BOOK REVIEWS

Heat Transfer and Evaporation. By W. L. BADGER. 306 pages, 113 illustrations. The Chemical Catalog Co., Inc., New York, 1926. Price, $5.00.

Because of the basic importance of heat transfer in evaporation, the first three chapters of this book deal with conduction, radiation, and convection in general. The next three chapters are devoted to film coefficients of heat transfer for the warming and cooling of gases and liquids flowing inside pipes, and to condensing vapors. Heater design is then treated, and about eight illustrative problems are solved in these seven chapters, which comprise roughly one-third of the book.

Chapter 8 describes the various types of evaporator bodies, and includes a brief, interesting history of the development of evaporators. The next chapter covers heat transfer in evaporators, hydrostatic head, boiling point raising, steam distribution, and other factors. The author courageously faces the fact that the present data are inadequate for a complete analysis of the problem. The importance of factors such as scale formation, temperature difference, viscosity, etc., are properly emphasized and illustrated by considerable data, part of which have not been published elsewhere. The author concludes that conditions on the liquor side, rather than on the steam side, usually control the coefficient of heat transfer from condensing steam to boiling liquids.

Chapter 10 deals with the theory of multiple-effect evaporators, and eight problems are solved, illustrating the application of heat and material balances, taken in conjunction with the necessary heat transfer and physical data. In the next chapter are considered problems of operation, such as the various methods of feeding, the removal of crystals, the formation, removal, and prevention of scale, foaming, entrainment, and steam separators. Chapter 12 is devoted to auxiliaries, such as condensers, pumps, and traps. Chapter 13 describes the practice in certain industries. The last chapter treats the important problem of costs. The book contains several hundred references, including many references to patents.

Throughout the book the treatment is from the modern point of view, the subject matter is arranged in logical order, and the principles are applied to commercial apparatus. This book should be of value to all engineers interested in the operation or design of evaporators, but is not intended as a manual for unskilled operators. Certain minor errors have crept in, but the number of these is no larger than normally appears in the first printing of any technical treatise having the scope of this book.

W. H. MCADAMS

Evaporation. Modern Library of Chemical Engineering. By A. L. WEBRE, assisted by C. S. ROBINSON. 500 pages. The Chemical Catalog Co., New York, 1926. Price, $6.00.

The book is divided into four sections and an appendix. The most important feature of Section I, Theoretical Consideration, is the discussion of evaporator heat balances. Heat transfer in evaporators is discussed very briefly. Such accessories as vapor piping, catch-alls, condensers, cooling towers, and heaters are discussed more or less empirically. In Section II, Information on the Operation of Evaporators, such matters as starting and shutting down, feeding, removing scale, venting gases, etc., are covered in a practical way and show plainly the author's extensive first-hand experience in operation. Of the 165 pages in Section III, Application to Various Industries, 50 pages cover the heat balance of the cane sugar mill (practically a reprint of the booklet by the same author published by the U. S. Cast Iron Pipe and Foundry Co.), 52 pages are a very similar discussion for a beet sugar mill, and 30 pages are calculations of a paper waste-liquor evaporator. These sections are especially designed to show the great importance in such problems, of a careful calculation of an evaporator heat balance for several possible arrangements; an idea that the reviewer can most heartily endorse. Section IV, Types of Evaporators, is the weakest in the book, being a series of chapters written by evaporator makers about their own machines, without editing or criticism by the author.

The book is essentially a practical one, having very few theoretical discussions aside from the evaporator heat balances, and making practically no references to the literature. This results in a large number of categorical statements, which to one type of reader would cast a doubt over the soundness of much of the discussion not warranted by the actual facts involved. Some of the detailed statements might be debated, but in the present state of our knowledge this would serve no useful purpose in a review. In general, the reviewer quite agrees with most of Webre's conclusions, though he takes exception to the statement that he is an exponent of the horizontal tube evaporator.

The book is profusely illustrated, with many line drawings and relatively few manufacturers' half-tones, except in the last section. It is a book well worth reading by anyone who has to do with the operation of evaporators.

W. L. BADGER

Metallurgy and Its Influence on Modern Progress. With Survey of Education and Research. By SIR ROBERT A. HADFIELD. D. Van Nostrand Co., New York, 1926. Price, $7.50.

This very interesting book might also have for a subtitle, "Research Pays," as it deals largely with the author's own investigations, and particularly those relating to manganese and silicon steels and their industrial application by the firm of which Sir Robert Hadfield has long been the distinguished head. The book is also of great interest as a metallurgical autobiography by one who has long been recognized as outstanding in investigation and as the head of a great metallurgical firm.

The author states that it has been his aim "to outline the rise of modern science and then to deal at greater length with the various aspects of the work with which he has been particularly associated." The book is evidently written mainly for the general reader and as an inspiration to young men. It is in no sense a textbook of the ordinary type, but the student and investigator will receive inspiration from its pages. The industrial executive may also well profit from a perusal of them, and the general reader who is desirous of knowing the relative position of modern metallurgy in its setting of historical background, education, research, and industry, will find much of interest in its pages, which are adorned by seventy illustrations, many of them being of distinguished scientific men and interesting documents.

The book is divided into five parts: the first being an historical background; the second dealing particularly with those portions of metallurgy to which the author has himself contributed so much; the third, on fuel economy, dealing largely with British practice; a fourth part which the author considers of perhaps greatest importance, the position of education and research in modern society; and the fifth part, a brief glimpse into the future, mainly from the British point of view. The reviewer has seen no better argument for research in fundamentals of science, presented both as a contribution to knowledge for its own sake and for the application of this knowledge to industry.

The author suggests that an effective method of bringing home to the man in the street the great importance of science in our affairs would be the establishment of an annual Science Day.

GEORGE K. BURGESS

Methods of the Chemists of the United States Steel Corporation for the Sampling and Analysis of Iron and Manganese Ores. Edited by J. M. CAMP. 3rd edition. 148 pages. Carnegie Steel Co., Bureau of Instruction, Pittsburgh, Pa. Price, $2.00.

The purpose of this book is stated in the preface as follows:

Thus while standardization of methods remains the chief objective, it is hoped the pamphlet will also prove of value in the training of young chemists in this line of work, and will be an aid to those analysts, who, having occasion to sample and analyze ores but seldom, are handicapped, when they do have these duties to perform, by lack of knowledge that comes from such experience.

About one-third of the book is devoted to a comprehensive study of sampling iron and manganese ores. The reasons for sampling, the general principles, and the difficulties of sampling ores of various physical characteristics are given. The various methods of sampling both hard and soft ores are enumerated, passing from the early exploration and development of the ore

body to ore in place, broken in the mine, or in transit to the furnaces. This latter stage includes sampling in mine tram cars, storage bins, railway cars, steamer holds, and stock piles, during building or shipping, or when completed. The importance of taking accurate moisture samples is stressed. In short, this section covers the sampling of the ores treated very thoroughly.

The methods of analysis of the samples so obtained are clear, concise, and complete. They are treated under two headings—Routine, and Complete or Control Analysis. The methods under each main heading are subdivided into various groups according to the ease of decomposition of the ore and the presence of interfering elements. Many alternative methods are given for the determination of the customary elements.

The book undoubtedly fulfils the aim of the editor and should properly be in the hands of all analysts interested in the ores of iron and manganese.

WILLIAM E. MILLIGAN

Potash. BY J. W. TURRENTINE. ix + 188 pages. Illustrated. John Wiley & Sons, Inc., New York, 1926. Price, $3.00 net.

With the slackening of the feverish activity in potash production in this country following the resumption of European importations, it is fitting to review the situation and take account of the possibilities for the future. Dr. Turrentine's volume is therefore most happily timed.

The body of potash research, experimentation, development work, and plant operation during the past ten years has been enormous, and the published results are widely scattered through government bulletins and chemical journals. For the layman also these results are often so shrouded in chemical technicalities as to be practically useless. This book makes no pretense of presenting results of new and original research, or of handling the subject from a highly technical standpoint, despite the author's eminent qualifications for such a task. It is, however, a scholarly presentation of the world potash situation, bringing together in orderly sequence and in brief compass the outstanding facts with which any one, whether chemist or layman, who is interested in potash, should become familiar.

It contains the latest figures on European production, costs, and prices, and on American importations and production. Following a discussion of the European sources, development, and economic position, nearly three-fourths of the volume is devoted to a survey of the sources of potash in this country and the developments and processes, both applied and proposed, for its recovery from these sources. Throughout this discussion emphasis is wisely laid on the necessity of linking potash recovery with that of other products, either as a by-product of established industries or as one of several products sharing in the costs of operation.

The rubber situation has recently brought home to Americans once more how highly undesirable it is that any foreign monopoly should be in a position to practice extortion in supplying us with a necessary raw material, and perhaps the most significant feature in Dr. Turrentine's book is the author's optimistic tone concerning an ultimate supply of potash from American sources, adequate for all our needs.

FREDERICK W. BROWNE

Indicators. Their Use in Quantitative Analysis and in the Colorimetric Determination of Hydrogen-Ion Concentration. BY I. M. KOLTHOFF AND N. H. FURMAN. 269 pages. John Wiley & Sons, Inc., New York, 1926. Price, $3.50.

This edition differs considerably from the second German edition. A chapter dealing with amphoteric compounds from the standpoint of Bjerrum's conceptions of hybrid ions (Zwitterionen) has been added and many minor changes and additions made. The bibliographies at the end of each chapter have also been brought up to date. The subject of indicators is exhaustively treated and their uses in neutralization, hydrolysis, testing and determining the purity of compounds, etc., are shown. The errors due to salts, proteins, alcohol, and temperature which affect the color changes of indicators are described in detail. The book closes with a short chapter dealing with the theory of indicators, in which the author offers proof for a modification of Ostwald's theory which he expresses as "Indicators are apparently weak acids or bases whose iogenic or aci- (or basi-) form has a different color and constitution from that of the pseudo or normal form."

Features of especial interest are the complete instructions given for the preparation and use of buffers and the detailed descriptions of a large number of indicators. In this connection it is to be regretted that so many writers continue to use the Schultz-Julius Farbstofftabellen to number a few of their dyes rather than number all of them from the more modern and complete Colour Index. For the purification of methyl red the reviewer has obtained better results by recrystallizing the dye from hot toluene than from acetic acid. The chapter on indicator papers should prove of value to those interested in this subject. In fact, the book should fill a much needed place in the chemical literature in the English language.

A few errors were noted in the text which should be corrected. On page 3 there are really three examples to show the relationship between $[H^+]$ and pH. Page 25, line 8, should read, "the buffer capacity is 0.1 *in* curve I." On page 31, the value for 100.1 cc. of 0.1 *N* alkali is omitted from the table although discussed in the text. Page 32, the reviewer is unable to understand the significance of the superscript numerals in lines 16 and 29; if they indicate a third decimal, as on page 19, line 9, the first at least is incorrect. On page 123, line 3, 0.99 K_1 should be 0.099 K_1. On page 138 we read that secondary sodium phosphate, boric acid, and borax are dried in an exiccator, while on page 139 succinic acid is dried in a desiccator. The reviewer does not wish to enter into the Kolthoff-Dawson controversy over neutral water, but cannot see how the disappearance of the green color of bromothymol blue in neutral water (page 189) when shaken in contact with air can mean anything except that the acidity has been increased by the solution of some carbon dioxide.

H. WALES

A Bibliography on Research. Selected Articles from the Technical Press, 1923–1924–1925. 46 pages. 6 × 9 inches. Published by the National Research Council, Division of Engineering and Industrial Research, New York. No date; no price.

This pamphlet has all the earmarks of having been compiled by the office boy, or some similarly uninformed functionary, who evidently was shown a card index in some library and told to select entries covering "research." He (or maybe she) has succeeded in gathering many articles on many subjects in which this important and much misunderstood word occurs in the title. Many of the articles contain descriptions of laboratories and a large number cover everything under the sun except research.

The classification, particularly that covering the divisions of chemical interest, is without rhyme or reason, and quite a number of the articles appear in various divisions, a needless repetition. Why the antiquated Dewey decimal library classification numbers are prefixed to the entries does not appear.

Chemistry is done a grave injustice both in regard to the paucity of the entries and in the selections made. It is possible to find more true "research" articles listed in any number of *Chemical Abstracts* than are contained in any of the chemical divisions of this pamphlet.

This publication appears to have been hastily thrown together without regard to accuracy, completeness, or usefulness, and it is evident that the compiler is not very proud of his achievement, since his name does not appear anywhere in or on the pamphlet.

D. D. BEROLZHEIMER

1914–1924. Dix Ans d'Efforts Scientifiques et Industriels. Volume I. Edited by JEAN GERARD. Quarto. 3000 pages. Illustrated. *Chimie et Industrie*, Paris. Price, $12.00.

The events of the last twelve years have introduced unusual conditions in the fields of human activity. The chemical industries, more than any others, have been influenced, developed, and enlarged through the necessary activity incident to the World War. Today no science plays a higher role in industry than chemistry. Indeed, the number and variety of its applications cause it to occupy first place. It is a basic essential to all industrial development. This truth, however, although easily demonstrable, has not been generally accepted. Therefore, the Société de Chimie Industrielle thought it desirable to emphasize and set forth in clear and concise form the chemical accomplishments, especially in France, of the last ten years. Such is the purpose of the work, "1914–1924, Dix Ans d'Efforts Scientifiques et Industriels," the first volume of which has just left the press.

This work, produced under the direction of Jean Gerard, with the assistance of the leading scientific and technical chemists of France, sets forth the "balance sheet" of progress realized in the field of applied chemistry since 1914. The work constitutes a real encyclopedia of accomplishments of the last ten years in applied chemistry. It consists of two volumes. The first volume contains three parts preceded by a valuable introduction by Daniel Berthelot, member of the Institute: (1) Evolution of Science; (2) Scientific and Technical Progress; (3) Industrial Accomplishments of France.

In the first part Urbain, Behal, Desgrez, and Lindet, members of the Institute, present a masterly review of the evolution of chemistry. The second part, written by specialists in each subject treated, evaluates the remarkable accomplishment in the chemical technic of different branches of the industry. The third part is devoted to the economic development of each industry, and the statistical information contained brings forth much better than possible in long dissertations the results obtained in ten years in French industries related to chemistry.

This publication is an important addition to chemical literature and should be found in all chemical libraries. It is difficult to understand how a work of its size and importance could have been written and published for the price asked. The work sets forth so clearly the series of accomplishments between the years 1914 and 1924 that readers may easily draw from the lessons of these ten years fruitful instructions for the future. Finally, they should by its perusal be able to understand the capital importance of chemistry in our modern economy and assign to it the place it should occupy—viz., the first.

An Introduction to Industrial Chemistry. By L. I. Levy. 288 pages. McGraw-Hill Book Co., Inc., New York, 1926. Price, $4.00.

The author points out that industrial chemistry not only depends upon all other branches of physical science, but draws from every field of engineering, as well as from the economic and sociological sciences. It is his aim to present the subject in such a manner that the student will gain some knowledge of the fundamentals of industrial chemistry, to illustrate which he has chosen a few selected chemical industries. The first chapter is devoted to general principles, showing the relation of pure to applied chemistry. The second chapter deals with cost accounting. Chapters III, IV, and V cover large-scale operation and works equipment. In Chapter VI brief mention is made of a number of specialized manufacturing operations. The general discussion in the first part of the book is applied to the fuel, sulfuric, alkali, and explosive industries.

The book is written in a logical manner and will help point out to the chemical graduate where pure science finds its application in the industrial field.

Allen Rogers

Portland Cement. Its Composition, Raw Materials, Manufacture, Testing, and Analysis. By Richard K. Meade. 3rd edition. xii + 707 pages. The Chemical Publishing Co., Easton, Pa., 1926. Price, $10.00.

The third edition of Meade's well-known volume is a thorough revision of the 1911 edition, comprising not only much rewriting but also seventy new illustrations and about two hundred pages of additional text. The author states in his preface that the work was originally designed more particularly for the plant chemist and cement inspector and hence emphasized plant control and testing procedure. But in each of the later editions the sections dealing with plant design and operation have been enlarged much more relatively than the other portions. Hence the volume would appeal to engineers and to those interested in the mechanical features of cement production.

However, in common with similar publications devoted to other industries, the information presented would not enable an engineer to construct a plant intelligently and advantageously, because there is no evaluation of the economy of operating the different types of equipment described. In this particular case it is no fault of the author, but rather of the industry which, like Topsy, has just grown up. The fundamentals of why one type of equipment is used in this or that plant, or this or that material, have never been determined. The industry uses rotary kilns of from 6 by 60 feet to 12 by 240 feet (and in the immediate future, 330 feet), because it has never stopped to study the economies of rotary kilns.

The portion of the work devoted to testing is largely based upon and written around the American Engineering Standard No. 1, sponsored by the American Society for Testing Materials. It seems rather unfortunate that the author has had his book appear before the public during the same month in which the American Society for Testing Materials, at its annual meeting, unanimously referred a new standard to the society as a whole for adoption, thereby rendering obsolete this standard cited and used as a basis for about 135 pages of text.

The volume is to be considered the superior of any in many respects and on the whole the equal of any dealing with the methods of making and the methods of testing Portland cement. Its weakness is its lack of a thorough discussion of what the cement is, how it reacts with water, and the conditions under which it should be used. Some errors are noted, but they are minor, except for that stating that the Bureau of Standards "tests all cement used by the National Government in fortifications, dry docks, public buildings, etc." The bureau tests only a portion of the cement purchased by the Government from cement plants located within reach of four of the bureau's laboratories. On page 352 the Bureau of Standards is also cited where undoubtedly the Bureau of Mines should have been indicated.

P. H. Bates

Corrosion: Causes and Prevention. An Engineering Problem. By Frank N. Speller. 621 pages. McGraw-Hill Book Co., New York, 1926. Price, $6.00.

There has been no recent general compilation of the knowledge of corrosion, and this volume fills the want completely for the field of iron and alloys high in iron. It gives a thorough outline of the theory of the corrosion of iron and steel according to the most recent workers, and it describes the practical use of this theoretical knowledge in the engineering problem of minimizing this corrosion. Some comparative data are given on nonferrous alloys used for their corrosion resistance, and on unusual uses of steel. The data are presented from a broad viewpoint, taking into consideration the views of differing authorities on questionable points, and with very little personal bias.

The arrangement of chapter and subheadings and the use of diagrammatic illustrations make the reading particularly clear. The diagrams have been developed to an unusually expressive degree. There is considerable repetition, but in most cases this seems necessary and useful.

The rendering of Part I, which deals directly with theory, is sometimes rather involved. This is partially due to the natural difficulties of the subject, in that a number of different factors are intertwined and dependent on each other for their effect. It is also due to the author's attempt to attach all these factors to what he calls "the electrochemical theory." This sets up in the mind of the reader a hope of simplifying all the data into one certain formula. However, electrochemistry is a complicated science, and the impossibility of such complete simplification is indicated by the lack of any brief statement of this "electrochemical theory." Nevertheless, the use of electrochemical reasoning is shown to be more valuable in understanding corrosion than the so-called "theories," based on a narrower selection from the chemical possibilities, such as the acid theory and the colloidal theory. The available theoretical data have been well systematized, and certain general rules stand out clearly and enable the student to obtain a comprehensive view of the subject in a short space of time. It is a real advance over former works.

Part II, Preventive Measures, indicates the methods of using knowledge of the theory in preventing corrosion under various conditions. The practical information given seems much superior to anything which has formerly appeared on the subject. The various phases of corrosion, such as atmospheric, under-water, under-ground, chemical, electrolytic, heating and boiler systems, are fully covered. A relatively large space is given to the discussion of corrosion in water, boiler, and steam systems, and the data on these subjects are unusually complete and convincing. Much of the information has not been previously published. The reader cannot expect to have every specific problem directly discussed in a work of this character, but any plant engineer who has a corrosion problem, or student interested in the generalities of the subject, can obtain the best available information from this work.

Robert J. McKay

La Chimie des Matières Colorantes Organiques. By P. Castan. 456 pages. 11.5 × 17 cm. Gaston Doin & Cie., Paris, 1926. Price, 30 francs.

This is a straightforward, systematic exposition of the chemistry of dyes. The structural formula of each is given with a statement as to how it is made, its uses and characteristics, and a few references to the literature. Manufacturing processes are not described. The book gives a good view of the whole subject from the scientific side such as is desired by the general reader and needed by the industrial chemist as an outline.

Chapter I is devoted to the theories of color, giving the various chromophores and auxochromes. This is followed by chapters on nitro dyes, nitroso and quinone oximes, azo dyes, triphenylmethane dyes, dyes from quinoline and acridine, dyes from quinone imine (which includes a number of sulfur dyes), anthraquinone colors, indigo and indigoids, and natural dyes.

E. Emmet Reid