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HIGHER ASPECTS OF ELECTRICITY.

A Treatise on Electrical Theory and the Problem of the Universe, considered from the Physical Point of View, with Mathematical Appendices. By G. W. de Tunzelmann. Pp. xxxii+654. (London: Charles Griffin and Co., Ltd., 1910.) Price 15s. net.

THE partial success which has attended the recent attempts of Einstein and Minkowski to found an electromagnetic system of mechanics has tended to strengthen the popular idea that the solution of outstanding problems and mysteries must be sought in the domain of electrical rather than other physical phenomena. From being a disturbing element characterised by unaccountable vagaries, the "electric fire" has come to be an all-pervading element, closely approaching the alchemist's idea of a primal substance. Mr. de Tunzelmann's work is an ambitious attempt to apply the Faraday-Maxwell theory of electricity, as modified by Larmor in the atomistic direction, to what he calls "the problem of the universe." Incidentally, the book gives a great deal of information with regard to recent work and speculation, and although the titular object of the work has not been attained (it could hardly be otherwise in our present state of knowledge), it will be valued on account of the information given on such varied subjects as electrolysis, radiation, radio-activity, the age of the earth, the solar corona, and the place of mind in the universe.

As might have been expected in a book of this kind, the interstellar ether plays a fundamental part in most of the ultimate speculations. That being so, it is to be regretted that no serious attempt was made to present the modern aspects of the various ether theories. Possibly the author may have considered the matter as too controversial. The electromagnetic principle of relativity (as distinguished from the mechanical or Newtonian one) is of such outstanding importance that it is quite impossible to state modern electrical problems without at least acknowledging its existence. Yet, neither in chapters v. nor xxii., where some statement of the principle is urgently called for, nor indeed in any other part of the work, is it even mentioned. And, although Le Sage's hypothesis and its later variants are dealt with to a remarkably full extent, there is no reference to H. Witte and his proof that the only chance for a mechanical explanation of electrical phenomena lies in the assumption of an ether composed of discrete particles.

Of minor blemishes we have "cathion" instead of "cation" (p. 19) evidently due to mistaken etymology, a micromillimetre described as "a thousandth of a millimetre" (p. 321), "coronarium" instead of "coronium" (p. 371), and plain "Norman Lockyer" (p. 644) beside the full titles of other savants. In dealing with magnetism, Langevin's important and successful theory, based upon the Zeeman effect and Curie's law, is not mentioned. In dealing with light,

the author suggests calling the velocity of light in space the "radiation constant" (a term already otherwise appropriated), and (p. 271) makes out that an absorbing body absorbs less (instead of more) energy in unit time on being moved in the direction from which the light is coming.

The chapter on "The Place of Mind in the Universe," is a fascinating one, though its connection with the main work is not very obvious. The author aims at an all-embracing system or hierarchy of ultimate realities, beginning at the absolute, or eternal self-consciousness, and passing through mind, energy, and ether down to matter. The chapter is well written, and most suggestive. It is, of course, open to criticism on many points, but as few physicists have the courage to penetrate far into that borderland on the confines of which they, more than others, are wont to dwell, a spirited attempt like the present deserves every encouragement. At a time when the ether is being tried for its very existence, it is unwise to describe such a philosophic scheme as based upon a substance the properties of which, as the writer somewhat hastily asserts, "are derived from empirical observation." And when that system is further "strengthened" by a reference to the discarded "N-rays," and a single experiment in thought transference unaccompanied by the elementary safeguards devised by the Psychical Research Society, the system put forward is placed at a disadvantage from the first. Nor is that disadvantage removed by too great an insistence on the principle of the conservation of energy, and its use to assign a time-limit to the existence of the visible universe. Such a time-limit is really a negation of science and philosophy, as it implies that *deus ex machina* from which all scientific achievement has had to liberate itself or perish.

There are eighteen appendices on miscellaneous electromagnetic and philosophical subjects. Many of these, especially that on astronomical anomalies, are very useful and valuable. E. E. F.

TECHNICAL DICTIONARIES.

The Deinhardt-Schlomann Series of Technical Dictionaries in Six Languages. By Alfred Schlomann. Vol. v., Railway Construction and Operation. Pp. xiii+870. Price 12s. net. Vol. vi., Railway Rolling Stock. Compiled by Dipl.-Ing. August Boshart. Pp. xiii+796. Price 10s. 6d. net. (London: Constable and Co., Ltd.; Munich and Berlin: R. Oldenbourg, 1909.)

THESE two volumes form part of a series of technical dictionaries in six languages—English, Spanish, German, Russian, French, and Italian—of which seven volumes have now appeared. They are edited and compiled by Messrs. Deinhardt and Schlomann, assisted by experts from all the leading countries in each branch of the subject. The essential features of the scheme are that the six languages are all on one page, and, wherever it is possible, sketches are given so as to elucidate the text and facilitate the use of the dictionary. At the end of each volume complete alphabetical indexes are given,

five of the languages under one alphabet, and the Russian under another. The general arrangement and the ground covered by each volume, leave nothing to be desired, and this dictionary will prove invaluable to all those who are engaged in technical work. Repeated tests of both volumes show that practically nothing has been omitted, and the long lists of contributors and revisers for the two volumes, embracing men eminent in the railway world in Europe and America, are a sufficient guarantee of the accuracy of the work. The great difficulty which often arises of finding a definition in one language which should have its exact equivalent in another has been very satisfactorily overcome, and the sketches render misunderstandings almost impossible.

In the volume dealing with railway construction and operation, only those terms are included which are of general importance in such work; such details as earthworks, bridge-construction, &c., could only be exhaustively treated in volumes specially reserved for them. Nevertheless, the railway expert will find that such subjects have been quite adequately treated so far as he is concerned in this volume. In preparing this volume, the subject has been divided into sections to facilitate reference; these sections include track, permanent-way, connections between tracks, stations, signalling, and safety appliances, railway service, &c., and one special section has been given to electric railway installations. Each section is again divided into a large number of subsections, and, as these are given fully in the table of contents, it will be realised how much care has been taken to facilitate reference. It is essential to those who are engaged in the work of translating or making extracts from foreign technical books and journals that any technical dictionary should be so arranged that no time should be lost in ascertaining the ordinary English equivalents to any unknown foreign words or expressions; the alphabetical index at the end of each volume ensures this, and the division of the whole subject into sections and subsections still further makes for simplicity and saving of time.

The sixth volume is given up entirely to the important subject of railway rolling stock. Here, again, the subject is divided up into a series of sections, such as common equipment for locomotives and carriages, including such details as wheels, axles, draw-bar and buffer gear, brakes, &c.; locomotives and motor coaches; carriages; systems of lighting trains; rolling stock for electric railways; and, lastly, railway workshops. This latter section is not, of course, intended to cover the subject of machine tools generally, but only in so far as special methods and working are employed in railway workshops.

With the help of these two volumes, the railway engineer, and all those who are concerned with the various industries which are devoted to the manufacture of the machinery and plant required for the working and upkeep of the railways of the world, will find that the task of keeping abreast of what is being done in other countries will be greatly facilitated. It is essential that every manufacturing firm should endeavour to learn from the technical

Press what is being done in other lands, and a thoroughly trustworthy technical dictionary, such as this series now in course of publication, is indispensable for this purpose. These volumes should be found in the head office of every firm which aspires to keep itself up to date in business methods. T. H. B.

PHYSICAL CHEMISTRY IN ITS GEOLOGICAL APPLICATIONS.

Principles of Chemical Geology: a Review of the Application of the Equilibrium Theory to Geological Problems. By Dr. J. V. Elsdén. Pp. viii+222. (London: Whittaker and Co., 1910.) Price 5s. net.

ALTHOUGH it is generally recognised that the new physical chemistry has far-reaching applications in geology, no less than in other branches of science, little has yet been done to bring this home directly, either to the working geologist or to the student. In Van 't Hoff's lectures on "Physical Chemistry in the Service of the Sciences," the only geological application discussed is that relating to the crystallisation of salts from sea water. The results of the chemist's beautiful investigation of this one problem are the first-fruits of work on these lines, and they serve to show how wide a field still remains to be harvested. Vogt and others have essayed to apply the laws of solutions to igneous rock-magmas, but in this much more difficult problem no more than a beginning can yet be recorded. Meanwhile, we suffer from that want of touch between workers in different branches of science which is one of the less happy consequences of specialisation. The chemist has, in most cases, little acquaintance with geological questions, while the geologist, of the older generation at least, has not usually a working knowledge of physical chemistry, or at best is unfamiliar with the specific results which have been obtained.

This gap Dr. Elsdén has now endeavoured to fill. The book before us is a compendium of physico-chemical principles as applied to the more important questions of chemical geology and petrology. In accordance with this plan, the arrangement adopted is primarily a chemical one, thus differing from the older method of Bischof and others. Successive chapters deal with the crystalline and amorphous states, viscosity, diffusion, solution, surface-tension, vapour-pressure, polymorphism, and mix-crystals. Throughout the author insists that the key to the many problems here touched "lies in the determination of the conditions of equilibrium," and indeed this last word occurs in the heading of almost every chapter. Unfortunately, as is duly recognised, many geological phenomena (such, e.g. as the glass in volcanic rocks) prove that the adjustment of equilibrium may be indefinitely delayed.

A surprising amount of matter is brought together in the compass of these two hundred pages, and the numerous references given in footnotes will be very useful to the student. Sometimes, perhaps, this fullness is gained rather at the expense of clearness of treatment; or it may be merely a wholesome caution which makes the author content to cite conflicting opinions and leave the question at issue open. In