

Cambridge University Press

978-1-107-50224-6 - Thermionic Valves Their Theory and Design

A. H. W. Beck

Index

[More information](#)

INDEX

- Air, properties of, 336
 amplification factor, *see* μ
 amplifiers
 distributed, 291, 292
 grounded cathode, 416–19
 grounded grid, 396–9
 klystron, 347, 370–5
 magnetron, 500–2
 pentode, 286
 space-charge wave tube, 458–62
 travelling-wave tube, 426–63
 triode, 247
 triode, at ultra-high frequencies
 394–425
 anode materials, radiation from, 330
- β factor, 354
 Beam admittance,
 in diodes, 200–2
 in gaps, 199
 beam coupling coefficient, 354
- Cathodes,
 emission constants of, 16, 48, 49
 filamentary, 311–13
 L, 537–9
 oxide-coated, 43; de Boer's emission theory of, 49–51; frozen-hole theory of, 535; interface resistance effects in, 535–7; Loosjes-Vink theory of, 529, 531, 532
 Child's law, 147
 contact potential difference, 17
 conversion conductance, definition of, 304
 cooling,
 air-blast, 331–6
 radiation, 329–31
 water, 336–8
 current,
 circulating, 341
 induced in diode, 190
 Maxwell's total, 189
 Ramo's theorem, 189–91
 at very high frequencies, 193–7
- Dushman's equation, 9
 diodes,
 beam admittance in, 200–2
 characteristics of, 175
 conductance of, 177, 178
 current induced in, 190
 cylindrical, 148; effect of initial velocities in, 174
 effect of anode and cathode work-functions in, 178, 179
 effect of cathode temperature on, 179, 180
 equivalent of cylindrical triode, 260, 261
 equivalent of planar triode, 257–9
 Llewellyn's results for, 202
 planar, 146; Child's law, 147; effect of initial velocities in, 168–74; Langmuir's treatment of, 170, 171; tables of Langmuir's functions for, 527, 528
 retarding field limit, 177
 shot noise in temperature-limited, 223–8
 distributed amplifier, 291, 292
 dynatron, 279
- Electron guns,
 Bunemann's method for design of, 166–8
 Pierce's method for design of, 161–5
 electron motion,
 laws of, in electromagnetic fields, 110–14
 Lorentz equation, 111
 electron optical systems, aberrations in, 137–9
 electron optics,
 bibliography, 144
 limits on current density in, 139–43
 ray tracing in, 132–7
 space-charge corrections in, 156–61
 electrostatic deflexion, 113
 electrostatic lenses, 119–26
 electrostatic potential,
 general theorems on, 95, 96

Cambridge University Press

978-1-107-50224-6 - Thermionic Valves Their Theory and Design

A. H. W. Beck

Index

[More information](#)

INDEX

- electrostatic potential,
 Laplace's equation of, 96, 97
 potential in a cylindrical cup, 99
 relaxation method for potential problems, 100–102
 solution of problems, using conformal transformations of Laplace's equation, 102, 103, 249, 253; using electrolytic trough, 105–9; using resistance network, 560; using rubber sheet, 103–5
 energy distribution of emitted electrons, 11
- Fermi-Dirac distribution functions, 5
 Fermi's energy level, 4
 field emission,
 Fowler-Nordheim equation for, 71
 theory of, 69–72
 filaments, mechanical design of, 338–40
 fluorescence, *see* luminescence
 frequency conversion, 302–5
 frequency convertors, noise in, 308
- Glass,
 infra-red transparency of, 330
 secondary emission properties of, 54
- Klystron,
 amplifier, 347, 370–5; noise in, 392, 393, 552
 reflex, 351; bunching theory of, 375–8; design, 386–8; frequency pulling, 381–3; hysteresis in, 388–92; performance charts, 384, 385; power output and efficiency, 379
- Larmor frequency, definition of, 111
 lead inductance, 341
 lenses
 electrostatic, 110–26
 focal properties of, 122
 magnetic, 126–32
 Llewellyn's electronic equations, 206–12
 Llewellyn's results for diodes, 202
 luminescence,
 explained, 83
 intensity of, 83–5
 of phosphors, 83–4, 91–2
- luminescence,
 theory of, 86–9
- μ , definition of, 246; *see also* triodes
 magnetic lenses, 126–32
 magnetron,
 amplifier, 500–2
 Brillouin steady state, 473–7
 cavity circuits, 480–7
 historical, 464–7
 interaction between electrons and field, 489–96
 maximum efficiency of, 496–8
 r.f. field, 487–9
 Rising Sun, 485
 scaling relations, 498, 499.
 space-charge oscillations in, 478, 479
 strapping, 483
 theory neglecting space charge, 467–72
 theory with space charge, 472–7
 mosaic, photo-electric, 507
 mutual conductance, definition of, 246
- Networks,
 equivalent, for ultra-high-frequency triodes, 411
 four-pole, for ultra-high-frequency triodes, 414
- noise,
 analysis of, in ultra-high-frequency triodes, 422–5
 Campbell's theorem, 225
 circuit aspects of, 221–3
 excitation of, by space-charge waves, 552
 flicker, 239–42
 in frequency convertors, 308
 Johnson, in resistance, 216
 in klystron amplifiers, 392, 393, 552
 Nyquist's theorem of thermal, 220, 221
 partition, 237–9
 produced by diodes, 273–6
 produced by pentodes, 293
 shot, in current, 217; frequency distribution of, 227; Rack's theory of reduction of, 233–6; reduced by space charge, 228–36; in temperature-limited diodes, 223–8.

Cambridge University Press

978-1-107-50224-6 - Thermionic Valves Their Theory and Design

A. H. W. Beck

Index

[More information](#)

INDEX

- noise,
 in travelling-wave tubes, 457, 458, 548–55
 in triodes, 273–6
- Orthicon, 511
- oscillators,
 reflex klystron, schematic diagram, 351
 theory of, 375–92
 triode, 399–401
- oxide-coated cathodes,
 application of semi-conductor theory to, 38–41
 de Boer's emission theory of, 49–51
 emission equation for, 41
 emission mechanism, 29
 frozen-hole theory, 535
 interface resistance effects in, 535–7
 Loosjes-Vink theory, 529, 531, 532
 preparation of, 25
 pulsed emission from, 45
 saturated emission from, 29
- Pentagrid, 307
- pentodes,
 characteristics of, 282–8
 design of suppressor grid for, 292
 effect of *Inselbildung* in, 289, 290
 gain $\times$ band-width product of, 287
 interelectrode capacitance of, 289
 mutual conductance of, 288
 noise produced by, 293
 transmitting, 343
- phosphorescence, *see* luminescence
- phosphors, *see* luminescence
- photo-electric emission,
 from complex surfaces, 79–81
 effect of initial energies, 77
 Einstein relation, 73
 Fowler's method for measuring threshold frequency, 75, 76
 storage in picture-convertors, 504–6
 theory of, 75
 yielded by alkali metals, 78
- picture convertors,
 C.P.S. emitron, 515, 516
 emitron, 506–9
 iconoscope, 506–9
 image iconoscope, 509, 510
 image orthicon, 512
 orthicon, 510–15
- picture convertors,
 storage by photo-electric emission, 504–6
 storage by secondary emission, 516, 517
 super-emitron, 509, 510
- Poisson's equation, 145
- power relations in gaps, 197–202
- Reflector parameter, 378
- Richardson's equation, 9
- Scaling,
 in magnetrons, 498, 499
 relations, 213–14
 in transmitter valves, 343
- Schottky effect, 13
- secondary emission,
 coefficient for glass, 54
 from complex surfaces, 60–2
 from insulators, 58–60
 from metals, 52–8
 storage in picture convertors, 516, 517
 surfaces used for, 67–9
 theory of, 62–7
- single-stream theories, inadequacies of, 212, 213
- Snell's law, 114
- space charge,
 effect on transit-time, 186–8
 injection at high velocities, 180–6
- space-charge flow,
 in circular tunnel, 151
 in magnetic field, 152–5
 in rectangular tube, 149–51
- space-charge waves,
 effect of cylindrical tunnel on, 544–7
 effect of velocity jumps, 554
 excitation of noise by, 552
 Hahn-Ramo theory of, 540–7
- space-charge wave tubes,
 bibliography on, 463
 description of, 458, 459
 propagation constants of, 460, 461
- Stefan-Boltzmann law, 329
- storage tubes,
 barrier grid type, 519–22
 graphecon, 517–19
 selectron, 522–4
- Tetrodes,
 beam, 295–300

Cambridge University Press

978-1-107-50224-6 - Thermionic Valves Their Theory and Design

A. H. W. Beck

Index

[More information](#)

INDEX

- Tetrodes,
 screen grid, characteristics of, 277–9; electrostatic theory of, 280–2
 transmitting, 343
thermionic emission,
 employment of pure metal emitters, 19, 20, 314–18
 measurement of, 12, 14
 from oxide-coated emitters, 25–51, 529–39; *see also* oxide-coated cathodes
 from pure metals, 1–20
 from thin films, 20–5
triode-heptode, 305, 306
triode-hexode, 305, 306
travelling-wave tubes,
 beam dynamics in extended field, 431–433
 bibliography on, 463, 564
 comparative performance of, 430
 effect of attenuation on propagation constant, 436, 437
 effect of beam on circuit, 433, 434
 efficiency of, 445
 expressions for gain, 440, 441
 general description of, 426–30
 helical circuit, 446–53
 helix wave components, 450
 initial conditions for waves, 439
 limiting gain, 443
 mutual conductance of, 432
 noise in, 457, 458, 548–55
 oscillation in, 444
 other circuits, 454, 455
 passive mode effects, 456
 propagation constants for, 435
 propagation equation solutions, 434–9
 two types of theory for, 430
triodes
 characteristics of, 245–8
 close-spaced, electrostatic theory of, 264–72
 current distribution in, 324–9
 cylindrical, 252; electrostatic potential in, 252, 253; equivalent diode of, 260, 261; mutual conductance of, 261
 generalized screening factor, 262
 grid current in, 318–22
 grid emission in, 322, 323
 interelectrode capacitance of, 273
 triodes,
 μ of, 252; adjustment of, 263; Bennett and Peterson's analysis of, 266–70; more exact treatment of, 253–7; Ollendorf's formula for, 265; Vodges and Elder's formula for, 256
 noise produced by, 273–6
 planar, 249; electrostatic potential in, 249–52; 'equivalent diode' device, 257–9; mutual conductance of, 259
 secondary emission in, 324
 ultra-high-frequency, 394–5; effect of frequency on conductance, 407; effect of frequency on mutual conductance, 408; equivalent grid plane voltage, 406; equivalent networks for, 414; four-pole networks for, 411; grounded grid amplifier, 396–9; grounded grid and grounded cathode compared, 416–19; high efficiency operation of, 420, 421; limitations of Llewellyn theory, 413; Llewellyn electronic equations for, 401–10; noise analysis, 422–5; oscillator, 399–401
tungsten,
 pure, emission constants of 16, 20, 315
 thoriated, emission constants of, 24
Velocity modulation,
 amplifiers (klystrons), 370–5; gain $\times$ band-width product, 374; maximum gain of, 372; maximum power output of, 372; optimum load resistance of, 373
Applegate diagram, 350
beam-loading at gap, 362, 363
bunching, 364–5
expression for r.f. current, 355
first-order theory of, 352–7; more accurate theory, 364–6
klystron amplifiers *see* klystron
physical principles of, 346–52
reflex klystron, *see* klystron
space-charge debunching, 366–70, 540–7
transconductance, 359
variation of transconductance with amplitude, 360, 361