

LIST OF CHAPTERS.

CHAPTER I.

INTRODUCTORY AND GENERAL.

PAGE

Early History and Development of Electrical Traction in America—Comparison of English and American Lines—Miles Electrically Equipped in United States—Cost of Operating Cable, Horse, and Electric Street Railways—Growth of the West End Street Railway Company, Boston, Massachusetts—Results obtained with Early Traction Methods... 1 to 17

CHAPTER II.

PERMANENT WAY.

Type of Rail used in America—Track Construction in America and England—Style and Weight of Rail used—Points and Crossings—Switches—Sidings—Curves—Permanent Way in Boston, Philadelphia, New Orleans, San Francisco, Des Moines, Canada, &c. ... 18 to 35

CHAPTER III.

THE RETURN CIRCUIT.

Electrolytic Action—Chemical Action—Corrosive Action on Metallic Pipes owing to bad Bonding—Suggestions made to obviate this Action—Bonding and Bonds used—Early Method of Bonding... ... 36 to 55

CHAPTER IV.

THE RETURN CIRCUIT.

Bonding—Electrical Welding Process—Rail Welding Appliances—Effect of Temperature on Welded Continuous Rail—Strength of Rail ... 56 to 64

CHAPTER V.

ELEVATED CONDUCTOR CONSTRUCTION.

History of Trolley—Trolley Wire—Trolley Wire Insulators and Hangers—West End Type—Sectional Switches and Insulators—Frogs—Crossings—Mechanical Tools for Erection of Trolley Wire—Feeders—Lightning Arresters, &c., &c. ... 65 to 85

CHAPTER VI.

ERECTION OF THE TROLLEY WIRE.

Methods of Suspension—Span and Bracket Arm—Erection Trolley Wire—Sag—Erection of Poles—American Tubular Iron and Steel Poles—Pole Specifications ... 86 to 96

CHAPTER VII.		PAGE
ERECTION OF THE TROLLEY WIRE.		
Single and Double Trolley Wire Erection—Men and Tools required—Tower Wagon— Curves—Cost of Labour, Material, and Pole Planting—Use of Crossings and Points	... 97 to 109	
CHAPTER VIII.		
MOTORS.		
Double Reduction Type Gearing—Double Reduction Motors—Single Reduction Gearing—Motors Mounted Directly on Axle—Average Horse-Power exerted by Street Motor—Winding Motors—Armatures—Brushes—Commutator—Chain—Worm Gearing— Walker Manufacturing Company—Edison Single Reduction Motor—"G. E. 800" Motor—Nose Suspension—Side Bar Suspension—Efficiency Curves—Westinghouse Single Reduction Motor—Westinghouse Motor Suspension—Sperry Motor—Oerlikon Motor—Schuckert and Company's Double Motor Truck—Allegemeine Elektricitats Gesellschaft Motor—Ganz and Company's Motor—Baltimore and Ohio Railway Company's 95-ton Motor Truck—Greenwood and Batley's Worm Gearing Motor Truck	110 to 137
CHAPTER IX.		
SPEED REGULATORS.		
Series-Parallel Controllers, K, K 2, K 4—Starting Curves—Traction Coefficients		138 to 150
CHAPTER X.		
CAR WIRING AND EQUIPMENT.		
Necessary Material—Connections for Motor Equipment—Lightning Arrester for Car— Circuit Breakers—Cables—Supplies	151 to 160
CHAPTER XI.		
MOTOR TRUCKS.		
Construction—Chief Conditions of Truck for Electric Traction—"Peckham" Motor Trucks—Taylor Four Wheel Truck—Lord Baltimore Truck—McGuire Truck—Brill Truck— Robinson Radial Truck—Bogie Trucks	161 to 179
CHAPTER XII.		
CAR CONSTRUCTION.		
Size, Weight, and Description of American and English Cars—Car Heating—Car Lighting—Snow Sweepers—Freight Cars—Specification for Closed Motor Car Body		180 to 195
CHAPTER XIII.		
CAR WHEELS AND BRAKES.		
Wheels—Chilled Cast Iron—Ferro Nickel—Ferro Manganese—Steel Tyred and Solid Steel—Brakes: Hand, Air, and Electrical—Genett Air Brake—Equipment—Sperry Electric Brake—Life and Wheel Guards—Sand Boxes—Safety Steps and Gates	196 to 209

List of Chapters.

ix

CHAPTER XIV.

THE TROLLEY.

PAGE

Early Form of Trolleys—Boston Pivotal Type—Mather and Platt's Trolley—T Shape
Trolley—Roof Seat Car Trolley Standard—Side Acting Roof—Top Seat Car Trolley 210 to 215

CHAPTER XV.

THE POWER HOUSE.

Power Absorbed by Motor Cars—Power Plant—Engines: McIntosh and Seymour,
Bass-Corliss, Reynolds-Corliss—Dynamos: Separately Excited, Shunt, Compound Wound
Machines 216 to 225

CHAPTER XVI.

GENERATORS.

“G. E.” Generators—Westinghouse Generators—Walker 4 Pole Railway Generator—
Types of Winding—Armatures—Field Magnets—Brush Holders—Data for Direct Coupled c.
Belt Driven Generators of various Types 226 to 246

CHAPTER XVII.

SWITCHBOARDS.

Method of Coupling and Connecting up Generators—Two Wire System—Compound
Wound Railway Generators—Three Wire System—Turbine Driven Railway Generators—
Instruments usually used in Switchboard Work—Circuit Breakers—Quick Breaking Switches
—Weston Instruments 247 to 262

CHAPTER XVIII.

CENTRAL STATIONS.

Dynamo Foundations—Erection of Generators—Running of Generators—Forced
Draught—Mechanical Coal Handling—Boilers—Car Sheds and Repair Shop ... 263 to 286

CHAPTER XIX.

THE WEST END STREET RAILWAY COMPANY OF BOSTON, MASS, U.S.A.

Capital of Company—Number of Miles of Track—Cars—Description of Company's
Various Power Stations 287 to 298

CHAPTER XX.

CHICAGO CITY RAILWAY.

Number of Miles of Track—Cars—Description of Company's Station—Engines
(Wheelock Type)—Water Tank Lightning Arresters—Motor Equipments—Number of Car
Employés—Coal Consumed 299 to 305

CHAPTER XXI.

CITY AND SUBURBAN RAILWAY COMPANY, BALTIMORE; CASS AVENUE AND FAIR GROUNDS
ELECTRIC RAILWAY, ST. LOUIS; AND OTHER TYPICAL POWER PLANTS.

City and Suburban Railway Company, Baltimore.—Capacity of Station—Campbell and
Zell Boilers—McIntosh and Seymour Engines.

List of Chapters.

	PAGE
<i>Cass Avenue and Fair Ground Electric Railway, St. Louis, Missouri.</i> —Capacity of Station—Number of Motor and Trailer Cars—Weight of Rail—Size and Description of Engine and Dynamo.	
<i>Kent Avenue Station, Brooklyn City Railroad.</i> —Capacity of Station—Number of Motor and Trailer Cars—Size, Description of Engine and Dynamo.	
<i>The Niagara Falls, Park and River Railway.</i> —Size and Description of Turbines—Number of Cars—Motors.	306 to 324

CHAPTER XXII.

LONG DISTANCE POWER TRANSMISSIONS, PORTLAND AND OREGON CITY.

Introduction of Alternating Current—Three-phase Transmission—Water Power.	
<i>The Portland General Electric Company, Portland, Oregon.</i> —Capital of Company—Capacity of Station.	
<i>Oregon City Power Station.</i> —Capacity of Station and Size of Turbines used ...	325 to 335

CHAPTER XXIII.

ELECTRIC RAILWAY LOCOMOTIVES.

<i>Union Pacific Coal Company Power Station.</i> —Size of Locomotives Used—Capacity Horse Power—Various Types of Locomotives Built by Mather and Platt, Siemens and Halske, Daft, Sprague, General Electric Company of America.	
<i>The Baltimore and Ohio Railway Co. Locomotive.</i> —Size—Weight—Horse Power—Construction—How Driven—Various Tests made on Line	336 to 354

CHAPTER XXIV.

ELECTRIC MAIN LINE RAILWAYS: THE NANTASKET BEACH RAILWAY AND THE METROPOLITAN ELEVATED RAILWAY, CHICAGO.

<i>The Nantasket Beach Railway.</i> —Length and Construction of Line—Power Station No. 1 of the New York, New Haven and Hartford Railroad—Description of Station—Pennsylvania Railroad Company's Lines—Elevated Railways of New York and Brooklyn.	
<i>The Metropolitan Elevated Railway of Chicago.</i> —Description of Station and Road	355 to 370

CHAPTER XXV.

BRITISH ELECTRIC RAILWAYS.

<i>The Dublin Electric Tramway.</i> —Date of Opening—Length of Line—Gauge—Construction of Line—Description of Main Station—Transformer Stations—Three-phase Generators—Method of Distribution—Engines—Boilers—Switchboard Connections—Board of Trade Regulations—Method of Motor Suspension.	
<i>The Bristol Electric Tramway.</i> —Track Construction—Gauge—Description of Station—Cars—Engines (McIntosh & Seymour)—Boilers—Station Switchboard Connections—Board of Trade Regulations—Passengers Carried.	
<i>The Douglas Southern Electric Tramway.</i> —Date of Opening—Length of Line—Gauge—Track Construction.	
<i>The Douglas and Laxey Electric Tramway.</i> —Date of Opening—Description of Plant—Number of Cars—Passengers Carried.	
<i>The Coventry Electric Tramway.</i> —Length of Line—Description of Plant—Motors—Engines—Board of Trade Regulations.	

List of Chapters.

xi

PAGE

The Guernsey Electric Tramway.—Description of Station—Engines—Trucks—Cost of Working—Passengers Carried.

The City and South London Electric Railway.—Construction of Track—Gradients—Gauge—Method of Driving Tunnels—Train Accommodation—(Speed—Weight—Size of Locomotive)—Description of Station—Engines (John Fowler & Co.)—Boilers—Generators—Working Expenses.

The Bessbrook and Newry Tramway.—Date of Opening—Length of Track—Gauge—Track Construction—Description of Turbines—Generators.

The Liverpool Overhead Railway.—Date of Opening—Track Construction—Length of Railway—Sharpest Curves—Design of Stations—Weight of Rails (Carrying Capacity and Weight of Train)—Engines—Boilers—Generators—Sliding Contact Shoe—Receipts—Expenditure—Total Cost 371 to 439

CHAPTER XXVI.

COMBINED LIGHT AND POWER PLANT.

Ways of Combining Traction and Lighting Plants.

Hamburg Tramway and Lighting Station.—Largest Combined Plant in Europe—Construction of Station—Engines—Boilers—Batteries—Switchboards—Method of Distribution, both for Lighting and Tramway.

Altona Tramway.

Rome Tramway and Lighting Station (Tivoli).—Curves giving Current Consumption—Method of Distribution—Description of Turbines—Batteries—Date of Opening—Motor used 440 to 459

CHAPTER XXVII.

OPEN CONDUIT SYSTEMS.

History and Development of system—Bentley-Knight Electric Railway Company—Date of Opening—Description of Conduit—Plough—The Siemens' Conduit at Budapest—Holroyd Smith's Conduit at Blackpool—The Waller-Manville Conduit—The Love Conduit at Washington—The General Electric Company's Conduit, as laid in Lenox Avenue—The Metropolitan Railway Company's Conduit Road, Washington—The Dresden and Berlin Conduits—General Remarks on Open Conduits—Disadvantages compared to the Overhead Trolley System—Approximate Cost of Construction—Special Points in Design of a Conduit 460 to 483

CHAPTER XXVIII.

SURFACE CONTACT SYSTEMS.

Description of : Siemens and Halske—Lichterfelde Line—Lineff System—Schuckert Frankfort Exhibition Line—Westinghouse System—Claret and Vuilleumier System 484 to 495

CHAPTER XXIX.

STORAGE BATTERIES AS APPLIED TO TRACTION PURPOSES.

Ways of using Accumulators in connection with Traction—Description of Cars : Raffard—Anthony Reckenzaun—Peckham Accumulator Truck—Data of Various Accumulators used for Traction Purposes—E. P. S.—Tudor—Chloride E. S. S.—Epstein—Julien—Laurent-Cely—Planté—Description of Accumulator Lines at Birmingham, the Hague—Paris—Berlin—Vienna—Method of Removing Accumulators from Cars, for Charging—Use of Accumulator and Trolley Car, Hanover 496 to 510

List of Chapters.

CHAPTER XXX.

SPECIFICATIONS.

For an Electric Tramway Equipment—General Conditions — Permanent Way—Line Work—Poles—Insulators—Feeders—Power House—Boilers—Engines—Generators—Rolling Stock—Motors—Repair Shops and Car Sheds—Protection of Telephone and Telegraph Wires 511 to 529

CHAPTER XXXI.

ACCOUNTS AND THEIR CLASSIFICATION.

Schedule of Operating Expenses—Maintenance of Track and Buildings—Maintenance of Equipment, Electric and Horse—Transportation Expenses—Injuries and Damages—Road and Snow Expenses—Station and Stable Service—Provender—New Construction, &c.—Form —Time Books necessary ... 530 to 540

CHAPTER XXXII.

THE MANAGEMENT OF ELECTRIC LINES.

Forms for Electricians, Motor-men, Engine Drivers and Monthly Report—Monthly Mileage Return, &c. ... 541 to 547

CHAPTER XXXIII.

ORGANISATION, DISCIPLINE AND RULES.

Training of Motor Men—System of Fares in America—Detective Department—Wreckage Staff—Snow Clearing by Electric Ploughs—Time Tables ... 548 to 555

CHAPTER XXXIV.

EFFICIENCY, MAINTENANCE AND DEPRECIATION.

Efficiency Tests—Car Tests—Traction Coefficient—Maintenance and Cost of Power Plants—Maintenance of Car Equipments—Maintenance of Track and Trolley Line 556 to 572

CHAPTER XXXV.

STATISTICS AND WORKING EXPENSES.

Rapid Growth of Electric Traction—American Statistics—American Working Expenses—European Statistics—European Working Expenses—Mileage of European Electric Roads—Comparison between Railways and Tramways in England and America ... 573 to 600

APPENDIX.

Board of Trade Regulations with respect to Electric Tramways ...	601
Statutory Rules and Orders, 1895, Tramway and Light Railway, Ireland ...	605
Statutory Rules and Orders, 1895, No. 433. With respect to Electric Traction ...	613
Statutory Rules and Orders, 1896, No. 747. With respect to Electric Traction ...	615
(I.) The Tramways Act, 1870 ...	618
(II.) Board of Trade Rules ...	620
(III.) Forms of Byelaws and Regulations issued by the Board of Trade ...	636
Light Railway Act, 1896 ...	641
Tables of Principal Acts relating to Railways ...	653
Some Books and Periodicals connected with Electric Traction consulted ...	653