ELECTRIC LIGHTING IN THE UNITED STATES.[1]

DR. ERNST HAGEN, professor of applied physics in the Royal polytechnic school of Dresden, visited the United States in 1884, and, having carefully examined the different systems of electric lighting there in vogue, presented a report to the directors of public buildings of Berlin. The largest portion of this report is devoted to the subject of incandescent lighting. A certain space is given to accumulators, and arc-lighting is also considered. The writer states in his preface that his travels have deepened in him the conviction that the subdivision of the electric light by means of the Hefner-Alterneck differential lamp gives a greater degree of steadiness than is possible with the lamp of any of the American systems.

The author enters at first into a comparison of the cost of electric lighting in general with that of gas and other sources of light. He shows that nearly ninety per cent of the energy produced by the ordinary gas-flame is in the form of heat, leaving only about ten per cent in the form of the radiations which appeal to us as light. He also discusses the subject of the noxious gases given off by illuminating-gas, and the poisonous compound called by DuBois-Reymond 'anthropotoxin,' which accompanies the carbonic-acid gas, and finds much to condemn in the use of illuminating-gas, and much good to expect in the further extension of the incandescent system of electric lighting. When amount of light and health are considered, the incandescent system is economical: viewed from the point of dollars and cents, however, this cannot be proved.

The author gives a short history of the development of the dynamo-machine, and the reader will find here a better summary than in any similar work with which we are acquainted. The use of diagrams and modest engravings, instead of the full-page illustrations of many recent treatises, is especially refreshing and comforting to one's pocket. The head is filled, while the pocket is not depleted, which cannot be said if one buys most treatises on electric lighting.

We learn from the chapter on the incandescent light, that Swan and Edison came almost simultaneously to the invention of the carbon-filament lamp, which, indeed, had been used in an imperfect way by inventors long before them. Both Swan and Edison reached the result of a more or less permanent incandescent lamp in 1879. The writer closes his history of the incandescent lamp by a glowing eulogy of the man who had the genius to create a new industry which employs hundreds of workmen, and to conceive of the grand project of lighting by electricity a great city from a central station. That this could have been accomplished without the careful training of the German polytechnic schools, evidently impresses the author.

Dr. Hagen corrects the impression, which is evidently carried abroad in certain quarters, that the whole of New York is lighted by the Edison system. He computes that New York proper covers eleven square miles, and the portion lighted by Edison embraces only a tenth of a square mile, and covers an area comprised within a circle of a little less than a thousand feet radius. A map of the region covered by this system in New York is given; and the dimensions and construction of the main leading wires, and the method of insulating them in underground pipes, are fully described, with a running criticism of the results that have been attained.

It is the author's opinion that large central electric-lighting stations will be established in all great cities, if the experiment in New York does not show some at present unforeseen obstacles. The system of underground wires forms, in his opinion, one of the greatest obstacles. There is no doubt that the insulation grows worse with time, and it is a question how much of the electrical energy is lost by defective insulation. He very properly remarks that the entire resistance of the circuit, including of course the lamps, must be considered, together with the loss of insulation in the underground conductors, and that even a very large loss of insulation might not consume more electrical energy than a single lamp.

The Edison plant is then carefully described, and the dimensions of the various machines fully given, together with the means of regulating the current, the method of weighing it and distributing it. We do not know where to look for a more careful description of the construction of the underground cables and the method of insulation. The author concludes, that, for equal amount of light, the Edison light costs about a third more than gas. In spite of this increased expense, the number of subscribers has continued to increase since the opening of the system, Sept. 3, 1883, and great satisfaction has been expressed with the light. Whether the system is suitable for

[1] *Die elektrische beleuchtung.* Mit besonderer berücksichtigung der in den Vereinigten Staaten Nord-Amerikas zu centralanlagen vorwiegend verwendeten systeme. Von Dr. ERNST HAGEN. Berlin, *Springer*, 1884. 8+307 p., illustr. 8°.

maintaining sixteen thousand lamps, even if only a fifth part would be in use at one time, and also for supplying power to small motors, is still in doubt. At present power is not supplied. It was intended that the system should be used for supplying power in the day-time, and light at night.

Leaving the central station in New York, Dr. Hagen then proceeds to inspect the village plant at Roselle, N.J., and studies this new and promising development of electric lighting, of which there are already several examples in the United States, notably that at Brockton, Mass. At Roselle three so-called two-hundred-and-fifty-light machines are installed, which are driven by a thirty-five-horse power engine. The price is a dollar per thousand candle hours (*kerzenstunde*). The electromotive force of the machine is 320 volts, and the current per lamp $\frac{48}{100}$ of an ampère. The number of lights in practical use is 800. The greatest distance to which the system is carried at present at Roselle is about 4,500 feet.

The writer then discusses the system of the U. S. electric-lighting company, which uses the Weston machine and the various modifications of the Maxim lamp, also the Bernstein electric-lighting system. The author closes his interesting and valuable discussion of the various systems of incandescent lighting by a *résumé* of the measurements made at Munich and at Paris, and an analysis of the cost of the Edison system. In this chapter will be found statements of the cost of this system from various agents of mills which are lighted by the incandescent light. So many elements peculiar to each installation enter into this analysis, that it is impossible to say in general what the cost of electric lighting is. Each business-man must decide for himself whether it is economical, on the whole, for him to use the electric light or not. In many cases there is decided advantage, and even economy, in its employment.

Dr. Hagen details in a graphic way the hopes raised by the various storage-batteries, and the leaden thoughts of those who have had their hopes dispelled. These batteries at present are useful only in laboratories.

The third portion of Dr. Hagen's treatise is devoted to arc-lighting, and in it the systems of Brush, of Weston, and of Thomson-Houston, are fully described. The treatise closes with a short essay on the dangers of electric lighting, and a copy of the regulations adopted by the board of fire-insurance inspectors in Boston.

NOTES AND NEWS.

MR. HENRY LOMB of Rochester, N.Y., has offered, through the American public health association, the sum of $2,800, to be awarded as first and second prizes for papers on the following subjects: —

1°. Healthy homes and foods for the working-classes: first prize, $500; second prize, $200. Essays to be of a practical character, devoid, as far as possible, of scientific terms. They must be within the scope and understanding of all classes, and designed especially for a popular work. 2°. The sanitary conditions and necessities of schoolhouses and school-life: first prize, $500; second prize, $200. 3°. Disinfection and individual prophylaxis against infectious diseases: first prize, $500; second prize, $200. 4°. The preventable causes of disease, injury, and death, in American manufactories and workshops, and the best means and appliances for preventing and avoiding them: first prize, $500; second prize, $200.

All essays written for the above prizes must be in the hands of the secretary, Dr. Irving A. Watson, Concord, N.H., on or before Oct. 15, 1885. It is expected that arrangements can be made to have these essays widely distributed to the public, and to the persons most interested in the respective subjects in the United States. The American public health association earnestly appeals to those able to compete, to take part in this work, which, it is believed, will do much to augment the health, comfort, and happiness of the people.

— In addition to the issue of its regular publications, the Leander McCormick observatory of the University of Virginia (Professor Ormond Stone, director) has begun the issue of a series of circulars, of which the number just received contains the elements and ephemeris of the small planet Barbara No. 234. The elements and perturbations by Jupiter were computed by Mr. S. M. Barton; and the perturbations by Saturn and the ephemeris, by Mr. F. P. Leavenworth.

— The quinquennial prize offered by the Belgian government for researches in mathematical and physical science has been awarded to Professor Le Paige of the University of Liége, for his investigations in the higher geometry, and especially for those relating to lines and surfaces of the third order.

— The valuable Cohen collection of Egyptian antiquities, which has recently been acquired by the Johns Hopkins university, will be of great interest, not only for art, but for the historical study of the customs and laws of Egypt. It was begun in 1832 by Col. M. I. Cohen, during his travels in Egypt, and consists of six hundred and eighty-nine objects, procured mainly in the localities where they were originally discovered. A number of objects, however, belonged to the famous collection of Mr. Salt, her Majesty's consul in Egypt, which was sold in 1835. The collection consists chiefly of small works illustrating the history of the minor arts in Egypt