The chosen material is presented in a clear manner with a fair number of references to original papers. The book is beautifully produced, only two errors being noted, in figures I. 2 and V. 5.

E. S. Waight

THE ELECTRON MICROSCOPE

The Electron Microscope

The Present State of the Art. By M. E. Haine, with a Chapter on Applications in Collaboration with Dr. V. E. Cosslett. Pp. xvi+282. (London: E. and F. N. Spon, Ltd., 1961). 55*s*. net.

THIS book, by the best British electron microscope engineer, with a chapter on applications written in collaboration with the doyen of British experts, is in many ways the last word on the electron microscope. It took the optical microscope 200 years to develop, from Leeuwenhoek to Abbe, from the 'dewdrop' to the apochromat. The electron microscope took less than 25 years from the primitive 'magnifying glass' of Knoll and Ruska, to the attainment of the present limiting resolution of about 6 Å., also by Ruska, in 1954, which, as readers of this book will soon become aware, is not likely to be much bettered in the future.

In the optical microscope two centuries of work went into correcting the aberrations, and the work is not yet quite finished. In electron optics it took only a few years before Scherzer demonstrated that the spherical aberration could not be corrected, and the question was only to find the optimum. In the electron microscope all the essential 'optical design' now boils down to a single curve (Fig. 1,7, p. 8), computed by the late G. Liebmann, one of the principal author's able collaborators, from which designers can pick their choice, according to the number of ampere turns which they are willing to embody in their objectives. The optimum theoretical resolution is about 2·7 Å. at 50 kV. and could be reduced to 1·5 Å. at 400 kV.—probably at the expense of contrast. The reasons why the practical resolution is only about one-half of the theoretical are fully and ably explained by Dr. Haine. It is particularly welcome that, apart from a detailed discussion of astigmatism, vibrations, creep, contaminations, etc., he describes, in full practical detail, the remarkable Haine-Mulvey Fresnel fringe test, so that every user of an electron microscope can test for himself the resolution limit of his own instrument.

The resolving power of the electron microscope has stopped at a particularly uninteresting stage. There are very few objects of 6 Å. size; organic molecules of this size have insufficient contrast, metal colloids tend to grow spontaneously to about twice this size, atomic lattice spacings are finer. (Only J. W. Menter was able to find an interesting example, by directly resolving the lattice of molybdenum trioxide, Fig. 10. 25, p. 270). If the resolution limit could be reduced below 3 Å., most atomic lattices could be resolved. The present book makes it clear why attempts to achieve this have failed, and are probably bound to fail for a long time—such as Scherzer's remarkable non-rotational lens, and the reviewer's suggestion of taking an imperfect electronic image, which is complete as it contains a record of phases as well as of amplitudes, and doing the corrections with light, in a second, optical process. The difficulties are so formidable that for a long time the electron microscope is bound to stay at the present limit—which, however, does not exclude interesting new special types, such as high-voltage instruments and interference microscopes, and the standard instrument will become a more and more convenient instrument for the user.

It is to the user—the biologist, the metallographer, the physical chemist—that this book is chiefly addressed. Correspondingly the mathematics is cut down to a minimum, but the critical attitude of Dr. Haine, who cannot suffer obscurities, has forced him to make this minimum so complete that it is somewhat doubtful whether most of the users of electron microscopes will not find it far above their heads. It takes a specialist to appreciate fully the amount of critical thinking which has gone into this book. I believe that it will have its greatest effect in the case of that small but important and growing class of users who are fully trained physicists (working mostly on imperfect crystals, such as metals) and who are willing to go to some pains to understand not only their object but also their instrument.

D. Gabor

ORGANO-METAL COMPOUNDS

Organo-Metallic Compounds

By Prof. G. E. Coates. Second edition. Pp. xiii+366. (London: Methuen and Co., Ltd.; New York: John Wiley and Sons, Inc., 1960.) 45*s*. net.

THE original stimulus for the investigation of organo-metallic compounds came from the possibility of their use in organic synthesis. Indeed, many chemists a decade or so ago were really familiar with only one class of compounds, namely, the Grignard reagents. To-day there exists an extensive subject covering compounds of almost all the known elements, which is rapidly developing and which is followed by many different kinds of chemist. The impressive advances which have been made have in many cases been the product of co-operation between theoretical, organic, inorganic and physical chemists. Synthetic organic chemistry is still, however, a major beneficiary from the investigation of these compounds, but there is an ever-increasing independence emerging in the studies in this field.

The first edition of this book (190 pages) appeared as a Methuen Monograph in 1956, having been written for the most part in 1953–54, with a section on the cyclopentadienyls having been added in proof. In the intervening years the amount of published work has been very great, so that even with certain condensations of material, notably that concerning organo-boron compounds, the second edition now comprises 360 pages and, in addition, has a larger page size. Such an expansion is inevitable and is completely justified in that this new and enlarged edition presents an almost complete picture of those compounds in which a direct metal–carbon bond is present. As in the previous edition the extensive organic chemistry of phosphorus, arsenic and silicon is omitted. The layout is little changed, but certain new theoretical and industrial aspects are now included. The main changes are to the sections on the alkali metals, boron, tin and the transition metals. This latter section has been expanded from 27 to 127 pages and now includes a thorough description of certain of the transition metal complexes in terms