in the same area, do not compete directly in food and feeding habits.

Sea-Birds is disappointing as a reference work. Related items of data are inextricably scattered throughout the book, and after reading them once, I found that the index, which is systematic and not alphabetical, was of little help in finding the items again. Both the vernacular (more or less local) nomenclature and the technical (apparently up-to-date) nomenclature are used confusingly and without explanation. Without previous knowledge of the subject, it would sometimes be difficult to know exactly which bird is being referred to.

However, it is a book that should stimulate interest and be enjoyed by any bird-minded reader to whom sea-birds are relatively little known. Its appeal is enhanced by many excellent portrait photographs of the diverse species and of their colonies. Furthermore, in browsing through its pages, a serious student of sea-birds can hardly fail to find data and ideas of value, especially where these are firsthand and not gleaned from the literature.

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The Structure of Metals and Alloys. Wilhelm Hume-Rothery and G. V. Raynor. Monogr. and Rept. Ser. No. 1, Institute of Metals, London, ed. 3, 1954. viii + 363 pp. Illus. + plates. $5.50.

This is really a new book, although it is called the third edition of Hume-Rothery's book, which was first published in 1936 as a brief book of some 120 pages (second edition in 1944). Hume-Rothery and Raynor are now the authors, and the text is about 3 times the size of the second edition. Whereas the first edition was addressed both to the research man and the practical metallurgist, the new edition is a survey of the modern approach to metallurgy, and as such it should help the practicing metallurgist to understand the electronic background and its consequences.

A brief chapter on the structure of the elements is followed by a chapter on atomic radii and some physical properties of the elements, these chapters are followed by some 70 pages on primary metallic solid solutions and some 40 pages on intermediate phases and alloy systems. Part 6 (some 50 pages) "The structure of the alloys of iron" is entirely new, and the last part, "Imperfections in crystals and deviations from the ideal lattice," has been considerably enlarged and brought up to date to give the main ideas of the theory of dislocations and their applications.

Both authors are well known, not only for their scientific research in the field, but also for their success in bringing the background of modern physics to the attention of the practicing metallurgist. An introduction to the *Electron Theory of Metals* by Raynor is Monograph No. 4 of this series, and Hume-Rothery has contributed in Monograph No. 3, *The Atomic Theory for Students of Metallurgy*. In 1948, Hume-Rothery also published, in the form of a dialogue, a discussion of the modern approach to metallurgy, entitled "Electrons, atoms, metals, and alloys." I am mentioning these monographs by Raynor and Hume-Rothery because I feel that the study of the present book would gain considerably if some of the background available in the other two books were available to the reader. I do not think that the mathematics that is used in the others is such that the practicing metallurgist would be frightened away, and it would help considerably in understanding the large amount of material that has been put together in this new work, which is entirely nonmathematical and more or less descriptive.

Therefore, it might be well to recall the cautious advice from the preface of Raynor's *Electron Theory of Metals*.

> The reader will not finish this monograph, therefore, with the feeling that he can immediately do research in metal physics. Nor will he necessarily be able to understand, without assistance or interpretation, probable future advances. He will, it is hoped, be more at ease with some of the more modern ideas, and the way they are being applied. He should have some idea of what has been achieved by their use in metallurgy, and in what directions future progress is likely.

The amount of material is so large and the number of references is so extensive that it should be possible for the reader to find out about almost any of the modern concepts that are of importance in present-day metallurgy. The book can be recommended for the physicist who wants to understand the problems of the metallurgist and the metallurgist who wants to become acquainted with the approach of modern physics to his problem.

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Linear Operators. Richard G. Cooke. Macmillan, London; St Martin's Press, New York, 1953. 454 pp. $10.

The theory of discrete and continuous eigenvalue expansions associated with Hermitian linear operators in Hilbert space has long been recognized as one of the mathematical disciplines fundamental to quantum mechanics. Five of the seven chapters of Cooke's book are devoted to an exposition of this important mathematical theory; the remaining two chapters contain brief discussions of various related topics.

Chapter 2 gives a somewhat hurried statement of the physical applications of the pure mathematics of the remainder of the book, treating several standard problems (harmonic oscillator, perturbation theory, anharmonic oscillator) from both the Heisenberg and the Schrödinger points of view, and giving a more careful description of the continuous spectrum than is ordinarily found in "physical" analyses.

Aside from Chapter 2, the first part of the book is organized around Chapters 4 and 5 and around the idea of giving a large number of different proofs of

the central Hilbert-von Neumann spectral resolution theorem. Proofs due to von Neumann, Lengyel, Cooper, Riesz and Lorch, and Lengyel and Stone are given explicitly, and a number of other proofs are sketched briefly. The relationships between the various methods of proof are discussed.

Chapter 6, in many ways the most unusual in the book, deals with the theory of matrix rings, extending the line of thought initiated in the author's earlier *Infinite Matrices and Sequence Spaces*. Chapter 7 takes up the Gelfand theory of commutative Banach algebras and develops this theory up to the point where a proof of the famous Wiener Tauberian theorem can be given. Finally, an extensive bibliography is given.

The text demands of the reader both a high level of general "mathematical maturity" and a fair working knowledge of the theory of functions of a real variable.

The principal drawback to this book is its somewhat disorganized character. For example, Chapter 6 is unrelated to any of the other chapters and constitutes, in essence, an appendix to *Infinite Matrices and Sequence Spaces*. Chapter 7 is independent of the preceding chapters; and although the methods developed in Chapter 7 could be used to give one of the most interesting proofs of the spectral resolution theorem in just a few additional pages, this is not done. The exposition throughout has the staccato character of lecture notes rather than the polished style customary in textbooks. It is my opinion that readers who are not interested in comparing a multiplicity of proofs of the spectral resolution theorem will find the recently published work of Riesz and Nagy more satisfactory.

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Dimensional Methods and Their Applications. C. M. Focken. St Martin's Press, New York; Edward Arnold, London, 1953. viii + 224 pp. $6.

The chief purpose of this book is to show the practical value of the use of dimensional analysis in solving problems of science and engineering.

In Chapter I, the author distinguishes between fundamental magnitudes as those that are arbitrarily defined, such as length, mass, and time, on the one hand, and derived magnitudes, such as Young's Modulus, on the other hand. He gives the basic rules for the conversion of units from one system to another.

In Chapter II, the "complete equation" is defined as one that remains true or invariable when the size of the fundamental units is changed. The general principles of dimensional analysis are defined. The pi theorem is stated and applications are given. This useful tool states that if there are n quantities, either physical magnitudes or experimental constants, such that one and only one complete equation holds among them, and if among these there are m fundamental magnitudes, the relationship among the n quantities may be expressed as a function of n-m independent dimensionless products of the original quantities. Numerous applications of this theorem and a general procedure for applying it to dimensional analysis due to Buckingham are given. O'Rahilly's measure ratio method for converting from one system of units to another is described.

In Chapter III, the questions of the dimensions of directed magnitudes and tensors of any rank are discussed. The problem of thermal magnitudes, requiring the introduction of a fundamental unit—for example, temperature or entropy—is discussed. Electric and magnetic magnitudes are described, with several suggested procedures for handling them, including the ideas of Maxwell and some more modern views.

In Chapter IV numerous applications to physical problems are described, including such modern devices as the chain-reacting pile (very briefly mentioned). Chapter V includes application to engineering phenomena and a description of model experiments.

The book contains numerous references to other workers in the field, including particularly P. W. Bridgman, E. Buckingham, H. Dingle, and Lord Rayleigh. It provides a more critical look into the problem of dimensions than the average scientist or engineer has given. The tables of dimensions—for example, of electromagnetic quantities in various systems—are useful. Some ideas on the design of experiments are suggested.

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Optical Instrumentation. George S. Monk and W. H. McCorkle, Eds. McGraw-Hill, New York–London, 1954. xxv + 262 pp. Illus. $3.75.

This is the eighth volume of the Plutonium Project Record of the "National Nuclear Energy Series." It contains a summary of the work carried out during World War II by members of the Optics Section of the Metallurgical Laboratory at the University of Chicago. This section, which started work in the fall of 1943 and was in existence for 2 years, was entrusted with the design and construction of optical equipment for remote control in irradiated areas. It also carried out research on the influence of high-energy radiation on optical materials and on the design of achromatic lenses consisting of materials that were found to be most resistant to destructive radiation.

The volume consists of two parts. The first part, entitled "A survey of optical and associated problems," makes the reader familiar with the peculiar optical problems encountered, discusses in general the possible ways of solution, and gives an over-all picture of the achievements made. The third chapter of this part is devoted to miscellaneous instruments and to investigations in connection with the project, and it also gives an account of work that was done on the production of thin films by evaporation and sputtering in vacuum. Two tables containing valuable data regarding a great number of deposited films deserve