

16. TRACTION

A. RAILWAY SYSTEMS

THE SCIENTIFIC CITY STREET

Rowland R. Hazard

Vol. i—1884, pp. 1-6, paper No. 6

Description of a proposed subway construction for Broadway, New York, involving tunnels for express and local train service and of public utilities such as gas, electricity, water, telephone, telegraph, etc.

ELECTRIC STREET CARS

T. C. Martin

Vol. iv—1887, pp. 26-38

General discussion of the disadvantages of animal power and cable power for street railways, followed by description of the Daft third rail, the Van Depoele overhead trolley and the underground conduit railway systems. Cost, operation maintenance and efficiency of electric system compared with older forms of motive power.

Discussion, pp. 38-57, by Messrs. O. E. Michaelis, Jno. M. Mitchell, Joseph Wetzler, Van Depoele, C. O. Mailloux, G. W. Mansfield, S. D. Field, J. M. Pendleton, ——— Stiles, T. C. Martin and R. M. Hunter.

Experience with different systems of electric propulsion of railway cars. Methods of connecting motor to driving axles. Brief description of Daft, Van Depoele, Julien, Field and Pendleton systems of electric traction.

A FEW COMPARATIVE STATISTICS OF ELECTRIC RAILWAYS

T. Commerford Martin

Vol. iv—1887, pp. 183-187

Tables giving location, equipment, cost of operation, service, etc., of European and American railways.

Discussion, pp. 188-189, by Messrs. Sidney F. Shelbourne, Frank L. Pope, T. Commerford Martin and J. A. Powers.

THE SOLUTION OF MUNICIPAL RAPID TRANSIT

Frank J. Sprague

Vol. v—1888, pp. 351-398

Discussion of the disadvantages of horse and cable traction and the advantages of electric traction. Method of determining the motor rating necessary for a given service. Description of the system and equipment of the Richmond Union Passenger Railway. Account of experiments in its early operation. Itemized cost of operation. Consideration of the rapid transit problem in New York. Brief review of several of the proposed plans and outline of comprehensive system proposed by the author. Discussion of methods of electric braking motors operating as generators.

Discussion, pp. 398-399, by Messrs. Edward O. Weston and Frank J. Sprague.

Further discussion incorporated with that of paper by Almon Robinson on "Note on Gearing for Electric Railway motors."

NOTE ON GEARING FOR ELECTRIC RAILWAY MOTORS

Almon Robinson

Vol. v—1888, pp. 408-410

General suggestion that variable speed of mechanical transmission will be desirable.

Discussion (including that of paper by Frank J. Sprague on "The Solution of Municipal Rapid Transit"), pp. 410-435, by Messrs. Elias E. Ries, J. M. Pendleton, C. O. Mailloux, S. S. Wheeler, Frank J. Sprague, L. F. Lyne, David E. Lain, M. B. Leonard, Thomas Whiteside Rae and Charles E. Emery.

Comparative merits of feeding regenerated energy into the line and into storage batteries. Independently driven axles vs. group drive axles. Disadvantages of rail return circuit. Construction of Sprague railway motor. Advantages of the overhead wire with rail return.

SOME RECENT ELECTRICAL WORK ON THE ELEVATED RAILROADS AND ITS BEARING ON THE RAPID TRANSIT PROBLEM

Leo Daft

Vol. vi—1889, pp. 359-378

Discussion of superiority of adhesive power of electric locomotive over steam due to effect of current at contact between wheel and rail. Account of service tests with electric locomotive ("Ben Franklin") on North Avenue Elevated lines, giving power, time and speed-time curves and profile of the road.

Discussion, pp. 378-387, by Messrs. Charles G. Curtis, Leo Daft, Francis R. Upton, Joseph Wetzler, W. A. Anthony, C. O. Mailloux and T. C. Martin.

MAGNETIC DATA OF THE SPRAGUE STREET CAR MOTOR

H. F. Parshall

Vol. vii—1890, pp. 218-224

Construction of the magnetic circuit. Magnetic leakage factors for different parts of the circuit. Magnetization characteristics under various conditions of magnetic circuit.

Discussion, p. 225, by Louis Bell.

REPORT OF HIGH-SPEED ELECTRIC RAILWAY WORK

O. T. Crosby

Vol. viii—1891, pp. 57-76

Description of an experimental automatic electric railway intended for rapid transportation of parcels. Account of experiments, power requirements, train resistance, etc., for speeds up to 100 miles per hour. Description of detailed plan for high-speed (150 miles per hour) interurban railway system, with working drawings of gearless motors and their mode of suspension. Commercial aspects of such a system between New York and Chicago.

Discussion, pp. 76-92, by Messrs. W. A. Anthony, W. H. Peirce, O. T. Crosby, F. L. Pope, Thos. D. Lockwood, Edw. P. Thompson, L. H. Landy, P. H. Dudley, Geo. B. Prescott, Jr., Wm. E. Geyer, Frank J. Sprague and J. Stanford Brown.

Train resistance. General results of studies of track conditions of steam railroad with Dudley dynagraph car. Effect of rail stiffness on train resistance.

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CONSIDERATIONS WHICH SHOULD GOVERN THE SELECTION OF A RAPID TRANSIT SYSTEM

Frank J. Sprague

Vol. viii—1891, pp. 331-346

Analytical discussion of the rapid transit problem facing the Rapid Transit Commission of New York. Consideration of different possible systems and recommendation of underground road with electric motive power.

Discussion, pp. 347-350, by Messrs. Thomas D. Lockwood, C. O. Mailoux and Geo. Forbes.

Conditions governing the construction of street railways in England. Experience of the South London Railway with electric traction.

METHODS OF ELECTRICALLY CONTROLLING STREET CAR MOTORS

H. F. Parshall

Vol. ix—1892, pp. 137-149

Description of series parallel platform controller and rheostat. Construction drawings.

Discussion, pp. 149-166, by Messrs. Thomas D. Lockwood, Charles Hewitt, Townsend Wolcott, Charles P. Steinmetz, Thorburn Reid, C. G. Curtis, F. B. Crocker and D. C. Jackson.

Relative advantages and efficiency of various types of motor connection. Eickemeyer railroad motor.

COMING DEVELOPMENT OF ELECTRIC RAILWAYS

Presidential Address

Frank J. Sprague

Vol. ix—1892, pp. 229-249

Brief review of current practice of steam roads and possibilities of introduction of electromotive power in these systems.

No discussion.

SERIES ELECTRIC TRACTION

Nelson W. Perry

Vol. ix—1892, pp. 547-565

Brief review of the advantages of the series system of distribution. Description of a proposed system of series distribution for electric railways, followed by a statement of the theoretical economies incidental to its use.

Discussion, incorporated with that of paper by Messrs. George D. Shepardson and Edward P. Burch on "Electric Railway Motor Tests."

A NEW SYSTEM OF ELECTRIC PROPULSION

H. Ward Leonard

Vol. ix—1892, pp. 566-577

General description of Ward Leonard system of railway motor control by means of motor generator set. Advantages claimed for this system over previous methods, together with comparison of estimated costs of equipment and operation.

Discussion, incorporated with that of paper by Messrs. George D. Shepardson and Edward P. Burch on "Electric Railway Motor Tests."

ELECTRIC RAILWAY MOTOR TESTS

George B. Shepardson and Edward P. Burch

Vol. ix—1892, pp. 578-53

Performance tests of Sprague and Thomson-Houston motors. Current and power consumption tests of cars on Minneapolis street railway.

Discussion (including that of paper by N. W. Perry on "Series Electric Traction" and paper by H. Ward Leonard on "A New System of Electric Propulsion"), pp. 595-600 and 761-793, by Messrs. Frank J. Sprague, C. E. Emery, C. S. Bradley, E. F. Thomas, H. Ward Leonard, C. T. Hutchinson, C. O. Mailloux, F. B. Crocker, Charles Hewitt and F. V. Henshaw.

General remarks on the relative efficiency of different types of railway motor control, including commutated fields, rheostat and Ward Leonard system.

HOW SHALL WE OPERATE AN ELECTRIC RAILWAY EXTENDING ONE HUNDRED MILES FROM THE POWER STATION

H. Ward Leonard

Vol. xi—1894, pp. 76-84

Description of the Ward Leonard single-phase railway system using single-phase transmission, synchronous motor direct-current generator on the car and direct-current traction motors. Explanation of working model.

Discussion, pp. 84-107, by Messrs. Charles G. Curtis, H. Ward Leonard, C. O. Mailloux, Nelson W. Perry, George Hill, Charles Hewitt, A. E. Kennelly, Wm. Elmer, Jr., C. J. Field, C. J. H. Woodbury, Joseph Sachs, R. N. Baylis and George P. Low.

Further explanation of the mode of operation of the Ward Leonard system. Experience with same system of control on hoists and printing presses.

THE ELECTRIC BRAKE IN PRACTICE

Elmer A. Sperry

Vol. xi—1894, pp. 682-709

Description of the construction and operative performance of electric disk brake designed by author. Performance tests of hand and electric brakes.

Discussion, pp. 710-728, by Messrs. Edwin J. Houston, Joseph Wetzler, Elmer A. Sperry, C. S. Bradley, W. J. Hammer, Ralph W. Pope, Joseph Sachs, Max Osterberg, Robert McA. Lloyd, Frankland Jannus, E. A. Merrill, W. E. Harrington, Carl Kammeyer, L. H. Rogers, Mr. Grier, B. J. Arnold, Edward Caldwell, W. M. Stine, Elbert F. Norton and Walter Lobach.

Additional data on performance of Sperry electric brake.

NOTES ON RECENT ELECTRICAL ENGINEERING DEVELOPMENTS IN FRANCE AND ENGLAND

H. Ward Leonard

Vol. xii—1895, pp. 36-53

Account of observations of European practice in manufacturing and engineering, synchronous converters, steam engines, Parsons and DeLaval turbines, electric railways, central stations. Description of equipment and

mode of operating and tests of Heilman self-contained electric locomotive.

Discussion, pp. 54-77, by Messrs. Townsend Wolcott, John W. Lieb, Jr., Chas. E. Emery, Herbert Lloyd, A. E. Kennelly, Wm. Mayer, Jr., M. N. Forney, Cary T. Hutchinson, W. L. Bliss, Richard Fleming, Joseph Sachs, F. B. Crocker, E. J. Houston, H. Ward Leonard, B. J. Arnold, W. M. Stine, C. K. MacFadden, L. L. Summers and A. V. Abbott.

General data on Berlin central stations. Discussion of the Heilman locomotive performance and probable usefulness.

THE SUBSTITUTION OF ELECTRICITY FOR STEAM IN RAILWAY PRACTICE

Louis Duncan

Vol. xii—1895, pp. 268-280

Analysis of steam road, freight and passenger conditions with reference to the economic advantages of adopting electric motive power. Description of Baltimore & Ohio electric power plant, distribution system and locomotive.

Discussion, pp. 280-287, by Messrs. Charles P. Steinmetz, Oberlin Smith and Louis Duncan.

Analysis of characteristics of electric railway system now in use. Description of three-phase induction motor equipment with concatenated control. Performance tests.

ELECTRIC TRACTION UNDER STEAM RAILWAY CONDITIONS

Vol. xiii—1896, pp. 327-372

Topical discussion, by Messrs. Charles E. Emery, Charles K. Stearns, Charles H. Davis, H. Ward Leonard, George S. Strong, A. E. Kennelly, C. F. Ueberlacker, E. E. Ries, F. W. Darlington, H. M. Brinckerhoff, W. M. Stine, M. Coster, W. D. Ball, J. R. Cravath, C. L. Brown, F. C. Drake and ——— Rugg.

General remarks on the problems in the design of electric railways. Experience with existing electric railways, and comparison of electric with steam motive power.

ELECTRIC TRACTION

M. H. Gerry, Jr.

Vol. xiv—1897, pp. 353-375

Description of equipment of the Metropolitan Elevated Railroad, Chicago, followed by tests of the power requirements of trains. Train resistance, speed-time and motor performance curves. Efficiency of straight direct current distribution system at different loads.

Discussion, pp. 376-383, by Messrs. F. B. Crocker, F. A. C. Perrine, R. W. Pope, Elihu Thomson, Gano S. Dunn and C. P. Steinmetz.

Effect of train acceleration upon energy requirements.

POWER TRANSMISSION AND DISTRIBUTION FOR RAILWAY WORK

Ernst J. Berg

Vol. xv—1898, pp. 379-401

Analytical study of the voltage regulation in a railway distribution system, bringing out the effect of circuit constants upon the e.m.f. characteristics of generators and synchronous converters.

No discussion.

THE MULTIPLE UNIT SYSTEM OF ELECTRIC RAILWAYS

Frank J. Sprague

Vol. xvi—1899, pp. 193-231

Brief résumé of the evolution of electric railways leading up to multiple unit system of train operation and dwelling upon the advantages of that system. Description of the equipment and operation of the South Side Elevated of Chicago which is equipped with third rail distribution for multiple unit trains.

Discussion, pp. 231-250, by Messrs. J. B. Blood, F. J. Sprague, F. V. Henshaw, C. W. Rice, H. Ward Leonard and A. H. Armstrong.

Relative merits of locomotive and multiple unit systems of train operation. Chronological list of achievements in evolution of electric railways.

B. TRAIN MOVEMENT AND MOTOR CAPACITY**ON ELECTRIC STREET CARS WITH SPECIAL REFERENCE TO METHODS OF GEARING CARS**

A. Reckenzaun

Vol. v—1888, pp. 1-15

Results of tests on Frankfort Electric Railway, giving cost of operation, energy consumption and train resistance. Description and discussion of relative merits of different types of mechanical transmission between motor and driving axles—steel rope, chain, belts, spur gears, friction gears and worm gears.

Discussion, pp. 15-32, by Messrs. Ralph W. Pope, A. Reckenzaun, Jos. Wetzler, C. O. Mailloux, S. S. Wheeler, J. M. Pendleton, T. C. Martin, W. M. Schlessinger, O. E. Michaelis and James D. Reid.

Accounts of experiences with various types of gearing.

THE LIMITATIONS OF STEAM AND ELECTRICITY IN TRANSPORTATION

O. T. Crosby

Vol. vii—1890, pp. 265-283

Discussion of the relative cost of train propulsion by steam and electricity. Advantages of high speed for electric propulsion. Train resistance at high speeds.

Discussion, pp. 283-286, by Messrs. Louis Bell, F. L. Pope, O. T. Crosby, Elihu Thomson, Joseph A. Miller and W. L. Hooper.

Gearing loss, air resistance.

ELECTRIC RAILWAY MOTOR TESTS

George B. Shepardson and Edward P. Burch

Vol. ix—1892, pp. 578-593

Performance tests of Sprague and Thomson-Houston motors. Current and power consumption tests of cars on Minneapolis street railway.

Discussion (including that of paper by N. W. Perry on "Series Electric Traction" and paper by H. Ward Leonard on "A New System of Electric Propulsion"), pp. 595-600 and 761-793, by Messrs. Frank J. Sprague, C. E. Emery, C. S. Bradley, E. F. Thomas, H. Ward Leonard, C. T. Hutchinson, C. O. Mailloux, F. B. Crocker, Charles Hewitt and F. V. Henshaw.

General remarks on the relative efficiency of different types of railway motor control, including commutated fields, rheostat and Ward Leonard system.

C. DISTRIBUTION SYSTEM

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SOME PHASES OF THE RAPID TRANSIT PROBLEM

Albert H. Armstrong

Vol. xv—1898, pp. 362-378

General investigation of train acceleration problems by straight line speed-time curves.

No discussion.

C. DISTRIBUTION SYSTEM

SOME OBJECTIONS TO THE OVERHEAD CONDUCTOR FOR ELECTRIC RAILWAYS

M. B. Leonard

Vol. v—1888, pp. 401-407

Account of experience with the overhead and return distribution system of the Richmond Union Passenger Railway, pointing out the many objections to that type of system.

THE PRACTICABILITY OF ELECTRIC CONDUIT RAILWAYS

Albert Stetson

Vol. x—1893, pp. 630-655

Description of different types of conduit systems in actual use—Bentley-Knight, Love, Buda-Pesth, also of Pollak surface contact. Detailed description of surface contact system devised by author.

Discussion, pp. 656-664, by Messrs. Nelson W. Perry, Albert Stetson, Charles Hewitt, Joseph Sachs, F. A. Scheffler and W. T. M. Mottram.

General remarks on surface contact system of electric car propulsion.

DESTRUCTIVE EFFECT OF ELECTRICAL CURRENTS ON SUBTERRANEAN METAL PIPES

Isaiah H. Farnham

Vol. xi—1894, pp. 191-213

Description of the electrolysis situation in Boston, giving various proposed remedies considered and results attained with those adopted. Corrosion and potential exploration tests. General conclusion regarding electrolysis from stray currents from electric railways.

Discussion, pp. 214-245, by Messrs. Geo. W. Plympton, Townsend Wolcott, A. E. Kennelly, I. H. Farnham, Thomas D. Lockwood, Leonard Waldo, Chas. E. Emery, Elihu Thomson, Hermann Lemp, Jr., B. J. Arnold, A. T. Welles, W. M. Stine, Paul Biefeld and Fred D. Silber, C. G. Armstrong and A. V. Abbott.

General discussion of electrolysis from stray currents, covering experience in various cities and proposed remedies.

RAIL-BONDING, AND ITS BEARING ON ELECTROLYTIC CORROSION

George P. Low

Vol. xi—1894, pp. 857-872

Account of bad case of electrolysis from stray currents. List of causes of electrolysis, of preventive measures and of the requirements of good return circuit.

No discussion.

AN ELECTRICAL SURVEY IN THE BOROUGH OF MANHATTAN, NEW YORK CITY

A. A. Knudson

Vol. xv—1898, pp. 613-631

Measurements of potential distribution between electric railways, pipes and foundations of Brooklyn Bridge. Examples of corrosion of rails and tie-rods due to stray currents.

Discussion, pp. 632-636, by Messrs. William Maver, Jr., A. C. Peckham, A. A. Knudson, Thatcher T. P. Luquer, Jesse M. Smith and Townsend Wolcott.

D. OPERATION

THE ELECTRIC LIGHTING OF PASSENGER TRAINS

George W. Blodgett

Vol. iv—1887, pp. 206-214

General discussion of the various methods of train lighting, with description of typical installations, giving cost and operation data.

Discussion, pp. 214-232, by Messrs. Ralph W. Pope, T. C. Martin, Geo. W. Blodgett, ——— Phelps, E. E. Ries, ——— Bracken, Thos. D. Lockwood, C. O. Mailloux, Joseph Wetzler and J. M. Pendleton.

General remarks on electric train lighting with special reference to the use of storage batteries. Actual cost figures.

RAILWAY TRAIN LIGHTING

A. H. Bauer

Vol. ix—1892, pp. 445-457

Brief résumé of early electric train lighting equipments, followed by description of system using special engine-driven generator installed in baggage car.

Discussion, pp. 457-459, by Messrs. C. R. Gilman, H. Ward Leonard, E. G. Willyoung, E. A. Sperry, Carl Hering, George D. Shepardson and C. F. Street.

E. INDUSTRIAL LOCOMOTIVES

ELECTRICITY IN BITUMINOUS MINING

Elmer A. Sperry

Vol. ix—1892, pp. 375-400

Brief résumé of the early mechanical methods of working mines. Description of electric drills, cutters, hoisting machinery and locomotives for use in coal mining.

Discussion, pp. 400-406, by Messrs. Frank J. Sprague, C. E. Emery, N. W. Perry, E. A. Sperry and H. Ward Leonard.

Experience with mining locomotives

F. AUTOMOBILES

ELECTRICALLY DRIVEN VEHICLES

Vol. xiv—1897, pp. 1-24

A topical discussion by Messrs. Andrew L. Riker, Louis Duncan, F.

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Merits of electric vehicles over gas and steam Design of electric vehicles and experience in their operation.

THE DEVELOPMENT OF ELECTRIC CABLEWAYS

Richard Lamb

Vol. xiv—1897, pp. 549-564

Description of Lamb system of electric tractors for cableway hauling, with account of experience with different installations.

Discussion, pp. 565-578, by Messrs. F. B. Crocker, Townsend Wolcott, Richard Lamb, Charles P. Steinmetz, Joseph Bijur, T. C. Martin, Joseph Sachs, E. E. Ries, C. O. Mailloux, H. Ward Leonard, A. E. Kennelly and P. G. Burton.

**OPERATING COSTS OF HORSE AND ELECTRIC DELIVERY WAGONS IN
NEW YORK CITY**

G. F. Sever and R. A. Fliess

Vol. xvi—1899, pp. 485-507

Analysis of actual cost of department store delivery by horse method and by electric vehicle. Comparative first cost and cost of operation of the two methods.

Discussion, incorporated with that of paper by Elmer A. Sperry on "Electric Automobiles."

ELECTRIC AUTOMOBILES

Elmer A. Sperry

Vol. xvi—1899, pp. 509-525

Account of some of the difficulties met with in the design of electric vehicles. Description of Sperry combined steering wheel and controller. Photographs of electric carriages.

Discussion including that of paper by G. F. Sever and R. A. Fliess on "Operating Costs of Horse and Electric Delivery Wagons in New York City"), pp. 525-527, by Messrs. Hermann Lemp, Jr., C. W. Rice, Elmer A. Sperry, J. B. Blood and Elihu Thomson.