LABORATORY MANUAL: DIRECT AND ALTERNATING CURRENT

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Prepared to accompany Timbie's Elements of Electricity

By

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PREFACE

This book of laboratory directions is designed for the use of students in courses other than that of Electrical Engineering, who take a brief amount of work in the fundamental principles of electricity.

The object of the laboratory work in such cases is to aid in the understanding of the theoretical and practical items given in the recitation and lecture room. It is the purpose, therefore, to eliminate in as far as possible all features in the actual work of the laboratory which would tend to lessen or detract from concentration upon the underlying principles involved in the experiment in hand.

To facilitate the work, each experiment is prefaced where possible by an assignment of articles in the text book which bear directly or indirectly on the experiment in question. Further, in a part of the experiments, diagrams of the electrical connections will be found, together with simple forms which may be followed in the recording of observations. These forms are somewhat more complete in the first than in the advanced experiments in order to serve at the outset as a guide in the preparation of the data sheets. In the latter experiments this general scheme of ruling up the data sheet is to be followed by each group of men in the preparation of data sheets before the laboratory exercise.

After teaching with a text book which was too advanced for the students and a laboratory manual which was not suited to the text book, the students nor the equipment, it was thought best to write a Manual which should be adapted to the specific requirements of the coming year. The difficulties encountered by the student have been observed and the aim of the Manual is to present the subject from his standpoint. The emphasis placed on such practical items as constant potential supply mains in the wiring diagrams, and the practical points connected with direct and alternating current generators and motors and power trans-

mission in the text, are intended to familiarize the student with the principles underlying the operation of standard apparatus which he may encounter after graduation.

Appreciation for many suggestions and helpful advice in the make-up of this book is due Professor Chas. F. Scott, Sheffield Scientific School of Yale University.

CLARENCE E. CLEWELL.

NEW HAVEN, CONN.,
July, 1913.

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LABORATORY MANUAL

INTRODUCTION TO THE LABORATORY WORK.

1. General Hints.—While the laboratory work is intended primarily as an aid to a clear understanding of the text book and lecture work, to be successful, it must be performed in a systematic manner, and with due care in handling electric circuits, instruments and machinery.

The electric current is somewhat intangible and when making connections and carrying out tests, the only way to conduct the work intelligently is to form at the outset definite ideas of the laws which govern the flow of current in the circuit involved.

A most important item to observe is the distinction between electric pressure (electromotive force) expressed in *volts*, and electric current expressed in *amperes*, and quantitative ideas should be gained early in the work regarding the usual values of these units. The most common value of pressure in commercial lighting is approximately 110 volts. The normal voltage is different in different plants; it may be 108, or 110, or 115, etc. In each case the aim is to maintain the normal value at all times. The general term "110 volts" is used to mean a constant potential circuit of the 110-volt class. An ordinary carbon filament incandescent lamp consumes one-half an ampere with a pressure of 110 volts across its terminals. The principal circuits used in the laboratory tests are 110 and 220 volts. Electric railway circuits are ordinarily 550 volts, and five 110-volt lamps are connected in series in the cars for lighting.

In connecting up a set of apparatus and the instruments for a test, some idea should be had of what each component part of the circuit stands for in its relation to the whole, as well as a fairly definite idea of what will happen when the main switch is closed. As a safeguard, the Instructor should always be asked to check