

CONTENTS

| | PAGE |
|---|------|
| CHAPTER 1 | |
| MEET THE ELECTRON | |
| CHAPTER 2 | |
| ELECTRON ESCAPE FROM SOLIDS | 12 |
| Thermal emission | 13 |
| Photoemission | 15 |
| Secondary Emission | 17 |
| High-Field Emission | 18 |
| CHAPTER 3 | |
| ELECTRICITY FROM LIGHT | 21 |
| Photoemissivity | 21 |
| Photovoltaic Devices | 26 |
| The Multiplier Phototube | 30 |
| CHAPTER 4 | |
| ELECTRICITY INTO LIGHT | 33 |
| The Cathode-Ray Oscilloscope | 40 |
| The Electron Microscope | 48 |
| Electronic Lamps | 53 |
| CHAPTER 5 | |
| TWO-ELEMENT TUBES | 60 |
| Classification of Two-Element Tubes | 60 |
| Kenotrons | 62 |
| Properties of a Gas Discharge | 68 |
| Introduction of Gas in Thermionic Tubes | 73 |
| Phanotrons | 76 |
| Gas Pressure and Operating Temperature | 79 |
| CHAPTER 6 | |
| THREE-ELEMENT PILOTRONS | 83 |
| The Function of the Triode | 83 |
| Grid Control of Space Charge | 83 |
| Triode Characteristics | 88 |
| CHAPTER 7 | |
| MULTIGRID PILOTRONS | 99 |
| Tetrodes | 99 |
| Interelectrode Capacitance | 103 |

CONTENTS

| | PAGE |
|---|------------|
| Pentodes | 104 |
| Beam Power Tubes | 106 |
| Variable-Mu Tubes | 110 |
| Multielement Tubes | 112 |
| CHAPTER 8 | |
| THYRATRONS | 116 |
| Cathodes | 118 |
| Anodes | 118 |
| Grids | 118 |
| Control Characteristics | 123 |
| Shield-Grid Thyratrons | 127 |
| CHAPTER 9 | |
| FROM ALTERNATING TO DIRECT CURRENT | 131 |
| Single-Phase Rectifier Circuits | 132 |
| Three-Phase Rectifier Circuits | 141 |
| Multiphase Rectifier Circuits | 149 |
| Voltage Doubler | 150 |
| Filters | 154 |
| Table of Rectifier Circuit Characteristics | 164 |
| CHAPTER 10 | |
| MERCURY-POOL TUBES | 168 |
| Mercury-Arc Rectifiers | 169 |
| Ignitrons | 171 |
| Excitrons | 187 |
| CHAPTER 11 | |
| AMPLIFICATION | 195 |
| Principles of Amplification | 195 |
| Amplifier Operation | 197 |
| Untuned Multistage Amplifiers | 209 |
| Representation of Amplifier Characteristics | 210 |
| Manner of Coupling Amplifiers | 213 |
| Push-Pull Amplifiers | 220 |
| Tuned Amplifiers | 223 |
| Tuned Voltage Amplifiers | 223 |
| Tuned Power Amplifiers | 225 |
| CHAPTER 12 | |
| PRINCIPLES OF OSCILLATION | 231 |
| A-C Circuits Containing Resistance, Inductance, and Capacitance | 232 |
| Oscillator Principles | 237 |
| Oscillator Circuits | 245 |
| Oscillator Operation | 248 |
| Frequency Stability with Crystal-Controlled Oscillators | 252 |
| Dynatron Oscillator | 255 |
| Beat-Frequency Oscillators | 256 |

CONTENTS

PAGE

CHAPTER 13

| | |
|---|-----|
| MODULATION AND DETECTION OF CARRIER WAVES | 262 |
| Producing Amplitude-Modulated Carrier Waves | 265 |
| Demodulation or Detection of Amplitude-Modulated Waves | 269 |
| Producing Frequency-Modulated Carrier Waves | 272 |
| Demodulation of Frequency-Modulated Carrier Waves | 274 |
| Suppressing the Carrier Wave — Single-Sideband Transmission | 277 |
| Industrial Applications of Carrier | 280 |

CHAPTER 14

| | |
|--|-----|
| HEATING BY HIGH FREQUENCY | 288 |
| Induction Heating | 291 |
| Radio-Frequency Generators and Applications | 291 |
| Calculations for Induction Heating | 296 |
| Where Induced Currents Flow | 296 |
| Calculation of Equipment Necessary for Induction Heating | 299 |
| Heating by Proximity — Flat Nonmagnetic Plate | 306 |
| Typical Examples of Induction Heating | 322 |
| Dielectric Heating | 339 |
| Computing the Radio-Frequency Generator Requirements | 342 |
| Voltage Limitations | 342 |
| Frequency Limitations | 343 |
| Impedance Matching | 343 |

CHAPTER 15

| | |
|---|-----|
| BASIC CIRCUITS OF ELECTRONIC CONTROL | 355 |
| D-C Supply for Anode and Grid Potentials | 355 |
| Pliotrons — for Proportional Control of Direct Current | 359 |
| Thyratrons — for Instantaneous Control of Direct Current | 359 |
| Thyratrons — for Proportional Control of Alternating Current | 362 |
| Circuits for Shifting the Phase of the Grid Voltage | 366 |
| Peaking Transformer | 369 |
| Thyratron Control by Peaking Transformer | 371 |
| Inverse-Parallel Connection of Thyatrons for Control of Alternating Current | 372 |
| Circuits for Electronic Timing | 375 |
| Circuits for Regulating Current and Voltage | 376 |
| Thyratron Inverters from Direct to Alternating Current | 379 |
| Thyratron-Circuit Details | 380 |

CHAPTER 16

| | |
|--|-----|
| INDUSTRIAL APPLICATION OF ELECTRONIC CONTROL | 388 |
| Electronic Timing | 388 |
| Photoelectric Relays | 392 |
| Resistance-Welding Controls | 402 |
| Electronic Motor Control | 430 |

CONTENTS

CHAPTER 17

| | |
|--------------------------------------|-----|
| ELECTRONIC REGULATORS | 443 |
| Static Regulators | 445 |
| Astatic Regulators | 453 |
| Astatic Voltage Regulators | 464 |
| Antihunting Circuits | 469 |
| APPENDIX | 489 |
| INDEX | 495 |