reason" (p. 112); "A product of mental laziness, ignorance, and superstition, . . . philosophical intuitionism is a form of dogmatism far more dangerous for culture than aprioristic rationalism. . . . It leads directly to authoritarianism, irrationalism, and charlatanism, the main enemies of cultural growth" (p. 120).

Perhaps the less excitable mathematician or scientist (as contrasted with the philosopher) will find more solidly rewarding Dr. Bunge's analysis of the role of intuition in relation to his own field of activity. Here, in the text and through the extensive bibliography, he will uncover much to engage his attention, if he should fall into an analytic mood.

The book originated in a course of lectures given to students of mathematics, philosophy, and physics in the University of Pennsylvania at the beginning of session 1960-61; philosophers will probably accept it as adequate by way of a sketch for a more leisurely and detailed study of a difficult topic; mathematicians and physicists may be content, having read it, to leave the issue where it stands, whilst they get ahead with the work in hand. But even they will not be ungrateful, one imagines, for so much insight into their modes of apprehension and thought.

Viscosity and Flow Measurement. A Laboratory Handbook of Rheology. By J. R. Van Wazer, J. W. Lyons, K. Y. Kim, R. E. Colwell. 406 pp. Interscience, New York, 1963. $14.00.
Reviewed by ***Herbert Leaderman,*** *National Bureau of Standards.*

A body may be said to manifest flow behavior if it possesses no definite rest configuration, its rest configuration thus being a function of the surface traction history; and if its deformation behavior from a rest configuration for any given surface traction history is repeatable. Ignoring the question of thixotropic behavior, the most general constitutive equation for a body manifesting inelastic inertialess flow behavior reduces for the case of steady simple shear to a single-valued monotonically increasing shear stress as a function of rate of shear. This relationship is often called the "flow curve"; for materials whose flow behavior can be thus represented the

flow curve is generally quite temperature-dependent. For sufficiently small shear stress and rate of shear, in the absence of turbulence, these quantities are proportional to each other. Apart from density, the flow behavior of an essentially incompressible body is then characterized by a single parameter, the (Newtonian) viscosity.

Methods of measuring Newtonian viscosity, for a wide range of values of this parameter, together with a description of the limited number of commercial instruments available at that time, were given in the classic monograph of Barr; later developments along these lines are found in the monograph of Philippoff and the smaller one of Merrington. During the past two decades, many commercial instruments have been developed for measuring flow properties, usually of specific industrial materials. At the worst, such instruments yield a number for given conditions of operation, which may or may not correlate with practical application. If such instruments are calibrated, for example with liquids of known viscosity, then if the material under investigation manifests Newtonian flow behavior, its viscosity can be determined. Many such materials, however, manifest a flow behavior which is nonlinear and often substantially inelastic; such instruments therefore give "pseudo-viscosities" for different conditions of operation. By suitable analysis of the data with or without some modification of the instrument, the flow curve of the material can often be determined.

The central portion of this book is concerned with a critical evaluation of several commercially available, and some unavailable, flow-measuring instruments; their range of application and advantages and limitations, based upon the experience of the authors with a somewhat wide range of materials, are discussed in detail. In the first instance, the measurement of the viscosity of materials manifesting Newtonian flow behavior is considered. Particular consideration is given to the question of the measurement of the flow curve of materials manifesting non-Newtonian inelastic behavior with each instrument as supplied or with suitable modification. The question of the effect of the heat generated in a material under high rate of shear on instrumental readings is considered.

The beginning of the book is concerned with some brief theoretical remarks concerning the elastic and flow behavior of materials. Disregarding the elaborate (and expensive) instrumentation found on many such commercial instruments, flow measuring instruments are basically simple; the design of such instruments and the interpretation of the data involve however a considerable knowledge of modern fluid mechanics. The reader not trained in this field cannot expect to get a good understanding of the theoretical basis of rheology from the brief introduction. However, a rather complete bibliography of currently available books and monographs in this field is supplied, with a few most valuable for parallel or further study specifically indicated.

The apparent hiatus in this book is due to the gap, now being closed, between theoretical and experimental nonlinear rheology. From the theoretical point of view, there has been an ignorance of the suitable forms of the constitutive equations to represent the flow behavior under various conditions of real materials; from the experimental point of view, there has been a lack of understanding of the principles of flow measurement and of the fundamental parameters or functions to be measured. From the point of view of one aspect of rheology, this book attempts to close the gap.

The final portion of the book is concerned with the theory and measurement of linear viscoelastic behavior. As in other treatises dealing with this type of behavior, the theoretical and experimental treatments appear to be based upon the extensive experience of the authors with certain types of materials manifesting linear viscoelastic behavior under certain conditions. For this reason the uninitiated should not be surprised to find other completely different approaches, for example, in the starred references given by the authors. This book covers approximately the same field last reviewed over twenty years ago in the monograph by Philippoff referred to above.

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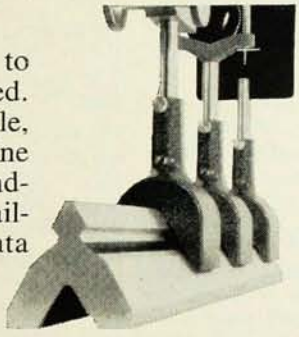

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There are several statements with which other rheologists will disagree. Apart from these minor points, this book should be of valuable service to the industrial rheologist, who is called upon to measure significant flow properties of industrial materials. The time and often the experience is lacking to design specialized equipment for the measurement of specific rheological properties. This book should help the industrial rheologist with some prior background in the field to select and if necessary modify commercially available equipment for the measurement of significant rheological properties.

Fluid Dynamics. An Introductory Account of Certain Theoretical Aspects Involving Low Velocities and Small Amplitudes. By G. H. A. Cole. 238 pp. (Methuen, London) John Wiley & Sons, Inc., New York, 1962. $4.95.

Reviewed by ***R. B. Lindsay****, Brown University.*

The accelerating development of aerodynamics in recent times, together with increased interest in such things as plasma dynamics and related physical problems, has served to put considerable emphasis on the need for up-to-date, concise, introductory treatments of fluid dynamics. The importance of such is all the greater since the older classical treatises, in addition to being heavily mathematical, usually fail to come to grips with the actual physical conditions prevailing in the interesting practical cases of fluid flow. The present work, one in the valuable series of Methuen's Monographs on Physical Subjects, endeavors to provide, in brief, but readable, compass, an adequate introduction to modern fluid dynamics.

The first four chapters contain a more or less conventional treatment of the motion of an ideal fluid, mainly restricted to irrotational flow, and including a very brief summary of sound waves in gases. Viscous and thermal effects are then introduced, followed by a study of the laminar boundary layer and turbulence. There is a substantial chapter on the various dimensionless parameters associated with fluid flow, like the Reynolds, Strouhal, Mach numbers, etc. The book concludes with a short chapter on hydromagnetics. This confined to treatment of continuum magnetohydrodynamics and does not include plasmas.

Though the mathematical analysis is adequate and in general clear, the principal emphasis is on the physical ideas involved, particularly in the case of turbulent flow and boundary layer problems. The general results are presented with clarity, though greater use of charts and graphs would have been helpful. In his desire to achieve brevity, the author occasionally leaves out material badly needed by the novice in the subject. This is true, for example, for the important concept of group velocity in wave motion. Here the reader not previously initiated will learn nothing of the meaning of group velocity and must make do with a series of formulas. The acoustician will not be contented with the chapter on sound waves. In particular, he will be depressed by the implication that sound waves are nothing but small oscillations in a gas. The sufficiently incautious reader may indeed receive the impression that because the compressibility of a liquid is much smaller than that of a gas (the author states that a liquid is essentially incompressible), there can be no sound waves in a liquid. This would make the submarine detection problem difficult indeed!

There is a brief but useful bibliography, somewhat marred by the careless misspelling of many proper names.

BOOKS RECEIVED

GENERAL

Reports on Progress in Physics, Volume 26. A. C. Strickland, ed. 472 pp. The Institute Of Physics and The Physical Society, London, 1963.

ATOMIC & MOLECULAR PHYSICS

The Theory of Atomic Spectra (1935 ed.). By E. U. Condon, and G. H. Shortley. 441 pp. Cambridge Univ. Press, New York, 1963. Paper $3.95.

CHEMISTRY & CHEMICAL PHYSICS

Effect of Ionizing Radiation on High Polymers. By T. S. Nikitina, E. V. Zhuravskaya, and A. S. Kuzminsky. Transl. from Russian by Scripta Technica, Inc. 90 pp. Gordon and Breach, New York, 1963. $4.95.

Annual Review of Physical Chemistry, Volume 14. H. Eyring, C. J. Christensen, and H. S. Johnston, eds. 433 pp. Annual Reviews, Inc., Palo Alto, California, 1963. $8.50.

Configurational Statistics of Polymeric Chains. By M. V. Volkenstein. Transl. from Russian by Serge N. Timasheff and M. J. Timasheff. 562 pp. Interscience, New York, 1963. $20.00.

ELECTROMAGNETIC WAVES & ELECTRONS

Advances in Electronics and Electron Physics, Volume 18. L. Marton and Claire Marton, eds. 342 pp. Academic, New York, 1963. $12.50.

Meteorological and Astronomical Influences on Radio Wave Propagation. (Nato Advanced Study Institute, Corfu, 1961). B. Landmark, ed. 318 pp. (Pergamon, Oxford) Macmillan, New York, 1963. $15.00.

EXPERIMENTAL TECHNIQUES

A Stress Analysis of a Strapless Evening Gown and Other Essays for a Scientific Age. Robert A. Baker, ed. 192 pp. Prentice-Hall, Englewood Cliffs, N. J., 1963. $3.95.

Principles of Reliability. By Erich Pieruschka. 365 pp. Prentice-Hall, Englewood Cliffs, New Jersey, 1963. $15.00.

Cryogenic Engineering. By J. H. Bell, Jr. 411 pp. Prentice-Hall, Englewood Cliffs, N. J., 1963. $16.00.

High-Pressure Measurement. Symp. Proc. (New York, Nov. 1962). A. A. Giardini and Edward C. Lloyd, eds. 409 pp. Butterworths, Washington, D. C., 1963. $10.75.

GEOPHYSICS & EARTH SCIENCES

Jet-Stream Meteorology. By Elmar R. Reiter. Transl. from German. 515 pp. The University of Chicago Press, Chicago, 1963. $17.50.

An Introduction to Atmospheric Physics. By Robert G. Fleagle and Joost A. Businger. Vol. 5 of Internat'l Geophysics Series, edited by J. Van Mieghem. 346 pp. Academic, New York, 1963. $12.00.

General Oceanography. An Introduction. By Günter Dietrich. Transl. from German by Feodor Ostapoff. 588 pp. Interscience, New York, 1963. $20.00.

HANDBOOKS, TABLES, ETC.

Soviet Men of Science. Academicians and Corresponding Members of the Academy of Sciences of the USSR. By John Turke-