OHIO.	
Cleveland, Southwestern & Columbus Ry.—Ashland, West Salem, Lodi and Leroy	30.00
Dayton, Springfield & Xenia Southern Ry.—In Spring Valley; in Dayton	1.50
Hocking-Sunday Creek Traction Co.	3.00
Northern Ohio Traction & Light Co.—Between Canton and Massillon	0.63
Ohio Electric Ry. (Columbus & Lake Michigan R. R.)—Lima to Defiance	42.00
Total	77.13
OKLAHOMA.	
Oklahoma City & Suburban Ry.	5.00
Oklahoma Ry.—Oklahoma City to Putnam City	8.00
Oklahoma Union Traction Co.—Tulsa to Orcutt Lake	2.50
Total	15.50
OREGON.	
Oregon Electric Ry.—From West Woodburn to Woodburn	2.50
Portland Railway, Light & Power Co.	3.00
Total	5.50
PENNSYLVANIA.	
Allegheny Valley Street Ry.	3.00
Central Pennsylvania Traction Co.	1.05
Chambersburg, Greencastle & Waynesboro Street Ry.—Through Chambersburg	2.50
Conestoga Traction Co.—Connects Christiana and Parkesburg	5.00
Mahoning & Shenango Railway & Light Co.	2.20
Pittsburg Railways Co.	10.00
Scranton Ry	3.00
South Bethlehem & Saucon Street Ry.—Friedensville and Centre Valley	3.40
Southern Cambria Ry.—Johnston, Conemaugh, Echo, Mineral Point and South Fork	11.00
Stroudsburg & Water Gap Street Ry.	0.50
Wilkes-Barre & Wyoming Valley Traction Co.—Wilkes-Barre to Hudson, Parsons, and Miners Mills	6.00
Total	47.65
RHODE ISLAND.	
Rhode Island Co.	1.38
Sea View R. R.	0.10
Total	1.48
SOUTH DAKOTA.	
Sioux Falls Traction System	1.50
Total	1.50
TENNESSEE.	
Memphis Street Ry.	0.75
Total	0.75
TEXAS.	
Corpus Christi Street & Interurban Ry.	5.50
Houston Electric Co.	0.93
Mt. Pleasant & Red Springs Street Ry.	1.13
Northern Texas Traction Co.	1.00
Port Arthur Traction Co.	7.00
San Antonio Traction Co.	6.43
Uvalde Street Ry.—Sansom to Uvalde	4.00
Wichita Falls Traction Co.—In Wichita Falls; to Lake Wichita	8.00
Total	33.99
VIRGINIA.	
Norfolk City & Suburban Ry.	1.00
Roanoke Railway & Electric Co.	1.50
Total	2.50
WASHINGTON.	
Everett Railway, Light & Water Co.	0.08
Great Northern Ry.	6.25
Seattle Electric Co.	25.00
Seattle-Everett Interurban Ry.—Seattle and Everett	8.00
Seattle, Renton & Southern Ry.	3.00
Spokane & Inland Empire R. R.	17.00
Whatcom County Railway & Light Co.	4.50
Yakima Valley Transportation Co.	13.00
Total	76.83
WEST VIRGINIA.	
Morgantown & Dunkard Valley R. R.—West Morgantown, Riverside, Granville and Ilandall	3.00
Total	3.00
WISCONSIN.	
Ashland Light, Power & Street Railway Co.	0.75
Chippewa Valley Railway, Light & Power Co.	0.64
Eastern Wisconsin Railway & Light Co.	2.00
Grand Rapids Street R. R.—Grand Rapids, Centralia, Port Edwards and Nekoosa	8.00
Milwaukee Northern Ry.	2.00
Wausau Street Ry.—Weston	1.00
Total	14.39
CANADA.	
British Columbia Electric Railway Co., Ltd.	12.35
Calgary Street Ry.	16.00
Hull Electric Co.	2.25
International Transit Co.	0.31
Montreal & Southern Counties Ry.	6.00
Niagara, St. Catharines & Toronto Ry.—Welland, Humberstone and Port Colborne	9.00
Nipissing Central Ry.—Cobalt, Port Cobalt and Haileybury.	5.00
Port Arthur & Fort William Electric Ry.	3.00
Sandwich, Windsor & Amherstburg Ry.	0.25
Sarnia Street Ry. Co., Ltd.	0.38
Total	54.54
MEXICO.	
Compania Electrica y de Ferrocarriles de Chihuahua	3.89
Total	3.89

HEAVY ELECTRIC TRACTION PROJECTS IN 1909

A large amount of work was done in 1909 on the construction and extension of heavy electric traction projects in the United States. New York City was the center of activity with the Pennsylvania cross-town tunnels nearing completion and important extensions of their terminal electric zones being made by the New York Central & Hudson River, New York, New Haven & Hartford and the Long Island railroads. In the Middle West the Michigan Central's tunnels and approaches under the Detroit River, which are to be operated by electric locomotives, will be opened early in 1910, good progress having been made on the construction and equipment. The Great Northern three-phase division over the Cascade Mountains was put in operation during July, 1909. No new track to be operated electrically was built during the year by the Baltimore & Ohio in Baltimore or by the St. Clair Tunnel Company at Sarnia.

In the following paragraphs the progress of the year on each of the projects on which active work was done is briefly summarized.

PENNSYLVANIA TUNNEL & TERMINAL RAILROAD

The Pennsylvania Railroad is building its new entrance into New York City under the name of the Pennsylvania Tunnel & Terminal Railroad. The extension begins at Harrison, just east of Newark, and crosses the Hackensack Meadows to the west portal of the tunnels under Bergen Hill on the west side of the Hudson River. The tunnels extend under the Hudson River, the Island of Manhattan and the East River, emerging in Long Island City and connecting with the Sunnyside yard. The extension connects with the Long Island Railroad near Woodside Avenue, Borough of Queens. The total length of the extension is 14.9 miles, of which 9.83 miles is on the surface, 2.29 miles under the two rivers and 2.78 miles under ground. Exclusive of the switching tracks in the Harrison transfer and Sunnyside yards, the total length of track in the extension will be 49.75 miles, all electrically operated. The Harrison and Sunnyside yards contain nearly 80 miles of track, not all of which will be electrically operated.

During the year 1909 the work has progressed actively on the extension, including the Harrison and Sunnyside yards. All the tunnels have been completed and main tracks have been laid in the tunnels and approaches from Harrison to Winfield, east of the Sunnyside yard. Ballasting is in progress and will be completed early in the spring of 1910. Yard tracks have been laid at Harrison for the interchange yard, and practically all the tracks in the Sunnyside yard have also been laid. Work is progressing actively on the interlocking and signaling throughout. Yard buildings at Sunnyside yard are under construction and will be finished early in the spring. The main station, facing Seventh Avenue between Thirty-first and Thirty-third Streets, has been completed on the exterior, and the work of finishing the interior is well advanced. It is anticipated that it will be practically completed early in the coming spring.

The installation of electric power cables, third-rail, power plant and substations is well advanced and will be completed in the spring of 1910. It is believed that early in the spring partial service of the Long Island Railroad into the station will be inaugurated, and in the early summer a partial service of the Pennsylvania Railroad will be in operation.

The initial order for electric locomotives to haul through trains in the tunnels included 24 double units of 4000 hp. Two of these locomotives have been delivered. They were described in the Electric Railway Journal of Nov. 6, page 982. The proposed initial daily service to be handled in the terminal station is 400 trains of the Pennsylvania Railroad and 600 trains of the Long Island Railroad.

LONG ISLAND RAILROAD

The Long Island Railroad completed the equipment for electric operation of 40 miles of track on which work was commenced in 1909, thus increasing its electric trackage to 140 miles. The most important pieces of work completed, or well

advanced during the year, were the construction of two additional running tracks, reduction of grades and elimination of grade crossings between Winfield and Jamaica, thus providing four tracks from the portal of the Manhattan tunnels to Jamaica, and the construction of the Glendale cut-off from Glendale to Woodhaven Junction to furnish a double-track connection from the Far Rockaway and Rockaway Beach divisions. Work has been begun on the double tracking and electric equipment of the North Shore division from Winfield to Port Washington. This will be finished by the end of next summer.

On Feb. 1, 1910, the company hopes to begin through electric operation from Jamaica to the Manhattan terminal and by June 1 to run all trains into Manhattan.

Contracts were placed during the year for 130 new steel cars for suburban service which will be delivered before May 1. This will give the company 400 steel motor and trail cars for the service on the electric lines betwen Manhattan and the present Brooklyn terminal at Flatbush Avenue. The through service to Manhattan will effect a saving in running time on all trains of 25 minutes each way as compared with the present ferry and crosstown street car trip required to reach the station site in New York.

NEW YORK CENTRAL & HUDSON RIVER RAILROAD

During the year 1909 the extension of the New York Central electric traction system has progressed a distance of 12 miles, between Wakefield and North White Plains, and it is contemplated that on or about Feb. 1 all passenger trains on the Harlem division will be operated electrically between Grand Central Station and North White Plains, thus eliminating the temporary terminal at Wakefield.

The extension includes the erection of two new substations, one known as No. 8, located at Tuckahoe, and the other as No. 9, at White Plains. Each station contains three 1000-kw rotary converters, with the necessary step-down transformers and switching equipment. The general arrangement of the two new substations is the same as those already in service on this system, with the exception that electric storage batteries, with their boosters, regulators, etc., have been omitted. The electric signal equipment, which at the other stations is in a detached building, in the two new stations has been installed under the same roof.

The aerial transmission lines have been extended a distance of about 13 miles to the end of the North White Plains yard. The construction is identical with that previously adopted, except that it has been necessary in several instances to use temporary wooden poles where a change in track alignment or the elimination of grade crossings prevented the permanent poles being located.

The third-rail work includes about 27 miles of new third-rail on main track and in yards. The type of construction is the same as that formerly adopted, with the exception that since the first installation it has been possible to obtain rolled steel offset side inclines in place of cast iron. This is a decided improvement, both in conductivity of the rail and from a construction standpoint.

There will be six new circuit-breaker houses containing the remote controlled circuit breakers through which the third-rails will be fed, the arrangement conforming to the existing practice on this road.

All passenger and freight stations on the division will be lighted electrically and the current will be taken from the 2200-volt signal circuits, which are carried on the high-tension transmission line poles. A 2200-volt signal circuit from substation No. 9 will feed a small light and power station which is located in the North White Plains engine house, and will replace the present steam-driven generators.

The temporary inspection sheds and repair shops for electric equipment located at Wakefield will be abandoned, the plant dismantled and the forces transferred to the permanent electric inspection shed and repair shop at North White Plains. The temporary steam locomotive house, turntable, water supply, etc., will be no longer required.

During the past year the electrical work has kept abreast of the civil engineering developments at the Grand Central Station terminal, and as existing tracks were dismantled the third-rail and feeders were taken down and returned to stock, while the new tracks were equipped with third-rail and permanent feeders, so that they were ready for electric operation as soon as the construction work permitted them to be turned over to the operating department.

For light and power purposes in the Grand Central Station terminal a 1500-kw lighting rotary has been temporarily installed in the Fiftieth Street substation. The primary current is obtained from the main generating station at Port Morris. This rotary, with an auxiliary connection to the Edison service, will be used for temporarily lighting the Grand Central Station terminal pending the construction of the terminal plant.

NEW YORK, NEW HAVEN & HARTFORD RAILROAD

The New York, New Haven & Hartford Railroad made no extensions of its electric zone between Woodlawn, N. Y., and Stamford Conn., during 1909, but in the Stamford yard and east of Stamford it erected a number of experimental catenary sections. The most important of these was a section about 6000 ft. long erected east of Glenbrook, the object being to study the best type of catenary construction to be adopted for future four-track and six-track electric operation. The partially electrified Stamford yard was completely equipped with a new form of catenary construction.

As the company made no extension of its suburban electric passenger service during the year, it did not order any additional passenger locomotives. In May, 1909, however, an order was placed with the Westinghouse Electric & Manufacturing Company for two electric freight locomotives, one of which has been received and the other rapidly nearing completion. These locomotives will be capable of hauling the heaviest freight trains on the New Haven road at an average schedule speed much higher than that now obtained with steam locomotives. In 1908 the company ordered four steel motor cars and six steel trail cars to be equipped for multiple-unit operation. These cars have been received and after thorough tests have been made they will be placed in suburban service early in the year. The activities of the New York, New Haven & Hartford in 1909 were concentrated chiefly on a study of the cost involved in the contemplated extension of its electric zone from Stamford to New Haven, within which it is proposed to operate both freight and passenger trains by electric locomotives.

GREAT NORTHERN RAILWAY

On July 10, 1909, electric operation was begun on the Cascade tunnel section of the Great Northern Railway in the State of Washington. This is the first mountain section of a steam railroad to be equipped and operated by electric locomotives. Its distinguishing feature is the use of the three-phase alternating current system taking current at 6600 volts from two overhead trolley wires. The total length of track which has been equipped for electric operation is 6.25 miles, which includes 13,873 ft. of tunnel, the remainder being in the yards at each end. The tunnel has a rising grade of 1.7 per cent eastbound and at the present time all eastbound freight and passenger trains are hauled through it by electric locomotives, but passenger trains only are hauled by electric locomotives westbound. The electric rolling stock consists of four locomotives each equipped with four three-phase motors having a one-hour rating of 475 hp or 1900 hp for each locomotive.

As previously stated, electric operation was begun on July 10, 1909, and was continued until Aug. 11, when the hydroelectric generating station was shut down on account of failure of both water wheels. The service was resumed on Sept. 9 and has been continued regularly since.

DETROIT RIVER TUNNEL OF THE MICHIGAN CENTRAL

The Michigan Central Railroad is building a double track tunnel under the Detroit River connecting Detroit, Mich., and Windsor, Ont. It will be operated electrically by direct-current locomotives, which were described in the ELECTRIC RAILWAY JOURNAL of June 19, 1909, page 1125. Six of these locomo-

tives of 1200 hp each will be delivered by March 1, 1910. The tunnel and approaches will contain about 6.25 miles of single track equipped for electric operation. The progress made in the construction and equipment of the tunnel and approaches may be summarized as follows:

With the exception of rodding the ducts and cleaning up, the construction of the approach tunnels is completed. The last section of the subaqueous tunnel was sunk Sept. 14, and on Oct. 15 an opening for passage from portal to portal was made. The work of placing the 20-in. ring of reinforced concrete inside the forms is progressing rapidly, and if the present rate of progress continues the tunnel construction will be finished early in March.

The electrical equipment is being installed as fast as conditions permit. The substation is nearing completion and the duct system follows closely the completion of the tunnel and yard work. Track bonding and the installation of the third-rail work are going forward on the Canadian side of the river and will be completed during the winter months. The placing of special ties in concrete in the approach tunnels has been started.

The entire reconstruction and enlargement of the Detroit yards and the separation of the grades between Fifteenth and Twenty-fourth Streets is going forward rapidly, and such tracks as are needed for the handling of trains through the tunnel will be ready when needed. It is expected that the tunnel will be ready for regular operation by electric locomotives early in the spring.

SWISS ELECTRIC RAILWAY STATISTICS AT THE END OF 1907

The Swiss Government has just issued its railway statistics for the year ending 1907. There were then 36 street railways in operation with a total length of 402 km (249 miles), of which 31 meter-gage lines having a combined length of 261 km (162 miles) were served by electric apparatus only. The only 4 ft. 8½-in. gage street railway reported in Switzerland is a 2.9 km (1.8 mile) line in Lucerne. The street railways carried 97,367,553 passengers and 181,561 metric tons of freight over 23,072,029 train-km (14,304,664 train-miles). Their total gross income was 12,313,430 Fr. ($2,376,492) and the total operating expenses were 9,455,353 Fr. ($1,824,874). These results were obtained with 2848 employees, eight steam or electric locomotives, 109 freight cars and 859 passenger coaches, of which 661 were motor cars.

There were in service 42 interurban narrow-gage railways, of which 21 roads with a total length of 416.6 km (258.3 miles) were operated exclusively with electricity, while three others with a total length of 24.7 km (15.3 miles) used a mixed service with steam locomotives. All of the electric and mixed lines were of meter (39.37 in.) gage. The total length of the steam narrow-gage lines was 514 km (318.7 miles). The combined railways carried 11,317,588 passengers and 787,616 metric tons of freight over 5,586,722 train-km (3,463,768 train-miles). Their total gross income was 13,402,307 Fr. ($2,616,645) and the operating expenses were $8,527,102 Fr. ($1,645,731).

The rack and pinion railways numbered 12 and totaled 97 km (60 miles) in length. Only three lines having a combined length of 16.9 km (10.5 miles) were all-electric and three more totaling 26.1 km (16.44 miles) were mixed steam and electric. The 12 roads carried 1,031,006 passengers and 69,989 metric tons over 302,538 train-km (187,573 train-miles). Their total gross income was 3,793,781 Fr. ($732,200) and the operating expenses were 2,026,505 Fr. ($391,115).

The cable railways numbered 36 and had a total length of 31.66 km (19.63 miles), mostly of meter gage. Of these lines, 22 having a total length of 21.32 km (13.22 miles) were operated electrically. They carried 6,060,926 passengers and 163,698 metric tons of freight over 570,716 train km (353,833 train-miles). Their total gross income was 1,879,714 Fr. ($362,785) and the operating expenses were 1,049,889 Fr. ($202,628).

RECENT WORK OF THE GERMAN STREET & INTERURBAN RAILWAY ASSOCIATION

BY A GERMAN ENGINEER

The plan originally followed by the German Street & Interurban Railway Association to secure technical papers for its meetings was to assign the subjects which required investigation to temporary committees. Later on, the association appointed four permanent committees, among which all topics were divided. This method proved unsatisfactory because the number of committees was too small to permit thorough work, but a remedy was found in the appointment of subcommittees. The men selected for the subcommittee work are always those who have had considerable experience in the matters assigned to them, but before a subcommittee report goes before the association it must be examined and approved by the parent committee. This method has proved very satisfactory, because it insures a thoroughgoing report by specialists, and the recommendations can be moderated if necessary by the broader point of view of a second body. The subcommittee system has also created considerable enthusiasm for association work, because it gave a larger number of members a chance to participate actively. Still another good feature of the plan is that the subcommittee reports attract more attention and are apt to be more valuable when signed by individuals than if the work of a committee. It was originally believed that the report of a single person would not be as unbiased as that of several men. This in a sense is true, but when a report has to be signed by several men with different ideas there is danger of its being a colorless compromise which provokes little debate. The committee method had also the great disadvantage in the German association of keeping out men of strong convictions who did not wish to see their personalities lost, or merged with the inferior work of others.

The standing committees of the association now are:

Committee "A," on organization and legal matters.
Committee "B," on construction and operation.
Committee "C," on electrical matters.
Committee "D," on steam interurban railways.
Committee "E," on miscellaneous city railway topics.

The following statements summarize the work accomplished during the last two years of committees "B" and "C," which are those in charge of technical subjects connected with electric railway matters:

WORK OF THE COMMITTEE ON CONSTRUCTION AND OPERATION

An idea of the importance of this committee may be gained from the fact that it discussed 15 topics, as follows: Rail specifications, standardization of rail sections, preparation and modification of the contract with the selling agency of the associated lamp manufacturers, rail corrugation, revision of the present ordinances relative to permissible braking distances, value of snow plows, co-operative buying of rails and other materials, rolling stock serviceable for both track and trackless operation, switches with cleansing and drainage means, manganese rails and ties, tire shrinkage for car wheels, projecting fenders, noiseless paving such as wood and asphalt, sprinklers.

RAIL SPECIFICATIONS AND STANDARDS

The rail specifications were prepared particularly for railways which are too small to employ engineers competent for that purpose. Up to the time of its adoption such lines were obliged either to buy what the rolling mills offered or to imitate without reason the practice of large railways with heavier traffic conditions. Conditions in Germany in regard to rail standards before this committee commenced its work were even worse than in the United States, for the "Phœnix" mills alone have been obliged to roll 129 different types of grooved rails to satisfy their customers. To terminate this condition the German association undertook a comparison of about 200 rail sections which had been used in Germany under various traffic conditions for the past 10 years, and, as a result, has recom-