and well written. The data on fluorescent screens is outstandingly good.

It is unfortunate that the rubber sheet and the electrolytic tank methods for experimental determination of electrode shapes have been omitted.

Techniques in experimental electronics is directly comparable to the well-known book by Strong, *Procedures in experimental physics.* Strong's book covers a very wide field of techniques quite adequately but is in consequence a little spotty. It has also become a little obsolescent in 10 years without revision. Bachman's book is fresh, concise, and coherent, but limited in scope.

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Radar beacons. Arthur Roberts. (Ed.) (Massachusetts Institute of Technology Radiation Laboratory Series.) New York-London: McGraw-Hill, 1947. Pp. xx + 489. (Illustrated.) $6.00.

Radar beacons, the third volume in the 28-volume Radiation Laboratory Series, summarizes the work of Division 7 of the Radiation Laboratory during the war, and it is believed to be the only book on this subject ever written. L. A. Turner was head of this division, with A. Roberts and M. D. O'Day serving as group leaders. The book lists 8 additional members of the editorial staff and 21 additional contributing authors. It is well illustrated with 246 figures, including numerous block and circuit diagrams and many photographs of complete beacon systems.

The volume is divided into four parts: (I) Basic Considerations, Chapters 1–6; (II) Beacon Design, Chapters 7–16; (III) Interrogator and System Design, Chapters 17–19; and (IV) Beacons in the Field, Chapter 20. Approximately one-quarter of the book is devoted to Part I, one-half to Part II, and one-quarter to Parts III and IV. The book is thus intended primarily for design engineers rather than for operational staff. For example, the amazingly large number of military uses of radar beacons are mentioned only briefly. Presumably much of this information is still classified. For all radar engineers, as well as for the highly specialized beacon engineer, the book would seem to be indispensable, since a radar designed without a full appreciation of beacon problems can hardly be expected to give completely satisfactory beacon performance. Most radars, whether ground, ship, or airborne, have found increased usefulness when provision is made for beacon operation.

The first chapter, written by L. A. Turner and A. Roberts, describes the uses of beacons. Though brief, it is a remarkably clear account of the way radar beacons were adapted during the war, first to defensive operations (submarine hunting) and later to offensive operations (strategic and tactical bombing). From the many uses of beacons one must indeed agree that "they also serve who only stand and wait."

The 5 remaining chapters of the first part treat such basic considerations as range, coverage, frequency, coding, and traffic capacity. The next 10 chapters, forming the second part, consider in detail the design of the many radar components peculiar to beacons, such as discriminators, coders, and special types of transmitters, receivers, antennas, and control devices. Chapters 17 and 18 are devoted to interrogator design and would be of particular interest to engineers designing radars. Chapter 19 describes complete beacon systems now available and the performance to be expected of such complete systems, while the final chapter discusses the installation, operation, and maintenance of beacons.

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Vacuum tubes. Karl R. Spangenberg. New York-Toronto-London: McGraw-Hill, 1948. Pp. xvii + 860. (Illustrated.) $7.50.

This is an excellent textbook for early graduate or late undergraduate study of vacuum tubes—of vacuum tubes alone. Circuits and gas phenomena are hardly mentioned, but the treatment of vacuum tubes, from diodes, triodes, tetrodes, and pentodes through cathode-ray tubes and photocells to klystrons, magnetrons, and "special" tubes is modern and penetrating.

The author says in the preface: "It is hoped that the view taken will be acceptable to both physicists and engineers." It should be, because the book is a reflection of the continuous struggle between the analytical and the experimental methods of advancing the subject matter. For example, in the chapters on "Determination of Potential Fields" and "Laws of Electron Motion," analytical expressions, which include relativistic masses and energies, are developed for the trajectories of charged particles in comparatively simple cases of electric and magnetic field configurations. Then, in order to handle the complicated electrode structures, those overbelittled "ingenious gadjets" are described, such as elastic-membrane and current-flow models and the graphical methods for determining electron paths. Theory and experimentation follow each other in this book just as they do in the development, design, and use of vacuum tubes.

After considerable attention to the physical principles, emphasis is shifted to the design and utilization of the tubes. There are numerous nomographs, design charts, field configurations, and a chapter on high-vacuum practice. There are 216 problems and excellent references to books and original papers to provide stimulus to the student. The rationalized MKS system of units is used throughout.

The book is especially outstanding for its chapters on Tetrodes, Pentodes, Tube Noise, Klystrons, and Magnetrons. There is much material presented here in textbook form for the first time.

The index seems to be too brief. Mention of Hull and Williams in connection with the early work on the screen-grid-tube seems to be missing. But the book is largely free from errors and the format is excellent. It is the second in the publisher's "Electrical and Electronic Engineering Series," the first of which is the well-known text, *Radio engineering,* by F. E. Terman.

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