ists, of theoretical views then under discussion, of their plans for travel and for lecturing, of their publications in periodicals, separates of which they forward to each other, as well as of purely personal and domestic matters, and but rarely of political questions. All the letters are given in full for reasons named by Dr. Kahlbaum in the preface.

About the year 1860 Schönbein wrote to Liebig of finding antozone in fluorite from Wölsendorf, and the Munich chemist replied that he had taken much pains to secure more of the mineral, but in vain; 'all the gold in the world' would not buy it, for no more could be found. In 1863 Liebig had the sad news to communicate of domestic affliction in the loss of a daughter, Frau Carrière. In this intimate way the friends exchanged words of sympathy, their hopes and fears, successes and discouragements, as well as their likes and dislikes.

The bibliographical and biographical notes added by the editor increase greatly the value of the interesting volume, which closes with a letter from Liebig to Schönbein's widow, dated September 8, 1868; in this he refers to his forty-six years of acquaintance with his Swiss friend whom he first met in student days at Erlangen.

HENRY CARRINGTON BOLTON.

Handbook for the Electrical Laboratory and Testing Room. By Dr. J. A. FLEMING. Vol. I., *Equipment, Resistance, Current, Potential, Power.* London, The Electrician Printing and Publishing Company; New York, D. Van Nostrand Co. 8vo. Pp. 538. $5.00.

Notwithstanding the shower of electrical books that has poured from the press for the past few years, comparatively few text-books have appeared which are well adapted for use in the American colleges of engineering. There has particularly existed a deficiency in the list of books available for the purposes of individual instruction and reference in the electrical laboratories. And a new book designed for this special purpose must be received with interest.

The widely and favorably known name of the author of the book before us adds to the interest in this volume, and an examination of the book shows that such an interest is justified. The volume (which the author proposes to supplement by a later one) contains five chapters, respectively setting forth the author's view of a proper laboratory equipment (190 pages), the measurement of electrical resistance (148 pages), the measurement of electrical current (82 pages), the measurement of electromotive force (48 pages) and the measurement of electric power (63 pages). It is proposed to complete the work—as announced in the preface—by a second volume devoted to the measurements of capacity, inductance, electric quantity, the magnetic testing of iron, photometry and the testing of electric lamps, the testing of electric batteries, electric meters, dynamos, motors and transformers. It is thus apparent that the book now in hand intentionally deals solely and somewhat abstractly with the measurement of the several fundamental electrical quantities which enter into various engineering tests, but a consideration of these tests is postponed until the later volume. We are therefore perhaps justified in assuming that this volume is intended for preliminary instruction in the laboratory where electrical engineering tests and measurements are actually executed in full. This assumption places a book of this character in its most favorable relation towards the instruction in American engineering colleges, and we will consider it from this point of view. No adequate book occupies this place, and a suitable one would be joyfully hailed by all teachers whose fortunes require them to direct college laboratories devoted to electrical engineering.

For text-book purposes, this volume, however, does not favorably appeal. More than thirty-five per cent. of the text is contained in the first chapter, which deals with the arrangement of electrical testing laboratories and the equipment which the author believes is desirable to have laid down therein. This is an interesting portion of the book, and contains much valuable suggestive matter. It may be read with profit by any teacher of electrical

engineering. But college laboratories in this country are not well supplied with funds and they cannot afford (nor do they need) the elaborate ultimate standards for the recovery of the several electrical units which are here adverted to as desirable or even essential portions of a laboratory equipment. Neither do our manufacturers usually find it warrantable to carry their measurements to the refinement that this chapter implies is essential to reasonable laboratory practice. Such refinement is necessary and warrantable in only a few standardizing laboratories, or the laboratories maintained by the equally few manufacturers of fine electrical measuring instruments; and we therefore believe that the book in its present form is seriously misleading to students unless accompanied by extended oral explanatory lectures.

The second chapter of the book partakes of the character of the first. It contains much of interesting and valuable suggestion to the laboratory administrator and laboratory teacher, but little which commends it for use as a text-book with the average undergraduate laboratory classes. Neither can a large proportion of the methods, discussed in this chapter, serve a useful purpose in the daily work of a manufacturer's laboratory, unless he is a manufacturer of standard electrical measuring instruments.

The third and fourth chapters, which treat of the measurement of electrical currents and pressures, make closer contact with daily work in the electrical laboratory, whether it be of the college or the manufacturer. But even here are to be found various recommendations which are of doubtful value in commercial testing. For instance, the author, in harmony with methods of testing used by him some years ago, recommends the adoption of a small synchronous motor as a means for driving a contact maker when it is desired to delineate the current or pressure curves of an alternating current circuit. The author fails, however, to caution the reader that inevitable error is introduced into the forms of the delineated curves by the 'hunting' of the synchronous motor, unless the curves of motor counter-pressure and impressed pressure (line pressure) are nearly alike, or the motor construction contains special expedients to prevent appreciable hunting.

The author wisely gives much attention to the potentiometer as an instrument to be used for setting the pressure when calibrating voltmeters and for general use as an accurate, convenient and reasonably rapid device for measurement of electrical pressure. He curiously fails to note the universal sluggishness of hot wire voltmeters and ampèremeters which often causes their readings to be misleading when the quantity under measurement is subject to fluctuations—as, for instance, the current feeding a constant pressure arc lamp. The author wholly omits from consideration the ordinary two-coil frequency indicator for alternating current circuits. While this instrument does not read in absolute values, it is admirable as an indicator of the constancy with which frequency is maintained during a series of tests, and is far more useful in the average laboratory than either of the 'frequency tellers' described in the text.

The final chapter of the book, chapter 5, on the measurement of electrical power, is particularly disappointing. It fails to throw any light upon the difficult problem of measuring the power absorbed, in an alternating current circuit, by devices of low power-factor. The only expedient proposed by the author is one of little utility, if not of impracticability, under ordinary conditions. It also fails to deal adequately with power measurements, in alternating current circuits, when the currents and pressures are great. Wattmeters and their use are dealt with and described, but the admirable portable wattmeters made in this country by the Weston, General Electric and Whitney companies are not described or referred to. This indeed is characteristic of the book, and such excellent secondary standards as the so-called 'laboratory standard' ampèremeters and voltmeters of the Weston Company are given no attention. A noteworthy feature of the book, but one of doubtful merit, is the enthusiastic recommendation of instruments using mirror and scale. This recommendation extends to electrostatic voltmeters.

It may seem ungracious to farther criticize

the details of an extensive and carefully written book which contains much that is admirable. It is a valuable book and every administrator of an electrical laboratory should own his copy and carefully ponder its words; but as a handbook for general use in the electrical engineering laboratory and amongst undergraduate college students in electrical engineering, it does not meet the American requirements.

The book is of fine 'get up' and is notably free from errors. The selection of references for short bibliographies which are scattered through the book, and the arrangement of tables at the end of each chapter, enlist favor for the author's judgment. But it seems doubtful wisdom, in a table showing the electromotive force of the Clark cell, to print the data to five significant figures (four decimals) when the values are confessedly not known with accuracy to four figures. Other tables are of similar character. For instance, on page 420, the electrochemical equivalents and data derived therefrom are given throughout to five significant places, though the original data depend upon ratios of atomic weights, many of which are not accurately known to three significant figures.

In reading the book one is impressed by its strong points, which are worthy of its author and in entire harmony with his reputation. But one leaves it seriously disappointed that the author, notwithstanding the promise of his preface, so signally fails to meet (at least as far as American practice is concerned) the special needs of the electrical engineering laboratories. We venture to hope that the second volume, which the author foreshadows in his preface, will more nearly meet those needs.

DUGALD C. JACKSON.

Die Vegetationsverhältnisse der Illyrischen Länder. Von Dr. GUNTHER BECK VON MANNAGETTA. Band IV. *Die Vegetation der Erde.* A. ENGLER and O. DRUDE. Leipzig, Wilhelm Engelmann. 1901. 8vo. Pp. xv, 533; 8 plates, 18 cuts and 2 colored maps.

The present work constitutes the fourth volume of the magnificent series of phytogeographical monographs founded by Engler and Drude. Like its predecessors, it is written by a lifelong student of the vegetation concerned. It differs from them chiefly in the nicer balance that is struck between floristics and ecology, showing how fully the author has kept abreast of the latest movements in phytogeography. The present volume is also unique in the series on account of the systematic treatment of formations, and especially on account of the consideration given the fungi and algæ. It not only maintains the high standard of the preceding volumes, but adds to it in these and other points.

The introduction treats of the history of the botanical investigation of Illyria, from the first recorded visit, that of Brasavolo (1500–55), to the present time. For a country with so few resident botanists, the number of botanical explorers is something remarkable. The thoroughness with which the flora and vegetation have been studied may be indicated in some degree by the fact that the bibliographical list, which contains very few general works, comprises nearly seven hundred titles contributed by more than two hundred workers, among whom Beck von Mannagetta, Borbás, Adamović, Ascherson, Baldacci, Farkás-Vukotinović, Fiala, Formanek, Freyn, Hirc, Kerner, Pančič, and Wettstein are prominent.

The entire work comprises four parts: I., 'A Sketch of the Physical Geography of the Illyrian Countries'; II., 'The Vegetation'; III., 'The Regional Floras and their Composition'; IV., 'The Relationship of the Flora to that of Adjacent Lands, and the Developmental History of the Flora since Tertiary Times.' The Illyrian lands comprise southern Croatia, the Quarnero Islands, Dalmatia, Bosnia, Hercegovina, Montenegro, northern Albania, Sandzak Novipazar and Servia, constituting a fairly natural region except on the south. The greater part lies in the drainage basin of the Danube; the western litoral, a relatively narrow strip, drains into the Adriatic. A peculiar hydrographic feature is found in the lost streams (Karstflüsse), which