Book Reviews

A History of Mechanical Inventions. Abbott Payson Usher. Harvard Univ. Press, Cambridge, Mass., rev. ed., 1954. xi + 450 pp. Illus. $9.

One might expect that the author of a comprehensive treatise on the history of mechanical inventions would be a professor of mechanical engineering, so engrossed in his subject as to delve deep among its hidden foundations. But while the professorial rank attributed to the author of this excellent book proved to be correct, it turns out (although this is not disclosed on the title page) that Usher is professor emeritus of economics at Harvard, with a very pronounced liking for history. But I think many of his readers will agree with me that with a little encouragement he might have become an engineer.

The book is in fact a revised and enlarged edition of an earlier work by the same author published in 1929 under the same title. The first four chapters present entirely new material. Their titles, in order, are "The place of technology in economic history"; "Historical analysis of social change"; "The particular system of events"; and "The emergence of novelty in thought and action." They are designed to provide the reader with a systematic statement of the philosophic and psychological theory that guided the author in the preparation of the descriptive and narrative chapters. As such, they should also be of interest and assistance to historians engaged in other fields. But they are not easy reading, and many readers will early be inclined to take the author's word for it and jump to the juicier chapters that follow.

These later chapters present to the student of mechanical inventions an intriguing story, with a wealth of detail, supplemented by many drawings and richly documented. They include the mechanical equipment of pre-Christian antiquity; water wheels and windmills; water clocks; mechanical clocks and their development into instruments of precision; printing; textile machinery; machine tools and quantity production. With the exception of the last chapter on the production and distribution of power, the historical account ends at 1850 and usually earlier. To me the transcendent chapter of all is the one devoted to Leonardo da Vinci, engineer and inventor.

It is of interest to note that photographic typesetting has been employed in producing this book. The result is pleasing, and it is fitting that the book itself should exemplify a new invention.

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The Physics of Experimental Method. H. J. J. Braddick. Wiley, New York, 1954. xx + 404 pp. Illus. $7.

Now that it is no longer practicable, with the increased enrollments in physics, to have undergraduates make minor repairs on their equipment or to design and build apparatus for their experiments, many colleges have introduced courses in laboratory arts. Braddick gives such a course at the University of Manchester entitled "The physics of experimental method." This book, bearing the same title, was written for the course. It is not and was not intended to be a source book for the student looking for detailed procedures and techniques. The course for which it was written is a lecture course, and, as the title indicates, it is primarily concerned with basic physical principles as they apply to experimental work. However, references to original sources and to other books are given so that the details of procedures may be found.

The student will find the chapters on "Errors and the treatment of experimental results," "Mechanical design," "The natural limits of measurements," and "Electronics" particularly valuable. This last chapter is for those who have not had a course in circuitry. The chapter on "Mechanical design," which deals with degrees of freedom, hysteresis, optimum size, and vibration, is especially well done and covers a field neglected by most teachers.

Those who have had a course in light will find little that is new in the chapter on optics, and most students will be disappointed that the chapter on nuclear physics is so brief. My chief criticism of the book is that too many items are discussed too briefly. For example, three pages are devoted to electric motors and three to vacuum gages.

This book is recommended for courses concerned with the broad aspects of experimental investigation. For courses emphasizing a particular area—for example, nuclear physics—and for those designed to develop manipulative skills, it should be available, and perhaps required, for supplementary reading.

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The Microtomist's Formulary and Guide. Peter Gray. Blakiston, New York, 1954. xiii + 794 pp. Illus. $10.50.

This is a valuable source and reference book for anyone who is concerned with the preparation of biological materials for microscopic examination. Numerous books on histologic technique are available, but not one of them written in English is equal to this work in logical organization and comprehensiveness.

There are 28 chapters. The first 16 chapters deal with the preparation of microscope slides. Chapters are devoted to whole mounts, smear and squash preparations, ground sections, paraffin, nitrocellulose, frozen sections, and methods utilizing injection masses. The chapters are well illustrated. Many of the drawings and much of the text of these first 16 chapters are to be found in the author's *Handbook of Basic Microtechnique.*

The last 12 chapters, which comprise more than two-

thirds of the book, contain methods and formulas for 3500 histologic preservative, fixative, staining, mounting, and miscellaneous procedures. These are grouped according to a decimal classification. Each chapter begins with an outline of its contents. The directions are considerably condensed by the uniform use of the metric system, with the solutions adjusted generally to give 100 parts, except for the fixatives which are adjusted to give 250 parts.

A discussion of the more important methods is included, and practical applications are frequently given. Literature references appear to be complete.

It is unavoidable in a book of this type that many procedures of purely historical interest are included. Perhaps the book will serve to revive some of the beautiful techniques that were the pride of the older microscopists but which are unsuited to the modern mass production of slides.

The Microtomist's Formulary and Guide shows an almost deliberate avoidance of histochemical methods. Even the Prussian blue procedures, which have been used by biologists for almost a century, are excluded.

This book should be a part of the library of every serious histology laboratory.

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Instrumental Analysis. John H. Harley and Stephen E. Wiberley. Wiley, New York; Chapman & Hall, London, 1954. vii + 440 pp. Illus. $6.50.

This book aptly fills a very definite need. The tremendous increase in instrument methods of chemical analysis has called for just this type of treatment. The authors discuss both the theory and applicability of practically all currently used instrument techniques. Sufficient theory is given so that a clear-cut understanding of the principles of a method is possible. Copious literature references are included for the reader who seeks more detail, but the treatment in this book is adequate for most purposes.

It is refreshingly up to date and supplies the reader with pertinent information on specific commercial instruments now on the market. Of course it is inevitable that some of the information given no longer holds true, but that is the penalty paid for completeness. I would have liked to have seen some reference to the use of the pressed-disc KBr technique in infrared because of its importance and usefulness, but perhaps this is expecting too much since it is only a year or so since this technique was introduced.

In general the authors have brought the latest developments in each of the fields discussed to the fore, and they are to be commended on the clarity of their presentation. This book should be useful not only to the practicing analytic chemist, in giving him both the fundamental principles involved for new techniques and sufficient practical know-how so that he can make use of a method, but it should be of even greater value to the nonanalytic chemist in giving him, under one cover, the theory and power of the newer analytic techniques and sufficient information to enable him to make a good estimate of the probable applicability of a specific technique to a specific problem.

The instrument techniques that are discussed include visible, ultraviolet, and infrared spectrophotometry; Raman and emission spectroscopy; fluorometry; flame photometry; colorimetric *p*H, potentiometric, conductimetric, amperometric, and high-frequency titrimetry; polarography; x-ray and mass spectrometry; and, of course, radiotracer techniques. A chapter on practical experiments is included to serve for a college laboratory course. This is an excellent treatment, remarkably brief and clear, of a complex field of science.

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Adhesive Bonding of Metals. George Epstein. Reinhold, New York, 1954. ix + 218 pp. Illus. $2.95.

It is probable that relatively few people are aware of the increasing extent to which industrial adhesives are being used as substitutes for rivets, bolts, weldments, and other conventional methods of fastening metal parts together. The author states:

> It is the purpose of this book to give sufficient details so that an engineer or technician, faced with the problem of joining two materials, will be able to determine if an adhesive bonded joint would be advantageous, what type of adhesive to select, how to employ the adhesive and how to design the joint for optimum performance.

All things considered, the book comes surprisingly close to achieving this rather ambitious goal.

After an introductory chapter discussing the advantages of adhesive fastening, with perhaps insufficient attention to the disadvantages, the chemistry of the basic materials is reviewed. The real meat of the book is contained in three valuable and lucidly written chapters dealing with the problems of formulation of metal adhesives, design and testing of adhesive joints, and bonding techniques.

The roles and effects of the various ingredients in the formulation of adhesives are discussed extensively, and examples are given. Emphasis is placed on thermosetting structural (high strength) adhesives. In the chapter on bonding techniques, emphasis is placed on the very important step of surface preparation, and detailed instructions are presented for the optimum mechanical and chemical surface treatments for many metals and alloys.

Two briefer chapters are devoted to heat-resistant adhesives and adhesively bonded metal sandwich structures. The author has drawn extensively on the growing applications in the air-frame industry for most of the many illustrative examples.

The book is not without faults. The tyro is not warned of the difficulties that may be encountered because of adsorption of moisture. The second chapter, dealing with the chemistry of adhesives, will un-