

TIME.

"On Uniform Standard—, for Railways, Telegraphs and Civil Purposes Generally." Sandford Fleming. X, 387 (1881).

TOLUOL.

"The Production of— from Gas Plants." Myron S. Palk. LXXXIII, 904 (1919-20). Discussion: A. C. Klein, and Horace C. Porter. LXXXIII, 293.

TOOLS.

—used in stone cutting. VI, 298 (1877).
Wrecking— for railroad emergencies. XXVII, 39 (1892).

TOPOGRAPHY.

"Geology in its Relation to—." John C. Brauner. (With Discussion.) XXXIX, 53 (1898).
"Methods of Location on the Choctaw, Oklahoma and Gulf Railroad." F. Lavis. (With Discussion.) LIV, 104 (1905).
"New Method of Making Conventional Signs on Original Topographical Maps." J. A. Ockerson. XIV, 399 (1885).
"Railroad Location." Michael L. Lynch. (With Discussion.) XXXI, 81 (1894).
"Rapid Methods in Topographical Surveying." William Bell Dawson. XI, 397 (1882). Discussion, XI, 405.
"Recent Stadia Topographic Surveys: Notes Relating to Methods and Cost." William B. Landreth. (With Discussion.) XLIV, 92 (1900).
"The Topographic Map of the United States." Herbert M. Wilson. XXXIII, 405 (1895).
"Topographic Surveys." Herbert G. Ogden. XXX, 62 (1893). Discussion, XXX, 611.
"Topographical Surveys Made by the American Section of the International Boundary Commission United States and Mexico." W. W. Follett. (With Discussion.) LXXVII, 989 (1914).
"— on the Survey of the Mexico-United States Boundary." J. L. Van Ornum. (With Discussion.) XXXIV, 259 (1895).

TORNADOES.

"Probable Wind Pressure Involved in the Wreck of the High Bridge over the Mississippi River on Smith Avenue, St. Paul, Minn., August 20th, 1904." C. A. P. Turner. (With Discussion.) LIV, 31 (1905).
"Wind Pressures in the St. Louis Tornado, with Special Reference to the Necessity of Wind Bracing for High Buildings." Julius Baier. (With Discussion.) XXXVII, 221 (1897).

TORRENTS.

"Characteristics of the Ravine du Sud in the Island of Hayti, and Plan for Averting Its Overflow." J. Poster Crowell. XXIV, 470 (1891). Discussion, XXIV, 478; XXV, 343 (1891).

See also **RIVERS.**

TOWERS.

"A Concrete Water Tower." A. Kempkey, Jr. (With Discussion.) LXX, 334 (1910).
"Reinforced Concrete—." D. W. Krellwitz. (With Discussion.) LX, 160 (1908).
"Replacing the Stone— of the Niagara Railway Suspension Bridge, with Iron—." L. L. Buck. XVII, 204 (1887).

TOWERS—(Continued).

"The Tower of the New City Hall at Philadelphia, Pa." C. R. Grimm. (With Discussion.) XXXI, 249 (1894).

TOWING.

"Steam and Electric Cableways for Logging and Canal-Boat—." Richard Lamb. (With Discussion.) XXXII, 44 (1894).

TRACK.

"A Brief Description of a Modern Street Railway— Construction." A. C. Polk. LXXVI, 455 (1913). Discussion: E. E. R. Tratman, Walter C. Howe, Louis A. Mitchell, William J. Boucher, and C. B. Vorce. LXXVI, 466.
"Car Tracks and Pavements." James Owen. XXXVII, 63 (1897). Discussion, XXXVII, 78.
Comparison of— in the Pennsylvania and Hudson and Manhattan Railroad tunnels. LXIX, 409 (1910).
"Construction and Maintenance of—." Julien A. Hall. (With Discussion.) XXIII, 350 (1890).
Cost of—, LXIX, 409, 424 (1910).
"Cylindrical Wheels and Flat-Topped Rails for Railways." D. J. Whittemore. XXI, 133 (1889). Discussion, XXI, 153.
"Development of the American Rail and —." J. Elfreth Watkins. XXII, 209 (1890).
Effect of increased weight of rolling stock on roadbed. LI, 105 (1903).
"English Railroad—." E. E. Russell Tratman. XVIII, 217 (1888). Discussion, XX, 61 (1889).
"Line and Surface for Railway Curves." Charles C. Wentworth. (With Discussion.) XLVIII, 357 (1902).
"Longitudinals vs. Cross-Ties for Railway Tracks." E. E. Russell Tratman. (With Discussion.) XXV, 615 (1891).
"Maintenance Expenses of— on Wooden and Metal Ties." J. W. Post. (With Discussion.) XVIII, 253 (1888).
"Management of Forces Engaged in Railway— Repairs." Benjamin Reece. XIII, 396 (1884).
"On the Gauges of Railroad—in General, with Special Consideration of Narrow-Gauge Railroads." E. A. Ziffer. (Translated from the German by Wolfgang G. Triest.) XXIX, 453 (1893). Discussion, XXX, 537 (1893).
"On the Theoretical Resistance of Railroad Curves." S. Whinery. VII, 79 (1873). Discussion, VII, 97; VIII, 179 (1879).
"Pioneer Railway Development in the United States." W. D. Taylor. (With Discussion.) LXXIV, 94 (1911).
"Progress Report of the Special Committee to Report on Stresses in Railroad—." LXXXII, 1191 (1918).
"Second Progress Report of the Special Committee to Report on Stresses in Railroad—." (With Discussion.) LXXXIII, 1409 (1919-20).
"Some Notes on the Creeping of Rails." Samuel Tobias Wagner. (With Discussion.) LIII, 486 (1904).
"Street Railway—." T. G. Gribble. (With Discussion.) XXIV, 80 (1891).
"The Advantages of a Longitudinal Bearing System for Railway Tracks." Thomas C. Clarke. (With Discussion.) XXV, 234 (1891).
"The Improvement of Railway and Street

TRACK—(Continued).

- Railway—." E. E. Russell Tratman. XXII, 135 (1890).
 "The Influence of Rails on Street Pavements." Edward P. North. (With Discussion.) XXXVII, 70 (1897).
 "The Permanent Way of Railways in Great Britain and Ireland, with Especial Reference to the Use of Timber Preserved and Unpreserved." John Bogart. VIII, 17 (1879).
 "The Rearrangement of Railroad Tracks and Stations in Cologne, Prussia." F. Lohse. (Translated from the German by Mansfield Merriman.) XXIX, 277 (1893).
 "The Relation of Wheels to Frog Points and to Guard Rails." Archibald A. Schenck. (With Discussion.) XXXI, 509 (1894).
 — changes, Manhattan Elevated Railway improvements. LXXXII, 556, 729, 735 (1913).
 — used in the tunnels and station of the New York terminus of the Pennsylvania Railroad. LXIX, 305, 345 (1910).

See also RAILS: TIES.

TRADE WINDS.

- "On the Cause of —." Franz A. Velschow. (With Discussion.) XXIII, 101 (1890).

TRAFFIC.

- "An Account of Some Observations of Street —." Francis V. Greene. XV, 123 (1886).
 Daily vehicular—count over East River bridges. LXXXIII, 436 (1919-20).
 Methods of taking—census. LXXXIII, 1 (1911).
 "Street—in New York City, 1885 and 1904." Clifford Richardson. LVII, 131 (1906). Discussion: S. Whinery, N. P. Lewis, and G. W. Tilson, LVII, 191.
 "The Concurrent Development of—on Improved Waterways and on Railroads." Edward P. North. (Inter. Eng. Cong. 1904.) LIV, Part B, 475 (1905). Discussion: Leo Sympher, Lionel B. Wells, and Th. Hoech, LIV, Part B, 495.
 "The Economic Depth for Canals of Large —." Joseph Mayer. (With Discussion.) XXXIX, 273 (1898).
 "The Elements of Cost of Railroad Freight —." O. Chanute. II, 381 (1873).
 "The Problem of the Lower West Side Manhattan Water-Front of the Port of New York." B. P. Cresson, Jr. (With Discussion.) LXXV, 228 (1912).
 "The Production of—and the Transportation of Freight and Passengers." Martin Coryell. (With Discussion.) II, 240 (1873).
 —census, Druid Hill Park, Baltimore. LXXVII, 1135 (1914).
 —census for roads and pavements. LXXXII, 1357, 1430 (1913).
 —on subways at Grand Central Station, New York City. LXXXII, 326, 328 (1913).
 See also TRANSPORTATION.

TRAIN LOADS.

- "Locomotive Performance on Grades of Various Lengths." Beverly S. Randolph. (With Discussion.) LXX, 321 (1910).
 "The Maximum Weights of Slow Freight Trains." C. S. Bissell. LXIV, 303 (1909). Discussion: L. A. Riley, 2d, LXIV, 312.
 *The Traction of Freight Trains at Dif-

TRAIN RESISTANCE.

- ferent Speeds." Clinton S. Bissell. (With Discussion.) LXVI, 58 (1910).
 "Air Resistances to Trains in Tube Tunnels." J. V. Davies. (With Discussion.) LXXV, 982 (1912).
 "Experiments on the Resistances of Rolling Stock." A. M. Wellington. VIII, 21 (1870).
 "Experiments with New Apparatus on Journal Friction at Low Velocities." A. M. Wellington. (With Discussion.) XIII, 409 (1884).
 "Locomotive Performance on Grades of Various Lengths." Beverly S. Randolph. (With Discussion.) LXX, 321 (1910).
 "Resistances of Railway Trains." (Report of Dynagraph Experiments of P. H. Dudley.) William P. Shinn. V, 341 (1876).
 "The Approximate Value of a Reduction of Ruling or Maximum Grades, Especially for the Use of Engineers on Location of Railroads." John G. Clarke. II, 399 (1873).
 "The Construction of the Atchison, Topeka and Santa Fe Railroad over the Raton Mountains, and the Performance of Locomotives on its Steep Grades." James D. Burr. (With Discussion.) VIII, 295 (1879).
 "The Location of the Knoxville, La Fayette and Jellico Railroad, of the Louisville and Nashville System." W. D. Taylor. (With Discussion.) LII, 467 (1904).
 "The Maximum Weights of Slow Freight Trains." C. S. Bissell. (With Discussion.) LXIV, 303 (1909).
 "The Proper Compensation for Railroad Curves." William B. Morley. (With Discussion.) XIII, 131 (1884).
 "The Traction of Freight Trains at Different Speeds." Clinton S. Bissell. LXXVI, 68 (1910). Discussion: A. C. Dennis, LXVI, 68.
 —in its relation to broad and narrow gauge. LXXVIII, 351 (1915).
 "Virtual Grades for Freight Trains." A. C. Dennis. (With Discussion.) L, 1 (1903).

TRAIN SHEDS.

See RAILROAD STATIONS: RAILROAD TERMINALS.

TRAMWAYS.

See CABLEWAYS: STREET RAILWAYS.

TRANSFER BRIDGES.

- "New Transfer Bridge, Harsimus Cove, Jersey City, N. J." J. A. Benschel. (With Discussion.) XIX, 309 (1888).

TRANSFER TABLES.

- "A Cheap Transfer Table." William P. Shinn. V, 377 (1876).
 See also TURN-TABLES.

TRANSPIRATION.

- Loss of water caused by plants: Experiments at Owens Valley, California, and elsewhere. LXXVIII, 193, 226 (1915).
 "The Duty of Water in the Pacific Northwest." J. C. Stevens. (With Discussion.) LXXXIII, 2094 (1919-20).
 —for various standard crops. LXXXIII, 224, 258 (1919-20).

TRANSPIRATION—(Continued).
 Water requirements of growing plants in their relation to run-off. LXXIX, 1090 (1915).

TRANSPORTATION.
 "Cheap—vs. Rapid Transit and Delivery." Martin Coryell. IX, 401 (1880).
 Commercial importance of river improvements. XLIX, 277 *et seq.* (1902).
 "How can Railways be made more Efficient in the—of Freight?" (Discussion on Paper No. 248, Vol. VI, p. 365.) William P. Shinn. XII, 189 (1883).
 "Inland—." F. A. Mahan. XXIX, 97 (1893).
 "On the Increased Efficiency of Railways for the—of Freight." Wm. P. Shinn. XI, 365 (1882).
 "Rivers and Railroads in the United States." William W. Harts. (With Discussion.) LXXIX, 919 (1915).
 "The Approaches and—Facilities of the Paris Exposition of 1900." E. D. Corthell. XII, 208 (1890).
 "The 'Light Railways' of the Battle Front in France." Frank G. Jonah. (With Discussion.) LXXXIII, 1220 (1919-20).
 "The Production of Traffic and the—of Freight and Passengers." Martin Coryell. (With Discussion.) II, 240 (1873).
 —on Russian rivers. LII, 215 (1904).

See also CANALS: RAILROADS: RIVERS: TRAFFIC.

TREMIES.
 Depositing concrete by—Cherry Street Bridge, Toledo, Ohio. LXXX, 764 (1916).
 Placing of concrete by—at Pearl Harbor Dry Dock. LXXX, 255, 296, 299 (1916).

TRIANGULATION.
 "A Method of Taking Cross-Sections in Deep Rock Cuts by—." F. W. Watkins. XXII, 336 (1890).
 —and alignment of Astoria Gas Tunnel. LXXX, 658 (1916).
 See also SURVEYING.

TRUCKING.
 "The Problem of the Lower West Side Manhattan Water-Front of the Port of New York." B. F. Cresson, Jr. (With Discussion.) LXXXV, 226 (1912).

TRUSSES.
 "A New Graphical Solution of the Problem, What Position a Train of Concentrated Loads must have in Order to Cause the Greatest Stress in Any Given Part of a Bridge Truss or Girder." Henry T. Eddy. XXII, 259 (1890).
 "Componential—for Traveling Crane." Henry B. Seaman. XXIII, 277 (1890).
 "Description of a Combined Triangular and Suspension Bridge Truss, and Comparison of its Cost with that of the Warren, Pratt, Whipple and Howe—." Edwin Thacher. XIII, 123 (1884).
 "Experimental Strains upon a Bowstring Trussed Girder." Theo. G. Ellis. II, 107 (1873).
 "Formulas for the Weights of Bridges." A. J. Du Bois. First Paper, XVI, 101

TRUSSES—(Continued).
 (1887); Discussion, XVI, 218, 257; Supplementary Paper, XVII, 179 (1888).
 "General Criterion for Position of Loads Causing Maximum Stress in any Member of a Bridge Truss." U. M. Hoskins. (With Discussion.) XLII, 240 (1899).
 "Maximum Stresses in Bascule—." W. Watters Pagon. LXXVI, 73 (1913).
 "On Truss Bridge Building." S. Whipple. I, 239 (1872).
 "Reconstruction of the Norfolk and Western Railway Company's Bridge over the Ohio River at Kenova, West Virginia." William G. Grove and Henry Taylor. (With Discussion.) LXXIX, 411 (1915).
 "Some Observations on—and Trussed Arches." T. Willis Pratt. I, 346 (1872).
 Stiffening—for suspension bridges. XLVIII, 371 (1902); LV, 1 (1905).
 "The Reconstruction of the Baltimore and Ohio Railroad Bridge over the Ohio River, at Benwood, West Virginia." J. E. Greiner. (With Discussion.) LV, 146 (1905).
 "Web Strains in Simple—with Parallel or Inclined Booms." Elnathan Sweet, Jr. IX, 415 (1880).
 Discussion, X, 20 (1881).

See also BRIDGES.

TUBERCULATION.
 Flow of water in 48-in. pipes. XXXV, 241 (1896).
 "On the Removal of Incrustation in Water Mains. A Description of the Operations Performed in Halifax, N. S., Canada." E. H. Keating. XI, 127 (1882).
 "The Effect of—on the Delivery of a 48-in. Water Main." James Duane. XXVIII, 26 (1893).
 Discussion, XXVIII, 257, 352.
 —in water pipe. XLIV, 55 (1900).

TUNNEL SHIELDS.
 —for Detroit River Tunnel. LXXIV, 304 *et seq.* (1911).
 —for North River Tunnels, Pennsylvania Railroad. LXXVIII, 52, 167, 237 (1910).
 —for proposed New York-New Jersey vehicular tunnel. LXXXIII, 443 (1919-1920).
 —used in construction of East River Tunnels, Pennsylvania Railroad. LXVIII, 420 (1910).
 —used in construction of Pennsylvania Railroad Tunnels, New York. LXIX, 39 (1910).

TUNNELS.
 "A Method of Tunnel Alignment." H. F. Dunham. (With Discussion.) XXVII, 453 (1892).
 "Air Resistances to Trains in Tube—." J. V. Davies. LXXV, 982 (1912).
 Discussion: George Gibbs, George H. Pogram, Charles S. Churchill, and L. J. Le Conte. LXXV, 1018.
 "American Irrigation Engineering." Herbert M. Wilson. (With Discussion.) XXV, 161 (1891).
 "Arching Bergen Tunnel on Erie Railroad." John Houston. I, 75 (1872).
 "Brafford's Ridge Tunnel." Charles W. Stanford. (With Discussion.) XXXII, 53 (1894).
 Brief description of—under North and East Rivers, New York City. LXXVI, 1690 (1913).

TUNNELS—(Continued).

- "Caisson Disease and Its Prevention." Henry Japp. (With Discussion.) LXXV, 1 (1909).
- "Colorado River Siphon." George Schobinger. (With Discussion.) LXXVII, 1 (1914).
- Concrete lining for—, Lexington Avenue Subway, New York City. LXXXI, 382 (1917).
- "Construction Methods for Rogers Pass Tunnel." A. C. Dennis. LXXXI, 448 (1917). Discussion: E. Lauchli, Robert A. Shailer, R. H. Keays, F. Lavis, James F. Sanborn, Lazarus White, T. Kennard Thomson, Francis Lee Stuart, J. V. Davies, S. A. Knowles, R. E. Dougherty, C. R. Hulsart, and J. G. Sullivan. LXXXI, 471.
- "Construction Problems of the Manhattan-Bronx, and Lexington Avenue Subway Junction and Queensborough Tunnel Connections." George Perrine. (With Discussion.) LXXXII, 278 (1918).
- Description of Alpine railroad—. LXXV, 751 (1912).
- Description of the pioneer or auxiliary heading method of construction used for the Rogers Pass Tunnel. LXXXI, 457 *et seq.* (1917).
- "Detroit River Tunnel." E. S. Chesbrough. (With Discussion.) II, 233 (1873).
- Drainage—to stop a land-slide. LXXXII, 767 (1918).
- Economic construction of—for hydro-electric plants. LXXXIX, 1012 (1915).
- "Experiments on Retaining Walls and Pressures on—." William Cain. (With Discussion.) LXXII, 403 (1911).
- First St. Tunnel, Washington, D. C. LXXI, 134 (1911).
- Flooding and unwatering of Astoria Gas Tunnel. LXXX, 642, *et seq.* (1916).
- General dimensions of the world's subaqueous highway—. LXXVIII, 278 (1915).
- "Grouting Operations, Catskill Water Supply." James F. Sanborn and M. E. Zipser. (With Discussion.) LXXXIII, 980 (1919-20).
- "Harper's Ferry Improvement." William Lee Sisson. XXXII, 351 (1894).
- "Heavy Railway Construction in Wyoming." J. I. Boggs. (With Discussion.) XLVI, 1 (1901).
- "Lining a Water-Works Tunnel with Concrete." Desmond FitzGerald. (With Discussion.) XXXI, 294 (1894).
- Lining for Astoria Gas Tunnel. LXXX, 620, 651 (1916).
- Masonry lining, Pennsylvania Railroad—, New York. LXVIII, 192, 413, 417 (1910).
- Method of tunnelling for subway under Trinity Vestry Building. LXXXI, 92, 102 (1917).
- Method of tunnelling on part of New Croton Aqueduct. LXIX, 388 (1910).
- "Nesquehoning Tunnel." J. Dutton Steele. I, 349 (1872).
- "Notes on a Tunnel Survey." Frederick C. Noble. (With Discussion.) LXXV, 68 (1912).
- "Notes on Tunnel Lining for Soft Ground." S. Johannesson and B. H. M. Hewett. LXXXIII, 1822 (1919-20). Discussion: J. C. Meem, E. G. Haines, Philip Aylett, Walter C. Parmley, C. M. Holland, T. Kennard Thomson, and Orrin L. Brodie. LXXXIII, 1856.

TUNNELS—(Continued).

- "Pressure, Resistance, and Stability of Earth." J. C. Meem. (With Discussion.) LXX, 352 (1910).
- "Reconstruction and Enlargement of Cork Run Tunnel on the Pittsburgh, Cincinnati & St. Louis Railway." 1870-3. Max J. Becker. VI, 1 (1877).
- Sewer—in Philadelphia, Pa. XLIV, 1 (1900).
- "Shaft Sinking under Difficulties at Dorchester Bay Tunnel, Boston, Mass." D. McN. Stauffer. X, 343 (1881).
- "Sinking a Wet Shaft." John P. Hogan. (With Discussion.) LXXXIII, 398 (1911).
- "Sketch of the Plans and Progress of the Detroit River Tunnel." E. S. Chesbrough. (With Discussion.) II, 35 (1873).
- Stress in tunnel lining. LXXXIII, 460 (1919-20).
- Stresses in tunnel linings. LXXXIII, 1824, 1839 (1919-20).
- "Subaqueous Highway—." George Duncan Snyder. LXXVIII, 252 (1915). Discussion: J. V. Davies, and Duncan D. McBean. LXXVIII, 306.
- "Tequiquiac Tunnel, Valley of Mexico." Albert Johnstone Campbell and Frederick William Abbot. XXXII, 171 (1894). Discussion, XXXII, 267.
- "The Astoria Tunnel under the East River for Gas Distribution in New York City." John Vipond Davies. LXXX, 594 (1916). Discussion: F. Lavis, Milton H. Freeman, W. H. Bradley, James F. Sanborn, Edward Wegmann, R. C. Kellogg, W. W. Brush, Thomas H. Wiggin, and William Cullen Morris. LXXX, 675.
- "The Bracing of Trenches and—, with Practical Formulas for Earth Pressures." J. C. Meem. (With Discussion.) LX, 1 (1905).
- "The Detroit River Tunnel." Wilson Sherman Kinnear. LXXXIV, 288 (1911). Discussion: H. A. Carson, H. F. Dunham, Charles B. Buerger, E. M. Walker, and Otaf Hoff. LXXIV, 357.
- "The Hudson River Tunnel." Arthur Spielmann and Charles B. Brush. (With Discussion.) IX, 259 (1880).
- "The Hudson River Tunnel." William Sooy Smith. (With Discussion.) XI, 314 (1882).
- "The Laramie-Poudre Tunnel." Burgis G. Coy. LXXV, 724 (1912). Discussion: W. C. Hammatt, W. L. Saunders, Lazarus White, O. J. Swenson, R. H. Wait, and C. Raymond Hulsart. LXXV, 750.
- "The Location of the Chimbote—." Othniel F. Nichols. IX, 365 (1880).
- "The Main Relief Sewer of Brooklyn." Willard Beahan. XXVI, 484 (1892). Discussion, XXVI, 507; XXVII, 97 (1892).
- "The New York Tunnel Extension of the Pennsylvania Railroad." Charles W. Raymond. LXVIII, 1 (1910).
- "The New York Tunnel Extension of the Pennsylvania Railroad. Contractors' Plant for East River—." Henry Japp. LXIX, 1, 393 (1910).
- The New York Tunnel Extension of the Pennsylvania Railroad. Discussion on the Sixteen Papers Descriptive of This Work. Edward Wegmann, Charles E. Fraser, Henry Japp, A. Bartocchini, C. L. Harrison, J. V. Davies, William J. Wilgus, Charles S. Churchill, G. R. Henderson, Edwin B. Katte, George A.

TUNNELS—(Continued).

- Harwood, N. W. Storer, J. H. Gandolfo, E. R. Hill, and George Gibbs. LXIX, 388 (1910).
- "The New York Tunnel Extension of the Pennsylvania Railroad. Station Construction, Road, Track, Yard Equipment, Electric Traction, and Locomotives." George Gibbs. LXIX, 226, 434 (1910).
- "The New York Tunnel Extension of the Pennsylvania Railroad. The Bergen Hill—." F. Lavis. LXVIII, 84 (1910).
- "The New York Tunnel Extension of the Pennsylvania Railroad. The Cross-Town—." James H. Brace and Francis Mason. LXVIII, 391 (1910).
- "The New York Tunnel Extension of the Pennsylvania Railroad. The East River Division." Alfred Noble. LXVIII, 62 (1910).
- "The New York Tunnel Extension of the Pennsylvania Railroad. The East River—." James H. Brace, Francis Mason, and S. H. Woodard. LXVIII, 419 (1910).
- "The New York Tunnel Extension of the Pennsylvania Railroad. The Lining of the Four Permanent Shafts of the East River Division." F. M. Green. LXIX, 78 (1910).
- "The New York Tunnel Extension of the Pennsylvania Railroad. The Long Island Approaches to the East River—." George C. Clarke. LXIX, 91 (1910).
- "The New York Tunnel Extension of the Pennsylvania Railroad. The North River Division." Charles M. Jacobs. LXVIII, 32 (1910).
- "The New York Tunnel Extension of the Pennsylvania Railroad. The North River—." E. H. M. Hewett and W. L. Brown. LXVIII, 152 (1910).
- "The Pennsylvania Avenue Subway and Tunnel, Philadelphia, Pa." George S. Webster and Samuel Tobias Wagner. (With Discussion.) XLVIII, 470 (1902).
- "The Philadelphia Tunnel of the Baltimore and Ohio Railroad, its Construction and Cost." W. W. Thayer. XXVI, 529 (1892).
- "The Problem of the Lower West Side Manhattan Water-Front of the Port of New York." B. F. Cresson, Jr. (With Discussion.) LXXV, 226 (1912).
- "The Proposed New York and New Jersey Vehicular Tunnel." An Informal Discussion. Edward A. Byrne, John F. O'Rourke, Paul G. Brown, J. V. Davies, James Fergie, W. C. Parmley, T. Kennard Thomson, F. Lavis, Calvin Tomkins, Amos Schaeffer, and E. E. R. Tratman. LXXXIII, 427 (1919-20).
- "The Protection from Corrosion, of Iron-Work Used as Covering for Railroad—." James G. Dagron. (With Discussion.) XXVII, 324 (1892).
- "The Scranton Tunnel of the Lackawanna and Wyoming Valley Railroad." George B. Francis and W. F. Dennis. LVI, 219 (1906). Discussion: F. Lavis, and V. H. Hewes, LVI, 242.
- "The Ventilation of—." Charles S. Churchill. LVII, 227 (1906). Discussion: George S. Rice, and R. P. Bolton, LVII, 240.
- "The Ventilation of—." N. W. Eayrs. (With Discussion.) XXIII, 288 (1890). Tunnel lining, Bergen Hill—, Pennsylvania Railroad. LXVIII, 114 (1910).

TUNNELS—(Continued).

- Tunnel lining, East River—; Pennsylvania Railroad. LXVIII, 459 (1910).
- Tunnel lining, North River—, Pennsylvania Railroad. LXVIII, 209, 254 (1910).
- "Tunnel Surveying on Division No. 6, New Croton Aqueduct." F. W. Watkins. (With Discussion.) XXIII, 17 (1890).
- "Tunnel Work on Sections 8, 9, 10, and 11, Broadway-Lexington Avenue Subway, New York City." Israel V. Werbin. LXXXI, 341 (1917). Discussion: Maurice Griest, John H. Madden, Robert H. Jacobs, T. Kennard Thomson, John H. Myers, H. G. Moulton, Robert Ridgway, C. V. Powers, and Francis Donaldson. LXXXI, 392.
- Tunneling in compressed air without a shield. LXVIII, 424 (1910).
- of Bear Valley Irrigation Company, California. XXXIII, 83 (1895).
- "of the Pacific Railroad." John R. Gilliss. I, 153 (1872).
- "Ventilation of—." Charles S. Churchill. (Inter. Eng. Cong. 1904.) LIV, Part C, 525 (1905).
- "Ventilation of—." Francis Fox. (Inter. Eng. Cong. 1904.) LIV, Part C, 533 (1905).
- Ventilation of—. Discussion on Inter. Eng. Cong. Papers, 1904. LIV, Part C, 567 (1905).
- Water pressure—. LXXX, 156 (1916).
- Water tunnel, New York City. LXXVI, 1805 (1913).

See also **UNDERGROUND RAILWAYS.**

TURBINES (STEAM).

- "Naval Architecture in Great Britain." Sir William H. White. (Inter. Eng. Cong. 1904.) LIV, Part D, 3 (1905).
- "Some Typical Tests of Steam Turbines." Francis Hodgkinson. (Inter. Eng. Cong. 1904.) LIV, Part E, 85 (1905). Discussion: M. L. Holman, G. O. M. Olsson, J. N. Chester, Charles Hermany, Elmo G. Harris, Charles A. Hague, F. R. Low, Karl P. Dahlström, and E. N. Ehrhart, LIV, Part E, 105.
- The steam turbine in marine service. LIV, Part C, 219 (1905).

TURBINES (WATER).

- "Characteristics of Modern Hydraulic Turbines." Chester W. Larner. LXVI, 306 (1910). Discussion: Lewis F. Moody, John C. Parker, C. M. Allen, E. Kulchling, Daniel W. Mead, and S. J. Zowski, LXVI, 347.
- "Chemi-Hydrometry and Its Application to the Precise Testing of Hydro-Electric Generators." Benjamin F. Groat. (With Discussion.) LXXX, 951 (1916).
- "Comprehensive Plotting of Water Turbine Characteristics." Karl E. Kennison. LXXXIII, 861 (1919-20).
- "Experiments on the Humphrey Turbine Water-Wheel, at the Tremont and Suffolk Mills, in Lowell, Mass." James B. Francis. XIII, 295 (1834).
- "Induced Currents of Fluids." F. sur Nedden. (With Discussion.) LXXX, 844 (1916).
- "Investigation of the Performance of a Reaction Turbine." R. L. Daugherty. LXXVIII, 1270 (1915). Discussion: S. J. Zowski, H. Birchard Taylor, Daniel W.

TURBINES (WATER)—(Continued).

- Mead, and R. C. Carpenter, LXXVIII, 1288.
- "Pressures in Penstocks Caused by the Gradual Closing of Turbine Gates." Norman R. Gibson. (With Discussion.) LXXXIII, 707 (1919-20).
- "The Design of Hydro-Electric Power Plants." J. D. Galloway. (With Discussion.) LXXIX, 1000 (1915).
- "The Hydro-Electric Development and Transmission Lines of the Canadian Niagara Power Company." A. H. Van Cleve. (With Discussion.) LXII, 190 (1909).
- "The Lock 12 Development of the Alabama Power Company, Coosa River, Alabama." E. L. Sayers and A. C. Polk. (With Discussion.) LXXVIII, 1409 (1915).
- "The Pulp Mill of the Cliff Paper Company of Niagara Falls, N. Y." Wallace C. Johnson. (With Discussion.) XXXII, 214 (1894).
- Water-wheel at Grass Valley, Cal. Power Plant. XXXVI, 177 (1896).
- affected by or affecting pulsations in pipe lines. LXXXII, 185 (1918).
- at Ogden, Utah, Power Plant. XXXVIII, 288 (1897).

TURN-TABLES.

- "Draw-Spans and Their—." C. Shaler Smith. III, 129 (1874). Discussion, III, 139; IV, 203 (1875).
- "The Turn-Table on the Main Track of the Silverton Railroad in Colorado." C. W. Gibbs. XXIII, 120 (1890).
- See also **TRANSFER TABLES.**

UNDERGROUND RAILWAYS.

- "Air Resistances to Trains in Tube Tunnels." J. V. Davies. (With Discussion.) LXXV, 932 (1912).
- "Compressed Air as a Motor for Subterranean Railways." J. Dutton Steele. I, 244 (1872).
- "Construction Problems of the Manhattan-Bronx, and Lexington Avenue Subway Junction and Queensborough Tunnel Connections." George Perrine. LXXXII, 278 (1918). Discussion: John Hays Myers, Clarence E. Carpenter, Robert A. Shaller, Robert Ridgway, Henry H. Quimby, and C. V. V. Powers. LXXXII, 320.
- New York City—, Brief description of. LXXVI, 1717 (1913).
- "Secure Subway Supports." A. B. Lueder and W. J. R. Wilson. LXXX, 914 (1916). Discussion: H. G. Moulton, Richard A. Fiesel, J. H. O'Brien, B. C. Collier, and Lazarus White. LXXX, 939.
- "Specifications for the Design of Bridges and Subways." Henry B. Seaman. (With Discussion.) LXXV, 313 (1912).
- "The Sixth Avenue Subway of the Hudson and Manhattan Railroad." H. G. Burrows. LXXVI, 1 (1913). Discussion: T. B. Whitney, Jr., William J. Boucher, Lazarus White, and H. L. Oestreich. LXXVI, 66.
- "Tunnel Work on Sections 8, 9, 10, and 11, Broadway-Lexington Avenue Subway, New York City." Israel V. Werblin. (With Discussion.) LXXXI, 341 (1917).
- Underground Railways. Discussion on Inter. Eng. Cong. Papers, 1904. Robert Moore, Samuel E. Fisher, Moritz Wormser, E. E. B. Frattman, W. M. Camp, George A. Kimball, George W. Parsons,

UNDERGROUND RAILWAYS—(Continued).

- Wilkie Woodard, and Howard A. Carson. LIV, Part F, 367 (1905).
- "— in Great Britain." Basil Mott and David Hay. (Inter. Eng. Cong. 1904.) LIV, Part F, 325 (1905).
- in Paris. XLI, 308 (1899).
- "— in the United States." William Barclay Parsons. (Inter. Eng. Cong. 1904.) LIV, Part F, 349 (1905).
- "—: The Metropolitan System of Paris." L. Biette. (Translated from the French.) (Inter. Eng. Cong. 1904.) LIV, Part F, 299 (1905).
- "Underpinning Trinity Vestry Building for Subway Construction." H. de B. Parsons. LXXXI, 74 (1917). Discussion: James C. Meem, Elias Cahn, T. Kennard Thomson, James F. Fouhy, Charles Rufus Harte, Joseph A. Connelly, J. S. Brance, and A. W. Euel. LXXXI, 102.
- Ventilation in New York Subway and other —. LVII, 227 (1906).

UNDERGROUND WATER.

See **GROUND-WATER.**

UNDERPINNING.

- Foundations and shoring of structures on Manhattan Elevated Railways. LXXXII, 634 (1918).
- "On the Mode of— Adopted for the Croton Lake Bridge, N. Y. C. & N. R. R., during the Repairs to the Masonry Piers." Alfred P. Boller. XI, 150 (1882).
- Roadway support at portals, Lexington Avenue Subway, New York City. LXXXI, 352 (1917).
- "Secure Subway Supports." A. B. Lueder and W. J. R. Wilson. (With Discussion.) LXXX, 914 (1916).
- "Sub-Aqueous—." A. G. Menocal. XI, 181 (1882).
- "The Failure and Righting of a Million-Bushel Grain Elevator." Alexander Alaire. (With Discussion.) LXXX, 799 (1916).
- "The— of Heavy Buildings." Jules Breuchaud. (With Discussion.) XXXVII, 31 (1897).
- buildings. XLVIII, 482 (1902).
- buildings near tunnel caissons. LXIX, 391 (1910).
- elevated railway and buildings on line of Hudson and Manhattan Railroad, New York. LXXVI, 1 (1913).
- Ninth Avenue during work on Pennsylvania Railroad Terminal. LXVIII, 305 (1910).
- "— the Cambridge Building, New York City." T. Kennard Thomson. LXVII, 533 (1910). Discussion: Henry Gorton Opdycke, E. A. Yates, Ogden Merrill, Oscar Lowinson, and J. C. Meem. LXVII, 565.
- "— Trinity Vestry Building for Subway Construction." H. de B. Parsons. (With Discussion.) LXXXI, 74 (1917).

See also **FOUNDATIONS.**

UNIT COSTS.

See **COSTS OF WORK.**

UNITED STATES WEATHER BUREAU.

- "Suggested Changes and Extension of the — Service in California." George S. Binckley, and Charles H. Lee. (With Discussion.) LXXXI, 161 (1917).