This is an extremely ambitious program, the last attempt of this magnitude having occurred fifteen years ago, when E. Waetzmann with the aid of about twenty collaborators published the two volumes entitled Technische Akustik in the series called Handbuch der Experimentalphysik. The Waetzmann group and Beranek posed for themselves similar tasks: namely to spell out the basic facts underlying acoustic measurements, to describe the most important acoustic appartus, to discuss the most useful methods of electro-acoustic measurement, and finally, to give as much theoretical material as necessary for the intelligent performance and evaluation of acoustic measurements. The mere enumeration of these tasks suffices to indicate the scope of the undertaking.

Beranek introduces his subject with a brief history of acoustic measurements, a 20 page section on terminology, and a generalized discussion of the propagation of sound through a medium that can be either free of obstacles or encumbered with spheres, cylinders, disks, and the like.

Following this, he goes into the matter of techniques for measuring sound pressure and particle velocity, being concerned largely with the reciprocity technique of calibration. Microphones and ears are treated at length; problems of measuring frequency, acoustic impedance, and man's ability to hear are discussed; various sound sources are considered for test purposes; and three chapters are devoted to the measurement of the characteristics of complex waves. Included in this section are discussions of some statistical properties of random noise, and also of various kinds of indicating instruments and analyzers.

The next major section of the book deals with tests: tests for microphones, earphones, loudspeakers, hearing aids, and other components of communication systems. And since we must test entire systems by means of listeners, there follows a chapter on articulation tests, including instructions for the statistical treatment of data. After two chapters dealing with room acoustics and acoustic materials the last chapter is dedicated to the sound level meter.

Beranek's book is certainly up to date as far as the American literature goes, although it bears perhaps too heavily the imprint of the last decade, which in Beranek's own opinion was essentially a period of applied acoustics. This was the period during which the author was in the thick of acoustic research, and therefore, perhaps, it has been somewhat difficult for him to apply in his writing the selective filtering that distance in either time or space naturally imposes. But in a sense it is a point of merit that Beranek has been a faithful recorder of the contemporary scene in American acoustics.

The style of his book is pleasant and only occasionally is it handicapped by its role of being almost a summary technical report. The level of exposition is appropriate for the public it wants to serve. One can safely predict that Beranek's book will find a place on the shelf of students and workers in acoustics. Those who do research in more fundamental aspects of the field will find it a convenient aid to be used in conjunction with basic works by such authors as Rayleigh, Morse, Bergmann, and others.

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More Usable Machines

APPLIED EXPERIMENTAL PSYCHOLOGY. By A. Chapanis, W. R. Garner, and C. T. Morgan. 434 pp. John Wiley and Sons, Inc., New York, 1949. $4.50.

Written as a beginning text in the field of engineering psychology, the style of writing in this book is exceptionally easy to follow and the authors have spared no means of making a rather difficult subject clearly understandable to anyone who might be interested.

The book is primarily concerned with what the communications engineer might call the coupling of a man to a machine. Important sections in it deal with means of displaying information, with the design of dials, with the design of tone signalling systems, with the design of controls such as those used in aircraft, and with the arrangement of work on production lines. Two excellent chapters are included which give summaries on the problems of fatigue, length of work periods, sleep, and on the effects of atmospheric conditions, noise, light, and color on human efficiency.

Applied Experimental Psychology differs markedly from previous books in the field in that it attempts to deal with the psychology of the human in relation to the job which he has to perform. Most of the results are in conformance with common sense. However, as an observer during the war, it was my experience that the average mechanical and electronic engineer pays little attention to what, after reading this book, seems obvious.

I was not able to discover any errors of consequence. At one point I was pleased to note four typographical errors in two sentences, only to find in the following sentence that the authors said I should have found five.

This work left me with one minor negative impression. The authors seem to have tried so hard to clarify the subject matter that they became a little talkative. The result was that insufficient space remained for them to introduce more detailed aspects of the experiments which they report. Also, in some cases, I feel that their attempts to simplify concepts leads one to believe that the data are of superficial significance.

It would please me to see this book on the shelves of electronic and mechanical design engineers throughout the country. I am certain that widespread reading of it will result in great improvement in the usability of machines of the future.

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Rockets

ROCKET PROPULSION ELEMENTS. By George P. Sutton. 294 pp. John Wiley and Sons, Inc., New York, 1949. $4.50.

In the growing engineering field of jet propulsion, perhaps the least well documented part is the one which relates to rocket power plants. Although rockets are devices of great antiquity, it is only in the last decade that serious effort has been made to develop them. It seems to this re-

viewer that it is desirable to bring the new subject of rocket engineering to the attention of physicists, since the design of rockets requires exploration into new problems of thermodynamics, materials, structures, physical chemistry, combustion, heat transfer, hydraulics, and fluid dynamics.

G. P. Sutton's book Rocket Propulsion Elements is an endeavor to bring together in less than three hundred pages sufficient information on these various topics to give a perspective on rocket design to persons unacquainted with the field, but who have the usual undergraduate training in thermodynamics, chemistry, and mechanics. This work is the first publicly available and unclassified book on the specific subject of rockets.

There is a chapter on the vocabulary and the concepts peculiar to rocketry, after which comes a quick sketch of rocket history, which dates back to the year 1232. This is followed by a long quantitative chapter on "nozzle theory," which combines enough thermodynamics with fluid mechanics to permit calculation of the velocity of the exhaust jet and the magnitude of the rocket thrust. This material is essentially an application of the supersonic de Laval nozzle flow theory used in turbine and wind-tunnel design.

The fourth chapter discusses to a rather limited degree the physical chemistry necessary to calculate the temperature and velocity of the exhaust gases when a particular chemical reaction is specified. In the fifth chapter a descriptive catalog of the qualitative properties of the most common liquid rocket propellants is given, after which in chapter six a discussion of the mechanical design of the rocket motor proper is presented. This latter topic is one in which the author is well versed by experience, and he discusses the hydraulic and heat transfer aspects of the mechanical design with commendable clarity.

An important chapter is number seven, on liquid propellant feed systems. The design of gas pressurizing systems, pumps, and tanks largely determines the empty weight and hence the efficiency of the overall rocket vehicle. This chapter features a diagram of the "plumbing" of a V-2 rocket, a system fully as complex as a gas flame refrigerator.

The concluding chapters on ballistics of rocket vehicles, experimental rocket test procedures, and solid propellant rockets are so limited in extent as to be of more cultural than engineering value. It is unfortunate that security restrictions and the author's own personal preferences precluded a fuller treatment of the important field of solid propellant rockets.

In summary one may say that a judicious selection of material has been clearly presented at an elementary to intermediate level. Space limitations have prevented really adequate treatment of a number of topics, but the book accomplishes its stated function of discussing the "elements" of rockets in a very satisfactory and workmanlike manner. It should prove interesting to a large group of students, engineers, and applied physicists.

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Useful Isotopes

ISOTOPIC CARBON. Edited by Melvin Calvin, Charles Heidelberger, James C. Reid, Bert M. Tolbert, and Peter E. Yankwich. 376 pp. John Wiley & Sons, Inc., New York, 1949. $5.50.

Isotopic Carbon gives its reader an authoritative and extremely complete discussion on the techniques of using stable and radioactive carbon isotopes. The book presents not only the advantages but also the pitfalls in the use of these materials, and contains a wealth of specific examples of isotopic utilization along with numerous diagrams of equipment employed. A considerable portion of the volume is devoted to biological and chemical synthesis of isotope labeled compounds. The appendices contain much helpful information on radioactivity assay, appropriate statistical methods, and equipment generally used for isotopic carbon research—features which will prove extremely helpful to the neophyte in the field as well as to workers in the most advanced laboratory.

The make-up of the book is good; the illustrations and presentation are clear. The authors are to be congratulated on the quality of the manuscript.

Paul C. Aebersold
U. S. Atomic Energy Commission

Books Received

HEAT TRANSFER, VOLUME I. By Max Jakob. 758 pp. John Wiley and Sons, Inc., New York, 1949. $12.00.

AN INTRODUCTION TO CRIMINALISTICS. By Charles E. O'Hara and James W. Osterburg. 705 pp. Macmillan Company, New York, 1949. $10.00.

AN INTRODUCTION TO THE MECHANICS OF VISCOUS FLOW. By H. F. P. Purday. (Printed in England as STREAMLINE FLOW.) 185 pp. Dover Publications, Inc., 1949. $2.50.

MATHEMATICS DICTIONARY. (Revised and Enlarged Edition.) Edited by Glenn James and Robert C. James. 432 pp. D. Van Nostrand Company, Inc., New York, 1949. $7.50.

MODERN OSCILLOSCOPES AND THEIR USES. By Jacob H. Ruiter, Jr. 326 pp. Murray Hill Books, Inc., New York, 1949. $6.00.

MODERN SCIENCE AND ITS PHILOSOPHY. By Philipp Frank. 324 pp. Harvard University Press, Cambridge, Massachusetts, 1949.

ELEMENTARY MODERN PHYSICS (Revised Edition of AN ELEMENTARY SURVEY OF MODERN PHYSICS). By Gordon Ferrie Hull. 503 pp. Macmillan Company, New York, 1949. $5.25.

THE NATURE OF PHYSICAL THEORY. By P. W. Bridgman. 138 pp. Princeton University Press, 1936. Dover Publications, Inc., 1949. $2.25.

INTRODUCTION TO SEMIMICRO QUALITATIVE ANALYSIS. By C. H. Sorum. 196 pp. Prentice-Hall, Inc., New York, 1949. $2.65.

THE THEORY OF ATOMIC COLLISIONS. Second Edition. By N. F. Mott and H. S. W. Massey. 388 pp. Oxford University Press, London, 1949. $8.75.

THE THEORY OF GROUPS AND QUANTUM MECHANICS. By Hermann Weyl. Translated from the Second Revised German Edition by H. P. Robertson. 422 pp. Dover Publications, Inc., New York, 1949. $4.50.

THE PHYSICAL PRINCIPLES OF THE QUANTUM THEORY. By Werner Heisenberg. English Edition. 183 pp. Translated from the German by Carl Eckart and Frank C. Hoyt. Dover Publications, Inc., New York, 1949. $2.50.