

## BOOK REVIEWS

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

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. 50s 6d.

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