rendering the ordinary electric-light plant efficient the whole day.

There is another field in which accumulators take an active part, — that of long-distance lighting, now so successfully occupied by the alternating converter system, in which the high-potential currents on the main lines are converted into those of lower potential before entering buildings for use. An accumulator is a chemical converter; and, now that the questions of cost and durability are practically solved, the accumulator is likely to find an application for this converting process.

There is, of course, a practical loss every time energy is transformed from one form to another, and this loss is greater the more rapid the rate of charge and discharge of a storage-battery; but this loss, added to the cost of the accumulators, is not believed to be enough to counterbalance the advantages already mentioned.

Generally speaking, the total current capacity, expressed in ampère hours, of a single cell of accumulator of the lead lead-oxide type, is proportional to the number and size of its plates; its rate of discharge depending upon the number of plates and the effective surface of each, while the time of such discharge varies with their thickness. Although there are no obvious theoretical reasons why a single cell of accumulator should not be made sufficiently large to possess any desired capacity, there are mechanical considerations which make it advisable to limit the dimensions of a cell to the extent that it may be conveniently portable. Therefore, when higher rates or longer discharges than an ordinary cell will give are demanded, two or more cells must be connected in parallel.

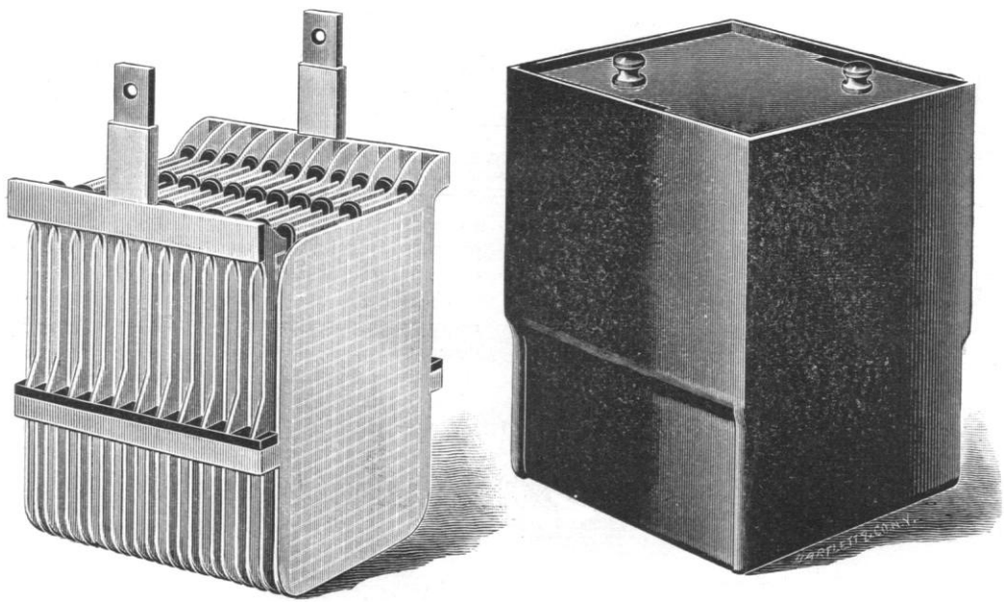

FIG. 2.

When two or more series of cells connected in parallel are to be charged at the same potential, it is evident, that, unless each series is in precisely the same state in respect to residual charge, there will be a difference in their electro-motive forces, and in consequence less current will flow in those series having higher potentials than in others. While the larger current flowing into the less charged cells will have a tendency to bring up their potentials

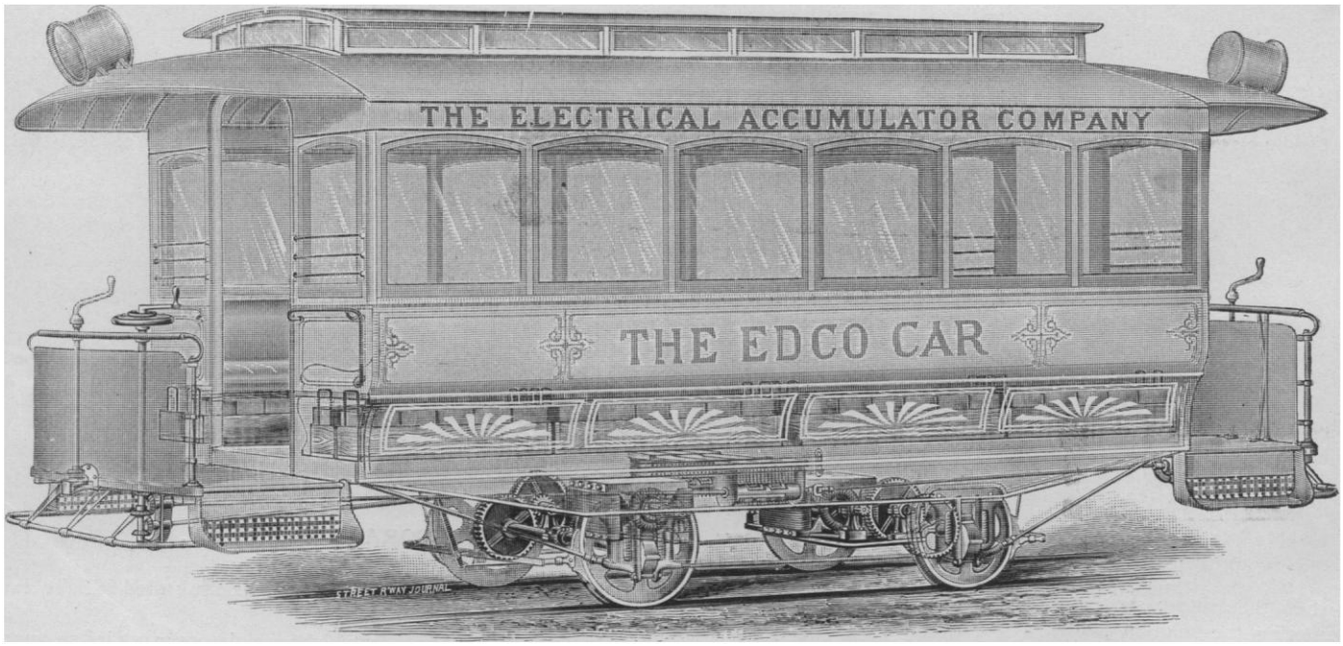

FIG. 3.

to the average, it is found in practice that some series will become fully charged sooner than others.

The details of the methods of use we hope to publish later. Our illustrations show the battery and street-car of the Electric Accumulator Company; this car, as is well known, calling for no street wires.

MAGNOLIA-METAL.

FOR the last fifty years the soft metal made of copper, regulus of antimony, and tin, invented by Isaac Babbitt of Boston, and named for him, has been in use for the bearings in machinery, as the friction was much reduced by its use.

In these days of demand for high speed on railways and in ocean steamers, a diminution of the friction is imperative, and magnolia-metal is offered as furnishing a material for bearings much superior to any thing that has gone before.

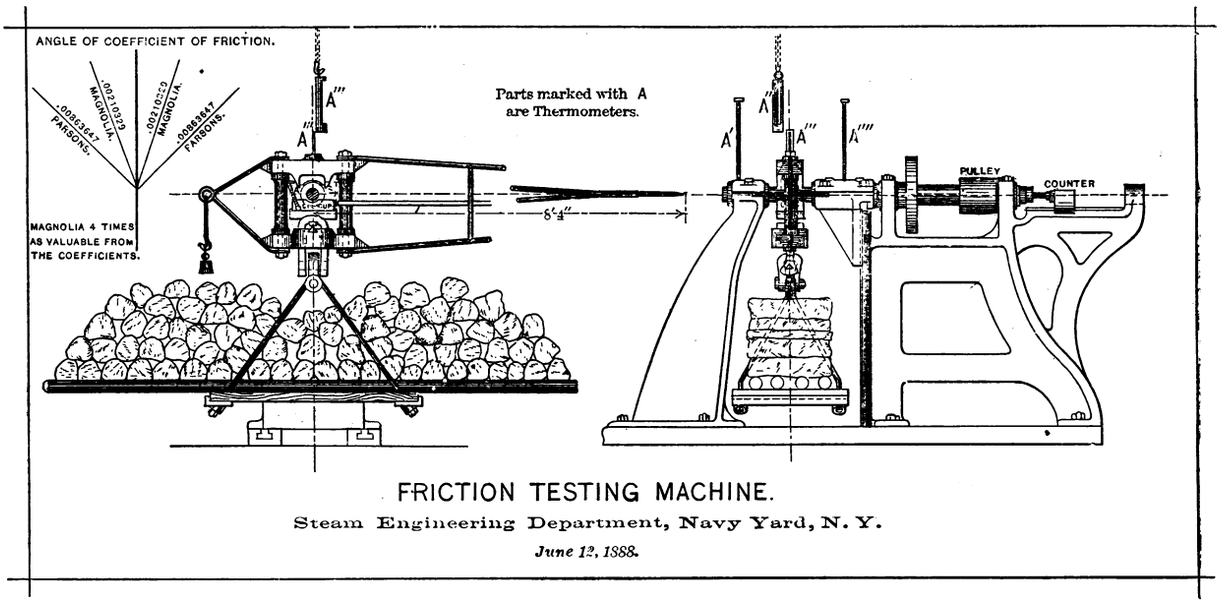

FIG. 1.—APPARATUS USED IN TESTING MAGNOLIA-METAL.

Time in Minutes.	Temperature. Magnolia Anti-Friction Metal.	Temperature. Hoyt's Genuine Babbitt.	Temperature. De-Oxidized Genuine Babbitt.	Pounds Pressure per Square Inch.	Revolutions of Shaft per Minute.	Speed of Rubbing Surface per Minute.
0	65° F.	90° F.	90° F.	2 gen. Babbs. 200 Magnolia 300	1,600	2,095 ft.
10	115°	156°	140°	300	1,550	2,030 "
20	150°	180°	170°	500	1,550	2,030 "
30	160°	230°	230°	800	1,500	1,965 "
40	180°	345°	320°	1,000	1,500	1,965 "
45		397°		1,000	1,500	1,965 "
50	270°		360°	1,000	1,500	1,965 "
55			375°	1,000	1,500	1,965 "
60	400°			1,000	1,500	1,965 "

Magnolia ran full time free without melting out or stopping machinery; Hoyt's melted and stuck to shaft at end of 45 minutes; de-oxidized genuine Babbitt melted and stuck to shaft at end of 55 minutes.

Mr. H. G. Torrey, who has been assayer at the United States Mint, New York, for thirty years, has made several friction tests of journal-bearing metals, the results of which have just been made known. Those selected were magnolia-metal, and Hoyt's genuine Babbitt and the de-oxidized genuine Babbitt, the latter two supposed to be the best of their class. The machine used was a 5-inch shaft keyed on a 3-inch shaft lubricated with sperm-oil, 5-inch shaft running in the oil. With light pressure and slow revolutions of shaft, the metals showed little difference, but, with rapid revolutions and heavy pressures, magnolia-metal showed great superiority. The foregoing table shows a detailed statement of the tests, which occupied an hour's time.

The testing-machine consists of a shaft revolving in suitable bearings, between two of which is a steel journal on which the test-piece is placed; the top half only of the bearing being used, which was lined with the metals tested. The brass sets in a frame, to the under side of which is suspended a platform. On this platform the weights are placed for producing the pressure. There are two knife-edges, allowing freedom of the frame, and the weighted platform. A pan beneath the test journal, carrying oil, lubricated the bearing. Thermometers were inserted in the oil-bath and in a recess in the top of the metal. In this machine the co-efficient of friction is obtained by the angle of deviation of the knife-edge from a vertical line passing through the centre of the journal in terms of the radius of the journal, and is independent of the weight entering directly into this calculation.

Other satisfactory tests have been made by the United States Government at the Brooklyn Navy Yard, and by Professor R. H. Smith of Mason College, Birmingham, England, who reports that his tests show the metal to be superior to either Babbitt or gun-metal, producing less friction, keeping the bearing temperature lower, requiring less lubrication, and possessing greater durability. Professor Smith says that the longer the magnolia-metal bearing is used, and the more severe the duty imposed on it, the better becomes its condition.

FIG. 2.—MAGNOLIA-METAL BEARING.

Recently this new metal has been introduced in the "City of Paris" and the "Augusta Victoria," contributing its share in the speed developed by these ocean racers.