The book leans heavily on the work of Sedov and his pupils and as such has the unique flavor of the original. The translation is apparently very good. The reviewer considers it an important contribution to the literature of both applied mathematics and fluid mechanics and a most excellent work. We can only hope that the author will some day have the opportunity of hearing one American scientist say to another "How many physical constants. . .?"

Rheology

Introduction à l' Étude de la Rhéologie. Edited by B. Persoz. Dunod, Paris, 1960. Cloth, 6 × 9½ in., xx and 251 pp., illus.

REVIEWED BY WILLIAM PRAGER[2]

THIS excellent introduction to rheology, which has been prepared on the initiative of the French National Committee on Rheology, contains well-co-ordinated contributions by the editor and fourteen collaborators.

Part I presents the general theoretical background. The first three chapters (by B. Persoz) deal with the rheological classification of materials by their behavior under simple states of stress, mechanical models of this behavior, and the superposition principle of Boltzmann. In Chap. IV (by J. Mandel and F. Germain) the extension of the analysis of Chap. I to three-dimensional states of stress and strain is discussed, and Chap. V (by J. Mandel) treats the application of operational calculus to the analysis of stresses and strains in viscoelastic materials.

Whereas Part I has textbook character, as is evidenced by the problems at the end of each chapter, Part II, which is primarily concerned with the mechanical behavior of various classes of materials, is more in the nature of a handbook. There are nine chapters treating the rheology of metals (Chap. VI by C. Crussard), glasses (Chap. VII by H. Saucier), high polymers (Chap. VIII by A. Képès), rubbers (Chap. IX by P. Thirion), aqueous suspensions (Chap. X by R. Durand and H. Lafuma), paints and varnishes (Chap. XI by F. Kauer), emulsions (Chap. XII by A. J. de Vries), petroleum products (Chap. XIII by H. Weiss), and soils (Chap. XV by A. Mayer). Two further chapters are concerned with the role of rheology in biology (Chap. XIV by M. Joly) and geological applications of rheology (Chap. XVI by J. Goguel). A one-page trilingual table of rheological terms (English-French-German) concludes the book.

As an English language edition of this work would nicely fill the gap between M. Reiner's "Twelve Lectures on Theoretical Rheology" and F. R. Eirich's three-volume "Rheology," it is to be hoped that an enterprising publisher will bring out such an edition.

Heat Conversion

Direct Conversion of Heat to Electricity. Edited by Joseph Kaye and J. A. Welsh. John Wiley & Sons, Inc., New York, N. Y., 1960. Cloth, 6 × 9 in., xix and 300 pp. $8.75.

REVIEWED BY JOHN HORLOCK[3]

INTEREST in the direct conversion of heat to electricity has increased in recent years. This renewed interest is due partly to the demand for light, compact power packs for satellites, and partly to the growing awareness that research on power conversion is not keeping pace with research on new methods of heat generation.

A series of lectures on direct conversion was given to a summer school at the Massachusetts Institute of Technology in July, 1959, and, following many requests for copies of these lecture notes, Professors Kaye and Welsh have very quickly brought the papers together into one volume. The editors have not attempted to produce a textbook but have simply grouped and edited the original papers.

The result is a stimulating book which is a mine of information, has considerable duplication of material, covers a tremendous variety of subjects, and is, in parts, very difficult to read. It is clear that no single textbook can possibly cover the fundamentals of topics such as electronic emission, irreversible thermodynamics, thermoelectric effects, and magnetogasdynamics. However, anyone interested in this rapidly developing field of direct conversion can now dip into this new book and, with judicious skipping here and there, obtain a general picture of the present situation. He can also find numerous references if he wishes to delve into the subject further.

Kaye and Welsh have divided the volume into five sections: The first two sections deal with thermionic engines in which a heated cathode and a cooled anode are connected through an external circuit, and there is a net transfer of electrons across the evacuated space between the electrodes. The resistance to the flux of electrons due to the space charges between cathode and anode may be reduced by spacing the electrodes close together (0.001 cm in one model devised by Kaye and Hatsopoulos) or by using a crossed magnetic field between the plates. Experimental and analytical work on these configurations of the thermionic engine is dealt with in the first group of papers.

In the second section, engines in which the space charge is neutralized by the introduction of cesium ions are described.

If an ionized gas is accelerated and passed through a magnetic field perpendicular to the flow, then a transverse current may flow through the gas and a connected external load. In the third section of the book, Kantrowitz and Rosa describe briefly some of the Avco work related to this magnetogasdynamic converter. A second paper uses concepts of irreversible thermodynamics to establish that the power developed by a plasma moving through a magnetic field is the same as that developed by a metallic conductor with the same conductivity moving at the same speed through the field.

Jaumot supplies a useful but somewhat difficult review of thermoelectric effects in the fourth section. Other contributors discuss the theory and practice of thermocouples; new semiconductor materials have been used to obtain increased thermodynamic efficiency.

Finally, there is an article containing much factual information on the development of fuel cells.

Perhaps the most important lesson to be learned from this book is that there can be very few people who will be able to understand all the papers. The field of direct conversion requires a new brand of engineering scientist, equally conversant with thermionic emission, irreversible thermodynamics, the engineering thermodynamics of power systems, fluid mechanics, and materials science. M.I.T. has recognized the need for such engineering scientists in the training of undergraduates and in the establishment of graduate schools such as the Research Laboratory of Heat Transfer in Electronics, from which much of the material for this book has come.

In summary, a useful book, variable in quality, and in parts difficult to read. It is nevertheless an essential addition to the library of any engineer or physicist interested in direct conversion, for no similar texts exist.

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