

INDEX.

AGA

- A** GATHARCHIDES, his description of the grinding-stones used in the mines on the Red Sea, i. 2
 Alaric and his barbaric hosts, their obliteration of almost all the mechanical arts, i. 5
 Annular wheels, i. 44.
 Archimedean screw creeper, i. 62
 Architecture, mill. *See* Mill Architecture
 Armour plates, machinery for rolling, ii. 260
 Axis, main, of a water-wheel, i. 113
 — modes of attaching the wheel to the axis, i. 117

- B**AMBOO paper, ii. 230
 Bann reservoirs, or Lough Island Reavy, in the county of Down, i. 68, 76, 79
 Bateman, Mr., his observations on rainfall, i. 71, *et seq.*
 Beam, the great, and the crank, i. 19
 Beam engines, stationary, i. 229
 Beaming cotton, ii. 179
 Bessemer process, ii. 271
 Bevel wheels and bevel gear, i. 46 ; ii. 7, 36
 — skew bevel wheels, ii. 39
 — bevel wheels preferable to universal joint, ii. 108
 Blackwell, Mr., his experiments on the discharge of water from weirs, i. 98
 Bobbins, silk, ii. 209
 Boilers, i. 253
 — old forms, i. 253
 — Cornish boiler, i. 256
 — double-flued stationary boiler, i. 256
 — dimensions of boiler at Saltaire, i. 258

VOL. II.

BUT

- Boilers—*continued.*
 — patented forms, i. 258
 — computation of the power of boilers, i. 259
 — horses power of boilers, i. 260
 — area of heating surface, i. 261
 — boiler capacity, i. 262
 — area of grate-bar surfaces, i. 263
 — evaporative power of boilers, i. 264
 — strength of boilers, i. 266
 — accessories of boilers, i. 270
 — the feed pump, i. 270
 — back pressure valves, i. 270
 — feed-water heating apparatus, i. 270
 — water gauges, i. 271
 — steam gauges, i. 271
 — safety valves, i. 272
 — man holes, i. 272
 — mud cocks, i. 272
 — fusible plugs, i. 272
 — plans for the prevention of smoke, i. 273
 Bolting machine of a corn mill, ii. 165
 Bolton, early cotton manufacture of, i. 8
 Bombay waterworks, area drained for, and storage capacity of the reservoir of the, i. 82
 Borrowdale, enormous rainfall of, i. 70, 72
 Bramah's hydraulic press used for expressing oil, ii. 225
 Brindley's machinery for the manufacture of tooth and pinion wheels, ii. 5 *note*
 Buff-jerkins worn by the labouring people of England, till the Commonwealth, i. 6
 Butterley, or Whistlemouth, boiler, i. 255

T

- CAM
- C**AMBS, i. 52
 — to produce a changing reciprocating motion by a combination of the camb and screw, i. 64
 — to find the curve forming the groove of a camb, so that the velocity ratio of the rod and axis of the camb may be constant, i. 53.
- Carron, Smeaton's weir at, i. 86
- Catrine works, in Ayrshire, i. 88
 — statistics of the, i. 89
 — the Catrine high-breast wheels, i. 126
 — statistics of, i. 127
- Cattle-mills for grinding corn, i. 2
- Charcoal, manufacture of, for gunpowder, ii. 244
- China, cotton manufacture of, i. 7
 — nankeens, i. 7
 — mode of making paper in, ii. 230–232
- Clutches, ii. 88, 90
 — Mr. Bodmer's, ii. 91
- Concentric wheels, i. 45
- Conduits, i. 88
 — of the Catrine works, in Ayrshire, i. 88
 — friction of fluids from conduits, i. 102
- Connectors, wrapping. *See* Wrapping Connectors
- Constantinople, description of a corn mill at, ii. 118
- Corbet Lough, embankments at, i. 77
- Corn mills, early history of, i. 1; ii. 117
 — — hand-mills, i. 2
 — — cattle-mills, i. 2
 — — water-mills, i. 4
 — — description of the corn mills erected at Constantinople and at Taganrog, ii. 118, 127
 — — on iron buildings for corn mills, ii. 120
 — — merits of bevel and spur gear for corn mills, ii. 123
 — — mechanism by which the grain is treated, both previously and subsequently to the process of grinding, ii. 124
 — — list of the various wheels, pinions, and pulleys employed in the mill at Constantinople, and the velocities imparted to them, ii. 125
- COT
- Corn mills—*continued.*
 — conical mills of Mr. Schiele and of Mr. Westrup, ii. 128, 129, *note*
 — list of wheels and speeds in the corn mill of Taganrog, ii. 130
 — floating corn mill and bakery constructed by Messrs. William Fairbairn & Sons, ii. 132
 — details of machinery, ii. 139
 — the elevator, ii. 139
 — the creeper, i. 62, and ii. 140
 — the separator, ii. 141
 — the screening machine, ii. 142
 — the smut machine, ii. 145, 146
 — the framing, ii. 147
 — the driving gear, ii. 149
 — the stone case and feeding hopper, ii. 149
 — the mill-spindle and its appendages, ii. 150
 — the millstones, ii. 152
 — adjustment of the lower stone, ii. 154
 — adjustment of the mill-spindle, ii. 155
 — the feeding apparatus, ii. 157
 — the disengaging apparatus, ii. 159
 — the stone-lifting apparatus, ii. 161
 — the dressing machine, ii. 163
 — the bolting machines, ii. 165
 — Clarke & Dunham's contrivance for balancing the running millstone, ii. 169
- Cornish boiler, i. 256
- Cottage cotton manufacture of England, i. 8
- Cotton cloth, history of the manufacture of, i. 5, 7
 — origin of the cotton manufacture in India, i. 7
 — cotton manufacture of China, i. 7
 — and of Italy, i. 7
 — rise of the cotton manufacture of England, i. 7
 — cottage cotton manufacture, i. 8
 — improvements of Arkwright, Hargreaves, and Crompton, i. 8
 — *See also* Cotton mills
- Cotton mills, early history of, ii. 113, 171
 — condition of the factory system thirty years ago, ii. 172
 — description of a modern mill as constructed by Messrs. William Fairbairn & Sons, ii. 173

COT

- Cotton mills—*continued*.
 — mode of working, ii. 173
 — cotton mill engines, ii. 173
 — the opening machines, ii. 174
 — the blowers, ii. 174
 — carding, ii. 174
 — drawing frames, ii. 175
 — slubbing or roving frame, ii. 175
 — machine for combing instead of carding, ii. 176
 — process of spinning and weaving cotton, ii. 177
 — subsequent processes, ii. 178
 — twill and figure weaving, ii. 180
 — value of the cotton manufacture, ii. 180
 — list of the most approved speeds of the different cotton machines, ii. 180
 — list of wheels and speeds, ii. 181
 Cotton paper, ii. 233
 Couplings for shafts, and engaging and disengaging gear, ii. 79, *et seq.*
 Crank and great beam, the, i. 19
 — relations of crank and piston, i. 21
 Creepers of corn mills, ii. 140
 Crown wheels, i. 46
 Crushing rollers for oil mills, ii. 222
 Cumberland, rainfall of, i. 70, 72
 Cutting machine of Messrs. Peter Fairbairn & Co., of Leeds, ii. 10

- D**ALTON, Dr., his observations on rainfall, i. 73.
 Dams or weirs, i. 83
 Deanston works, details of the, i. 130
 Detent, ratchet-wheel and, i. 29
 Dimities, early English manufacture of, i. 8
 Discharge of water, and the estimation of water power, i. 91
 Domestics, manufacture of, ii. 203
 Drawing flax, ii. 199
 Dressing cotton, ii. 179
 Dressing machine of a corn mill, ii. 163
 Dutch take the lead in the field of mechanical enterprise, i. 5
 Dyer's Croft, remains of a Roman water mill at, i. 4

- E**CCENTRIC wheel, the, i. 52
 Edward III., improvements in the the manufacture of woollen goods introduced by, i. 6

FRI

- Egyptians, the ancient, their knowledge of the processes of spinning and weaving, i. 6
 Elevators of corn mills, ii. 139
 England, cotton manufacture of, i. 7
 — its preeminence in productive industry, i. 8
 Epicycloidal teeth of wheels, ii. 17
 Estimation of water power, i. 109
 Evaporation and rainfall, i. 69
- F**ACE-wheel and lantern, i. 45
 Face-wheels and trundles, ii. 7
 Factory system, rise of the, in England, i. 8
 — division of labour by means of the, i. 9
 — Dr. Ure's definition of the word 'factory,' i. 9
 — effects of the factory system, i. 10
 Fairbairn, Messrs. Peter & Co., of Leeds, their cutting machine, ii. 10
 Feed pumps of boilers, i. 270
 Feed-water heating apparatus of boilers, i. 270
 Feeding apparatus of a corn mill, ii. 157
 Feeding hopper of a corn mill, ii. 149
 Felting of wool, known probably before spinning and weaving, i. 6
 — modern process of, ii. 182
 Flax mills, history of, ii. 190
 — Mr. J. G. Marshall's account of the flax manufacture, ii. 190, 191
 — flax manufacture of Ireland and Scotland, ii. 190
 — Dr. Ure's description of flax, ii. 191
 — account of a flax mill erected for the Baron Stieglitz at Narva, ii. 192
 — processes of flax manufacture, ii. 196
 — lists of wheels and speeds, ii. 204
 — and of pulleys and speed of machines, ii. 205
 Flishmann's tow-combing machine, ii. 201
 Framing of a corn mill, ii. 147
 Friction of shafting, ii. 74
 Friction clutch, ii. 85
 Friction cones, ii. 86
 Friction coupling, ii. 87
 Friction discs, ii. 87

- FRI
- Friction, means adopted to lessen the, at the foot of the main vertical shaft, ii. 105
- Fulling cloth, art of, attributed to Nicias of Megara, i. 6
- blankets and broadcloth, ii. 182, 186
- Fustians, early English manufacture of, i. 8
- G**RATE-BAR surfaces of boilers, area of, i. 263
- Guide pulleys, i. 34
- Gun cotton, invention of, ii. 252
- Gunpowder mills. *See* Powder mills
- Gutta percha, value of, for straps, ii. 3
- H**AMMERS, iron, ii. 255
- Hangers, ii. 93
- Heberden, Dr., his observation on rain-falls, i. 71
- Heckling flax, ii. 197
- Herbert, Mr., his oil mill, ii. 221
- Hero of Alexandria, his mention of toothed wheels, ii. 4
- High-pressure engines, i. 245
- Hydraulic presses adapted to expressing oil from seeds, ii. 225
- I**DLE wheels, i. 44
- India, invention of cotton cloth in, i. 7
- Intermittent motion produced by link-work connected with a ratchet-wheel, i. 29
- Involute teeth of wheels, ii. 26
- Iron manufactures, changes in progress in the, i. 10
- improvements in the smelting processes effected by Mr. Neilson, i. 10
- mills, ii. 253
- processes of manufacture at present employed, ii. 253
- hammers and squeezers, ii. 255
- rolling mills, ii. 257
- ‘uses,’ ii. 257
- machinery for rolling armour plates, ii. 260
- description of the process of rolling armour plates at Messrs. John Brown & Co.’s works at Sheffield, ii. 268
- MEC
- Italy, cotton manufactures of, i. 7
- Izmet, description of the woollen mill at, built for the Sultan, ii. 182
- J**AMES I., his abortive efforts to grow the mulberry and produce silk in England, i. 5
- Journals, length of, ii. 73
- L**ANTERN, face-wheel and, i. 45
- Lewis’s frame for shearing woollen cloth, ii. 187
- Linen, manufacture of, i. 5; ii. 196
- Linen hand-loom weavers of Ulster, ii. 203
- Link-work, i. 18
- the crank and great beam, i. 19
- to construct Watts’s parallel motion, i. 23
- to multiply oscillations by means of link-work, i. 25
- to produce a velocity which shall be rapidly retarded by means of link-work, i. 26.
- to produce a reciprocating intermittent motion by means of link-work, i. 27
- ratchet-wheel and detent, i. 29
- intermittent motion produced by link-work connected with a ratchet-wheel, i. 29
- Lombe, Mr. John, his silk mill, ii. 206
- Longendale Valley, rainfall of, i. 74
- Losh, Mr., his double furnaces, i. 274
- Lough Island Reavy. *See* Bann Reservoirs.
- Lubrication of shafting, ii. 77
- M**ACHINERY of transmission, on, ii. 1
- Man holes of boilers, i. 272
- Manchester, Roman water mill at, i. 4
- early cotton manufacture of, i. 7
- McNaughting, i. 239
- Mechanical arts obliterated by the conquest of Rome, i. 4
- Mechanism, principles of, i. 12
- general views relative to machines
- definitions and preliminary explanations, i. 12

MEC

- Mechanism—*continued*.
 — parts of a machine, i. 15
 — elementary forms of mechanism, i. 17
 — link-work, i. 18
 — the crank and great beam, i. 19
 — to construct Watt's parallel motion, i. 23
 — to multiply oscillations by means of link-work, i. 25
 — to produce a velocity which shall be rapidly retarded by means of link-work, i. 26
 — to produce a reciprocating intermittent motion by means of link-work, i. 27
 — ratchet-wheel and detent, i. 29
 — intermittent motion produced by link-work connected with a ratchet-wheel, i. 29
 — wrapping connectors, i. 30
 — endless cord or belt, i. 30
 — speed pulleys, i. 32
 — guide pulleys, i. 34
 — to prevent wrapping connectors from slipping, i. 35
 — systems of pulleys, i. 36
 — to produce a varying velocity ratio by means of wrapping connectors, i. 38
 — on wheel-work producing motion by rolling contact when the axes of motion are parallel, i. 40
 — idle wheels, i. 44
 — annular wheels, i. 44
 — concentric wheels, i. 45
 — wheel-work when the axes are not parallel to each other, i. 45
 — face-wheel and lantern, i. 45
 — crown wheels, i. 46
 — to construct bevel wheels and bevel gear, when the axes are in the same plane, i. 46
 — to construct bevel gear when the axes are not in the same plane, i. 47
 — variable motions produced by wheel-work having rolling contact, i. 48
 — Roemer's wheels, i. 49
 — intermittent and reciprocating motions, produced by wheel-work having rolling contact, i. 49
 — the rack and pinion, i. 50
 — sliding pieces, producing motion by sliding contact, i. 51

MIL

- Mechanism—*continued*.
 — the wedge, or movable inclined plane, i. 51
 — the eccentric wheel, i. 52
 — cambs, wipers, and tappets, i. 52
 — the swash plate, i. 55
 — screws, different forms of, i. 56, *et seq.*
 — mechanism for cutting screws, i. 63
 — to produce a changing reciprocating motion by a combination of the camb and screw, i. 64
 — to produce a boring motion by a combination of the screw and toothed wheels, i. 65
 — on prime movers, i. 66
 — accumulation of water as a source of motive power, i. 66
 — on the flow and discharge of water, and the estimation of water power, i. 91
 — on the construction of water-wheels, i. 111
 — on the undershot water-wheel, i. 148
 — on turbines, i. 154
 — varieties of stationary steam-engines, i. 228
 — boilers, i. 253
 — windmills, i. 276
 Medlock river, Roman water-mill on the, i. 4
 Melbourne waterworks, statistics of the, i. 82
 — table of rainfall and evaporation, i. 83
 Mill architecture, on, ii. 110
 — early history, ii. 110
 — Smeaton and Rennie's improvements, ii. 111
 — the Albion steam-mills, ii. 111
 — early cotton mills, ii. 113
 — the shed principle or 'saw-tooth' system, ii. 115
 — corn mills, ii. 117
 — cotton mills, ii. 171
 — woollen mills, ii. 182
 — flax mills, ii. 190
 — silk mills, ii. 206
 — oil mills, ii. 221
 — paper mills, ii. 230
 — powder mills, ii. 243
 — iron mills, ii. 253
 Mill-spindle, and its appendages, the, of a corn mill, ii. 150

MIL

- Millstones, ii. 152
 — adjustment of the lower stone, ii. 154
 — stone-lifting apparatus, ii. 161
 — Clarke and Dunham's contrivance for balancing the running millstone, ii. 169
 Millwrights, and engineers, and machinists, ii. 219
 — claims of the millwright upon almost every mechanical profession, ii. 219
 Mud cocks of boilers, i. 272
- N**ANKEEN manufacture, the Chinese, i. 7
 Narva, Baron Stieglitz's flax mill at, ii. 192
 Neilson, Mr., his improvements in the smelting of iron, i. 10

- O**DONTOGRAPH, Prof. Willis's, ii. 31
 Oil mills, ii. 221
 — early history, ii. 221
 — Mr. Herbert's mill, ii. 221
 — modern processes for obtaining the oil, ii. 222, *et seq.*
 — comparative merits of stampers and hydraulic presses, ii. 228, 229
 — extent of English oil manufacture, ii. 229
 Oscillations, to multiply, by means of link-work, i. 25

- P**APER MILLS, ii. 230
 — early history of the manufacture of paper, ii. 230
 — Chinese mode of making paper, ii. 230–232
 — English paper manufacture, ii. 232
 — variety of the materials used in the manufacture of paper, ii. 233
 — various stages of the manufacture of paper, ii. 235
 — improved paper mills, ii. 236
 — section, plan, and cross section of a mill, ii. 237–239
 — water marks, ii. 240
 — different kinds of paper, ii. 241
 — papier-maché, ii. 241

RAI

- Paper mills—*continued.*
 — extent of the paper manufacture, ii. 241
 — list of wheels and speeds, ii. 242
 Parallel motion, Watt's, to construct, i. 23
 Phillips, Mr., his observations on rainfall, i. 72
 Pinion from Ramelli, ii. 5
 Pipes, friction of fluids in, i. 102
 — tables of friction, i. 106, 107
 Piston, relations of the crank and, i. 21
 Pliny, his description of Roman corn mills, i. 2
 Plugs, fusible, i. 272
 Plummer-blocks, ii. 93
 Pompeii, cattle corn mills disintombed in, i. 2
 Poncelet, M., his undershot water-wheel, i. 151
 Powder mills, ii. 243
 — expansive force of gunpowder, ii. 243
 — other expansive substances, ii. 243
 — process of manufacture of gunpowder, ii. 244
 — description of the government powder mill at Waltham Abbey, ii. 246
 — construction of mixing mill, ii. 248
 — composition of gunpowder among various nations, ii. 251
 — list of wheels and speeds, ii. 252
 Press, the common, i. 59
 — the hydraulic, ii. 226
 Pressure of water, i. 91
 Prideaux, Mr., his improvements in boilers, i. 275
 Prime movers, i. 66
 Pulleys, speed, i. 32
 — guide, i. 34
 — systems of pulleys, i. 36
 — on pulleys and wheels, ii. 1

QUERNNS, Roman, i. 2

- R**ACK and pinion, the, i. 50
 Rags, advantages of, over all other materials used for making paper, ii. 234, 235
 Rainfall and evaporation, i. 69
 — table of mean rainfall at London and Manchester, i. 69

INDEX.

279

RAI

- Rainfall—*continued*.
 — method of determining the rainfall, i. 70
 — rain-gauges, i. 71
 — increased rainfall corresponding to increased elevation, i. 72
 — relation of rainfall to the discharge by rivers, i. 74
 — Lough Island Reavy, or river Bann reservoirs, i. 68, 76
 — rainfall and evaporation in tropical countries, i. 82
 Ramelli, pinion from, ii. 5
 Ratchet-wheel and detent, the, i. 29
 — intermittent motion produced by link-work connected with a ratchet-wheel, i. 29
 Reciprocating intermittent motion, to produce a, by means of link-work, i. 27
 Reeling flax, process of, ii. 202
 Regnault's apparatus for determining the latent heat of steam, i. 221
 Rennie, Mr. John, his introduction of cast-iron into all the details of mill-work, ii. 7
 — his improvements in mill architecture, ii. 111
 Reservoirs, formation of, i. 67
 — large works of this kind, i. 68
 Rolling contact, motion produced by, i. 40
 — variable motions produced by wheel-work having rolling contact, i. 48
 Rolling mills used in iron manufacture, ii. 257
 Romans, their querns, or hand-mills, i. 2
 — their water-mills, i. 4
 — woollen manufactures of the, i. 6
 Roving flax, process of, ii. 200
- S**AFETY valves of boilers, i. 272
 Sails of windmills, forms and proportions of the, i. 278
 Saltaire mills, the, ii. 102, 115
 — stationary beam engines at, i. 229
 — dimensions of boiler at, i. 256
 Sang, Mr., his arrangement for the approximate measurement of the flow of water over a rectangular notch in a waste board, i. 101

SHA

- Screen, or shaker, for oil mills, ii. 222
 Screening machine of a corn mill, ii. 142
 Screws, i. 56
 — construction of a helix or screw, i. 56
 — transmission of motion by the screw, i. 57
 — pitch of a screw, i. 57
 — solid screw and nut, i. 58
 — the common press, i. 59
 — compound screw, i. 60
 — endless screw, i. 61
 — differential screw, i. 61
 — Archimedean screw creeper, i. 62
 — mechanism for cutting screws, i. 63
 — to produce a changing reciprocating motion by a combination of the camb and screw, i. 64
 — to produce a boring motion by a combination of the screw and toothed wheels, i. 65
 Scutching flax, ii. 196
 Separators of corn mills, ii. 141
 Shafts, on the strength and proportion of, ii. 50
 — 1. The Material of which shafting is constructed, ii. 51
 — 2. Transverse Strain, ii. 52
 — rules for the strength of shafts, ii. 54
 — resistance to flexure—weights producing a deflection of $\frac{1}{1200}$ of the length in cast-iron cylindrical shafts, ii. 58
 — resistance to flexure—weights producing a deflection of $\frac{1}{1200}$ of the length in wrought-iron cylindrical shafts, ii. 59
 — deflection arising from the weight of the shaft in both cast-iron and wrought-iron cylindrical shafts, ii. 60
 — 3. Torsion, ii. 61
 — values of modulus of torsion according to Mr. Bevan, ii. 63
 — résumé of experiments on cylinders of circular section, ii. 64
 — résumé of experiments on the torsion of hollow cylinders of copper, ii. 65
 — résumé of experiments on the torsion of elliptical bars, ii. 65
 — safe working torsion for cast-iron and for wrought-iron shafts, ii. 68, 69

SHA

- Shafts—*continued*.
 — diameter of wrought-iron shafting necessary to transmit with safety various amounts of force, ii. 71
 — 4. Velocity of Shafts, ii. 72
 — 5. Length of Journals, ii. 73
 — 6. Friction, ii. 74
 — table of coefficients of friction under pressures increased continually up to limits of abrasion, ii. 76
 — 7. Lubrication, ii. 77
 — 8. On Couplings for shafts, and engaging and disengaging gear, ii. 79, *et seq.*
 — disengaging and re-engaging gear, ii. 82
 — 9. Hangers, plummer-blocks, &c., for carrying shafting, ii. 93
 — diameters, pitch, velocity, &c., of spur fly-wheels of the new construction, ii. 101
 — Material, &c., of the main shafts, ii. 101
 — vertical shafts, ii. 102
 — the Saltaire mills, ii. 102, *et seq.*
 — table of length, diameter, &c., of couplings, coupling-boxes, &c., ii. 109
 Shaws' waterworks at Greenock, i. 68
 Shrouds of a water-wheel, i. 118
 Shuttle-box, revolving, of the powerloom, ii. 180
 Silk, efforts of James I. to grow the mulberry, and produce silk in England, i. 5
 — progress of the silk manufacture in this country during the reigns of Charles I., the Commonwealth, and Charles II., i. 6
 — foundation of the Spitalfields weaving trade, i. 6
 Silk mills, ii. 206
 — early history of silk, ii. 206
 — the first silk mill, ii. 206
 — improvements in machinery, ii. 207
 — Mr. Vernon Royle's mill, ii. 207
 — Fairbairn and Lillie's improved silk-spinning mill, ii. 208
 — process of manufacture, ii. 209
 — speed of shafts, wheels, &c., ii. 212
 — raw silk spinning machinery, ii. 213
 — novel machines lately introduced into the silk trade, ii. 217

STE

- Skew bevel wheels, ii. 39
 Sliding-pieces, producing motion by sliding contact, i. 51
 — the wedge, or movable inclined plane, i. 51
 — the eccentric wheel, i. 52
 — cambs, wipers, and tappets, i. 52
 — the swash plate, i. 55
 — screws, i. 56
 — the common press, i. 59
 — to produce a changing reciprocating motion by a combination of the camb and screw, i. 64
 Smeaton, Mr., his weir at Carron, i. 86
 — his introduction of cast-iron gearing in place of wood, ii. 6
 — his improvements in mill architecture, ii. 111
 Smoke, plans for the prevention of from boilers, i. 273
 — Watts's patent, i. 273
 — Losh's double furnaces, i. 274
 — Mr. Wye Williams and Mr. Prideaux's improvements, i. 275
 Speed pulleys, i. 32
 Spindles, silk, ii. 209
 Spinning cotton, process of, ii. 177
 — flax, process of, ii. 202
 — raw silk, machinery for, ii. 213
 Spitalfields weavers, establishment of the colony of, i. 6
 Spreading flax, ii. 198
 Spur gearing, ii. 5
 Squeezers, iron, ii. 255
 Stamper-press, Dutch, ii. 222
 Steam, on the properties of, i. 180
 — history of the employment of, i. 180
 — general laws of vaporisation of, i. 183
 — the vaporisation of water, and the formation of steam, i. 186
 — the relation between the pressure and temperature of saturated steam, i. 186
 — relation of temperature and density of saturated steam, i. 203
 — on the latent heat of steam at different pressures, i. 218
 — on the law of expansion of superheated steam, i. 224
 Steam engines, varieties of stationary, i. 228
 — stationary beam engines, i. 229

STE

- Steam engines—*continued*.
 — compound engines, i. 242
 — high-pressure engines, i. 245
 — the duty of engines, i. 249
 — boilers, i. 253
 — plans for the prevention of smoke, i. 273
 Steam gauges of boilers, i. 271
 Steam kettle for oil mills, ii. 223
 Steam power, expenses of, contrasted with those of water power, i. 89
 Stieglitz, Baron, his flax mill at Narva, ii. 192
 Stone case of a corn mill, ii. 149
 Straps compared with geared wheel-work, ii. 2
 — materials of which straps are made, ii. 3
 — strength of straps, ii. 3
 — table of the least width of straps for transmitting various amounts of work over different pulleys, ii. 4
 Straw paper, ii. 234
 Sulphur, preparation of, for making gunpowder, ii. 244
 Swash plate, the, i. 55
 Swineshaw Valley, rainfall in the, i. 74

TABLE of mean rainfall at London and Manchester, i. 69
 — showing the amount of spontaneous evaporation and rainfall for twelve months, ending Jan. 31, 1858, i. 83

Tables relating to the Flow and Discharge of Water.

- Table I. Theoretical velocity of effluent water, i. 92
 — II. Coefficients of discharge of vertical rectangular orifices, thin-lipped, with complete contraction. The heads of water measured at a point of the reservoir where the liquid was perfectly stagnant, i. 95
 — III. Coefficients of discharge of vertical, thin-lipped, rectangular orifices, with complete contraction. The heads of water measured immediately over the orifice, i. 96
 — IV. Theoretical and actual discharge from a thin-lipped orifice of a sectional area of one square foot, i. 96
 — V. Coefficient of discharge for weirs, from experiments on notches

TAB

- eight inches broad, by Poncelet and Lesbros, i. 98
 Table VI. Coefficients of discharge from weirs, from experiments by Mr. Blackwell, i. 99
 — VII. Examples of estimation of discharge from weirs, i. 100
 — VIII. Discharge of water over a thin-edged notch or weir for every foot in breadth of the stream in cubic feet per second, i. 101
 — IX. Friction of water in pipes, i. 106

Tables relating to Water-wheels.

- Table of diameters of the main axis journals of water-wheels, i. 116
 — Proportions of water-wheels, i. 144

Tables relating to the Properties of Steam.

- Table I. Influence of changes of atmospheric pressure on the boiling point of water, and the boiling point at different altitudes, i. 184
 — II. Elastic force of the vapour of water, i. 189
 — III. Elastic force of steam, from the experiments of the Franklin Institute, i. 191
 — IV. Results of MM. Arago and Dulong's experiments on the relation of pressure and temperature of saturated steam, i. 192
 — V. On the pressure and corresponding temperature of saturated steam, i. 202
 — VI. Results of experiments on the density of steam at pressures of from 15 to 70 pounds per square inch, i. 212
 — VII. The results of experiments on the density of steam at pressures below that of the atmosphere, i. 213
 — VIII. On the relation of pressure, volume, and weight of saturated steam deduced from experimental data, i. 215
 — IX. The latent and total heat of steam from one pound to one hundred and fifty pounds per square inch, i. 223
 — X. Showing the coefficient of expansion of superheated steam, i. 227
 Table showing the progressive economy of high pressure steam, i. 250

TAB

- Tables relating to straps. *See* Wrapping connectors:—
 — — — wheels. *See* Wheel-work
 — — — shafts. *See* Shafts
 Taganrog, description of a corn mill at, ii. 127
 Tail-race, direction of, i. 124
 Tappets, or wipers, i. 54
 Teeth of wheels. *See* Wheel-work
 Textile fabrics, history of mills for the manufacture of, i. 5
 — — silk manufactures in England, i. 5, 6
 — — woollen mills, ancient and modern, i. 6
 — — cotton mills and cotton, history of, i. 7
 Thrutchers, i. 238
 Toothed wheels, history of, ii. 4
 Torricellian vacuum, i. 210
 Tow-combing machine, Flishmann's, ii. 201
 Turbines, on, i. 154
 — turbines in which the water passes vertically through the wheel, i. 155
 — turbines in which the water flows horizontally and outwards, i. 159
 — turbines in which the water flows horizontally inwards; vortex wheels, i. 163
 — efficiency of turbines, i. 173
 — water-pressure engines, 174

UNIVERSAL joint, bevel wheels preferable to, ii. 108

- Ure, Dr., his description of flax, ii. 191
 — — — of the silk worm, ii. 206
 — — — of materials employed in the manufacture of paper, i. 233
 — — — of the manufacture of the ingredients of gunpowder, ii. 244

VALVES, back pressure, of boilers, i. 270

- safety, of boilers, i. 272
 — adapted for the discharge of reservoirs at great depths, i. 80
 Vaporisation, general laws of, i. 183. *See* Steam
 Velocity, to produce a, which shall be rapidly retarded, by means of link-work, i. 26
 Velocity of water, i. 91, 92

WAT

- Venice, exportations of cotton cloth three hundred years ago from, i. 7
 Ventilation of water-wheels, i. 133
 — low-breasted ventilated wheel, i. 135
 Vermilions, early English manufacture of, i. 8
 Vitruvius, his account of water-mills, i. 4
 Vortex wheels, i. 163
 — experiments on Mr. Thomson's vortex wheel at Ballysillan, to determine its efficiency, i. 281

WALTHAM ABBEY, government gunpowder mills at, ii. 246

- Water, on the accumulation of, as a source of motive power, i. 66
 — classification of mill machinery, i. 66
 — formation of reservoirs, i. 67
 — rainfall and evaporation, i. 69
 — method of determining the rainfall, i. 70
 — Lough Island Reavy, or Bann river reservoirs, i. 76
 — amount of rainfall and evaporation in tropical climates, i. 82
 — weirs or dams, i. 83
 — conduits, i. 88
 — statistics of the Catrine works, i. 89
 — water power and steam power, expenses of, contrasted, i. 89
 — on the flow and discharge of water, and the estimation of water power, i. 91
 — relations between pressure, velocity, and discharge of water, i. 91
 — thick-lipped orifices or mouth-pieces, i. 93
 — thin-lipped orifices, i. 94
 — discharge with incomplete contraction, i. 97
 — discharge from rectangular notches, waste-boards, and weirs, i. 97
 — Mr. Blackwell's experiments, i. 98
 — friction of fluids in conduits and pipes, i. 102
 — flow of water in open channels, i. 105
 — estimation of water power, i. 109
 Water gauges of boilers, i. 271
 Water marks on paper, ii. 240
 Water-mills for grinding corn, history of, i. 4

- | WAT | WHE |
|---|--|
| Water-wheels, on the construction of, i. 111 | Weirs— <i>continued</i> . |
| — classification of water-machines, i. 111 | — Mr. Sang's mode of measurement, i. 101 |
| — vertical water-wheel, improvements in, i. 112 | Wheel-work producing motion by rolling contact when the axes of motion are parallel, i. 40 |
| — component parts of water-wheels, i. 113 | — idle wheels, i. 44 |
| — the overshot water-wheel, i. 121 | — annular wheels, i. 44 |
| — the pitch-back wheel, i. 124 | — concentric wheels, i. 45 |
| — direction of tail-race, i. 124 | — when the axes are not parallel to each other, i. 45 |
| — the Catrine high-breast wheels, i. 126 | — face-wheel and lantern, i. 45 |
| — of the Deanston works, i. 130 | — crown wheels, i. 46 |
| — ventilation of water-wheels, i. 133 | — to construct bevel wheels, or bevel gear, when the axes are in the same plane, i. 46 |
| — low-breast ventilated wheel, i. 135 | — to construct bevel gear when the axes are not in the same plane, i. 47 |
| — high-breast ventilated wheel, i. 137 | — variable motions produced by wheel-work having rolling contact, i. 48 |
| — arrangement of gearing, i. 137 | — Roemer's wheels, i. 49 |
| — speed of water-wheels, i. 138 | — intermittent and reciprocating motions, produced by wheel-work having rolling contact, i. 49 |
| — area of opening of bucket, i. 138 | — the rack and pinion, i. 50 |
| — the shuttle, i. 140 | — to produce a boring motion by a combination of the screw and toothed wheels, i. 65 |
| — the water-wheel governor, i. 140 | — experiments on Mr. Thomson's vortex wheel at Ballysillan, to determine its efficiency, i. 281 |
| — table of proportions of water-wheels, i. 144 | — power of straps compared with that of geared wheel-work, ii. 2 |
| — considerations in designing water-wheels, i. 146 | — history of toothed wheels, ii. 4 |
| — on the undershot water-wheel, i. 148 | — Hero of Alexandria, ii. 4 |
| — old forms of undershot wheels, i. 148 | — Ramelli, ii. 5 |
| — improved forms, i. 149 | — introduction of cast-iron gearing, ii. 6 |
| — Poncelet wheel, i. 151 | — face-wheels and trundles, ii. 7 |
| — turbines, i. 154 | — bevel wheels, ii. 7, 36 |
| — water-wheel of the woollen mill at Izmet, ii. 184 | — causes of the defects of wheel-work, ii. 8 |
| — water-wheel of the Narva mill, ii. 193 | — cutting machine of Messrs. Peter Fairbairn & Co., of Leeds, ii. 10 |
| Waterworks, Shaws', at Greenock, i. 68 | — definitions of spur gearing, ii. 11 |
| Watt's parallel motion, to construct, i. 23 | — the pitch of wheels, ii. 13 |
| — his patent for the prevention of smoke, i. 273 | — table of the relation of diameter, pitch, and number of teeth, for wheels of from $\frac{1}{2}$ inch to 5 inches pitch, and from 12 to 200 teeth, ii. 18, 19 |
| Weaving, history of the process of, i. 6 | — the principles which determine the proper form of the teeth of wheels, ii. 17 |
| Weaving trade of Spitalfields, establishment of the, i. 6 | |
| Wedge, the, or movable inclined plane, i. 51 | |
| Weirs or dams, i. 83 | |
| — Mr. Blackwell's experiments on the discharge of water from weirs, i. 98 | |
| — table of coefficients of discharge from weirs, i. 99 | |
| — table of examples of estimation of discharge from weirs, i. 100 | |
| — table of discharge over a thin-edged notch, or weir, for every foot in breadth of the stream in cubic feet per second, i. 101 | |

WHE

- Wheel-work—*continued*.
 — epicycloidal teeth, ii. 17
 — construction of epicycloidal teeth, ii. 22
 — the rack, ii. 25
 — involute teeth, ii. 26
 — Prof. Willis's method of striking the teeth of wheels, ii. 28
 — Prof. Willis, his odontograph, ii. 30
 — general form and proportion of toothed wheels, ii. 32
 — table giving the proportions of the teeth of wheels in inches and thirty-seconds of an inch, ii. 35
 — table of proportions of teeth of wheels for average practice, ii. 34
 — skew bevel wheels, ii. 39
 — worm and wheel, ii. 40
 — strength of the teeth of wheels, ii. 41
 — table of thickness, breadth and pitch of teeth of wheels, ii. 43
 — table of the relation of horses power transmitted, and velocity at the pitch circle, to pressure on teeth, ii. 47
 — table showing the pitch and thickness of teeth to transmit a given number of horses power at different velocities, ii. 48
 — table showing the breadth of teeth required to transmit different amounts of force at a uniform pressure of 400 lbs. per inch, ii. 49
 — water-wheel at the woollen mill at Izmet, ii. 184
 Wheels and pulleys, on, ii. 1
 Whistlemouth, or Butterley, boiler, i. 256
 Williams, Mr. Wye, his improvements in boilers, i. 275
 Willis, Professor, his method of striking the teeth of wheels, ii. 28
 — his odontograph, ii. 30
 Winding and warping cotton, ii. 179
 Windmills, causes of their limited use, i. 276
 — the vertical windmill, i. 277
 — forms and proportions of sails, i. 278
 — regulation of the speed of windmills, i. 279

WRA

- Wipers, or tappets, i. 54
 Wood paper, ii. 234
 Woolf's engine, i. 242
 Woollen cloth, history of the manufacture of, i. 5, 6
 — woollen manufactures of the Romans, i. 6
 — and of the English in the reign of Edward III., i. 6
 — difference between woollen and worsted fabrics, ii. 188
 — Mr. Edward Baines's paper on the woollen manufacture of Leeds quoted, ii. 263
 Woollen mills, ii. 182
 — — till lately always driven by water-power, i. 7
 — — effects of the introduction of improved machinery, i. 7
 — — the felting process, ii. 182
 — — description of the woollen mill erected for the Sultan at Izmet, ii. 182, *et seq.*
 — — water-wheel and millwork, ii. 184
 — — processes pursued in a woollen mill, ii. 186
 — — lists of wheels and speeds, and of pulleys and speeds of machines, ii. 189
 Worm and wheel, the, ii. 40
 Worsted manufacture, value of the, ii. 188
 Wrapping connectors, i. 30; ii. 1
 — — endless cord or belt, i. 30
 — — speed pulleys, i. 32
 — — guide pulleys, i. 34
 — — to prevent wrapping connectors from slipping, i. 35
 — — systems of pulleys, i. 36
 — — to produce a varying velocity ratio by means of wrapping connectors, i. 38
 — — power of straps compared with that of geared wheel-work, ii. 2
 — — table of the approximate width of leather straps in inches necessary to transmit any number of horses power, ii. 4