

## INDEX.

The references are to the pages.

Absolute measurement, 247 Accumulator, the Water-dropping, 85 Acid-metal contact, 313 Action, Local, 197; electromagnetic, 328, 337 Action of Keepers, 128 Action of a Magnet on a Current, Alphabet, the Morse, 408 Alternating currents, measurement of, 371 Ammeters, 364; soft iron, 363 Ampere Balance, the, 368; Lord Kelvin's, 369 Analogy between Temperature and Potential, 29 Annual Variations, 178 Arago's Disc, 382 Armature, shuttle wound, 394 Armature, reactions, 399 Arrangement of Batteries in series, 207; in multiple arc or parallel, 208 Artificial Magnets, 106 Astatic Coil, 331 Attracted Disc Electrometer, the, 90 Attraction, Electric, 3: explanation

Ballistic Galvanometer, the, 279

Axis of a magnet, determination of

Attraction, Magnetic, 108

of, 8, 9

the, 168

Batteries, Magnetic, 127; two fluid, 202; secondary, 205; in series, 207; in multiple arc or parallel, 208; experiments on, 255; in series and parallel, 262
Batteries of Leyden Jars, 66
Battery, resistance of a, 275; Joule's Law applied to, 290
Bichromate Cell, the, 200
Boxes, Resistance, 240
Bridge, Wheatstone's, 268
Bunsen's Cell, 203

Calculation of Potential, 51
Calculation of Capacity, 63
Capacity, Inductive, 45, 62; of a conductor, 54; of a condenser, 60; calculation of, 63; unit of, 285

Cell, Voltaic, 182, 197, 219, 220; singlefluid, 200; bichromate, 200; Leclanché, 201; dry, 202; Grove's, 202; Bunsen's, 203; Daniell's, 203; Clark's, 204; Weston, 205 Charge and Potential, Relation of,

Charge and Potential, Relation of, 54

Charged Conductor, Potential of, 53; energy of, 55 Charges of Magnetism, 122 Chemical Action of a Current, 191 Chemical Theories, 312 Circuit, magnetic, 347 Clark Cell, the, 204



436 INDEX

Closed Conductor, no electrification within, 16 Closed Cycle, Magnetic Force due to, 134 Coefficient of Mutual Induction, 377 Coil, Astatic, 331 Coil Galvanometer, 361 Coil, Induction, 389 Commutators, 238 Comparison of Resistances, 264 Condensers, 58, 281; explanation of the action of, 59; capacity of, 60; energy of charged, 62 Condensing Electroscope, 68 Conductance, 213 Conductor, no electrification within closed, 16; Potential of a charged, 53; capacity of, 54; heating by a current, 286; motion in a magnetic field, 337; in series, 214; in parallel, 215 Conductors, electromagnetic action between, 336 Conductors and Non-Conductors, 5, 6 Contact, acid-metal, 313; potential, 314 Contact experiments, in a vacuum, 313 Contact potential, 309 Contact theories, 312 Contact theory of Voltaic Cell, 221 Corpuscles, 425 Coulomb's Law, 45 Coulomb's Torsion Balance, 87 Crookes' Tubes, 419 Current, distribution of, 217; unit of, 224; practical unit of, 225; law of magnetic force due to a, 236, 323; absolute measurement of, 247; action of a magnet on. 326

Disc Electrometer, the Attracted, 90 Distribution, Electrical, 24 Distribution of Current, 217 Dry Cell, the, 202 Dynamo Machines, 395 Earth, Magnetism of the, 171 Electric Attraction, 3; explanation of, 8, 9; theory of Potential applied to, 41 Electric Currents, 182; measurement of, 185; tubes of force and. 186; effects due to, 188; magnetic action of, 188; thermal effects of, 191; chemical action of, 191; experiments on, 245; heating of conductor by, 286 Electric Discharge through Gases, Electric Force, Law of, 45; resultant at a point, 47 Electric inertia, 411 Electric Intensity, 47 Electric motors, 401 Electric Spark, the, 72 Electric Telegraph, the, 406 Electric Waves, 414 Electrical Action, Theories of, 23 Electrical Distribution, 24 Electrical Energy, 291 Electrical Power, 291 Electrical Pressure, or Potential, 26; explanation of, 28 Electricity, quantity of, 19; thermo-, 293; observations on, 294

effects of, 191; chemical action

Currents, Electric, experiments on, 245; heating of conductor by,

Curve of magnetic induction, 352

Daniell's Cell, 203; electromotive

Declination, measurement of the,

Daily Variations, 178

Demagnetisation, 128

Dielectric, effect of the, 45 Dip, measurement of the, 172

force of, 303

174

of, 191

Current and Quantity, relation be-

Currents, Electric, 182; measurement of, 185, 223; tubes of force

and, 185; effects due to, 188;

magnetic action of, 188; thermal

tween, 185



INDEX 437

Electrification, 4, 5; by induction, Electro-chemical equivalents, 5; determination of, 250 Electrodynamometer, the, 367 Electrolysis, observations on, 193; Faraday's laws of, 194; transformations in, 304; Ionic charge in, 421, 425 Electromagnetic Action, 328, 337; between conductors, 336 Electromagnetic forces, 331 Electromagnetic machines, 392 Electromagnets, 341 Electrometer, the Attracted Disc, 90; the Quadrant, 94 Electrometers and Electroscopes, Electromotive Force, in a simple circuit, 210, 211; of a Daniell's cell, 303; standards of, 204 Electron Theory, 427; of Matter, Electrons, 425; production of, 427, and galvanic action, 428; and magnetism, 429 Electrophorus, the, 74 Electroscopes, 9-15; condensing, 68; and electrometers, 87 Electrostatic Actions, explanation of, 23 Electrostatic Measurement of Potential, 93 Multicellular Electrostatic and Voltmeters, 97 Energy, of a Charged Conductor, 55; of a Charged Condenser, 62 Energy, Electrical, 291; needed to magnetise iron, 356 Energy changes in a cell, 302 Equilibrium condition, 337 Equipotential Surfaces, 31, 53 Equivalent, electro-chemical, 195, 250Experiments with Leyden Jars, 68 Experiments with the Magnetometer, 157 Experiments on electric currents,  $2\overline{45}$ Experiments on batteries, 255

Explanation of Electrostatic Actions, 23 Faraday's experiments on induction, 373 Faraday's laws of electrolysis, 194 Field of Force, 39 Field, Magnetic, 111; tensions and pressures in, 118 Force, the Field of, 39 Force, Law of, 44 Force, Lines of, 32; and equipotential surfaces, 34; forms of, 35; magnetic, 112; tracing, 114; electromotive in a circuit, 210, 211 Frictional Machines, 70 Galvanic action, 428 Galvanometer, tangent, 227; construction of, 230 Galvanometer, sine, 229 Galvanometer, resistance of, 274 Galvanometer, ballistic, 279 Galvanometer Constant, 228 Galvanometers, 223, 226; sensitive, 232; moving coil, 361 Gases, electric discharge through, 418 Gramme ring, the, 397 Grove's Cell, 202 Holtz Machine, the, 82 Hysteresis, 354 Illustrations, Mechanical, 40 Inductance, unit of, 379 Induction, electrification by, 7; magnetic, 111, 342; curve of, 352; Faraday's experiments on, 373; coefficient of mutual, 377; observations on, 379 Induction Coil, the, 389 Inductive Capacity, 45, 62 Inertia, electric, 411 Influence, of Temperature, 130; of external fields, 371 Influence Machines, 77 Insulating Medium, importance of, 30



**43**8

INDEX

Insulators, Properties of, 7
Inverse Square, Laws of the, 155
Ionic charge in electrolysis, 421, 425
Trop propertie force in 2444 property

Iron, magnetic force in, 344; energy needed to magnetise, 356 Isoclinal Line, 176

Joule's Law, 287; applied to a battery, 290

Kathode Rays, 420; charge carried in, 422; number of particles in, 424 Keepers, Action of, 128

Keepers, Action of, 128 Kelvin's (Lord) Ampere Balance, 369

Law, Joule's, 287; applied to a battery, 290; Lenz's, 378 Law of Magnetic Force, 44, 122; due to a current, 236

Law, Ohm's, 212; graphic representation of, 218; observations on, 252

Laws, Sine and Tangent, 148; Law of the Inverse Square, 155 Leclanché Cell, the, 201

Lenz's Law, 378

Leyden Jar, 64; Batteries of, 66; experiments with, 68

Lines of Force, 32; and equipotential surfaces, 34; forms of, 35; magnetic, 112; tracing, 114
Local Action, 197

Machines, Frictional, 70; Plate Electrical, 70; Influence, 77; Wimshurst's, 79; Holtz, 82; Voss, 85

Machines, electromagnetic, 392; magneto-electric, 393; dynamo, 395

Magnet, in a Uniform Field, 135; magnetic force due to a simple, 138; forces on one due to a second, 141; determination of the axis of, 168; action on a current, 326 Magnet, rotation about a current, 339

Magnetic Action of Electric Current, 188

Magnetic Attraction, 108; Induction, 111, 342; curve of, 352; Field, 111; tensions and pressures in, 118; Lines of Force, 112; Pole, Unit, 123

Magnetic Batteries, 127 Magnetic Charge, Total, 124

Magnetic Force, due to a Closed Cycle, 134; due to a simple magnet, 138; law of due to a current, 236, 323

Magnetic Force, Law of, 122; Resultant, 125; in a crevasse, 344; in a mass of iron, 344; transmission of, 414

Magnetic Maps, 174; Storms, 179 Magnetic Moment, measurement of the strength of a, 163

Magnetic Permeability, 346; measurement of, 349, 383; circuit, 347; reluctance, 347 Magnetic Potential, 125

Magnetic Shells, 325 Magnetic Survey, 174

Magnetisation, Methods of, 126; Theory of, 130, 355

Magnetism, Charges of, 122 Magnetism of the Earth, 171; secular variations of, 178

Magneto-electric machines, 393
Magnetometer, experiments with
the, 157; the mirror, 160

Magnets, Natural, 105; Artificial, 106; Solenoidal, 124; Total Magnetic Charge of, 124; molecular, 131

Maps, Magnetic, 174
Matter, electron theory of, 429
Maximum Strength of the Pole of
a Magnet, 130

Measure of Potential, 49 Measurement of Potential, Electrostatic, 93

Measurement, of the Dip, 172; of the Declination, 174; of electric currents, 185; of magnetic per-



INDEX

meability, 349; of alternating current, 371 Measurement, Units of, 46 Mechanical Illustrations, 40 Medium, Insulating, importance of, 30 Methods of Magnetisation, 126 Microphone, the, 409 Mirror Magnetometer, the, 160 Molecular Magnets, 131 Morse Instrument, the, 407; Morse Alphabet, the, 408 Motor, transformations of energy in, 402; starting a, 403 Motors, electric, 401 Moving Coil Galvanometers, 361 Multicellular and Electrostatic Voltmeters, 97 Multiple Arc, batteries in, 208 Mutual Induction, coefficient of, 377

Natural Magnets, 105 Non-Conductors and Conductors, 5, 6

Observations, on Electrolysis, 193; on Ohm's Law, 252; on Induction, 379 Ohm's Law, 212; graphic representation of, 218; observations on, 252

Particles in Kathode Rays, 424 Peltier effect, the, 296 Permeability, magnetic, 346; measurement of, 349, 383 Plate Electrical Machine, 70 Platinum Thermometer, the, 300 Pole, Unit Magnetic, 123 Pole of a Magnet, Maximum Strength, 130 Potential or Electrical Pressure, 26; explanation of, 28; zero of, 29; analogy between temperature and, 29; applied to electrical attraction, 41; measure of, 49; unit of, 51; calculation of, 51; relation of charge and, 54 Potential, Electrostatic Measurement of, 93; magnetic, 125; contact, 314
Potential at a point in the air, 99
Potential of a charged conductor, 53
Potentiometer, the, 260, 261
Power, Electrical, 291
Practical Unit of Current, 225
Principles of Transformers, 388
Production of Electrons, 427
Proof Plane, the, 15, 16
Properties of Insulators, 7

439

Quadrant Electrometer, the, 94 Quantity of Electricity, 19

Rays, Kathode, 420; charge carried in, 422; number of particles in, 424; Rontgen, 426 Reactions, Armature, 399 Reduction Factor, 228 Relation of Charge and Potential, 54 Reluctance, magnetic, 347 Replenisher, the, 77 Resistance, unit of, 213; specific, 216, 277; of galvanometer, 274; of a battery, 275 Resistance Boxes, 240 Resistances, comparison of, 264 Resultant Electric Force, 47, 48; at a point, 47 Resultant Magnetic Force, 125 Rontgen Rays, 426 Rotation of a magnet, 339

Secondary Batteries, 205
Secular variations of the Earth's magnetism, 178
Self-induction, 378
Sensitive Galvanometers, 232
Shells, Magnetic, 325
Shunts, 242, 364
Shuttle wound Armature, 394
Sine Galvanometer, 229
Sine and Tangent Laws, 148
Single fluid cells, 200
Solenoid, 330
Spark, the Electric, 72
Specific Resistance, 216, 277
Square, Law of the Inverse, 155



440 INDEX

Standards of electromotive force, 204
Storms, magnetic, 179
Strength of the Pole of a Magnet, 130
Surface Density, 24
Surfaces, Equipotential, 31, 53; and lines of force, 34
Survey, Magnetic, 174
Susceptibility, 129
Tangent Galvenometer, 227; con-

Tangent Galvanometer, 227; construction of, 230 Tangent Laws, 148 Telegraph, the electric, 406 Telegraphy, wireless, 416 Telephone, the, 408 Temperature, 29; influence of, 130 Tensions and Pressures in Magnetic Field, 118 Theories of Electrical Action, 23 Theory, of Magnetisation, 130, 355; Volta's, 309 Theory of Potential applied to Electrical Attraction, 41 Thermal effects of a Current, 191 Thermo-electricity, 293; observations on, 294 Thermometer, the Platinum, 300 Thermopile, the, 299 Thomson effect, the, 298 Torsion Balance, Coulomb's, 87 Total Magnetic Charge, 124 Tracing lines of Force, 114 Transformations in electrolysis, 304; in a Voltaic cell, 306; of energy in a motor, 402 Transformers, 391; principles of,

Transmission of magnetic force, 414 Tubes of Force and Electric Currents, 186 Two fluid batteries, 202

Uniform Field, Magnet in a, 135; measurement of the strength of a, 163
Unit of Capacity, 285
Unit of Current, practical, 225
Unit of Inductance, 379
Unit Magnetic Pole, 123
Unit of Potential, 51
Unit of Resistance, 213
Units of Measurement, 46

Vacuum, contact experiments in, 313
Variations, secular, 178; daily, 178; annual, 178
Voltaic Cell, the, 182,197; chemical theory of, 219; contact theory of, 221; transformations in, 306
Volta's Theory, 309
Voltmeters, 254, 366; electrostatic and multicellular, 97
Voss Machine, the, 85

Water-dropping Accumulator, the, 85 Waves, Electric, 414 Weston Cell, the, 205 Wheatstone's Bridge, 268 Wimshurst's Machine, 79 Wireless Telegraphy, 416

Zero of Potential, 29

388