

ELECTRICAL ENGINEERING TEXTS

---

# THEORY OF THERMIONIC VACUUM TUBES

FUNDAMENTALS—AMPLIFIERS—DETECTORS

BY

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## PREFACE

This book is based on the author's lecture notes for a course on vacuum tubes given at Harvard University since 1922. As the preparation of the manuscript progressed, it became apparent that not all of the material could be contained in a single book. Consequently, only the theory of the operation of vacuum tubes at low power is presented here; the remaining material, including the theory of power amplifiers and oscillators, gas-content tubes, rectifiers, etc., will, according to present plans, appear in a second book.

Although this book is written primarily as a textbook, it is hoped that it will serve also as a reference book. The author has endeavored to present only the fundamental principles of the subject, avoiding discussion of the multifarious circuits in which the vacuum tube may be used. The circuits and applications of vacuum tubes change from year to year but the fundamental theory is the same for all time. With an understanding of the principles, any circuit and any application can be analyzed.

Certain sections, which go into considerable detail, may to advantage be omitted on the first reading of the book. For the guidance of the reader these sections are indicated by an asterisk(\*).

The author takes this opportunity to express his gratitude to his wife, always a companion, coworker, and inspiration in the preparation of the manuscript; to David P. Wheatland who so generously assisted in collecting experimental data and in reading the proofs, and to all others who have aided in various ways. The author wishes especially to acknowledge his obligation to Prof. H. E. Clifford, Dean of the Harvard Engineering School, for his many valuable suggestions and corrections in editing the manuscript.

E. L. C.

CRUFT LABORATORY, CAMBRIDGE.  
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Vacuum Tubes or Thermionic Valves come in many forms including the Diode, Triode, Tetrode, Pentode, Heptode and many more. These tubes have been manufactured by the millions in years gone by and even today the basic technology finds applications in today's electronics scene. It was the vacuum tube that first opened the way to what we know as electronics today, enabling first rectifiers and then active devices to be made and used.Â Thermionic basics The simplest form of vacuum tube is the Diode. It is ideal to use this as the first building block for explanations of the technology. It consists of two electrodes - a Cathode and an Anode held within an evacuated glass bulb, connections being made to them through the glass envelope. It was also called a thermionic valve, vacuum diode, kenotron, thermionic tube, or Fleming valve. Fleming made numerous contributions not only to electronics, but also to photometry, electric measurements and wireless telegraphy. He became a consultant to the Edison Electric Light Company and a popular teacher at University College.Â Fleming was the author of more than a hundred scientific papers and books, including the influential "The Alternate Current Transformer" (1889), "The Principles of Electric Wave Telegraphy" (1906), "The Propagation of Electric Currents in Telephone and Telegraph Conductors" (1911) and "Memoirs of a Scientific Life" (1934).