have proved their very high efficiency. With HgO united to I their available electro-motive force is about 1.4 volts and their internal resistance between one and three ohms, and their total output greater than the silver chloride cells described.

The battery problem is not an electrical one merely. It is chiefly a chemical and mechanical question and one which a person with only an electrical knowledge can scarcely hope to undertake with success. There are many improvements yet to be made in primary cells, and those who take the work up should bear in mind that a good battery, like anything that is at all complicated, cannot be stumbled upon, but must be laboriously and logically studied out, and then proved by careful experimenting to be of sterling value.

Franklin Institute

[*Proceedings of the stated meeting, held Wednesday, April 19, 1893.*]

HALL OF THE FRANKLIN INSTITUTE,
PHILADELPHIA, April 19, 1893

JOSEPH M. WILSON, President, in the chair.

Present, seventy-eight members and fourteen visitors.

Additions to membership since last report, eight.

The Secretary reported the resignation of Mr. John Hall from membership in the Committee on Science and the Arts. The resignation was accepted, and the meeting proceeded to fill this vacancy and the two others held over from the previous month, by election.

The result of the vote was the election of Mr. C. L. Prince for the unexpired term of Mr. Pistor; Mr. Henry Brinton for the unexpired term of Mr. McAllister; Mr. W. N. Jennings for the unexpired term of Mr. Hall.

Mr. John Hartman exhibited a series of handsome lantern views, representing the most notable specimens of ancient Egyptian architecture, and made some critical observations and comments upon their architectural and mechanical features. (To be published in abstract.)

Mr. George F. Simonds, of Fitchburg, Mass., read a paper on the manufacture of anti-friction ball-bearings, describing a system and apparatus which he had invented for this purpose. The speaker illustrated the subject by the exhibition of a number of specimens, large and small, provided with his improved journal bearings. He also showed examples of hardened

steel spheres of $\frac{1}{32}$ " and $\frac{1}{64}$ " diameter, claimed to vary from perfect spheres by less than the $\frac{1}{1000}$ of an inch; and a collapsing mandrel devised by himself and used in his method of insuring absolute uniformity in the dimensions of the hardened sleeves employed in the production of his improved bearings. (Mr. Simonds' paper is referred for publication.)

Mr. James G. Satterthwait read a paper, briefly reviewing the history and development of the applications of electricity for heating purposes, and at the close of the meeting exhibited and showed in operation a large number of domestic heating appliances, of the Carpenter type, offered for inspection by Messrs. Walker & Keppler, of Philadelphia.

The Secretary read an official communication from Mr. S. Lloyd Wiegand, Trustee of the Elliott Cresson Medal Fund, notifying the Institute of the fact that a vacancy existed in the trust by reason of the resignation of Mr. Samuel Sartain, as a trustee, and, that in accordance with the terms of the deed of trust, the said vacancy must be filled by election, at the next succeeding stated meeting of the Institute after the receipt of this notice.

A communication from a special committee of the American Philosophical Society was presented, announcing the fact that "the Society will celebrate the one hundred and fiftieth anniversary of its foundation by a series of reunions at the Hall of the Society, during the week beginning Monday, May 22, 1893, terminating on Friday, May 26, 1893, at which papers may be offered by title by such delegates as may honor the Society with their presence." The communication concluded with the statement that the Society will be pleased to receive a delegate from the Institute.

The President was authorized by vote to name a delegate to participate in the proposed reunions.

A communication was presented from "The Committee of Fifty for a New Philadelphia," asking the Institute to appoint three delegates to represent the Institute in a "Union Committee," to be composed of delegates from the various organizations of citizens interested in public work, with the object of promoting needful municipal improvements. The President was authorized to name three delegates to represent the Institute in the committee, in the manner requested.

The meeting then adjourned.

WM. H. WAHL,
Secretary.