Int. J. Heat Mass Transfer. Vol. 3, pp. 161–162. Pergamon Press 1961. Printed in Great Britain.

BOOK REVIEWS

Elements of the Kinetic Theory of Gases. E. A. GUGGENHEIM. Pergamon Press, Oxford, 1960, 89 pp. 17*s* 6*d*.

IT IS a long time since the reviewer has obtained from a technical work the illumination and pleasure afforded by Professor Guggenheim's introduction to the kinetic theory of gases. In the hundred years which have elapsed since the work of Clausius and Maxwell, treatises on this subject have become so weighty and impenetrable that most scientists have had to content themselves with primitive theories of transport processes in gases. Yet here is a work of eighty-nine pages which brings the rigorous theory within the comprehension of the non-expert, an achievement which might well have been judged impossible.

The secret of the authors' success lies in his deep knowledge of the subject, which enables him always to choose the shortest path to his objective, and to eschew unprofitable digressions. He scorns to use the elaborate artifices of arrangement and illustration which lesser authors require to make their texts palatable, yet always provides sufficient insight into the mathematical derivations and enough discussion of their practical significance to carry the reader along with him.

The Maxwell distribution is derived by means of Maxwell's original method, the objections to which the author believes to have been misplaced. The formulae for the transport properties are derived by way of Maxwell's transport-equation along the lines first suggested by Chapman. The rigid-sphere model is given the most detailed attention; the formulae for other force laws are left in the form of quadratures, for the evaluation of which the reader can turn elsewhere. The relations between the force laws, gas imperfections and solid-state properties are given brief but penetrating treatment, with some original material relating to argon.

Despite the author's austere concentration on the bare bones of his subject, he finds space for a number of stimulating asides. For example page 80, if the reviewer interprets it correctly, suggests that the "Lennard–Jones 6–12" force law is perhaps incorrectly given this appellation. Professor Guggenheim's remark about the deduction of force laws by "fitting" their constants to measured values of viscosity deserves quotation: "This is a harmless exercise for those who have the patience. But if they believe that such an analysis, based on such a small temperature variation of the effective value of d (molecular diameter), leads to reliable information on the form of the interaction energy, they are deluding themselves."

The work under review is Volume 1 of Topic 6 of the new International Encyclopedia of Physical Chemistry and Chemical Physics, of which Professor Guggenheim is one of the three editors-in-chief. Let us hope that he can persuade the authors of subsequent volumes to emulate his style.

D. B. SPALDING

Physikalische Grundlagen der Chemie-Ingenieur-Technik. P. GRASSMANN. H. R. Sauerländer, Aarau and Frankfurt am Main, 1961, 939 pp. DM80.

FEW authors are nowadays courageous and hardworking enough to write a book which covers more than a restricted corner of science; yet, as the author reminds us in his preface, students are justifiably dismayed when they are required to master a field which is so large that a whole team of specialists is needed to display its complexities. Professor Grassmann has therefore done a great service to chemical engineers by showing that one man can indeed absorb and expound all the fundamental sciences which underlie their technology. His range is adequately exhibited by listing the chapter headings, which are (freely translated)—Quantity and energy balances; the concept and use of entropy; probability theory and kinetic theory of gases; mechanics of solids; particles, powders and porous materials; fundamentals of fluid flow; applications of fluid flow; dimensional analysis and the theory of models; the exchange of momentum, heat and mass; multi-phase flow phenomena; rheology; and general discussion.

Of course, even in a book of over nine hundred pages of small print, the treatment is bound to be somewhat superficial. This is perhaps particularly the case in the sections on heat and mass transfer; Fick's Law is presented in an exceedingly non-general form, and the author appears to have made an elementary error in modifying it (on p. 225) for the case of gases of non-uniform temperature.

Nevertheless, the author's energy of mind and individual viewpoint are evident throughout, and even readers who, at one point or another, would prefer a different treatment cannot fail to be stimulated; the book can be read with profit by students and teachers alike. Professor Grassmann's discussion of the motion of vapour bubbles in liquids is particularly to be commended.

D. B. SPALDING

Units, Dimensions and Dimensionless Numbers. D. C. IPSEN. McGraw-Hill, New York, 1960, 236 pp. 50*s* 6*d*.

THIS is an exasperating book. The cover blurb claims that it is "clearly written", but one wonders whether the writer of the blurb has read the book; the reviewer's pencilled marks against obscure passages are too numerous to let the claim pass. The book is exasperating because, while there are some things in it that are worth saying, too many are said badly.

The subject demands precise treatment and clear definition of terms, but clear definitions we do not get; *vide:* "The physical variables that we use are of two *significantly* different sorts. The sort of variable that *probably first comes to mind* . . . we shall class as substantial variables." (Reviewer's italics.) The chapters on units are too often verbose and obscure. Those on similitude and dimensional analysis are more rewarding, though they are also unnecessarily laboured. This is not a book to be recommended to the busy reader who wishes to clarify his ideas with a minimum expenditure of effort.

R. W. HAYWOOD

Electrodynamics of Continuous Media. L. D. LANDAU and E. M. LIFSHITZ. Authorized translation from the Russian by J. B. SYKES and J. S. BELL. Pergamon Press, Oxford, 1960, 417 pp. 84*s*.

THIS work is the eighth in a series of publications by the authors on theoretical physics. The essential basic theory of electrodynamics of continuous media is presented rigorously and with great economy so that the reader is assumed to be familiar with the main mathematical techniques and theories of physics. Although the book deals primarily with the macroscopic theory the authors have successfully incorporated the atomic and molecular viewpoint.

The initial chapters deal with a very comprehensive study of the electrostatics of dielectric materials. Here temperature-dependent properties are fully discussed with the aid of classical thermodynamics. The conductivity tensor is introduced, and the theory relating to the flow of current in isotropic or anisotropic materials is developed and leads to a discussion of the Hall effect and thermoelectric phenomena. An exhaustive treatment, carefully supplemented by physical arguments, is then given on the structure of magnetic materials and the theory of superconductors. Some transient problems are discussed, namely the effect of a variable magnetic field on a conductor, i.e. eddy currents and the skin effect, together with a discussion on the excitation of currents by the motion of a conductor in an electromagnetic field.

The remainder of the book, apart from that section which deals with the electromagnetic field equations, is devoted to the discussion of some special topics. These are magnetohydrodynamics, magnetic-optical effects, ionization losses of fast particles in matter, black body radiation, dispersion theory of electromagnetic waves and finally the general theory of X-ray diffraction.

This book stands out as a piece of careful exposition and should have a strong appeal for both physicists and applied mathematicians. The translators are to be commended on the excellence of their work.

G. POOTS