

- Open hearth practice, Modifications of, 198-205.**
 ——— Bertrand-Thiel process, 197.
 ——— Duplex process, 204.
 ——— Monell process, 203.
 ——— Talbot process, 200.
 ——— Twynam process, 203.
- Open hearth process, 140a-196.**
 — Pig-iron for, 230.
- Ore, Effect of addition, on slag in acid Siemens process, 172.**
- Origin of blisters in cement bars, 246.**
- Ormesby Rolling Mill Co., Electric driving at, 730.**
- Osann, on removal of Sulphur in electric furnaces, 280.**
- Osmond, on allotropic modifications of iron, 359.**
 — Carbide of iron, 343.
 — critical points, 352.
 — etching microsections, 454, 455.
 — "polish attack," 455.
 — polishing microsections, 450.
 — Tungsten steel, 416.
- Osmond and Werth, on hardening Carbon, 343.**
- Osmondite, 464.**
- Osnabrück, Electrically-driven reversing mills at, 734.**
- Ostrowiec, Maerz ports at, 145.**
- Otto engine, 698.**
- Output of the forging press, 880, 881.**
 — of the steam hammer, 744, 745, 835, 846, 881.
- Outputs of rolling mills, 526, 810.**
 — Bar mills, 753, 756, 759, 760, 762, 821.
 — Bedson's mill, 802, 803.
 — Belgian wire mill, 799.
 — Billet mills, 753.
 — Cogging mills, 639, 744, 746.
 — Continuous mills, 821.
 — Dowlais, 799.
 — Garrett's mill, 805.
 — Guide mills, 760, 762.
 — Hoop mills, 634, 796, 821.
 — Morgan's mill, 803, 821.
 — Plate mills, 634, 775, 778, 784.
 — Rail mills, 766, 768.
 — Reversing mills, 775.
 — Rod mills, 526, 797, 799, 801, 802, 803, 805, 810, 811.
 — Sheet mills, 792.
 — Slabbing mills, 747.
 — Strip mills, 634, 796, 821.
 — Three-high mills, 639, 766, 830.
 — Tire mills, 772.
 — Universal mills, 634, 784.
- Ovals, 608, 810.**
- Overheated steel, Microstructure of, 468.**
- Overheating, Damage to steel by, 527.**
- Oxidation of Carbon and Silicon during melting, 170.**
 — Heats of, 106, 108, 109.
- Oxidation of metalloids in Siemens, Heat developed by, 205-207.**
- Oxide additions to basic Bessemer, 103.**
 — of iron, Charging in basic Siemens, 184.
- Oxygen, Specific heat of, 132.**
 — in steel, 386.

P

- Pallet for hammer, 837.**
- Parkhead Steel Works, Presses at, 881, 887.**
- Parry, on occlusion of gases, 382.**
- Parsons, C. A., Exhaust steam turbine, 682.**
- Pass, 613, 627.**
 — Box, 606, 609, 611.
 — Closed, 609, 610, 613, 624.
 — Closing, 619.
 — Diamond, 609, 614, 623.
 — Drawing, 608, 614.
 — False, 623, 628.
 — Finishing, 608.
 — Forms of, 608, 609, 613.
 — Gothic, 609, 612, 623.
 — Open, 609, 610, 613.
 — Oval, 608, 614, 808, 810.
 — Roughing, 606, 608, 611.
 — Square, 608, 614, 808.
- Pearlite, 344, 463.**
- Peclet, on temperature of waste gases, 535.**
- Peel, 160, 167.**
- Pencoyd Steel Works, Melting shop at, 200b, 208, 209.**
- Pennsylvania, Natural gas, 139.**
- Pens, Rolling steel for, 596, 796.**
- Pepys, on diamond and iron, 341.**
- Percy, experiments of strength of wire, 916.**
 — on blisters in cement bars, 246.
 — on iron-cobalt alloys, 398.
- Permanent set, 298.**
- Perrin's tube rolling process, 906.**
- Perry, T., & Sons, Ltd., Bloom shears by, 751.**
 — Guide mill by, 760.
 — Housing by, 583, 588.
 — Plate mill by, 652, 653.
 — Roll lathe by, 619, 620.
- Petersen, O., reactions in steel processes, 216.**
- Petren and Grabe, on case-hardening, 249.**
- Phoenix Iron Works, Casting pit at, 208.**
- Phosphate of iron, Heat of formation of, 111.**
- Phosphate of lime, Formation of, in basic Bessemer, 101.**
 — Heat of formation of, 111.
- Phosphoric acid, Solubility of, in slag, 193.**
- Phosphorus, amount required for basic blow, 99.**
 — Condition of, in steel, 373.
 — Detection of, by the microscope, 468.

- Phosphorus, Influence of, 372.**
 — on high Carbon steel, 373.
 — on mechanical tests, 373.
 — on steel castings, 234, 235.
 — Rapid determination of, 522.
 — Removal of, in acid Bessemer, 82, 88, 92, 110.
 — acid Siemens, 168.
 — basic Bessemer, 99-101.
 — basic Siemens, 185, 186.
 — electric furnaces, 279.
 — in steel castings, 234, 235.
- Photographs of microstructure, 358, 461-464, 468, 472-490.**
- Photomicrographs of burnt steel, 468.**
 — constituents of Carbon steel, 461-464.
 — copper-silver alloys, 358.
 — steels, 472-490.
 — showing effect of heat treatment, 480-489.
- Pickling, 835, 895, 919, 925, 926, 927.**
- Pierie acid, Etching with, 455.**
- Pietzka reheating furnace, 545.**
- Pig-iron for acid Bessemer, 81, 230.**
 — acid Siemens, 168, 230.
 — basic Bessemer, 66, 92, 230.
 — basic Siemens, 186, 193, 230.
 — Charging of, in Siemens furnace, 160.
 — Proportion of, to scrap in Siemens furnace, 160.
 — Recarburising with, in Siemens furnace, 176, 177.
 — for Robert converter, 74.
- Pigging-back, 176, 177, 189.**
- Pilger rolls, 909.**
- Piling iron, 527, 533, 598.**
- Pinion housing, 588, 628, 786.**
- Pinions, 588, 596, 610, 628, 629, 786.**
- Pink on bottom casting of ingots, 36.**
- Pins and boxes, 587.**
- Pipes in ingots, 386, 524, 525, 551, 835, 838.**
- Piston, Speed of, 666, 670, 672, 673, 676.**
- Pit, Circular Bessemer, 49, 50.**
 — Straight Bessemer, 50, 52.
 — Stripping, 46, 48.
- Pit sample, Testing the, 57.**
- Pittsburg, natural gas, 139.**
- Plastic condition of steel, 525, 883.**
- Plastic deformation, 298.**
- Plate, Armour, Manufacture of, 284-290.**
- Plate mill, 598, 608, 634, 643, 774, 777.**
 — Output of, 634, 643, 775, 778, 784.
 — Types of American, 630, 632, 772, 783, 786.
 — early English, 774.
 — Lauth's, 597, 630, 784, 785.
 — modern English, 777.
 — universal, 631, 784, 785, 786.
- Plate rolling, 601, 609, 610, 617, 630, 666, 778.**
- Plate rolls, 575, 778, 779.**
- Plated bars, 247.**
- Plates, Buckling of, 779.**
 — Cooling of, 778, 783.
- Plates, Cost of, 775, 781, 782.**
 — "Extras" on, 782.
 — Handling of, 779, 780, 781, 783.
 — Iron, 782.
 — Ordering, 778.
 — Shearing of, 781, 782.
 — Size of, 781, 782, 783.
 — Straightening of, 780.
- Plating out test, 328.**
- Plug of basic converter, 62.**
 — Casing and bottom plate for ramming, 63.
 — Inserting, in bottom section, 64.
 — Repairing twyer, 13.
- Pneumatic power, 781, 835.**
- Points, Critical, 352, 353.**
- Polish attack, 450.**
- Polhem, early rolling, 600.**
- Polishing microsections, Methods of, 449-454.**
 — powders, Preparation of, 452, 453.
- Ponsard reheating furnace, 541.**
- Ponthiere, on thermo-chemistry of steel, 107.**
- Porter, C. T., on engines, 670.**
- Porter-Allen engine, 671, 830.**
- Porter bar, 843, 844, 877.**
- Portland cement, 932.**
- Ports of Siemens furnace, 142, 143, 144, 145.**
- Pot melting of steel, 251.**
- Potassium cyanide for case-hardening, 250.**
- Potentiometer for temperature measurement, 445.**
- Pots, Converting, 243.**
- Pourcel, on Bessemer reactions, 79.**
- Power, Electric transmission of, 719.**
 — factor, 721.
 — levers, 637.
 — obtainable from current, 720.
 — Transmission of, 718.
 — used in rolling, 724, *et seq.*
 — Water, 718.
- Premier gas engine, 707.**
- Press for fluid compression, 885, 886, 887.**
- Press, Forging, Accumulators for, 857, 860, 878, 879.**
 — Action of, 853.
 — adapted to tires, 769.
 — compared with hammer and rolling, 854, 879, 880, 881, 882.
 — Cylinders, adjustable to, 859, 861.
 — Cylinders for, 856.
 — Difficulties with high pressures in, 855, 856, 879.
 — Effects of, 853, 854, 855.
 — Essentials of a, 855.
 — Gun Foundry Board on, 853.
 — Handling the ingot at, 877, 878.
 — History of, 853.
 — Hollow forgings made under, 882.
 — Intensifier for, 864, 865, 867, 872, 873, 874, 878.
 — Introduction of, 853, 854.
 — Leaks in, 855, 856, 879.

Press, Forging, Low pressure for, 857, 858, 860, 862, 864, 869, 871, 874, 877.
 — Necessity for, 853, 854.
 — Output of, 880, 881.
 — Pressure of water used in, 856, 857, 858, 860, 862, 864, 869, 871, 872, 874.
 — Pressure on ingots in, 880.
 — Pumping engines for, 857, 860, 862, 875, 878.
 — Pumps for, 856.
 — Sizes of, 855, 860, 869, 872, 874, 880, 881.
 — Sizes of, equivalent to steam hammers, 880.
 — Speed of, 862, 864, 869, 878.
 — Valves for, 856, 860, 872, 879.
Press, Forging, Varieties of, 857, 878.
 — Abouchoff, 874, 878.
 — Allen's, 875.
 — Beardmore's, 881.
 — Bessemer's, 853, 875.
 — Bochum, 860, 878.
 — Bramah, 853.
 — Breuer & Schumacher's, 872, 873, 874, 879.
 — Brown's, 874.
 — Continuous-acting, 857.
 — Davy Bros. new quick-acting, 864-869.
 — Davy's, 862, 863.
 — Dillingen, 874, 878.
 — Fielding & Platt's, 874, 875.
 — Galloway's, 875.
 — Greenwood & Batley's, 872, 873, 874.
 — Haniel & Lueg's, 869-872.
 — Haswell's, 875, 881.
 — Homestead, 881, 882.
 — Intermittent-acting, 864.
 — Multiple power, 860, 874, 878.
 — Tannett-Walker's, 857, 878.
 — Tweddell's, 874.
 — Vicker's, 882.
 — Whitworth's, 854, 861.
Press, Piercing, 893.
Press, Staving, 904, 905.
Pressure, Hydraulic, used in steel works, 581, 855.
Prevention of blowholes by chemical means, 386.
 — by mechanical means, 891, 892.
Price's retort furnace, 541.
Pricker bar, 167.
Process of manufacture, Selection of, 215b.
 — Specification of, 491.
Producer gas, Analysis of, 134.
 — Changes in composition on passing through regenerators, 146.
 — Sulphur in, 174.
 — Temperature variations of, 136.
Producer, Gas, 112-129.
 — Automatic feed for, 129, 130.
 — Charging of, 129.
 — Efficiency of, 130-136.
 — Calculation of, 133.

Producer, Gas, Efficiency of, Jenkin's formula for, 131.
 — Fuel for, 129.
 — Irregularities of working, 136.
 — Mechanical feed for, 120.
 — Position of, relative to furnace, 156, 157.
 — Reactions in, 113, 114.
 — Theory of, 112.
 — Types of, 115.
 — Dawson, 121.
 — Duff, 121.
 — Hughes, 126, 127.
 — Kerpely, 127, 128.
 — Mechanical, 124-128.
 — Mond, 121-124.
 — Rehmann, 128.
 — Siemens, 115, 116, 117.
 — Talbot, 124, 125, 126.
 — Wilson, 117, 120.
 — Use of lime in, 175.
 — Use of steam in, 134, 135.
 — Water, 138.
Production in basic open hearth, 220, 223.
 — combined process, 224.
 — Hoersch process, 218.
 — Talbot process, 227, 228, 229.
Production of pure iron from Phosphoric iron, 195, 196.
Production of shear and crucible steel, 241-260.
Protection of steel from corrosion, 919-933.
Puddled steel, 293.
Puddling, 526, 527.
 — "Pull-over" mill, 595, 596, 608, 759, 762, 763.
Pusher car, 52, 53, 54.
Pyrometers, 439-448.
 — Baird & Tatlock, 442.
 — Callender, 440.
 — Féry radiation, 445.
 — Roberts-Austen's recording, 442.
 — Thermo-couple, 440.
 — Uehling, 447.

Q

Quenching, 345.
 — Effect of Carbon on results of, 351.
 — in oil, 437.

R

Rabble, 167.
Radcliffe reheating furnace, 541.
Radiation pyrometer, 445.
Rails, 616, 619, 763, 764, 765, 766, 830, 833.
 — Cooling of, 616, 763, 765.
 — Drop testing, 329, 495, 496.
 — Finishing of, 763, 765.
 — Inspecting of, 764.

Rails, Mills for rolling, 742, 762, 763, 764, 765, 827, 830, 833.
 — Photo-micrography of, 490.
 — Re-rolling, 765.
 — Rolling of, 575, 598, 616, 619, 763, 765, 827, 830.
 — Straightening of, 764.
 — Tests for, 495, 496, 763, 764.
 — Tramway, 619, 764.
 — Weight of, 764.
 — worn, Use of, 528.
Railways, 831, 833.
Ramming basic linings, 61.
Ram's-horn test for red-shortness, 328.
Ramshotbottom, 526, 598, 666, 725, 730.
Rankin & Ludington, Wire drawing machines by, 912.
Rateau exhaust steam turbine, 682.
 — heat accumulator, 682-685.
Razor steel, 257.
Reactions, acid Bessemer, curves and analyses, 84, 85, 87, 88, 89, 90, 91.
 — basic Bessemer, curves and analyses, 93, 94, 100.
 — acid Siemens, 168-175.
Reamur, on nature of steel, 341.
Recalescence, 356, 420.
Recarburising in acid Bessemer, 55.
 — in acid Siemens, 176, 189.
 — in basic Bessemer, 67, 102.
 — Darby process, 189.
 — Use of anthracite in acid Siemens for, 176.
Receiver, Metal, 15-18.
Receiving ladle, 52.
Reciprocal mill, 629.
Recovery of waste heat from reheating furnaces, 556.
Regenerators in reheating furnaces, 541.
Red-shortness, 2, 611.
 — Test for, 328.
Reduction of area, 299.
 — Calculation of, 316.
 — in rolling, 608.
 — in wire drawing, 914.
Reeling, 608, 896, 897, 898.
Reels, 608, 799, 811, 812, 813.
Reflectors for microscopic work, 456-458.
Refractory materials, Analyses of, 232, 233.
Regenerators of Siemens furnaces, Size of, 143, 146.
Reheating, 531-561.
 — Risk in, 840.
 — temperature, 553.
Rehmann producer, 128.
Reimer's method for keeping ingot tops hot, 839.
Reinhart, on gas engines, 712.
Reinische Stahlwerke, Mill at, 734.
Repairing bottom of Siemens furnace, 167.
Repeaters, 805, 810.
Rephosphorisation, basic Bessemer, 67, 101.
Re-pouring metal, before casting, 52.

Republican Iron and Steel Co.'s Mill, 766.
Reschitz, Press at, 881.
Resistance pyrometer, 440.
 — type of electric furnaces, 266.
Restoration of steel by heat treatment, 439.
Reverberatory furnace, 574.
Reversing gear, 774.
Reversing mill, 595, 598, 627, 644, 734, 774, 776, 827, 828.
 — Advantages of, 639, 827, 828, 829.
 — compared with three-high mill, 639, 641, 764, 827.
 — Driving of, 730.
 — Electrically driven, 734.
Reversing motors, 722.
Reversing valves, 149-155.
Reynolds, on fluid compression, 883.
Richards, A. Windsor, on basic process, 59.
 — restoring steel by heat treatment, 439.
Richards, E. J. Windsor, on removal of Silicon in mixer, 19.
Ridsdale, on basic Bessemer reactions, 101.
 — etching microsections, 455.
 — influence of work on size of grains, 434.
 — removal of Sulphur, basic Bessemer, 95, 96.
 — results on heating low Carbon steel, 432.
Riley, E., on basic process, 59.
Riley, J., on nickel steel, 404.
 — charging molten metal in Siemens furnace, 197.
Rinman, on Carbon and iron, 342.
"Rippers" for wire, 912.
Robert converter, 73.
Robert steel, Analysis of, 74.
Roberts, J. & S., Ltd., Housings, etc., by, 583, 589, 777.
Roberts-Austen, Sir Wm., on allotropy, Definition of, 358.
 — diamond and iron, 341.
 — etching microsections, 454.
 — polishing microsections, 450.
 — pyrometer, 442.
Robinson & Rodger, compression of steel ingots, 387, 887, 888.
Rochling-Rodenhauser electric furnace, 264-266.
Rod for drawing into wire, 797, 810, 811.
Rod mills, 608, 797, 801, 802, 805.
 — various systems compared, 811.
Roll turner, 610, 616, 621, 779.
Roller, The duties of, 616, 636, 637, 638, 639, 778, 783, 797, 798, 832.
 — Live, 639, 641, 643, 651, 746, 758, 778, 779, 784.
 — Loose, 593, 638, 639, 758.
Roller beds, 639.
Roller-table, 639.
"Roller's side," 593, 596, 638, 639, 642.
Rolling angles, 612, 615, 618, 756, 758.
 — Armco iron, 196.

- Rolling bars**, 578, 594, 600, 608, 638, 818.
 — beams, 610, 612, 613, 627, 635, 756, 822, 829.
 — billets, 753, 754, 821.
 — channels, 607, 616, 756.
 — Cold, 762.
 — Examples of, 612, 613.
 — Five chief examples of, 595.
 — flats, 610, 612, 623, 625, 631, 634, 753.
 — girders, 610, 612, 613, 627, 635, 756, 822, 829.
 — gun barrels, 902.
 — History of, 526, 528, 600.
 — iron, 614, 627.
 — joists, 610, 612, 613, 627, 635, 822, 829.
 — long lengths, 528, 529, 608, 638, 640, 643, 674, 753, 797, 799, 810, 821, 822.
 — material unequally heated, 548, 560, 614, 801.
 — mills. See *Mills, Types of*.
 — Object of, 524, 526, 573, 601, 602.
 — "off," 895, 898, 902.
 — "on," 895, 898.
 — over a mandril, 619, 893.
 — plates, 598, 609, 610, 617, 651, 653, 778, 779.
 — rails, 616, 619, 763, 765, 827, 830.
 — rounds, 602, 603, 612, 614.
 — sections, 596, 613, 615, 616, 617, 619, 623, 624, 674, 827.
 — sheets, 596, 610, 617, 778, 787, 789, 790, 791, 792.
 — Speed of, 607, 608, 626, 627, 638, 640, 799, 811.
 — squares, 612, 614, 616, 753.
 — Temperature for, 527, 529, 553, 560, 616, 765, 792.
 — tires, 770.
 — tram rails, 619, 830.
 — tubes, 893, 895, 900, 902, 904, 906, 908, 909.
Rolls, Action of, 573, 600, 601, 854, 855.
 — Adjustment of, 577, 581, 583, 586, 587, 591, 763, 775, 803, 808, 818.
 — Balance for, 577, 581, 582, 778.
 — Bending of, 576, 779.
 — Bodies of, 573, 576, 624.
 — "Bolting," 760.
 — "Breaking down," 608, 760, 808, 810.
 — Breaking of, 575, 604, 607, 608, 613, 625, 629, 789, 790, 821, 826, 828.
 — Casting of, 573, 574.
 — Changing of, 580, 599, 612, 754, 755, 756, 762.
 — Chilled, 573, 574, 575, 619, 621, 777, 783, 789.
 — Cogging, 575, 610, 611, 612, 622, 786, 827.
 — Collars on, 592, 593, 609, 610, 622, 624, 625.
 — Cooling of, 778, 783.
Rolls, Cost of, 573, 575.
 — Designing of, 610.
 — Examples of, 617, 618, 809.
 — Expansion of, 617, 778, 811.
 — Finishing, 604, 607, 611, 612, 617, 777, 826.
 — Fixed, 578.
 — Forged, 575, 777.
 — Grooved, 573, 578, 584, 592, 598, 600, 601, 603, 606, 609, 809, 855.
 — Iron box, 573, 574.
 — lower, Functions of, 610, 615.
 — Materials for, 573, 574, 575, 777.
 — Movable, 578, 582, 827.
 — Necks of, 575, 778.
 — Planishing, 794.
 — Plate, 575, 778, 779.
 — "Pilger," 909.
 — Re-turning of, 575, 787, 803.
 — Roughing, 604, 606, 608, 611, 612, 623, 826.
 — Sheet, 610, 787, 789, 790.
 — Shock on, 582, 607, 826.
 — Side braces for, 583, 787.
 — Size of, 600, 604, 606, 607, 627, 632, 742, 744, 745, 746, 752, 754, 756, 758, 760, 762, 764, 777, 784, 786, 787, 789, 792, 796, 799, 828.
 — "Slabbing," 612.
 — Speed of, 598, 606, 607, 608, 615, 627, 631, 746, 760, 764, 775, 787, 792, 799, 801, 803, 826.
 — Springing of, 560, 779, 801.
 — Steel, 575, 777.
 — Stiffener for, 605, 606.
 — "Stranding," 760.
 — Strength of, 575, 601, 604, 606, 607, 624, 630.
 — Three-high, 583, 584, 585, 622, 623, 624, 625.
 — Tinning, 929.
 — Train of, 826.
 — Turning of, 575, 619, 620, 621, 779, 787, 811.
 — upper, Functions of, 610, 615.
 — Size of, 610, 622.
 — Use of, 600.
 — Wear of, 607, 608, 613, 803, 827.
Rosenhain, on polishing microsections, 451.
Rotating mechanism for converter, 7.
Rottmann, variable expansion gear, 688.
"Round", 533.
Royston, on diffusion of Carbon, 246.
"Rumbling", 924.
"Running stopper", 56.
Ruthenburg electric furnace, 275.

S

- Saklin**, cost of rolling billets, 821.
Sal ammoniac, 920, 930.
Salt solution, Freezing, 355, 356.
Sample spoon, 167.

- Sampling from basic Bessemer converter**, 66.
 — for micro-examination, 449, 466.
 — producer gas, 137.
Sand, Loam, Analysis of, 235.
Sand shovel, 167.
Saniter, on etching microsections, 456.
 — process of desulphurisation, 96, 192, 193.
Sankey, alternate bending machine, 325.
 — Calibration of, 327.
Sauveur, on changes in structure by heat treatment, 430, 431.
 — critical points and microstructure, 362.
 — etching microsections, 454.
 — influence of work on size of grain, 434.
 — microstructure of quenched steels, 466.
 — unhardened steels, 465.
 — polishing microsections, 454.
Saw file, Steel for, 257.
Sawing, Cold, 756, 757, 769, 847, 848.
 — Hot, 756, 757, 763.
 — Speed of, 756, 757.
Scale, 597, 617, 631, 762, 795, 801, 804, 846, 847.
"Scavenging", 706.
Schloesing, on preparation of polishing powders, 452, 453.
Schoffel, fume from converter, Analysis of, 81.
Schuckert Electric Co., Crane by, 822.
Schuster, Dr. F., on comparison of various steel processes, 215a.
Scott, G. Shaw, on case-hardening, 249.
Scrap, 846, 847.
 — proportion to pig-iron in Siemens furnace, 160.
 — Use of, in basic Siemens, 186, 187.
 — electric furnaces, 261, 268, 270, 272, 276, 277, 280.
 — Siemens furnace, 169, 186.
Scraper, 795.
Scrapping the Bessemer charge, 54.
Screwing gears, 587, 597, 777.
Seaton and Jude, impact test, 322.
Sebenius revolving moulds, 892.
Sections, Cruciform, 607.
 — Rolling of, 596, 613, 615, 616, 617, 619, 623, 624, 674, 756, 827.
 — Selection of, 755, 834.
 — Straightening of, 616, 756.
Seebohm, on cement bars, 245.
 — temper of steel, 256.
Segregation, 378-381.
"Self-hardening" steel, 414, 416, 425b.
Sellers, on presses, 881.
Sellge, F., on economy of gas engines, 715.
Separating machines for sheets, 791.
Seraing Works, Forging press at, 860.
Setts, Steel for, 257.
Shaft, Cold-rolled, 762.
Shaft, Crank, 847, 848.
 — Hollow, 882.
 — Tests from broken, 841.
Shakell, W., on the properties of cast nickel, 404.
 — Titanium experiments by, 412.
 — on Tungsten steel, 414.
"Shaking barrel", 924.
Shapes. See *Sections*.
Shear steel, 1, 241, 247.
Shearing test, 318.
Shears, Billet, 752, 753, 815.
 — Bloom, 747, 748, 749, 750, 751, 815.
 — Flying, 814, 815, 816.
 — Hydraulic, 750.
 — Plate, 780, 781.
 — Sheet, 792.
 — Strip, 814.
Sheet mill, Output of, 792.
Sheets, Annealed, 794, 927.
 — Black, 794.
 — Bright cold-rolled, 794, 796, 927.
 — Cold-rolled, 794, 927.
 — Corrugated, 919.
 — Definition of, 787.
 — "Doubles," 790, 794.
 — Galvanised, 919, 923.
 — Gauge of, 792, 793.
 — "Lattens," 794.
 — Mill for, 596, 787, 790.
 — Rolling of, 596, 610, 617, 778, 787, 789, 790, 791, 792.
 — Separating, 791.
 — "Singles," 790, 794.
 — Tinned, 926, 927, 932.
 — "Trebles," 794.
Sheffield crucible, 253.
Sheffield University, Gas-fired crucible furnace at, 260.
Sherrardising, 925.
Shingling iron, 527.
Shrinkage in steel castings, 236.
Side pressure of rolls, 603.
Siemens, F., on gas-fired crucible furnaces, 260.
Siemens, Sir W., on blisters on cement bars, 246.
 — on efficiency of crucible furnace, 555.
 — electric crucible furnace, 277.
Siemens and Bessemer processes compared, 212-216.
Siemens furnace, admitting gas into, Precautions necessary, 158.
 — Charging, 159.
 — Chimney for, 155.
 — Drying of, 157.
 — Materials for drying, 232.
 — New form, 258, 260.
 — New form reheating, 541, 552.
 — Old type, 141.
 — Ports, 142-144.
 — Regenerators, 141, 145.
 — Reheating, 538.
 — Repairing bottom of, 167.
 — Valves for, 149-155.

- Siemens furnace**, Vertical underground reheating, 552.
Siemens gas producer, Modern form, 117.
 — Old form, 115.
Siemens process, 140a, 158.
 — acid, Composition of charge, 169.
 — — Precautions in working charge, 164.
 — — Removal of impurities in, 170.
 — basic, 180.
 — direct, 295.
 — Evolution of heat in, 110.
 — Labour and other costs in, 214.
 — Pig-iron for, 230.
 — Removal of Sulphur in, 110.
 — slag, Composition of, 171.
 — Yield in, 214.
Siemens producer gas, Analysis of, 134.
Siemens pyrometer, 441.
Silica bricks, Analysis of, 232.
Silico-spiegel additions, 65.
 — for tire steel, 177.
Silicon, Effect of, on magnetic properties, 369.
 — Elimination of, in Bessemer blow, 81, 82, 84, 85, 86.
 — Influence of, on medium and high Carbon steels, 369.
 — — mild steel, 365a.
 — in steel castings, 234, 235.
Silicon and Aluminium steels compared, 395.
Silicon and Manganese in Bessemer (basic) converter, 94.
 — in Bessemer converter, 83, 86, 88, 90.
Silver-copper alloys, Freezing point curve of, 356.
 — Photo-micrographs of, 358.
Single shear heat, 245.
 "Singles," 790, 794.
Siphon valve, Wailes, 154.
Size of grain, Micro-examination for, 460.
Skelp, 900.
Skids, 650, 653.
Skinninggrove Iron Co., Mill, 734, 735.
Slab, 611, 742, 747, 748, 785.
Slabbing mill, 747, 778, 784, 785.
 — rolls, 612.
Slack-fired reheating furnace, 533.
Slag chambers, 147.
 — clean, Importance of, in acid practice, 176.
 — Heat of formation of, 109.
 — Removal of, from open-hearth furnaces, 200a.
Slag, Acid, Composition of, 169, 171, 173, 174.
 — Effect of ore additions on, 172.
 — Variations in, 172.
Slag, Basic, Composition of, 188.
 — Fluidity of, 188.
 — Iron in, 103.
 — Removal of, from melting shop, 65.
 — Sulphur in, 97.
 — Value of, 65, 93, 193.
Slag, Bessemer, Action of, in converter, 82.
 — from reheating furnace, 531.
Sleeve, Fireclay, for stopper rod, 26.
Small converters, 68-79.
Smith, J. Bucknall, on the strength of wire, 916.
Smith, Kent, on Vanadium steels, 424.
Snelus, Analyses of gas from converter, 81, 106.
 — — metal from converter, 88.
 — on basic linings, 59.
 — Bessemer reactions, 79, 88, 89.
 — segregation, 379.
Soaking pit, 529, 548, 833.
 — Fired, 529, 550.
 — Objections to, 549, 550, 551.
 — Output of, 552.
Société Metallurgique de l'Oural Volga, Cogging mill for, 746.
Solubility of Phosphoric acid in slag, 193.
Solution theory, 353-358.
Sorbite, 464.
Sorby on microscopical examination of steel, 449.
 — on Pearlite, 344.
 — on polishing microsections, 449.
Sorby-Beck reflector, 456.
Sound ingots, Production of, 387-390.
Sound steel, Production of, 390-392.
 "Spawling," 574.
Special steels, 393-426.
Specific heats of gases, 132.
 — of products of combustion, 106.
Specification of process of manufacture, 491.
Specifications, 491-515.
 — American details of axles, tires, castings, rails, etc., 491-494.
 — British, details for rails, axles, tires, etc., 495-505.
 — Comparative summary for Great Britain, United States, and Germany, 506-515.
Speedicut steel, 417.
Spelter, 920, 921.
Sperry, on nickel steel, 406.
Spherical mould, Effect of, 524.
Spiegel, Additions of, to Bessemer charge, 55.
 — — basic Bessemer, 67, 101, 102.
 — Analysis of, 55.
 "Spills," 604.
Spindles for rolling mills, 590.
 — Steel for, 257.
 "Spread," 601, 602, 604, 609, 613, 614, 615, 622.
Spring steel, 245, 247.
 — Manufacture of, 175.
Springs, Deflection of, under varying loads, 340.
 — Testing of, 336-340.
Squeeze, compared with blow, 854.
Stafford, tilting furnace "block," 148.
Stahl, on nature of steel, 341.
 "Stalling," 666.

- Stamping under the hammer**, 835, 843, 846.
Standard wire gauge, 917, 918.
Standards. See *Housings*.
Stands, Arrangement of, 826.
Stansfield, on burnt steel, 467.
 — potentiometer for temperature measurement, 445.
 — solution theory, 358.
Stanton & Bairstow, impact testing machines, 323.
Starting gas engines, 712.
 — valves, 689.
Stassano electric furnace, 277, 278.
Staving tubes, 904.
Stead, on alloys of copper and iron, 376.
 — analyses of firebricks, 553.
 — Armco iron, 196.
 — Arsenic in steel, 375.
 — basic Bessemer reactions, 93, 101.
 — detection of Phosphorus by the microscope, 468.
 — etching microsections, 455.
 — gas sampler, 137.
 — heat tinting, 455.
 — illumination of microsections, 457.
 — low Carbon steel, Results of heating, 432.
 — occlusion of gases, 382.
 — Phosphorus in steel, 373.
 — Removal of, in basic Bessemer, 99.
 — polishing apparatus, 452.
 — — microsections, 451.
 — rephosphorisation, basic Bessemer, 101, 102.
 — restoring steel by heat treatment, 439.
 — Saniter process, 192.
 — Sulphur, Removal of, basic Bessemer, 95, 96, 97, 98.
Stead & Evans, influence of copper on steel, 370, 376.
Stead & Richards, on the restoration of, dangerously crystalline steel, 439.
Stead & Wigham, copper in steel wire, 376.
Steam, Action of, in gas producer, 113.
 — Consumption of, 673, 827.
 — Economy of, 663, 664, 678, 687, 830.
 — Effect of different quantities, on producer gas, 135.
 — Expansion of, 669, 678, 682, 687.
 — Method of raising, 534, 655-665.
 — Pressure of, 664, 666, 672, 674, 678, 679, 682, 684, 685, 830.
 — Superheating, 663.
 — Use of, in Mond producer, 121.
 — Use of, in producers, 134, 135.
Steam engines, 666-690.
 — Efficiency of, 695.
Steam hammer. See *Hammer*.
Steam turbines, 680, 682, 685, 686.
Steel, alloys, 393-426.
 — Aluminium, 393-396.
 — Analysis of, 231.
Steel, Axle, 175.
 — Boron, 396.
 — Burning of, 467, 527.
 — Cast, 251-260.
 — for castings, 233.
 — Chisel, 257.
 — Chrome, 396-398.
 — Clapp-Griffiths, Analysis of, 72.
 — Compressibility of, 350.
 — Constituents of, 461-464.
 — Constitution of, 352.
 — Contraction of fluid, 523, 525, 887.
 — Crescent, 414.
 — Critical ranges in, 353.
 — Crucible, 251-260.
 — Curve showing separation of iron and Carbide during cooling of, 357.
 — Definition of, 2.
 — Diffusion of Carbon in, 246.
 — Direct processes of manufacturing, 291-295.
 — Electric smelting of, 261-283.
 — forgings, 837.
 — Gases in, 382-386.
 — Hardening of, 345, 429.
 — Heat treatment of, 428-448.
 — Imperial, 414.
 — Influence of Antimony on, 377.
 — — Arsenic on, 375.
 — — Bismuth on, 377.
 — — Carbon on physical properties of, 345.
 — — Cobalt on, 398.
 — — Copper on, 375, 376.
 — — Manganese on, 374.
 — — Phosphorus on, 372, 373.
 — — Silicon on, 365a-369.
 — — Sulphur on, 370, 371.
 — — Tin on, 377, 378.
 — — Zinc on, 378.
 — Internal stresses in, 525, 526, 840.
 — Magnet, 420.
 — Manganese, 399-403.
 — Microscopical examination of, 449, 469.
 — Microstructure of unhardened, 465.
 — Molybdenum, 403, 850.
 — Mushet, 414.
 — Nickel, 403-411.
 — Occlusion of gases by, 382-386.
 — Photo-micrographs of, 358, 472-490.
 — Plastic condition of, 525, 883.
 — Pot melting of, 251.
 — processes, Advantages and disadvantages of various, 213-216, 280-283.
 — Production of, in small quantities, 751, 752.
 — Protection of, from corrosion, 919-933.
 — Puddled, 293.
 — Robert, Analyses of, 74.
 — Rusting of, 919.
 — Self-hardening, 414, 416.
 — Shear, 1, 247.

- Steel**, Solidification of, 524, 525, 526, 837, 838, 884.
 — Special, 393-426.
 — Speedicut, 417.
 — Spring, 175.
 — Swedish, 71.
 — Tantalum, 411.
 — Taylor-White, 416, 425b.
 — Tilting of, 835.
 — Tire, 175.
 — Titanium, 412.
 — Tool, 257, 835, 837, 847, 849, 850.
 — Tungsten, 413, 850.
 — Uranium, 420.
 — Vanadium, 420-425b.
 — Welding of, 527, 899, 901, 902, 906.
 — Wootz, 292.
- Steel castings**, 233-240.
 — Additions of Aluminium, Silicon, Manganese to, 234.
 — Analyses of, 234, 235.
 — Annealing of, 237-240.
 — Composition of charge for, 234.
 — Internal stresses in, 236.
 — Moulds for, 235, 236.
- Steel plates**, Tests for, 500, 501.
 — Typical acid Siemens charge for, 169.
- Steel rails**. See *Rails*.
- Stevenson, A. A.**, tests of tires, 772.
- Sticker press**, 57.
- Stiffener**, 605, 606.
- Stirling boiler**, 658, 661, 662.
- Stock converter**, 78.
- Stock yards**, 822.
- Stokers**, Mechanical, 657.
- Stopper end** to stopper rod, 26.
- Stopper rod** on casting ladle, 25, 27.
- Stopper**, Running, 56.
 — for taphole, 167.
- Straightening**, 756, 763, 764, 780, 791, 796, 819.
- Stranding rolls**, 760.
- Strength** of rolled steel, Variation in, 318.
 — of steel castings, 235.
- Stress diagrams**, 300-302.
 — Internal, in steel, 236.
 — Maximum or tensile, 298.
 — theories of hardening, 362-365.
- "Stringing up"** for drawing wire, 913.
- Strip**, 582, 596, 625, 628, 634, 795, 796, 899, 900, 901.
- Strippers**, Ingot, 41-47.
- Stripping Bessemer pit**, 48.
 — cranes, 166.
 — ingots, 40.
- Stubbs' wire gauge**, 794, 918.
- Stückofen**, or high bloomery, Production of steel in, 294.
- Sub-Carbide of iron**, 344.
- Sub-Carbide theory**, 360.
- Sulphate of Ammonia** from Mond producer, 121.
- Sulphide of iron and Manganese**, Effect on microstructure, 468.
- Sulphur** in basic slag, 97.
- Sulphur**, Condition of, in steel, 371.
 — Influence of, in producer gas, 174.
 — on steel, 370, 371.
 — on steel castings, 234.
 — Removal of, in acid Siemens, 168.
 — in basic process, 95-99.
 — in Bell's and Krupp's washing process, 191.
 — in Bessemer process, 82, 110.
 — in electric furnaces, 279, 280.
 — in Heaton process, 191.
 — in Henderson process, 191.
 — from pig-iron, 192.
 — in Siemens process, 110.
- S.W.G.**, 917.
- Superheating steam**, 663.
- Superheating tops** of ingots, 838.
- Swage**, 601, 602, 603, 604, 846.
- Swaging machine**, 895, 911.
- Swedish bars for cementation**, 243.
- Swedish Bessemer process**, 68.
 — analyses of gases, 85.
 — details of converter, 69.
 — Reactions of, 84, 85.
 — Sulphur in, 85.
- Swedish Lancashire hearth bars**, Analysis of, 244.
- Swedish pig-iron**, Analysis of, 69, 263.
 — for tires and axles, 177, 179.
- Swedish steel**, Analysis of, 71.
- Swindell reheating furnace**, 541.

T

- Tables**, Lifting, 638, 641, 747.
 — Travelling, 641, 651, 778.
- "Tailoring"**, 604.
- Talbot**, on the influence of Aluminium on segregation, 380, 381.
- Talbot continuous process**, 200b-203.
 — Chemical changes in, 225, 226, 227.
 — Dr. Schuster's conclusions on, 215a.
 — Weekly record of, 227.
 — Summary of working of, 229.
- Talbot continuous reheating furnace**, 547.
- Talbot method** for producing sound steel, 390-392.
- Talbot producer**, 124-126.
 — gas, Analysis of, 134.
- Talbot regenerative soaking pit**, 550.
- Talbot washing process**, 196.
- Tamm**, Analyses of gases from Swedish Bessemer, 85.
- Tandem gas engine**, 701, 702.
- Tangye Tool and Electric Co., Ltd.**, Lathe by, 850.
- Tannett-Walker forging presses**, 857-860, 878.
- Tantalum steel**, 411.
- Taper** of grooves, 607.
- Tapping acid Siemens furnace**, 164.
- Tapping hole**, 158.
 — hook, 167.
- Tar** for basic material, 59.

- Tariffs**, 832, 833.
- Taylor-White**, on self-hardening steel, 416, 849.
 — steel, 425b, 849.
- Teeming Bessemer charge**, 56.
 — crucible steel, 255.
 — steel ingots, 30.
- Tees**, 607.
- Telegraph tongs**, 567.
 — wire, 799.
- Temper Carbon**, 343, 344.
- Temper** of crucible steel, 254, 256, 257.
- Temperature** of gases leaving Siemens furnace, 157.
 — Influence of, in annealing, 430.
 — on removal of Phosphorus in basic Siemens, 101.
 — Reheating, 553.
 — in Siemens furnace, 174.
 — Variations of, in producer gas, 136.
 — Working, 527, 614.
- Tempering colours**, 345.
- Tempering of steel**, 345, 429.
- Tenacity**, Influence of Carbon on, 346-348.
- Tensile strength**, 298.
 — Increase of, due to rolling, 779.
 — Influence of Carbon on, 346-348.
 — Influence of Phosphorus on, 373.
- Tensile stress**, 298.
 — Calculation of, 316.
 — Relation of Carbon to, 516.
- Terne plates**, 932.
- Terni**, Water pressure at, 718.
- Test**, Cold-bending, 329.
 — Details of Sankey, 326, 327.
 — Drop, 329-336.
 — Welding and hot-working, 328.
- Test bars**, before and after testing, 314, 315.
- Test pieces**, 311, 492.
 — Gauging of, 313.
 — Shape of, 310-313.
- Testing**, 297-340, 495-505.
 — rails, 764.
 — rails and axles by drop test, 329.
 — springs, 336-340.
 — tires, 332.
- Testing machines**, 302-309.
 — Adamson, 307-309.
 — Arnold alternate bender, 324, 325.
 — Brinell ball, 320.
 — Calibration of, 309, 310.
 — Drop, for axles, 330.
 — for tires, 334, 335.
 — Impact, 322, 323.
 — Sankey alternate bending, 325.
 — Spring scragging, 337.
 — Types of, 302.
 — Weighting, for springs, 338.
 — Wicksteed, 303-307.
- Tests**, Compression, 317.
 — Hardness, 320.
 — Impact, 322.
 — Shearing, 318.
 — Torsional, 318.
 — Transverse, 318.
- Theory** of case-hardening, 249.
 — of gas producers, 112.
 — of heat engines, 693, 694.
- Thermo-chemistry** of acid and basic Bessemer processes, 103-111.
- Thermo-couple pyrometer**, 440.
- Thickening tubes**, 904.
- Thomas, R.B.**, on tin plates, 930.
- Thomas-Gilchrist**, Early experiments by, 58.
- Three-high mill**, 526, 579, 596, 597, 622, 625, 760, 783, 785.
 — Advantages of, 624, 764, 797, 827, 828.
 — American, 625, 626, 764.
 — Carrying rolls in, 582, 583, 584, 586.
 — Cogging, 622.
 — compared with reversing mill, 639, 641, 764, 790, 827.
 — compared with two-high, 597, 763, 790.
 — Crewe, 638.
 — English, 625.
 — Guide, 761.
 — Housings for, 582, 583, 584, 586.
 — Introduction of, 526, 596.
 — Output of, 639, 766, 830.
 — Reversing, 828.
 — Reversing engines fitted to, 828.
 — Rolls for, 583, 584, 585, 622, 623, 624, 625, 827.
 — suitable for, 760, 797.
 — Tables for, 638, 639, 643, 829.
 — Tilters for, 647.
 — Universal, 784, 785.
 — Wear in, 827.
- Threlfall, Prof.**, on life of gas engine cylinders, 715.
- Thury**, Automatic electrode regulator, 272.
- Thwaite, B. H.**, on blast-furnace gas engine, 698.
- Tilters** for ingots, 644, 746.
- Tilting hammer**, 836.
- Tilting open hearth furnace**, 147-149.
- Tilting tool steel**, 835.
- Tin**, Influence of, on steel, 377, 378.
- Tin plate**, 926-932.
 — Annealing of, 927.
 — Bars for, 617, 787, 818.
 — Boxes for, 927.
 — scrap, 932.
 — Thickness of, 932.
 — Thickness of tin on, 929, 930.
- Tinning**, Flux for, 930.
 — Pot for, 929, 930, 931.
 — process, 928-932.
- Tipping ladles**, 21, 22, 23.
- Tire ingots**, 178, 179, 769.
 — Method of casting, 769.
- Tire steel**, Manufacture of, 175-180.
 — Typical charges for, 177, 179.
- Tire testing**, 332-336, 497, 498.
 — machine, 334, 335.
- Tires**, Making of, 768-773.
 — Strains in, 772, 773.

Titanium alloy, 413.
— in steel, 412.
Tongs, 567, 568, 596, 636.
Tool steel, 257, 835, 847, 849.
— Tilting of, 835.
Tools employed at Siemens furnace, 163.
— High-speed cutting, 414, 416, 425*b*, 849.
— for steam hammers, 837, 846.
— Steel for, 257.
"Topping" of ingots, 835.
— and grading crucible steel, 256.
Torpedo boats, Galvanising, 925.
Torsional test, 318.
Traction reel, 812.
Transverse test, 318.
Travelling tables, 641, 651.
"Trebles," 794.
Treatment of cast-steel ingots, 255, 256.
Treatment of feed water, 658.
Tresca, on revolving moulds, 892.
Tressider's process for hardening armour plate, 288.
Troost, on thermo-chemistry of steel, 107.
Troostite, 464.
Tropenas process, 76.
— Converter for, 77.
Tubes, Bedstead, 903.
— Bicycle, 898, 899, 903.
— Boiler, 898, 899, 900, 904.
— Butt-welded, 901, 902.
— Close-jointed, 903.
— Cold-drawn, 895, 900.
— Drawing of, 895, 900, 909.
— Erhardt's process, 910.
— Finishing, 900, 901, 904.
— Fittings for, 905.
— formed from sheets, 898.
— Galvanising, 924, 925.
— Gas, 902, 904.
— Lap-welded, 899, 900.
— Length of, 904.
— Lock-jointed, 905.
— Making of, 893.
— Mannesmann process for making, 908.
— Material used for, 898.
— Nickel steel for, 899.
— Perrin's process for making, 906.
— Piercing blanks for, 893, 909, 910.
— Reeling of, 896, 898, 900.
— Robertson's process, 910.
— Rolling of, 893, 894, 895, 900, 902, 903, 904, 906, 908, 909.
— Special processes for making, 906.
— Spirally welded, 902.
— Staving, 904.
— Stay, 901.
— Steam, 902, 904.
— Stiefel's process for making, 909.
— Straightening of, 900, 902, 904.
— Tests of, 899, 904.
— Thickening, 904.
— Water, 902, 904.
— Welded, 899, 900, 901, 902.
— Weldless, 893, 895, 898, 899.

Tucker, on influence of Arsenic, 375.
Tucker and Harbord, on reheating furnace bottoms, 553.
Tumbler for ingots, 570, 571.
Tungsten steels, 413-420, 425*b*, 849.
— Analysis of, 414, 415, 425*b*, 850.
— Crucible charge for, 414.
— Treatment of, 416, 426, 849, 850.
Tunner, on basic linings, 58.
Tup of steam hammer, 743, 836, 845.
"Tupping," 845.
Turbines, Exhaust steam, 682.
— Economy of, 686.
— Mixed pressure, 685.
Turnbull, N. K., on rod mills, 811.
Turner, Prof. T., Disposal of spent acid, 926.
— on influence of Silicon, 365*b*.
— on sound ingots, 257.
Turner, Thomas, method of casting ingots, 36, 37.
Turning blooms on edge, 767.
Turnover transfer, 650.
Tweedell, Forging press by, 874.
Twining caused by quenching, 363.
Twisting guides, 816.
Two-cycle engines, 708.
Twyer for converter bottom, 10.
Twynam, T., direct process, 203, 291.
— on Nitrogen in steel, 382.

U

Uehling pyrometer, 447.
Ultimate stress, 298.
Union Works, Removal of slag from open-hearth furnaces, 200*a*.
United States Navy, Armour plates of, 289.
Universal mill, 631, 632, 633, 784, 785, 786.
Unwin, on calibrating testing machines, 309, 310.
— on elastic limit, 298.
— extensometer, 315.
Uranium steel, 420.
"Use," 742, 745.

V

Vacuum casting, 891.
Valves for Siemens furnaces, 149-155.
— Butterfly, 150.
— Reversing, Dimensions of, 151.
— Hall, 133.
— Kirkham, 150, 152.
— Mills' water-cooled, 155, 156.
— Wailes' siphon, 154.
— Water seal, 155.
Vanadium steel, 420, 425*b*.
— Effect of, on occluded gases, 422.
Vandergriff Works, Continuous bar mill at, 818, 819.

Variation in strength of specimens from same plate, etc., 318.
— in temperature of producer gas, 136.
Vibration caused by hammer, 843, 854, 879.
— of lathe, 850.
Vickers, armour plate, 284, 286.
— crucible steel patent, 254.
— on theory of fluid compression, 884, 890.
Vickers' Works, Forging press at, 769.
Vis-a-vis engines, 701, 702.
Volklingen, Electric furnace at, 266.
Volga Co., Cogging mill at, 746.

W

Wages, 831.
Waggon tires, Effect of annealing, 336.
Wahlberg, on experiments on heat treatment, 437.
— results of hardness tests, 351.
Wailes' siphon valve, 154.
— water-seal reversing valve, 155.
Walloon Swedish bars, Analysis of, 263.
— Use of, in cementation process, 243.
Walrand-Legenisel process, 74.
— Converter for, 75.
Walter, on determination of Manganese, 522.
Walton, on removal of Silicon and Carbon during melting, 170.
— on removal of Sulphur in basic Bessemer, 96, 97, 98.
Ward, L., system of motor control, 731.
Washburn and Moen Mfg. Co., Rod mill at, 802.
Washed metal, 177.
Washing processes, 191.
— Talbot, 196.
Waste heat from reheating furnaces, Recovery of, 556.
Water, Consumption of, by condensing engines, 679.
— by non-condensing engines, 678.
— Feed, Chemical treatment of, 658.
— Heating of, 659, 660.
— Hardening by, 426, 427, 428.
— power, 718.
— softeners, 659.
Water-cooled blocks, Siemens furnace, 144.
Water gas, 137-139.
— Composition of, 139.
Water-seal reversing valve, Wailes', 155.
Water vapour, Action of, in gas producer, 113.
Watt, 721.
Webster, on influence of Sulphur, 370.
— Manganese on mild steel, 374.
Wedding, on basic linings, 58.
— on Bessemer reactions, 98.
— on reduction of Manganese during after blow, 94, 95.
Wedding, on removal of Phosphorus in basic Bessemer, 99, 100.
— on removal of Sulphur in basic Bessemer, 95, 96, 98.
Weiffenback, on case-hardening, 250.
Weighing test for springs, 339.
Welding, 527, 899, 901, 902, 906.
— Tests for, 328.
Weldless tubes, 893, 895, 898, 899.
Wellman, on American mills, 765.
— charging machine, 15, 161.
— electric ingot stripper, 45, 46.
— fore-hearth, 210.
— furnace, 149.
— ingot charger, 565.
— ingot crane, 40.
Wellman-Seaver charging machine, 162, 565, 568.
— guided ingot stripper, 47, 48.
Wenstrom's mill, 634.
While, Chas., continuous mill, 598.
While, J. M., Barrow Bessemer shop, 53.
White, M. C., on nickel steels, 406.
Whitehouse, C., wrought-iron tubes, 901.
Whitworth, casting under pressure, 387, 883, 884, 887, 890.
— Forging press by, 854, 861.
Wicksteed testing machine, 303-307.
Wiener, on Vanadium steels, 422.
Wigham and Stead, on copper in steel, 376.
Wild, J., & Co., Uehling pyrometer, 448.
Wilson producer gas, Analysis of, 134.
Wilson gas producer, 117-120.
Wilson's compound armour plates, 289.
Wingham and Ball, on desulphurisation, 191.
Winkler and Lunge, calorific power of gases, 131.
Wire, 911.
— Annealing of, 915.
— Bench for drawing, 911.
— "Bench-hardened," 917.
— Galvanised, 917.
— "Improved," 916.
— "Patented," 916.
— "Plough steel," 916.
— Strength of, 916.
— Telegraph, 799.
— Tempering of, 916.
Wire blocks, 911, 912.
Wire drawing, 911-914.
Wire fencing, 811.
Wire gauge, 917.
Wire mill, 799.
Wire reels, 799, 811, 812, 813.
Wire rod mill, Bedson's, 801.
— Belgian, 797.
— Boecker's, 805.
— Continuous, 801, 804.
— Garrett's, 803.
— Morgan's, 802.
— Output of, 810.
— Speed of, 608.
Wire rods, 797, 810, 811.
Wisconsin Steel Co.'s mill, 760

Witkowitz, Combined process at, 224.
 — Melting shop at, 212.
 — Open hearth experiments at, 215.
 — Talbot process at, 202.
Wobblers, 576.
Wohler alternating bending machine, 324.
 — experiments on fracture, 701.
Wolfram, Reduction of, 413.
Wootz, or Indian steel, 292.
Work, Influence of, on size of grain, 434.
Working, Effects of, 523, 608, 609, 853.
Wylie, W., on Scotch mills, 760.

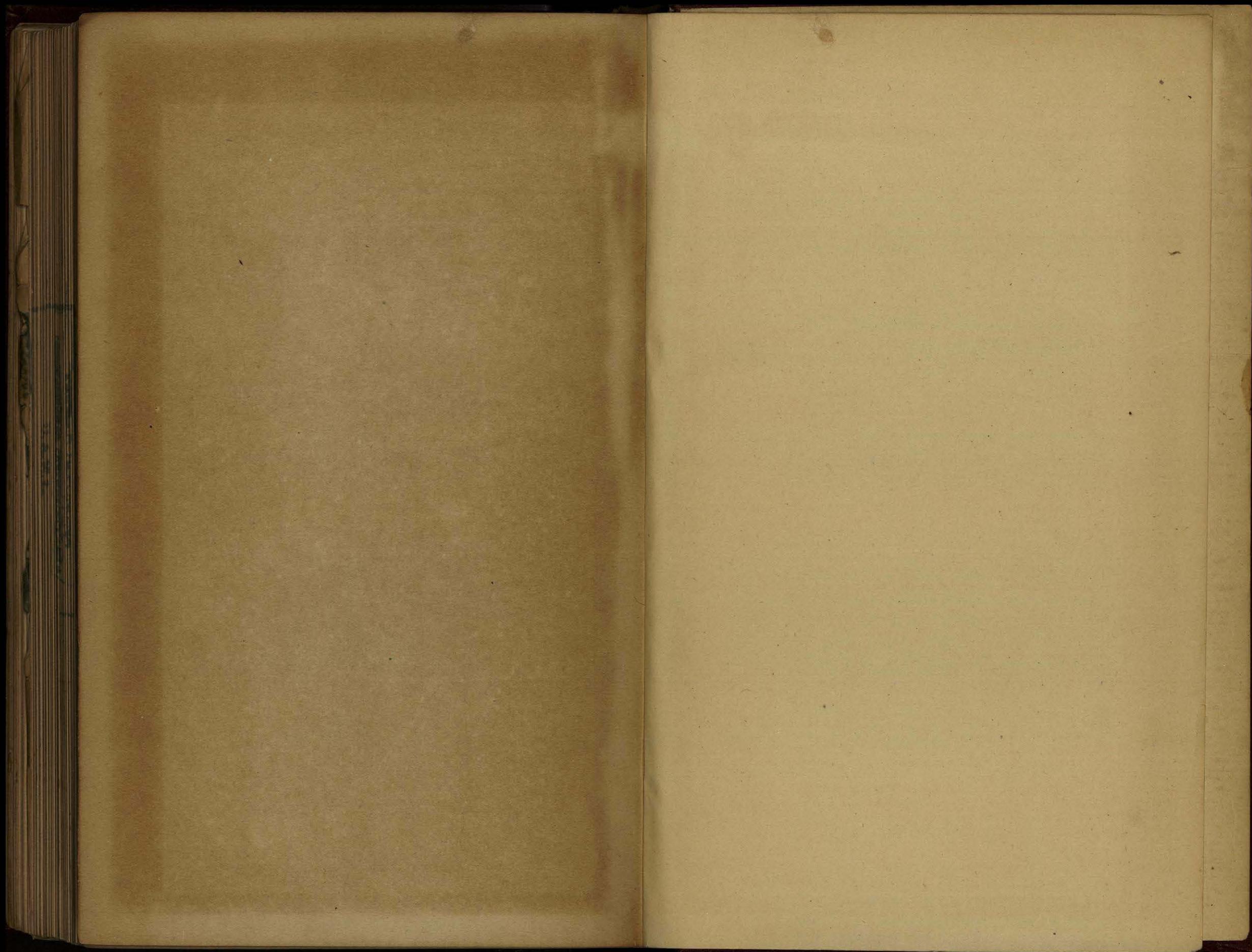
Y

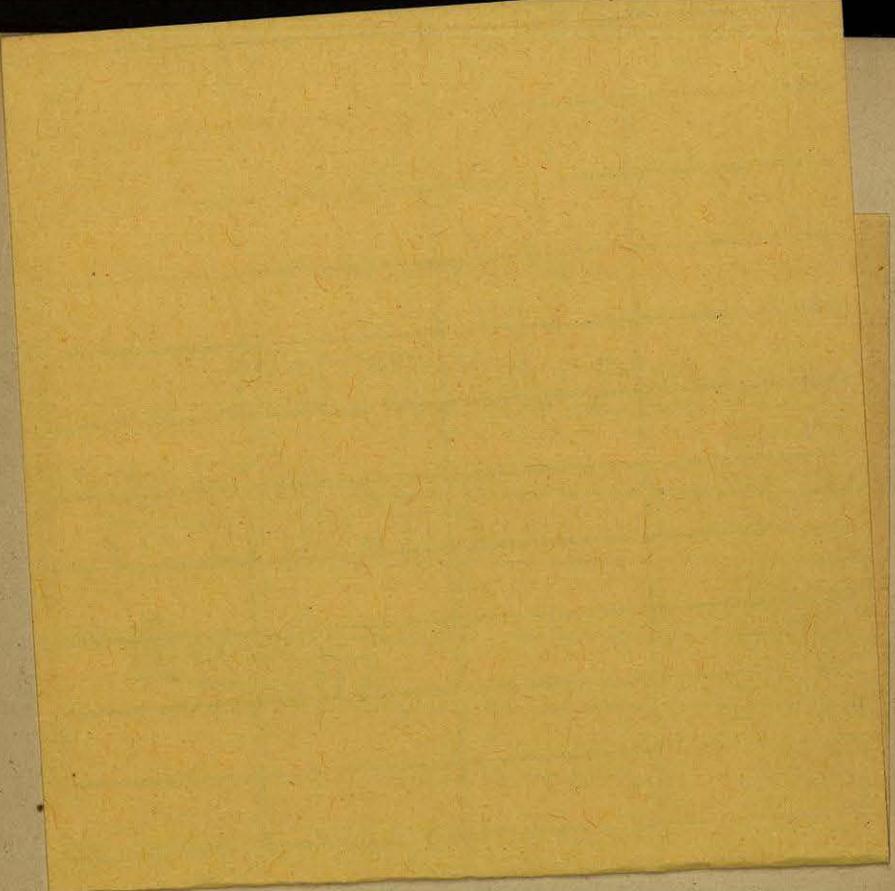
Yarrow, A. F., experiments on tubes, 899.
Yarrow & Co., Ltd., Experiments on
 drilling by, 851.
Yield in basic open hearth process (Hubert-
 ushütte), 220.

Yield in basic open hearth process (Jurievka),
 222.
 — Bertrand-Thiel process, 199.
 — Bessemer and Siemens processes,
 214.
 — combined process (Witkowitz), 224.
 — Hoesch process, 218.
 — Talbot process, 201, 227, 228, 229.
Yield point, 299.
Young's modulus, 298.
Youngstown, Continuous mill at, 821.

Z

Zinc, 920.
 — ashes, 921.
 — Chloride, 933.
 — Galvanising by, 919.
 — Influence of, on steel, 378.
Zugger, Influence of tin on steel, 378.





TN730
H26
1916
V. 2



127458

AUTOR

HARRISON B. ...

127458



