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Electric Illumination

Two years after Thomas Edison patented his electric light bulb, the 1881 International Exposition of Electricity in Paris, featuring many spectacular lighting displays, showcased the potential of this technology for commercial and domestic use. The accompanying International Congress of Electricians also agreed on international standards for units of electrical resistance, potential and current. In its wake, James Dredge (1840–1906), editor of the British periodical *Engineering*, compiled this illustrated overview of electrical technology and its application to lighting. First published in two volumes between 1882 and 1885, and using material that had previously appeared in *Engineering*, as well as new articles by various contributors, this substantial work reflects the complexities and possibilities of a propitious technological development. Among other topics, Volume 2 covers electrical measurement, standard textbooks, photometry, and recent developments in lamps and dynamos. The appendices give abstracts of British electrical patents from 1873 to 1882.

Electric Illumination

Volume 2

Edited by James Dredge

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["ENGINEERING" SERIES.]

ELECTRIC ILLUMINATION.

BY

JAMES DREDGE. DR. M. F. O'REILLY.

AND

H. VIVAREZ.

EDITED BY

JAMES DREDGE.

(Partly compiled from "ENGINEERING.")

With Abstracts of Specifications having reference to Electric Lighting.

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VOL. II.

LONDON:
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1885.

PREFACE.

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IN the preface to the first volume of "Electrical Illumination," a reference was made to the headlong impetuosity with which the too credulous public—encouraged by speculators and sanguine or astute inventors—threw enormous sums of money into electric lighting enterprises, and it was predicted that the time was fast approaching when a disastrous reaction must set in, which would have the inevitable effect, not only of overthrowing all those numerous companies that had been established on an insecure basis, but also of shaking to their foundations the more solid and responsible associations. The course of events has fully justified the views expressed, as well as the consequences indicated, and public confidence which had been so misplaced, was succeeded by doubt and mistrust that have checked materially the commercial progress of electric lighting. By effecting large reductions in capital, and by vigorous retrenchment in expenses, some of the more powerful electric lighting companies have weathered the storm, and are to day doing a considerable and a more or less profitable business; for although none of the extensive projects for lighting on a large scale, which occupied the attention of promoters two years ago, have been realised, yet installations on a modest scale have become more numerous, and isolated plants are now largely in use. The use of electricity for lighting ocean steamers may now be said to be general, and will soon be universal, and the details involved by this special application, have been worked out in a manner that leaves little to be desired.

The time having past when the inventors of a dynamo or an incandescence or arc lamp, could hope to obtain large sums by the sale of their patents, it has followed as a necessary consequence, and by the law of the survival of the fittest, that the number of types of dynamos in use has been reduced, and that invention has followed more closely the narrower path towards improvement in detail and increase of efficiency. With several well-known systems the latter object has been achieved, and practically

nothing further can be hoped towards the attainment of a higher percentage of useful work.

It would of course be absurd to suppose that science has no more to do in effecting further economy, or that inventors must confine themselves to the perfection of details, but a stage has now been reached in the progress of electric illumination, when cost can be counted and comparisons be made with the older modes of lighting. And the result of such comparison may be briefly stated as follows: For large commercial and industrial establishments, electricity, employed for arc lighting, is cheaper than gas, and even when applied by means of incandescence, the extra trouble and expense incurred are often more than repaid by the purer and increased light obtained, and by the total absence of deleterious effects to employés and material. The same remark applies with equal force to the lighting of theatres by incandescence lamps; for although experience obtained in this application tends to prove that gas is by far the cheaper illuminant, the advantages of electric illumination are so great that its adoption for this purpose will be soon general. Its use in private houses supplied with isolated plants and secondary batteries, is in all respects a luxury, and has to be paid for as such, and it does not appear at all probable that any scheme of general district lighting can, with our present knowledge, be made to compete with gas, the price of which would be largely reduced, if competition rendered such a step necessary.

Whilst electric lighting must thus, for private uses, be regarded as a luxury, it has for many purposes become an absolute necessity, and at the same time the practicability of employing it as a steady and reliable means of illuminating, has been demonstrated at the two great Exhibitions held at South Kensington. At the Health Exhibition this year more than four millions of people have witnessed the solution of a problem which would have been considered impracticable four or five years ago—the illumination night after night of a series of vast halls and public gardens without any trouble or interruption. The actual cost of this demonstration, it must be admitted, is probably impossible to ascertain. Since their inauguration at the Palais de l'Industrie in 1881, exhibitions having the same object, have been held at Vienna, Münich, London, Philadelphia, and elsewhere, but all these differ from the Fisheries and the Health Exhibitions, in this respect, that the electric lighting of the two last named was an incidental feature, and a commercial undertaking.

The foregoing remarks certainly do not apply to the United States of

North America, where the high price of gas, and the facility with which new enterprises take root, and make rapid growth, have combined to render electric lighting rather the rule than the exception. The system of distribution of electrical energy from fixed centres, has already been largely carried into practice, and is supported by thousands of subscribers as well as by municipal authorities. But though it must be admitted that America is far in advance of Europe in this application of electrical science, it should be remembered that she possesses a richer and more easily cultivated field for the development of the industry than can be hoped for either in England or on the Continent.

While it has to be conceded that, upon the whole, the progress made in the science of electric lighting during the last two years, in England at any rate, has not been so rapid as its previous growth had suggested, it may be confidently asserted that its future prospects are improved rather than injured by delay.

In the present pages an effort has been made to bring the subjects treated of in the first volume down to the present time, and to present in a convenient form some of the subjects inseparably connected with the conversion of mechanical into electrical energy.

The first section, contributed by Dr. M. F. O'Reilly, treats of the principal measurements which occur in electrical engineering. It opens with a brief *exposé* of the fundamental principles necessary for a good comprehension of the practical methods. In deducing and explaining these, as well as the theories of the standard instruments, a knowledge of elementary mathematics is implied such as every one should possess who aims at working intelligently at applied electricity. In two cases only has the calculus been used, and that on account of the rapidity of the method and importance of the results.

The section on Photometry is chiefly the work of M. H. Vivarez, and that on Dynamometers, which has appeared substantially in the pages of *La Lumière Electrique*, is by M. Gustave Richard. The pages devoted to the descriptions and illustrations of modern dynamos and lamps, contain, it is hoped, all, or nearly all, systems and arrangements introduced to the public since the publication of the first volume, and which are worthy of notice.

It is almost superfluous to speak of the Appendix containing the abstracts of specifications relating to electrical matters. This arduous work has been done carefully and conscientiously by Mr. W. Lloyd Wise, and will, we have no hesitation in saying, be found of very high value. It was

impossible within the limits of the present volume to bring these abstracts down to the end of the year 1883, but it is hoped that this may be done on a subsequent occasion.

Some errors have, it is feared, escaped notice. On page 15, the multiplying power of the shunt should be $n+1$, which will make S, its resistance, $\frac{G}{n}$; on page 29, for the phrase "A being an axis," read "A being on axis;" on page 76, for ($\frac{1}{10}$th ampère) read (10 ampères); on page 88, the formula given should read $w_2\ (t_2 - t_1)$ J; on page 158, in the heading of the table, read "wick variable and chimney constant," for "wick constant and chimney variable."

The writer desires to acknowledge the assistance rendered by Mr. Conrad W. Cooke, in contributing the notice of the Hochhausen system, by Mr. Thomas Wilkins, and by Mr. B. A. Raworth, Dr. A. Borns, and Mr. J. Munro.

JAMES DREDGE.

OFFICES OF ENGINEERING, 35 AND 36, BEDFORD STREET, STRAND,
November, 1884.

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