

greatly enjoyed by everyone interested not only in birds but also in general zoology, geography, folklore and so forth. These values, together with the author's literary abilities, have resulted in a beautiful book which will be read by everyone, not only with profit but also with great pleasure.

Special mention must be made of the photographs illustrating the text. Most of them were made by Eric Hosking, a name that speaks for itself. All are at the highest level of technical and ornithological skill and talent—they are simply wonderful. The ornithologists of the expeditions were fortunate enough not only to watch some very rare species but also to photograph and film them. Photographic material collected by the expeditions contains pictures of species that have never before been photographed. Some of these unique scientific documents are included into the book, others could be seen on the colour film already mentioned.

Many black-and-white drawings by Penelope Mountfort and the author himself add much charm to this tastefully edited and executed book. It should not only be recommended; it certainly will be a desirable and greatly enjoyed acquisition in every library.

W. RYDZEWSKI

ELECTRODYNAMICS OF MOVING MEDIA

Electromagnetism and Relativity with particular reference to Moving Media and Electromagnetic Induction

By Prof. E. G. Cullwick. Pp. xxiii+300. (London and New York: Longmans, Green and Co., Ltd., 1957.) 63s. net.

THERE is a need in the literature, the author reminds us in the preface to his book, for a systematic study of the electrodynamics of moving media. The title of the volume under review leads one to expect that this need would be met by Prof. Cullwick's book. Unfortunately, it disappoints, and leaves the impression that the author has been primarily concerned with elucidating a familiar theory by a number of isolated problems some of which are now classical.

The book does not lack general interest; but certain misleading and controversial conclusions do much to detract from its value as a reference book. The book is divided into four parts and it will be convenient to deal with each in turn. The first part is concerned with the uniform rectilinear motion of charged particles and moving media, and includes chapters on special relativity and the relativistic transformation of Maxwell's equations. Earlier chapters in this part summarize some elementary results in electricity and include a discussion of the definitions of electric and magnetic forces in polarized media. The treatment here differs in several important respects from that usually found in treatises on electricity and appears to be unnecessarily involved. It leads to the curious, though correct, conclusion that the polarization vector, as defined in this book, should vanish for a conductor under the influence of an electrostatic field.

It would have been more logical and instructive to have deduced the first-order effects of charges in uniform rectilinear motion from the relativistic

formula derived in the chapter on relativistic electrodynamics instead of devoting a separate chapter to the subject. Again, in his account of the advent of the theory of relativity, Prof Cullwick specially singles out Poincaré's work, and in this respect appears to follow the lead given by the late Sir Edmund Whittaker in his "History of the Theories of the Aether and Electricity". Prof. Cullwick also dissents from the generally accepted explanation of the so-called 'clock paradox' in relativity and allies himself with Prof. H. Dingle in this controversy.

The second part of the book is on electromagnetic induction. Here the author appears to have been more successful, and the reader will find much that is useful. The distinction between electromotive force and potential difference is well drawn and illustrated by interesting examples. Likewise, the essential difference between the problem of a non-magnetic conductor rotating in an external magnetic field and the problem of a magnet rotating about its axis is made clear and is instructive. Prof. Cullwick has also rightly included in this part brief accounts of Bullard's theory of the maintenance of the geomagnetic field by dynamo action, and of magnetohydrodynamic waves. A fuller account of this new science, especially the parts which are essentially theorems in electrodynamics, would have enhanced the value of the book.

The third part of the book relates to the relativistic theory of second-order electromotive forces in moving circuits. A simple relation is shown to exist between the measurement of induced electromotive forces in systems in uniform relative motion, and this relation is illustrated by well-designed examples.

The fourth part is devoted to electromagnetic energy and momentum of moving systems. After discussing the reasons for introducing the Poynting and electromagnetic momentum vectors to retain the conservation laws of energy and momentum, the author devises examples to illustrate systems in which ponderomotive forces are 'unbalanced'. The reviewer, however, found the discussion here obscure and involved.

Prof. Cullwick also appears to be under a misapprehension about the nature of the magnetic energy of a system of electric currents. On p. 260 we read that "the hypothesis is introduced that the magnetic energy of a current circuit is the same as the kinetic energy of the effective conduction electrons, by virtue of their mean velocity along the wire". The author then derives from this hypothesis a linear relation between the magnetic vector potential and the mean velocity of the charges, this relation involving an "effective mass" which is left undefined. The reviewer is unable to agree with the findings of the author, and the hypothesis appears to be rather misleading. It is used in the chapter on superconductors to derive the familiar equations due to F. and H. London. Here the application is legitimate and indeed the linear relation mentioned above was first derived in connexion with the phenomenological theory of superconductors. But the relation cannot be universally true since it would seem to carry with it the implication that all conductors are superconductors.

To sum up, there is much that is of value and of interest in this book, but for reasons given in this notice, the book cannot be recommended unreservedly.

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