

**RADIO RECEIVING AND  
TELEVISION TUBES**

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JAMES A. MOYER

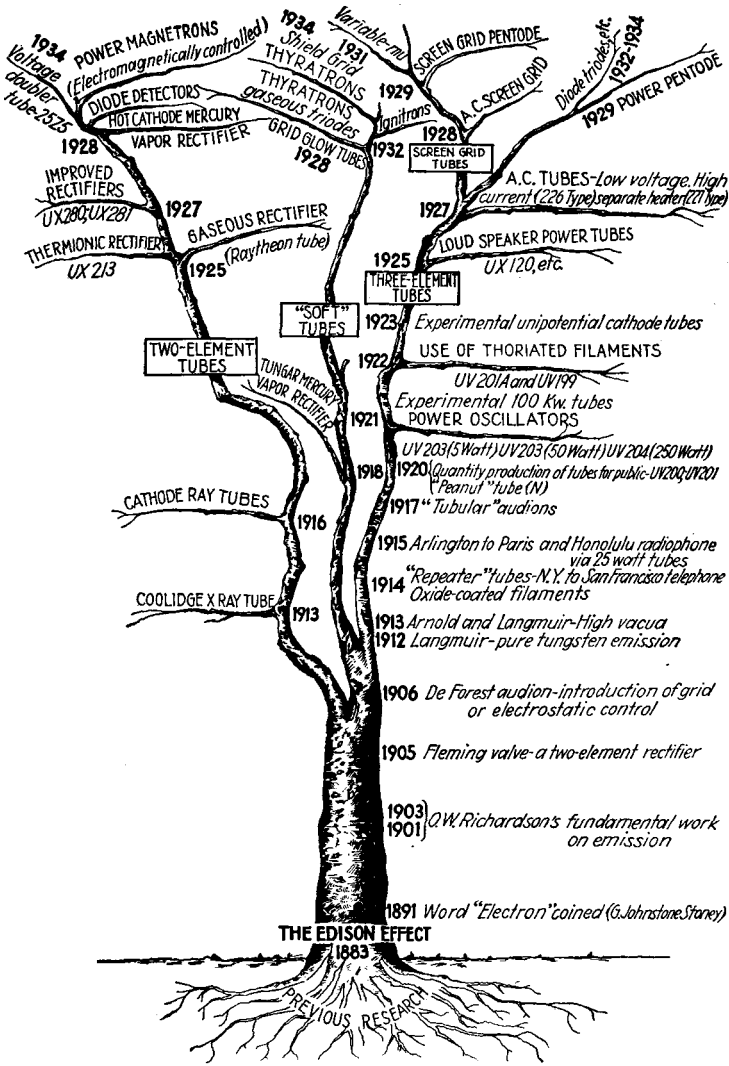
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TUBES  
RADIO HANDBOOK  
INDUSTRIAL ELECTRICITY AND WIRING

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Development of electronic tubes.

# RADIO RECEIVING AND TELEVISION TUBES

INCLUDING APPLICATIONS FOR DISTANT CONTROL  
OF INDUSTRIAL PROCESSES AND PRECISION MEASUREMENTS

BY

JAMES A. MOYER, S.B., A.M.

*Director of University Extension, Massachusetts Department of Education,  
Member of Federal Commission on Radio Education; Member of American  
Institute of Electrical Engineers; Fellow of the American Association  
for the Advancement of Science; Fellow of the Royal Society of  
Arts; Mitglied des Vereines Deutscher Ingenieure; Membre  
Titulaire Association Internationale du Froid; Member  
of the Franklin Institute; American Society of  
Mechanical Engineers; Society of Automotive  
Engineers*

AND

JOHN F. WOSTREL

*Instructor in Radio Engineering, and Supervisor in Charge of Industrial  
Subjects, Division of University Extension, Massachusetts  
Department of Education*

THIRD EDITION

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## PREFACE TO THE THIRD EDITION

Every year a seemingly new crop of radio tubes comes from the laboratories of the manufacturers. Although their bewildering technical names refer in most part to improvements rather than to fundamental changes, there have been in the last few years many really important developments which have had a significant influence on the application of all kinds of electronic equipment.

When the previous edition was published, the radio receiving tubes then in practical use had only two, three, or four elements. With the development and introduction into practical designing of tubes with five, six, or more elements, combining in one tube the functions that were formerly performed by two or more tubes, there were, of course, made available to the designer opportunities for obtaining results in radio reception that previously were economically impossible.

The introduction of all-metal tubes by which the glass bulb of radio receiving tubes is replaced by a much smaller thin metal cylinder has made it possible for engineers to make their new designs more compact and safer in transportation than before.

In this revision, the previous edition has been entirely rewritten and reset; information that is no longer of general usefulness to designers has been omitted, and emphasis has been given to the strictly modern types of tubes and their applications, not only in radio receiving and television equipment, but also in other practical uses.

Opportunities for employment in the radio and television fields, and, in fact, in the whole general field of electronics, may be said, in the words of a well-known and successful engineer, to lie "both forward and sidewise—forward into

new types of applications, and sidewise into more extensive use in the services for which they have already demonstrated their value." Those having guidance responsibilities in universities, engineering colleges, and technical institutes may very well have in mind these facts, so that courses in engineering science may be arranged to include electronic theory and practice. Such employment possibilities, important as they are for the person recently graduated, are equally important, however, for the engineer who graduated before the modern electron tube was invented or before it emerged from the laboratory and entered into actual services. Those engineers of an earlier vintage in graduation who have not had the benefit of systematized instruction in the subject of electronic theory and practice while in college should somehow acquire a knowledge of the fundamental characteristics and applications of the new electronic tubes—whether or not they have permanent employment—or they are much in danger of dropping behind in their profession.

The authors are especially indebted in the preparation of this revision to M. J. Carrol of the R.C.A. Victor Corporation, Camden, New Jersey; Chester L. Dawes, Professor of Electrical Engineering, Harvard University, Cambridge, Massachusetts; C. Davis Belcher, Boston, Massachusetts; and also to the Raytheon Production Corporation, and the Hygrade-Sylvania Corporation, for important text material.

In the preparation of this revision, frequent references have been made to the current issues of *Electronics*, *Electrical Engineering*, *General Electric Review*, *Electric Journal*, *Proceedings of the Institute of Radio Engineers*, and the *Journal of the Franklin Institute*. The engineering departments of the Westinghouse Electric and Manufacturing Company, Radio Corporation of America, and Bell Telephone Laboratories have made valuable contributions.

THE AUTHORS.

## PREFACE TO THE FIRST EDITION

Until the invention of printing, the communication of news and ideas was accomplished almost entirely by word of mouth. Thereafter, the avenues of communication were broadened enormously, and as a result the eye supplanted the ear as the principal external medium for the reception of ideas. With the present development of radio devices, the ear has come into its own again. Sound borne upon radio waves transcends space and transcontinental communication is commonplace. This remarkable accomplishment owes much to the vacuum tube, the most essential part of all radio apparatus.

In a comparatively short time, there has been a great increase in the use of vacuum tubes for radio purposes. Concurrently, popular interest in a practical knowledge of radio principles and radio operation has greatly increased.

In this book the essential principles underlying the operation of vacuum tubes are explained in a manner calculated to present a well defined picture to students and general readers. The vacuum tube possesses a remarkable variety of functions and, accordingly, this book includes, in addition to the use of two- and three-element vacuum tubes for radio reception and transmission, other applications that are of considerable practical significance. These additional applications include the remote control of airplanes and sea-going vessels by the use of instruments which employ vacuum tubes in essential capacities, as well as methods of applying vacuum tubes to the remote control of humidity and similar uses. The first chapter of the book is introductory; its purpose is to outline briefly some present theories concerning the flow of electrons from highly heated bodies to those which are relatively cool.



The authors wish to express their appreciation of the assistance they have received from Mr. Glenn H. Browning of the Browning-Drake Corporation and Mr. Horatio Lamson of the General Radio Company, and to acknowledge the contributions made by the Radio Corporation of America, the General Electric Company, the New England Telephone and Telegraph Company and E. T. Cunningham, Inc.

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