

**ELECTRICAL EQUIPMENT, ITS  
SELECTION AND ARRANGEMENT:  
WITH SPECIAL REFERENCE TO  
FACTORIES, SHOPS AND  
INDUSTRIAL PLANTS**

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Electrical Equipment, Its Selection and Arrangement: With Special Reference to Factories,  
Shops and Industrial Plants by Harold W. Brown & Alexander Gray

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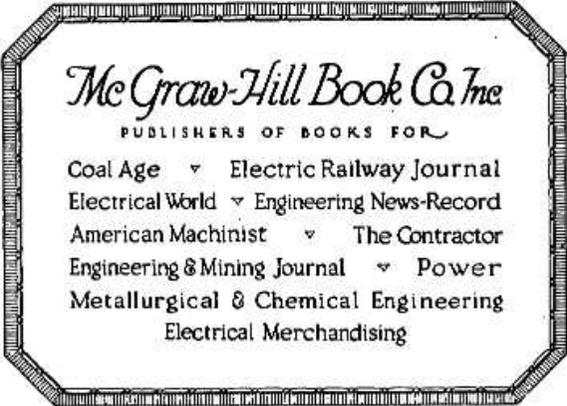
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**HAROLD W. BROWN & ALEXANDER GRAY**

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# ELECTRICAL EQUIPMENT

ITS SELECTION AND ARRANGEMENT

WITH SPECIAL REFERENCE TO FACTORIES,  
SHOPS AND INDUSTRIAL PLANTS

BY

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## INTRODUCTION

A working knowledge of electrical engineering is becoming of greater importance every day as the applications of electrical apparatus increase. The usual course of instruction given to mechanical engineers includes a discussion of the theory of operation of the various electrical machines but goes no further. It is often said in criticism of college instruction that the student learns more of engineering in the first three months of practice than he does during his whole college career. What he really does when he begins his practice is to work on a limited number of problems, to the solution of which he has to bring the sum total of his experience; and thus he gradually gains confidence in himself.

The mechanical engineers at Cornell University cover the usual course on the principles of electrical engineering during their junior year, and it was considered desirable that the work of the senior year include one or two pretentious projects, consisting of the selection and arrangement of all the electrical equipment for an industrial plant, such as a machine shop or a cement plant—problems that require for their solution a comprehensive rather than a detailed knowledge of electrical apparatus. It was soon found, however, that the student lacked the broad point of view that comes from practice. He knew for example that direct-current motors were good for speed adjustment and that alternating-current motors were essentially constant-speed machines, but he was not able to reach the conclusion that therefore direct-current supply was desirable for machine shops with many variable-speed tools.

The set of notes prepared by Mr. Brown to guide the student in his work contained so much useful information not to be found in books that it was considered desirable to offer them to the engineering profession. There are innumerable books for wiremen and for the shop mechanic, but there was no book on the market written specially to guide the mechanical engineer in the selection of his electrical equipment.

While it was considered not only advisable but necessary to give extensive references to the literature of the subject, it

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was recognized that the mechanical engineer would not have an extensive library of electrical texts, nor would he be familiar with the electrical periodicals. It was therefore decided that, except in rare cases, the references would not go beyond one of the standard texts in addition to the electrical handbooks. If the student can be trained to use the matter contained in the handbooks in an intelligent manner, and also to check up his theory from a reliable text, he will approach the dreaded electrical problems with great confidence. Our experience with this course at Cornell has given us great satisfaction.

ALEXANDER GRAY,  
*Head of Electrical Engineering Department,  
Cornell University.*

## PREFACE

A great mass of electrical data is now available in the various handbooks, and other technical literature. The engineer must not only have such data at hand—he must know how to use them. The purpose of this book is to show how to apply the available data, and the principles laid down in textbooks, to the equipping of shops, factories and industrial plants. Numerical examples are worked out illustrating these applications; and in addition a progressive series of problems is placed at the end of the book. Both the text and the problems are drawn largely from the author's experience as engineer with the Westinghouse Electric & Manufacturing Co., in the Detail and Switchboard Divisions.

I acknowledge with thanks the privilege extended by the McGraw-Hill Book Co., Inc., publishers, to make use of the material in the *Standard Handbook*,<sup>1</sup> and a similar privilege extended by John Wiley & Sons, Inc., with reference to the *American Handbook*.<sup>1</sup> Only condensed data and brief statements of theory are included in the text; references are given throughout the book to fuller data in these two handbooks, and to fuller description and theory as given in Gray's "*Principles and Practice of Electrical Engineering*".<sup>1</sup>

It gives me pleasure to express my thanks to Professor Alexander Gray, Head of the Department of Electrical Engineering, for suggesting the publication of this material, for painstaking reading of manuscript and proof, and for important suggestions, as to both details and general form of presentation. I am glad to acknowledge also my obligation for valuable suggestions and data, to members of the Engineering and Sales Departments of the Westinghouse Electric & Manufacturing Co.; of the Engineering Department of the National Lamp Works of the General Electric Co.; of the Sales Department of the American Steel and Wire Co.; also to Mr. W. H. Kniskern, General Manager of the Cayuga Cement Corporation; and to Mr. R. A. Hunt, Power and Electrical Engineer at the Sayre Shops of the Lehigh Valley Railroad.

H. W. B.

CORNELL UNIVERSITY,  
*January, 1917.*

<sup>1</sup> See footnote, page 1.