and for his attempt to reduce to bare minimum formal derivations". The aim has been to bring together short contributions to a variety of physical problems written in this spirit.

The forty-two contributions presented are not intended to cover new ground, but rather to discuss familiar concepts from somewhat unusual angles, thus often directing attention to aspects that are not widely known. Most of them deal with topics in high energy physics, although there are a few contributions relevant to Weisskopf's own particular interest in nuclear structure physics and one or two in solid state theory and classical electromagnetism. There is, understandably, a large variation in the quality and significance of the various contributions. Many of them clarify difficult or puzzling concepts with demonstrations of great elegance and simplicity, and should be of great help to the student of theoretical physics. Some suggest searching questions for Ph.D. orals. One or two are very slight. On the whole, however, the authors do succeed in catching the spirit intended by those who conceived the enterprise, and altogether it is an exciting volume worthy of the aim of honouring the great scientist to whom it is dedicated.

It is perhaps a little invidious to single out a few articles for special mention, but I found of particular interest the articles by T. D. Lee on T, CP and CPT non-variance in hyperon decays, Y. Yamaguchi on the group S_3 and strong interactions, G. Källen on intuitive analyticity, L. L. Foldy on bottles for neutrons, D. R. Inglis on inelastic scattering and associated gamma radiation, H. A. Bethe on shadow scattering by atoms; and one should not fail to mention for novelty the dialogue between an inventor and physicist about causality and dispersion relations by R. Hagedorn.

The large number of American authors is not unexpected and reflects how Weisskopf was able to attract the most eminent American theoretical physicists to visit CERN. It is more surprising perhaps that the United Kingdom is represented by a single author. It is to the credit of the editors and publishers that in spite of the speed with which the work was produced a high standard of production has been maintained throughout.

E. H. S. BURHOP

THERMODYNAMICS OF METAL–GAS SYSTEMS

Interaction of Metals and Gases

By J. D. Fast. Vol. 1: Thermodynamics and Phase Relations. Pp. x+302. (New York: Academic Press, Inc.; London: Academic Press, Inc. (London), Ltd., 1965.) 104*s*.

THIS is the first of a two volume work which is intended to cover both the thermodynamic and kinetic aspects of metal–gas interactions. This topic is, of course, a very large one in terms of experimental information, and the author apologizes in his introduction for having to select for discussion only a representative sample of present knowledge. Such selection is commendable, providing that the examples are chosen to be properly representative and are not unduly weighted in the direction of the author's main research interests. Unfortunately, that cannot always be said to be the case in this first volume.

The book begins with a condensed treatise on chemical thermodynamics, much of which could well have been omitted. For example, there is a tabulation of thermodynamic data which is in no way authenticated by reference to origin and no hint of accuracies of the numerical values is given. The definition of activity follows the dangerous line of making it seem a "fudge factor" without relation to net reversible work. One would imagine that the Gibbs–Duhem relationship would occupy an important part in any thermodynamic exposé related to solutions, but the topic receives scant treatment in this book.

The remainder of the book is an account of the thermodynamics of solutions of gases, mainly hydrogen, nitrogen and oxygen in iron and its alloys, the refractory metals such as titanium and zirconium and thorium–aluminium getters. Thus, no attempt is made to survey this general chemical field but rather the technologically important gas–metal systems are given special attention.

This would be satisfactory if all the principles involved in discussing those systems which have been left out of the book were exemplified here. This is not so, most significantly in relation to concentrated ternary alloys, and such topics as the interpretation of hydrogen solubilities in alloys in terms of free electron theory.

The strength of the book is to be found in the treatment of such topics as quench-ageing, phase transformations, brittle fracture and the precipitation of nitrides in solid iron. These aspects of the subject, which are related to the physical properties of the metallic matrix, are usually not to be found in one book together with a thermodynamic discussion. The rapprochement here is indeed welcome at a time when physical metallurgists are beginning to appreciate the importance of chemical factors in the behaviour of metallic systems.

All in all, it can be said that this book was aimed at filling an obvious omission in the modern literature on metallurgical topics. It certainly replaces all earlier works (and these are largely much earlier works) on the subject, but leaves a great deal to be desired even within the close confines laid down by the author. It will undoubtedly lead to a wider awareness of the importance of thermodynamic properties in influencing the physical behaviour of metals, and for this reason it is to be welcomed.

C. B. ALCOCK

CHEMICAL REACTORS

Fundamentals of Chemical Reaction Engineering

By Walter Brötz. Translated from the German by David A. Diener and John A. Weaver. (Addison-Wesley Series in Chemical Engineering.) Pp. ix+325. (Reading, Mass.: Addison-Wesley Publishing Company, Inc., 1965.) 113*s*.

IN the early development of chemical engineering the concept of unit operations enabled a systematic and analytical approach to be developed for the design of equipment for most physical processes occurring in the chemical industry. In particular these concepts led to the idea of sequences of stages, so that a distillation tower or an extraction battery was designed on the basis of a number of equilibrium stages. At the same time the realization of the need to combine a knowledge of fluid dynamics with that of heat transfer led to the design of much improved heat exchangers and evaporators. The design of the key reaction vessels was not amenable to this treatment since they required considerable knowledge of the interaction of chemical conversion with physical operations such as mixing, diffusion or heat transfer. The purpose of this text by Walter Brötz is to show how the operation of chemical reactors can be understood and to show the methods that are now available for their design. In particular he shows the need and the way to connect chemical reactions with such parameters as residence time, pressure, heat transfer and cost so as to produce an optimum design.

In an excellent introductory chapter the author explains the types of reactors and indicates the complexity of the interplay between the chemistry, the kinetics and the engineering. The aim now is not just to produce a reactor which gives the main product but to select from possible