

under disinfection, or of the "Dreyer method" under agglutination. Directions are given for the preparation of the dye for Leishman's stain, which is now stocked by all dealers, and the impression is given that students are unrestricted in the performance of experiments on animals. A book of this kind must necessarily have a limited circulation, hence perhaps its high cost. R. T. H.

Technical Electricity.

Electric Circuit Theory and the Operational Calculus.

By John R. Carson. Pp. ix + 197. (New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd., 1926.) 15s. net.

THIS book is the outcome of a course of lectures given by the author in 1925 to the University of Pennsylvania. After a brief introduction to electric circuit theory, a critical exposition is given of the Heaviside operational calculus. It is pointed out that Heaviside's method is known to and employed by only a few specialists. This is partly due to the intrinsic difficulties of the subject and to obscurities in Heaviside's own exposition. In the present work the Heaviside rules are deduced from an integral equation.

The second part of the book deals with the propagation of current and voltage in transmission lines and wave filters. The simplest of the transmission systems is the non-inductive cable, the theory of which was given in Kelvin's early work on the possibility of trans-Atlantic telegraphy. In particular, the physical phenomena can be studied best, as the author shows, when we consider an infinitely long cable. We are sorry that the skin effect in cylindrical cables and the eddy current losses in them are not dealt with, as they give such an excellent illustration of Heaviside's methods.

The author considers that Heaviside over-estimated the value of power series in solving problems. In particular he objects to Heaviside criticising those mathematicians who prefer solutions in the form of definite integrals. It is possible that power-series solutions have only a restricted utility in some cases and that definite integrals have proved useful when suitable tables are available. We think, nevertheless, that Heaviside's criticism was justified. Poisson, for example, expressed the capacity coefficients of two spheres as definite integrals, and Dr. Barnes, now Bishop of Birmingham, expressed them as double gamma functions, but when engineers want their values they use series formulæ or interpolate from Kelvin's tables. The book can be recommended to mathematical physicists.

Alternating Current Rectification and Allied Problems: a Mathematical and Practical Treatment from the Engineering View-Point. By L. B. W. Jolley. Second edition, revised and enlarged. Pp. xxii + 472 + 27 plates. (London: Chapman and Hall, Ltd., 1926.) 30s. net.

WE were pleased to see that a second edition of this book has now been published. Whilst alternating current seems to be almost universally

used in large power stations, there is a considerable demand for direct current for auxiliary and control circuits. To obtain this current it is now usual to employ some form of rectifying apparatus. The rectified current is generally pulsating, and it is necessary to know the magnitude of the ripple in it. The author, therefore, starts by giving an account of Fourier's theorem and the methods employed in practice to find the harmonics. From the engineer's point of view this chapter will be found very satisfactory.

Recent improvements in the design and manufacture of all kinds of rectifiers have been noted in this edition. There are also three new chapters on the installation of thermionic rectifiers, on radio supplies, and on inverters. It is pointed out that while the mercury rectifier is essentially a heavy current low-voltage device, the thermionic rectifier is a high-voltage device, and can only be efficiently used when the rectified voltage is of the order of thousands of volts.

The chapter on radio supplies will be of interest to all broadcast receivers. When the house is supplied by alternating current, a rectifier can be used to charge the batteries generally used with a receiving set. In most cases the interest per annum on the capital outlay of a rectifier is less than the cost per annum of charging the batteries by sending them to a local contractor. Where direct current supply is available, the charging can be easily done, but care must be taken not to earth the companies' mains. This can be provided against by inserting a two-microfarad condenser between the radio set and the earth.

Elements of Alternating Currents and Alternating-current Apparatus. By Prof. J. L. Beaver. Pp. 370. (New York and London: Longmans, Green and Co., Ltd., 1926.) 18s. net.

THIS book proves that alternating-current theory is settling down into orthodox lines. It is written partly to help the average student and partly to help the more ambitious student who is anxious to master the complete theory. Numerous examples are given at the end of many of the chapters which the ordinary student will not have much difficulty in doing. There is a 'snap' about some of these questions which we miss in Great Britain. For example, p. 67: "Prove that $L \frac{di}{dt} = \dots = \text{what?}$ " p. 213: "The exciting current is what per cent. of the name-plate current?"

The capacitance (capacity) of a conductor is defined, but the capacitance of a condenser is not. We do not agree with the author when he says that effective current, effective voltage, and average power are not ordinary algebraical quantities and cannot be handled by ordinary algebraical methods. We think that they are perfectly real numbers. If we want to combine alternating currents and voltages, we have to use the parallelogram law, but the effective values of the components and their resultants are real numbers. The author has been successful in simplifying considerably the theory of polyphase currents and machines. If we neglect