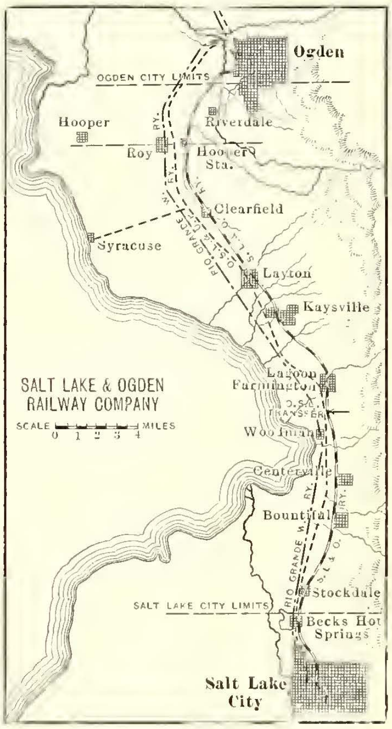
ELECTRIFICATION OF THE SALT LAKE & OGDEN RAILROAD

Nearly 20 years ago Simon Bamberger, of Salt Lake City, and several business associates began to construct a railway line that was to extend northward to a point near Ogden and thence in a southeasterly direction through the Weber River canyon to Coalville, there to tap the coal mines of that district. The total length of the road was to be 68 miles, with a 10-mile branch to Ogden. Some rights-of-way were obtained and a 5-mile extension was constructed as far as the Becks Hot Springs. Later the road was built 10 miles farther north to Lagoon, where Mr. Bamberger established a beautiful artificial resort that since has been successfully operated in connection with the road. An extension was next made to Layton, 22 miles from Salt Lake. This was the northern terminus of the road for several years.



Salt Lake & Ogden Railway—Map of Route

A few years ago it was decided that it would not be wise to build the line through to Coalville as originally planned, inasmuch as the Union Pacific Railroad had built its main line through the Weber canyon, with a branch to Coalville. The increase in wealth of the Salt Lake valley lying west of the Wasatch Mountains and the growth in importance of the two largest cities of the State—Ogden and Salt Lake—on the other hand influenced the completion of the line to join those two cities. The cities already were connected by two steam railroads, but it was believed that a profitable business could be derived from an interurban railway catering by means of frequent trains to a passenger as well as an express and freight traffic. That this belief was justified has been evidenced by the success with which the Salt Lake & Ogden Railroad Company has met since it began operating electric car service between Salt Lake and Ogden in May, 1910. During this period the gross receipts have more than doubled.


Salt Lake & Ogden Railway—Exterior of Car House at Ogden

The old road, extending from Salt Lake City to Layton, was operated by steam. The changes preparatory to electrical operation have included the bonding of the rails and the stringing of feeder high tensions and trolley wires over the old track; the building of 13 miles of new roadbed and track from Layton north into Ogden; the construction of the necessary generating stations and substations and the purchase of electric motor cars.

ROUTE

The main line is 35.5 miles long. The principal towns en route are shown on the accompanying map. At St. Joseph, Bountiful and Kaysville branch lines connect with brickyards, thereby bringing the total trackage up to 40 miles.

The road has excellent terminal facilities at both Salt Lake and Ogden. The railway enters the suburbs of the former city opposite the Oregon Short Line depot. The company has franchises, however, which will permit its tracks to reach the center of the business district, and the Federal Building, over the city streets.

The track runs in a general northerly and southerly direction, skirting the western slope of the Wasatch range and lying between the mountains and Great Salt Lake. Midway between the terminals the line runs within a mile of the lake, of which it affords an excellent view. The route parallels the main lines of the Oregon Short Line and the Rio Grande Western railways, but its location makes it more accessible to the farmers of this valley, one of the most fertile belts in the State.

At Ogden the track leaves the private right-of-way and runs to Twenty-fifth Street, the principal cross street of the city. The Ogden depot is midway between the union station and the center of the business district on the line of the Ogden Rapid Transit Company. An extension is now being built north to reach the northern and eastern portions of the city. The company owns a right-of-way up the Ogden River canyon to "Idlewild," a mountain hotel owned by Mr. Bamberger; but it is doubtful if a railway will be built there by his company, inasmuch as the Ogden Rapid Transit Company now operates a line in the canyon as far as the Hermitage Hotel and is planning to build on to "Idlewild" and points in the valley beyond in 1911.

The Salt Lake & Ogden company owns several pieces of property fronting on the streets traversed by its tracks, which can be used as needed for storage tracks, shops and terminal stations and facilities. The main car and repair shops, however, are to be located at St. Joseph, 5.4 miles north of Salt Lake City. Here the company owns a large tract of land and at present has its main storage tracks and a small repair shop. As necessity arises modern and complete shop buildings and car houses will be erected at that point.


Salt Lake & Ogden Railway—Bridge Over Union Pacific Railway

Track connections for the interchange of freight are maintained at Salt Lake with the Rio Grande and the Ogden Short Line railways, and at Ogden with the Union Pacific.

ROADBED

Outside of the cities the company operates on its own right-of-way, which has a standard width of 66 ft. Although only single track with sidings is at present in use, provision is made for a double track throughout. The heaviest roadbed construction occurs at the Ogden end of the line, where bridges with the required cuts and fills are necessary for crossing the Weber River, the Union Pacific tracks and a local street railway track. At present the river crossing is made on a temporary trestle, but a concrete bridge with concrete approaches will soon be built at that point.

The Union Pacific crossing is made over two tracks and over Pacific Avenue. Above the tracks is a pony truss with 180-ft. span covering the entire right-of-way at the steam road. Over Pacific Avenue is a 9-ft. plate girder, the span being 89 ft. The bridge carries two tracks and is built on a slight skew with a grade of 1.1 per cent descending toward Ogden. A clearance of 22 ft. is provided over the Union Pacific tracks. At Wall Avenue the 80-ft. street is crossed with an 83-ft. bridge, made up of a 48-ft. central plate-girder span and two approaches, all resting on concrete abutments.

TRACK

The maximum grade is 1.1 per cent and the maximum curvature outside of the cities is 6 deg. The track is laid with 85-lb. T-rail, A. S. C. E. section, on a gravel-ballasted roadbed with standard size Oregon pine ties. All rail joints are bonded with No. 0000 "twin-terminal" copper bonds and the rails are cross-bonded every 600 ft. with cross bonds of like section. Long sidings are used to avoid delays at meeting points.

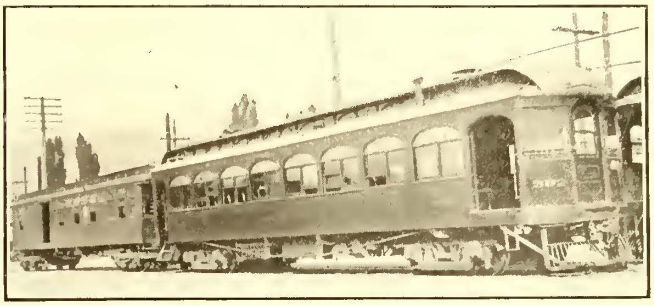
POWER AND SUPPLY

The Salt Lake & Ogden road within the coming year will have two independent sources of power. One of these is from the high-tension supply lines of the Telluride Power Company and the other is a generating station which the railway company is building near the midpoint of its line. For the first year of operation a contract for power was made with the Telluride company.

POWER-STATION BUILDING

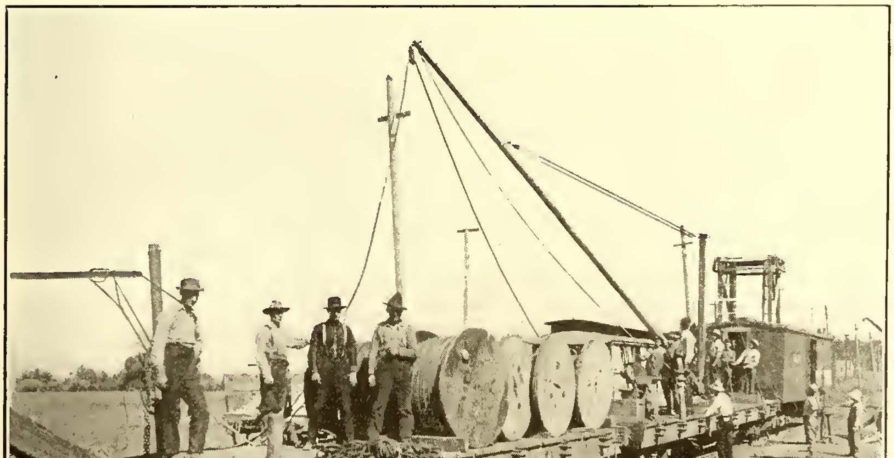
The site of the steam power station is at Lagoon directly across the tracks from an extensive summer garden and amusement park, which has for several years been operated successfully by this company. The park was described and illustrated in the Oct. 2, 1909, issue of the Electric Railway Journal, page 522. A steadily flowing stream from the nearby mountains passes through the park and its waters are stored to form a lake. This water supply determined the location of the generating station at Lagoon and, as will be described later, condensing water is obtained with a lift of less than 3 ft. The discharge from the condenser is utilized to warm the water in a bathing pool.

The new power station building is a steel-frame structure with concrete foundations and brick curtain walls. It is 106 ft. 6 in. wide by 143 ft. long. The floor space is subdivided by a fire-resisting wall into a boiler house and an engine room. A bay in the engine room 49 ft. long x 25 ft. wide incloses the high-tension buses and switching apparatus. The boiler and engine room roofs are carried on structural steel girders spanning from wall to wall. These girders carry 8-in. I-beam purlins which support a roof of reinforced concrete that is protected by a tar and gravel coating.

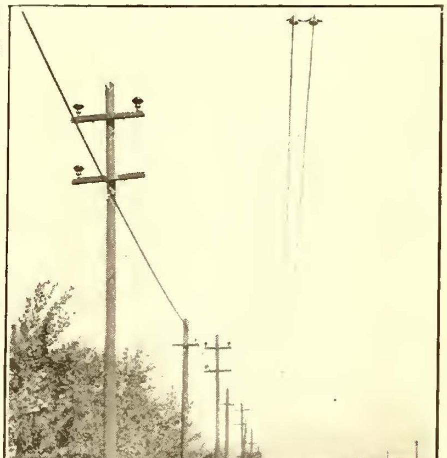


Salt Lake & Ogden Railway—Train at Salt Lake Terminal

Coal is received over an elevated track supported on a steel floor structure and a wing wall so arranged that a storage space directly beneath the receiving track is opposite the boiler firing aisle. The boiler equipment includes one 306-hp, two 250-hp and four 150-hp Heine boilers equipped with American underfeed stokers and force draft. The boiler-plant auxiliaries are located on the boiler house floor. This boiler house has no basement. Ashes will be removed by a belt conveyor which will carry them to overhead bins from which they may be loaded into cars.



Salt Lake & Ogden Railway—40-ft. Derrick for Stringing Feeder Lines and Setting Poles

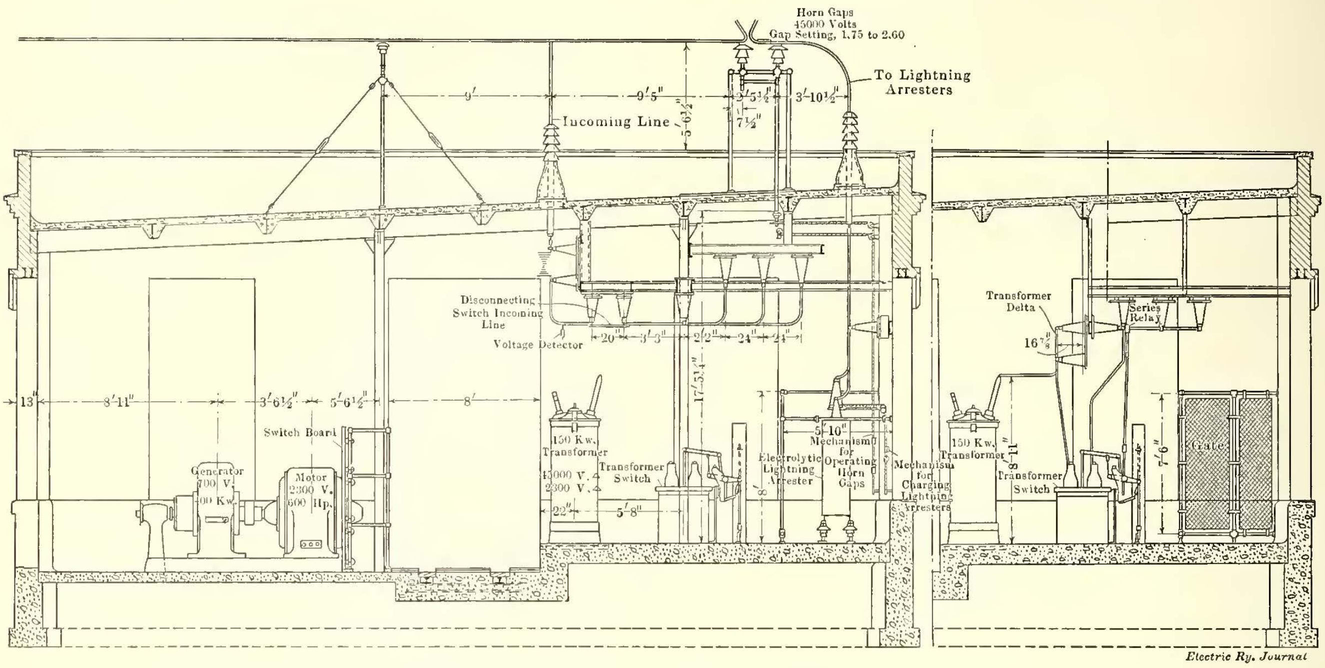


Salt Lake & Ogden Railway—Track Construction Inside of Town Limits

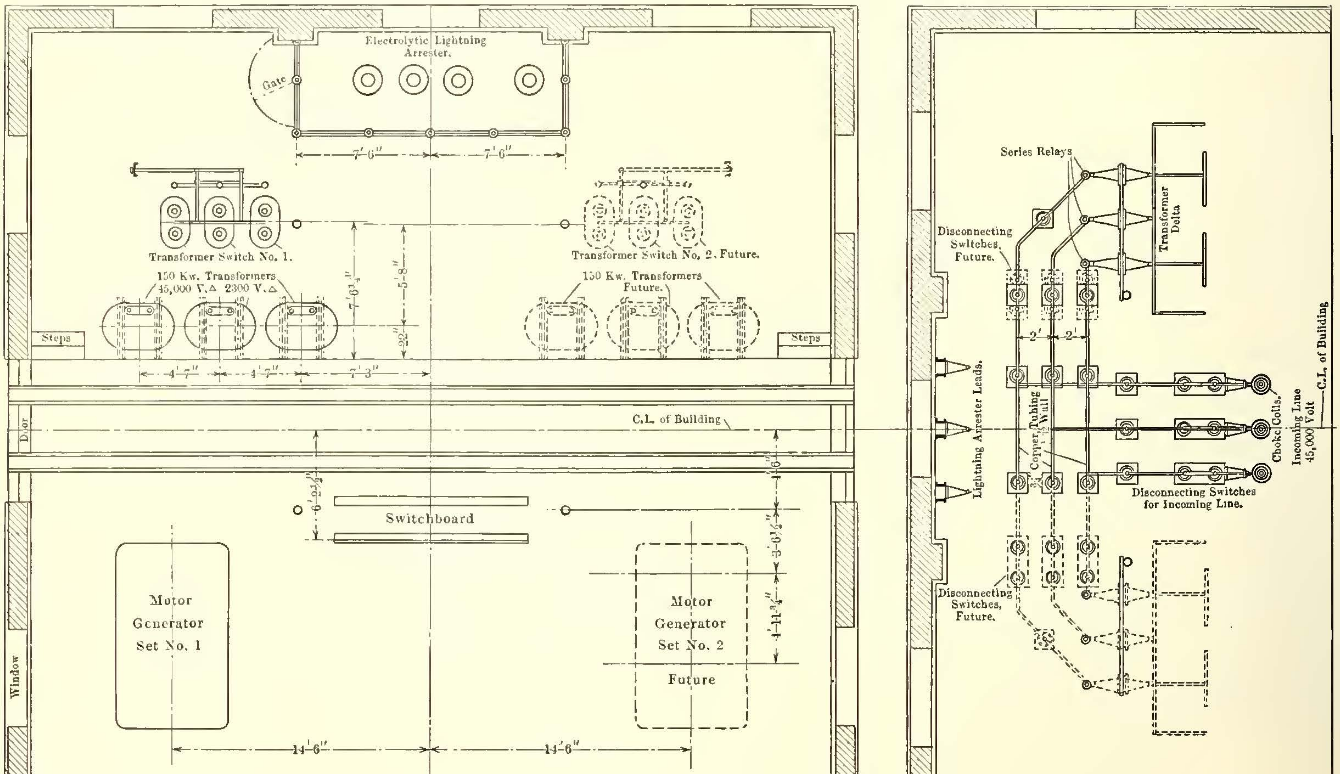
The initial generating equipment includes two Allis-Chalmers cross-compound Corliss engines belted to two 400-kw General Electric, 2200-volt, three-phase, 60-cycle generators, and a 400-horizontal type Curtis turbo-generator connected for operation either on high-pressure steam or the exhaust from the reciprocating engines. Exciting current for the generators is furnished by a turbine-driven unit. A condenser equipment of the Le Blanc type will serve the two engines as well as the turbine.

CONDENSING WATER SUPPLY

The supply of condensing water is taken from the large lake at Lagoon, 560 ft. distant. An intake well has been built of concrete at the shore of the lake and duplicate supply conduits have been laid. The intake well is subdivided into two water-tight sections. From each of these sections a 16-in. cast-iron pipe carries water by gravity to an intermediate well close to the power house. Each of the intake pipes is fitted with screens and a valve at the intake end. The intermediate well also is subdivided so that each intake system is independent. With this arrangement, if it is desired to clean either one of the conduits, its intake valve may be closed and its section of the intermediate well may be emptied by a boiler-feed pump. Meanwhile the condenser may be supplied by the duplicate intake pipe. The conduits have sufficient fall to discharge refuse into the intermediate well. The water level in the intermediate well normally is about 2 ft. below the water inlet to the condenser so that the circulating pumps have comparatively little work to do. The circulating water after having passed through the condenser is discharged through 900 ft. of 20-in. wood-stave pipe into a swimming pool in Lagoon Park. The overflow from this pool flows into the main reservoir from which the cir-



Salt Lake & Ogden Railway—Cross-Section of Substation Showing High-Tension Apparatus



Plan showing Location of Apparatus. Plan showing H.T. Wiring, (Looking Up.)

Electric Ry. Journal

Salt Lake & Ogden Railway—Floor Plan and High-Tension Connections in Substation culating water is taken and which is fed by the stream earlier mentioned.

ELECTRICAL WIRING

The generators deliver 2300-volt current through oil switches and buses located in the engine room basement to a bank of 150-kw transformers which raise the potential to 45,000 volts. The transformers are delta-connected on both sides. A sectional elevation through the high-tension bay shows in general the arrangement of the low-tension switch gear beneath the engine room floor, the main control board in the engine room and the transformers and lightning arresters in the high-tension bay. All the high-tension connections within the power house are made of 5/8-in. copper tubing mounted on post-type insulators. The buses into which are connected the high-tension leads from the transformers are supported under the ceiling of the high-tension bay. Parallel with the transformer bus is a similar bus for the outgoing lines. Both buses may be sectionalized with hand-throw switches. The line bus is connected with the transformer bus through K-10, 45,000-volt solenoid-operated switches. Similar switches are installed for each outgoing line.

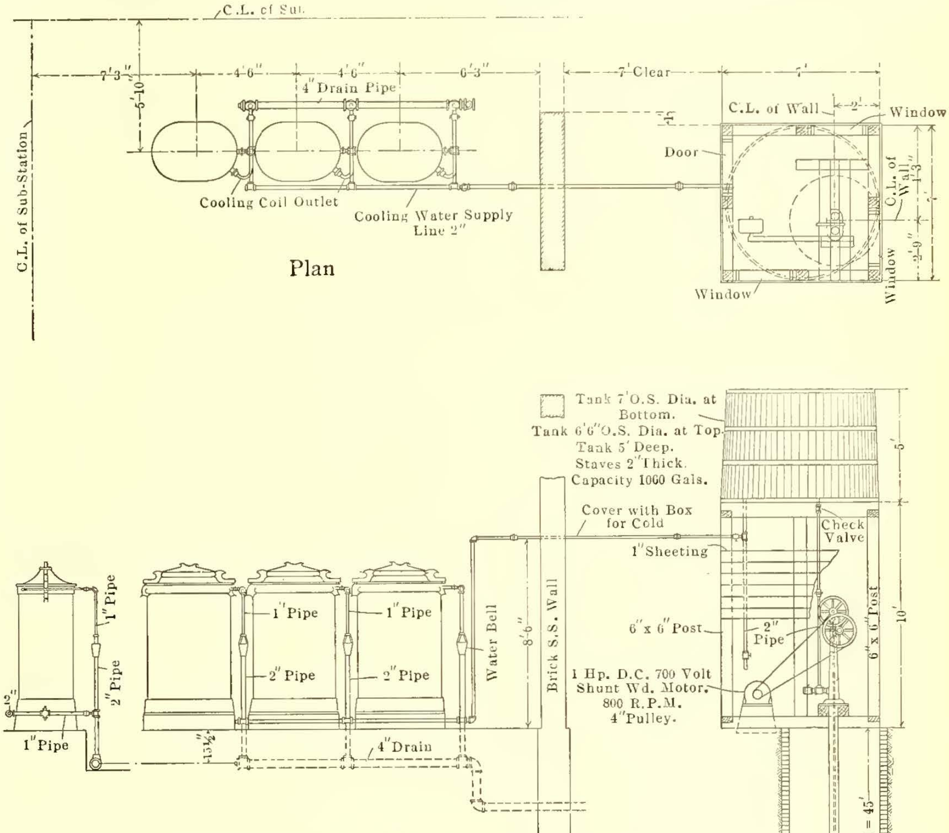
The high-tension bay with its exposed 45,000-volt connections is so arranged that all of the wiring is in plain sight and any disturbance may quickly be located and segregated. Facility of access for inspection and repairs is provided by a mezzanine floor and provision is made for handling the transformers on industrial railway tracks built in the floor. The wiring is so laid out that practically all leads are suspended and thus the floor space is clear for the movement of employees and apparatus. The transformer leads are fitted with special potheads which permit of quick disconnection in case it is necessary to run on open delta or to replace a transformer. All 45,000-volt leads pass in or out of the building through the roof. They are insulated from the reinforced concrete roof slabs by large nested porcelain roof entrance insulators installed as shown in the accompanying engravings of the power house and substations.

LIGHTNING ARRESTERS

Three high-tension lines extend out of the power station, one in each direction along the railway company's right-of-way, and the third to connect with the transmission system of the Telluride Power Company. All three outgoing lines have similar protection against disturbance from lightning. This protection is afforded by banks of electrolytic lightning arresters having horn-gap discharge points above the roof of the building, which are shown in the vertical section through the high-tension bay. Lightning arrester connections are made with copper tubing. The bank of electrolytic lightning arresters is installed within a protecting framework on the floor of the high-tension bay directly behind the transformers. From the tops of the arresters the leads pass directly up and through the roof to one side of the horn gaps. The other side of the horn gaps connects with the outgoing line. Electrolytic lightning arresters require charging and so an operating mechanism has been provided with which the horn gaps may be closed to supply current to the aluminum cells which form the arresters. This operating mechanism has a latch to prevent accidental closure of the horn gaps.

TRANSMISSION LINE

The transmission wires are carried on an independent pole line built of 45-ft. cedar poles with 8-in. tops and 12-in. butts set 6 ft. in the ground. The transmission poles are set 150 ft. apart on tangents and 80 ft. on curves, while the trolley poles are spaced 80 ft. apart throughout. The butts of the transmission poles, as well as those of the trolley suspension, were treated with Carbolineum. Where wet ground made it necessary the poles are set in concrete, barrels being used for forms. An accompanying engraving shows the general dimensions and arrangement of the transmission poles. The transmission circuits consist of three No. 14 copper or aluminum wires carried on 8½-in. triple petticoat porcelain insulators supplied by the Ohio Brass Company. Two 4-in. x 5-in. x 8-ft. cross-arms are used, the wires being spaced 7 ft. apart.



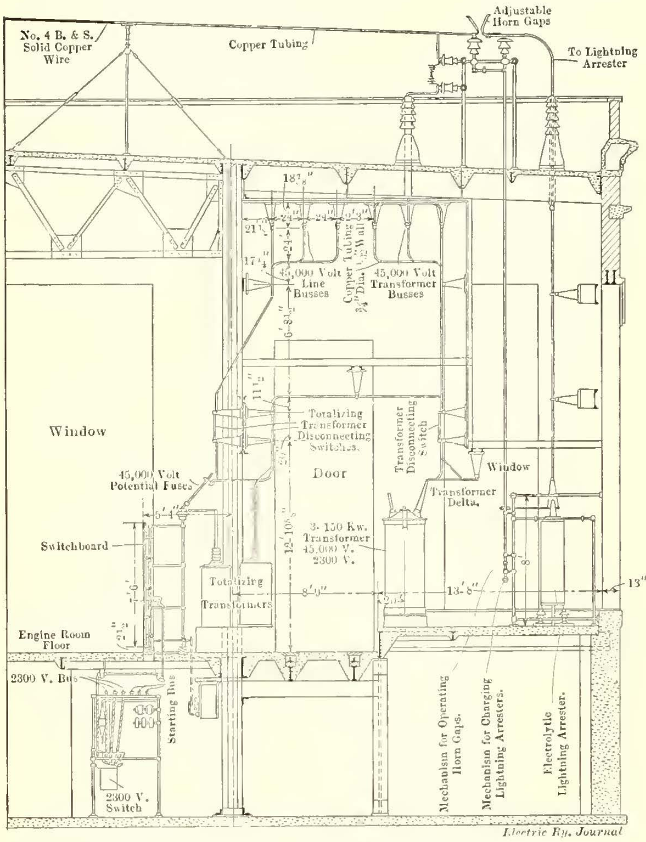
Salt Lake & Ogden Railway—Pump and Pipe Layout for Transformer-Cooling Water in Substations

The valley of the Great Salt Lake, closely shut in by high mountains, is subject to very severe electrical storms. For that reason the transmission line of the newly electrified line was designed with particular regard to lightning protection. The fact that during the first eight months of operation up to the time this article was written the transmission system had not experienced a shutdown indicates the thoroughness of construction and the excellence of the design. A No. 8 galvanized-iron guard wire is strung on top of the poles for lightning protection, its support being a galvanized channel iron fastened with lag screws to the pole top. To the fact that the protecting ground wire is grounded at every pole may be credited the freedom from lightning troubles enjoyed by this transmission line.

SUBSTATIONS

The trolley wire and feeders are supplied with 700-volt direct-current from four motor-generator substations located about 10 miles apart. One substation is installed within the power house at Lagoon. The substation installations are similar and each includes one 400-kw motor-generator set receiving 2300-volt a. c. and delivering 700-volt d. c. Banks of three 150-kw water-cooled oil-insulated transformers receive current from the transmission line at 45,000 volts potential and deliver it to the motors at 2300 volts. The generating and substation apparatus is chiefly of General Electric manufacture.

The building design of the substations conforms to that of the power house, having concrete foundations, floors and roofs with brick side walls. A floor plan of one of these substations



Salt Lake & Ogden Railway—Section Through High-Tension Bay of Power House

is shown. This design is standard for all stations. The building provides a generous amount of floor space for the accommodation of duplicate motor-generator sets and attendant apparatus. An aisle and tracks between the high and low-tension sections of the substation furnish an economical means for handling heavy apparatus directly into the substation on cars.

In general the wiring plan of the substations is similar to that in the power house. All high-tension leads are brought into the building through roof insulators. The circuits of the 45,000-volt, three-phase power line pass through choke coils just below the roof insulators, thence through disconnecting switches to underhung buses supported on post-type insulators. From these buses connections are made to K-10 oil switches which throw the transformers onto the line. All the high-tension connections are made with ¾-in. copper tubing. The extreme simplicity of the high-tension connections in one of these substations is shown in the plan. The arrangement of the roof entrances and the location of the larger apparatus are shown in a sectional view.

The substations, as well as the power house, are protected from lightning discharges by electrolytic arresters, the horn gaps of which are installed above the substation roofs. The aluminum cells are placed directly under the high-tension entrances and are inclosed in a grillwork to protect against accidental contact. A special mechanism has been installed to facilitate the operation of the horn gaps and the transferring of the fourth electrolytic arrester cell from the ground side to the line side for charging. This mechanism essentially consists of rope drive for the moving parts with special stops attached to the ropes, indicating the extent of travel for completing the movements necessary to close the horn gaps and to transfer the end cell. Arrester discharges are indicated by an alarm bell.

TRANSFORMER WATER SUPPLY

An independent plant has been installed at each substation to supply cold water for the transformers. One of these plants is shown in elevation by the engraving on page 703. Water is taken from a well by a 1-hp, 700-volt shunt-wound motor, driving a Rumsey pump which discharges into a storage tank having a capacity slightly more than 1000 gal. The pump and its driving motor are installed within the inclosure surrounding the supports for the storage tank.

OVERHEAD LINE CONSTRUCTION

The overhead construction of the road is of particular interest because of the care taken to gain permanence and because an especially large amount of copper has been installed. An accompanying engraving shows a cross sectional view of the right of way and indicates the arrangement and dimensions of the poles and fittings supporting the trolley and feed wires. Span construction with 80-ft. pole spacing along the track and 35-ft. spacing across the track has been used throughout the length of the line. Two No. 0000 grooved trolley wires have been installed over the present track and one of these wires is so arranged that it can, at comparatively small expense, be shifted on the span wire to a position over the second track which the company expects to build. The span wires are supported by 35-ft. poles on one side and 30-ft. poles on the other. Every trolley span pole has been back-guyed with a 6-in. anchor. A variety of anchors has been utilized. The anchors have ⅝-in. rods and are connected with the pole tops by ⅜-in. steel strand cables.

In the cities where the poles could not be guyed they were set in concrete for the full distance below ground. On the right of way all poles were anchored with a concrete collar 24 in. in diameter extending 18 in. below the ground and 5 in. above. The butts of the poles were treated with Carbolineum for a length of 8 ft.

The poles on one side of the track carry two-pin cross arms, on one pin of which a 750,000-circ. mil feeder cable has been installed for the full length of the road. The south section of the road, 5 miles in length, where the heavy switching will be done, is fed by the two such cables. Westinghouse type M. P.

Salt Lake & Ogden Railway—Switching Tower at Power House

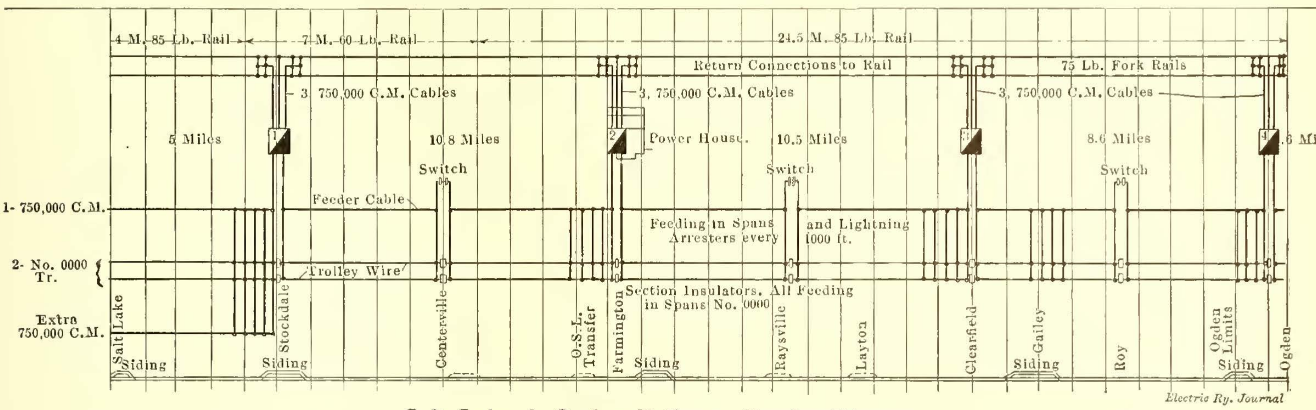
lightning arresters are installed on every eleventh pole, at which points trolley feeding taps also are made. The lightning arrester ground wires are No. 4 B. & S. solid copper, which for a distance of 7 ft. above the ground are inclosed in sections of ¾-in. standard wrought-iron pipe terminating in malleable points 6 ft. below the ground surface. It is planned to supplement the trolley line arresters with electrolytic arresters placed in the substations.

Two pairs of telephone wires, one of No. 12 galvanized iron and the other of No. 10 copper, have been erected. The iron wire line is used by the traffic department and the copper line is for the dispatcher and for a system of dispatcher's signal boards operated by telephone selectors.

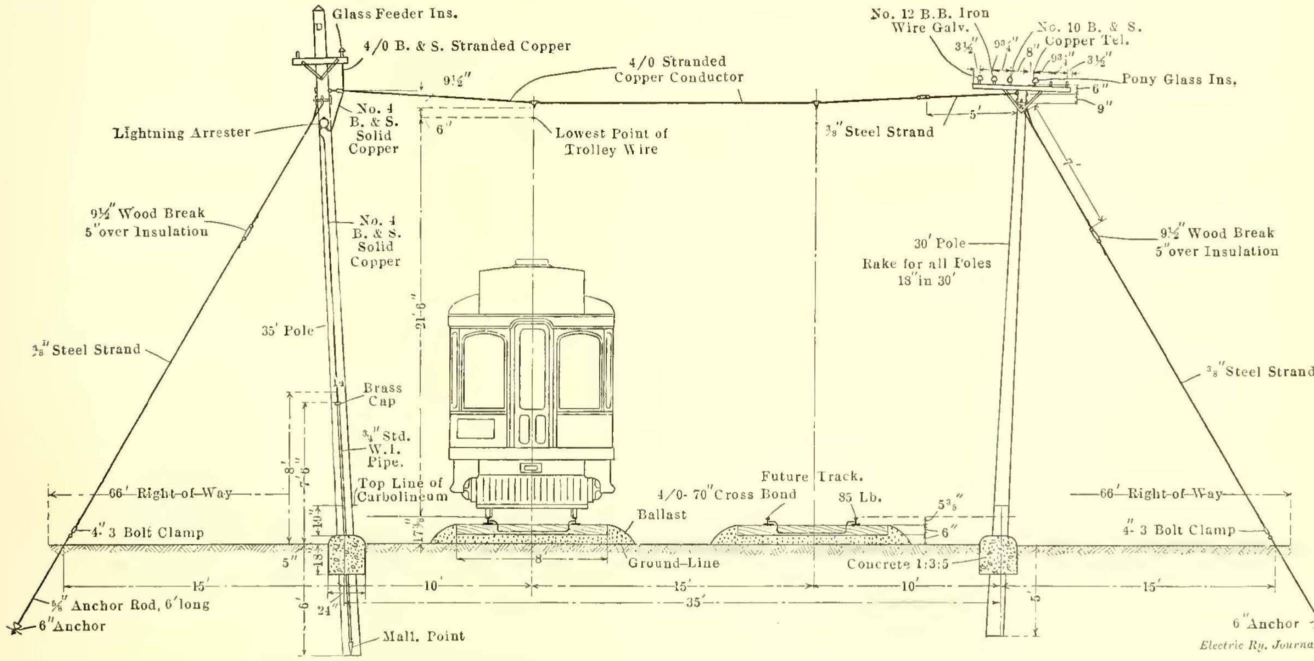
So far as possible special tools were used to facilitate the construction of the pole line and overhead wiring. A hand derrick with a 40-ft. boom, as illustrated, was mounted on a flat car and used for setting poles. This derrick also was used to place the feeder and trolley wires at the pole tops. So far as possible all of the work of fitting up the span and guy wires and serving them into the strain insulators was done at a field shop at one point on the road. In this way considerable labor was saved and the speed of the work could be accelerated because the wire men were protected from the weather and could use heavier tools than would be convenient to carry along the road. In the towns and cities all poles are painted a dark green and each trolley pole is plainly numbered, the figures reading alternately from the north and the south. The overhead fittings for the trolley and feeder installation are of the Westinghouse type, but the pole hardware was supplied by the Western Electric Company.

DISPATCHERS' SIGNALS

The safety of train operation is assisted by the use of an equipment of dispatchers' signals with stop boards located at all sidings. Normally all these boards are held in the clear position, but any one may quickly be dropped at the will of the dispatcher. The dropping of the semaphores is effected by an installation of Gill selectors supplied by the United States Electric Company. These selectors do not require an independent signal line, but are operated over the dispatcher's telephone circuit. The dispatcher is provided with a separate key for each semaphore and by turning this key certain impulses are sent over the telephone line. These impulses will cause to operate only that selector switch controlling the semaphore corresponding with the sending button turned by the dispatcher. The semaphores are returned to the clear position by the train crews which are stopped by them.



Salt Lake & Ogden Railway—Feeder Diagram



Salt Lake & Ogden Railway—Standard Overhead and Track Construction

ROLLING STOCK

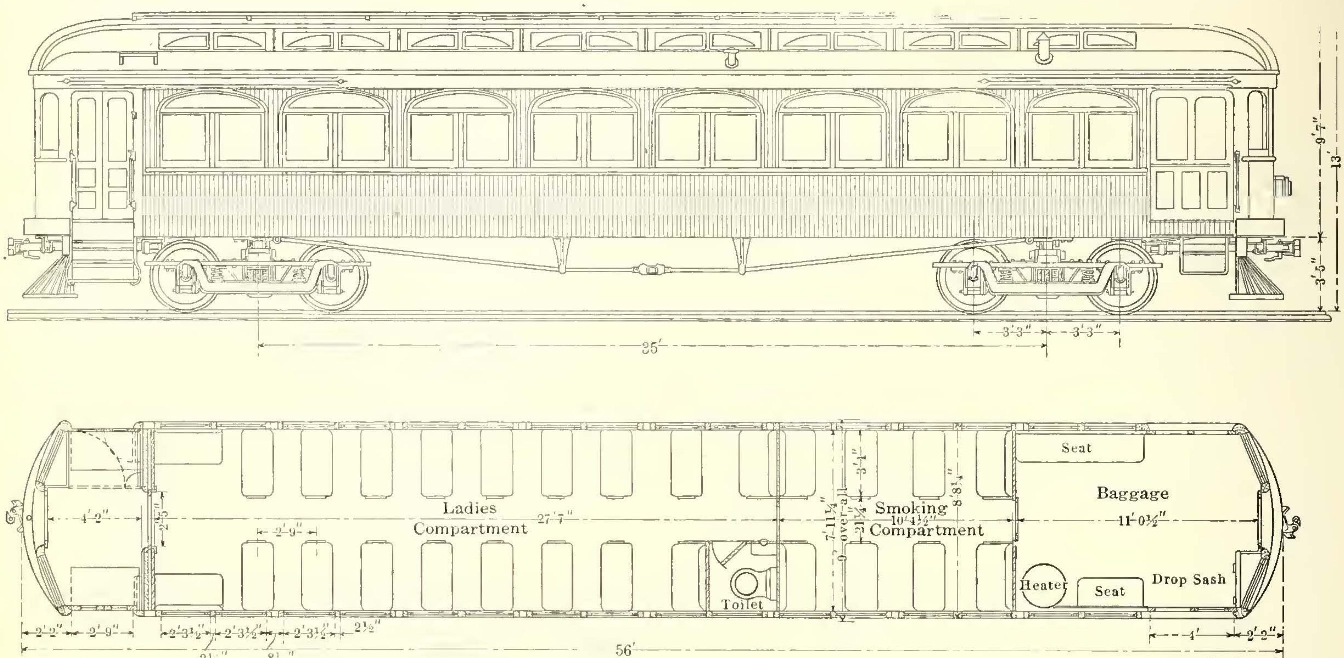
The initial motor-car equipment of the road consists of 10 three-compartment cars built by the Jewett Car Company. The 40 coaches used by the company when the road was operated by steam are brought into service as trailers. Some of these coaches are being remodeled for electrical operation and 10 trail-car bodies of the same dimensions as the new motor cars are now under construction at the shops of the Niles Car Company, Niles, Ohio.

The motor cars, which have a seating capacity of 60 passengers, are designed to conform as nearly as possible to standard M. C. B. specifications. The following are the dimensions of the cars:

Length over buffers	55 ft. 0 in.
Length over corner posts	44 ft. 0 in.
Length over center to center of trucks	35 ft. 0 in.
Width over all	9 ft. 0 in.
Height from bottom of sill to top of car	9 ft. 7 in.
Wheel base	6 ft. 6 in.
Weight complete	80,000 lb.

The interiors of the cars are finished in solid mahogany with full-vaulted Empire ceilings. The main compartment has 15 reversible and four stationary seats of the Hale & Kilburn No. 199 type. The smoking compartment has four reversible and four stationary seats.

The baggage compartment occupies a space 11 ft. long at the front end of the car and has two sliding doors. Two folding seats are placed along the side walls. The vestibules, which are 4 ft. 6 in. long, have end doors for use during train operation. The front end of each car is set off as a motorman's cab. The cars are built for single-end operation, but are equipped with double-end control.



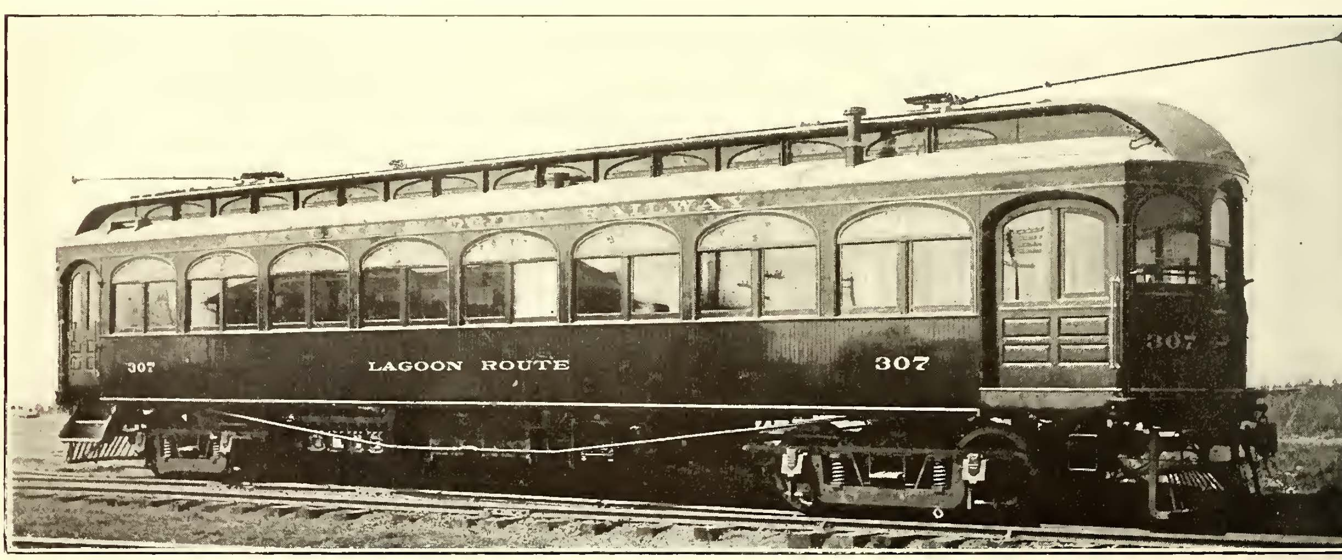
Salt Lake & Ogden Railway—Elevation and Plan of Standard Motor Car

The cars are equipped with Janney radial M. C. B. couplers and McConway & Torley draft gear adapted for train operation in heavy interurban service. Other equipment installed on these cars includes: Baldwin class 78-30 trucks, Symington ball-bearing centerplates, Woods roller side bearings, Keystone air sanders, Edwards window fixtures, Curtain Supply Company's ring curtain fixtures, Duner toilet fixtures, Westinghouse AMM brake equipment, General Electric 205-B motors, General Electric type M automatic control and Peter Smith hot-water heating system.

The cars are designed for a schedule speed of about 30 m.p.h. They are geared to 53 m.p.h. so that the run between Salt Lake and Ogden may be made in less than an hour.

TRAIN SERVICE

The operation of the road is handled by a train dispatcher located at Salt Lake. Twelve trains are operated each way daily, the headway being 1 hour and 20 minutes. For the regular run, making 16 stops between Salt Lake and Ogden, 1 hour and 10 minutes is required. Three of the trains are operated on a "flyer" schedule, making but four stops en route and requiring only one hour for the trip. Agents are located at Bountiful, Centerville, Lagoon, Kaysville and Layton, and at the terminals. Since the road was electrified and extended to Ogden the passenger traffic has more than doubled and is increasing rapidly. Between 150 and 200 through passengers are carried each way daily and many more local passengers. This increase in traffic has been made in spite of the fact that the rates have been increased over those charged during the steam period, and also in spite of the steam railroad competition. The company sells its local tickets at a rate of practically 2½ cents a mile. In addition it issues 500-mile mileage books for $8.75, or at the rate of 1¾ cents a mile. These books can be used unrestrictedly. Under steam operation the Salt Lake & Ogden Railway charged 80 cents one way and $1.60 round trip



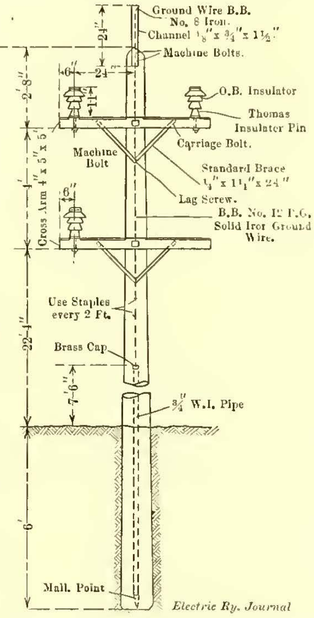
Salt Lake & Ogden Railway—Standard Motor Car between Salt Lake and Ogden. Under electrical operation the corresponding rates are $1 and $1.80. The steam roads, especially the Oregon Short Line, have bettered their service considerably, even placing a "flyer" in service which makes the trip in 45 minutes. The bulk of the traffic, however, goes to the electric railway, as the passengers seem to prefer the cleaner ride, the regular schedule and also the facility of boarding cars on the street.

FREIGHT AND EXPRESS

In addition to the passenger traffic the company handles baggage and an express, milk and general freight business. At present the total traffic averages 9000 car miles a day. Although a good, substantial local freight business has been built up this summer, this is being discouraged now in an effort to build up the express business.

Local freight is not solicited except in carload lots. A through freight train is operated every other day. Express is carried on every train. The rates for both express and freight are identical with those charged for corresponding service by the steam railroads. The company does not operate under the regulations of the Interstate Commerce Commission, but conforms in every respect to standard steam railroad practice. Interchange of freight is now made between the Oregon Short Line and Rio Grande roads at Salt Lake and with the Union Pacific at Ogden and the electric railway receives a fixed switching charge for cars turned over to a steam road.

At present the carload freight is handled by steam locomotives, but orders have been placed for two electric locomotives of a heavy type capable of handling 10-car trains. The bulk of the foreign traffic consists of coal for the company's own plant and for the consumers along the line. About 75 per cent of the foreign freight passes through Salt Lake. An average of five or six cars of freight is shipped out daily, the shipments consisting principally of brick and the products of the canning factories on the road.



Salt Lake & Ogden Railway—High-Tension Pole Details

In the way of local business the company hauls into Salt Lake about 30 to 40 cars a week of brick, vegetables, fruit, etc. Under a contract with the City of Salt Lake all garbage of the city is hauled to a dump 6 miles north. The railway company furnishes the cars and power, unloads the cars and sets fire to the dumping. The spur to the dump crosses the Oregon Short Line, the crossing being protected by an automatic electric block signal. Another remunerative class of freight is the manure which the company hauls from the city and distributes to the farms along the line.

PERSONNEL

The work of placing the road on a firm operating basis is in the hands of the superintendent, Robert H. Grinnell, formerly of the Chicago City Railway.

The officers of the Salt Lake & Ogden Railway Company are: President, Simon Bamberger; vice-president, Sidney M. Bamberger; secretary and treasurer, J. B. Bean; auditor, W. E. Jones; general station agent, Roy Needham.

The selection of system and the design of conversion from steam to electricity were placed in the hands of H. A. Strauss, consulting engineer of Chicago, and the construction of the entire system was carried out by the Falkenau Electrical Construction Company, of Chicago, as general contractors.

FLANGE WEAR ON ST. CLAIR TUNNEL LOCOMOTIVES

Since electric operation of the St. Clair Tunnel of the Grand Trunk Railroad was begun the driving wheels of the locomotives have been subject to excessive flange wear. After 10 months' operation, when the locomotives had made only 80,000 miles, it was necessary to turn the driving wheels and form new flanges. To do this 5/16 in. of metal had to be cut off of the treads and the operation was expensive owing to the cost of removing and replacing the wheels and the loss of good metal. Under normal conditions the tires should last six years. The following information regarding the nature and probable cause of the excessive wear has been furnished this paper by W. D. Hall, superintendent of power plant and electrical equipment of the St. Clair Tunnel:

The three locomotives in use each consist of two duplicate half-units. Each half-unit is mounted on three pairs of driving wheels 62 in. in diameter. No guiding wheels are used and the rigid wheel base is 16 ft. The total weight of each half-unit is 67½ tons, which is evenly divided on the three pairs of driving wheels. The motors are each of 250 hp and are geared to the driving axles. The height of the center of gravity of the locomotives is 51 in.

Almost all the flange wear takes place on the leading wheels at each end of the half-units, which are turned end for end at regular intervals to distribute the wear as evenly as possible. The flange wear on the interior wheels is very slight and wear on the tread of any wheel is barely perceptible. The depth of the flanges is 1¼ in. and the minimum thickness allowed is 1 in. The steam locomotives which formerly were used for hauling trains through the tunnel did not show excessive flange wear on any wheels.

While some of the flange wear on the electric locomotives is due perhaps to the frequent application of the brakeshoes in descending the 2 per cent grades in the tunnel, there is no doubt that it is mainly due to curve resistance encountered in the tunnel yards. Conditions have been improved very much since last June. Up to that time various wheel flange lubricators had been tried out, but satisfactory results were not obtained, mainly on account of the heating of the tires due to the almost continuous braking which is necessary in descending the long approaches.

Mr. Hall designed an apparatus which would spray oil on the wheel flanges and one which would do this only when the tires required lubricating to enable them to take the curves with as little resistance as possible. By pressing an electric contact button at any controller or, in the case of a steam locomotive, by opening a small air valve, oil is sprayed on the flanges of the leading wheels of each locomotive from one lubricator. The action of the combination of oil and air not only lubricates the flanges, but cleans them from grit as well, as the spray forces the dirt and grit to the outer edge of the flange. When two or more locomotives are coupled together the pressing of a button on any locomotive will cause the leading wheels of each locomotive to be lubricated. For steam locomotives, or where electric current is not available, the action of the lubricator is the same except that it is controlled by an air valve placed near the operator and controlled by hand. This device has been giving very satisfactory results since all the electric locomotives were equipped.

The first lubricator of this design was tried out and has been in continuous operation since July 10, 1910, but a sufficient time has not elapsed to determine just what saving has been effected.

MEETING OF CENTRAL ELECTRIC TRAFFIC ASSOCIATION

The Central Electric Traffic Association met in Lima, Ohio, on April 12, 1911. After transacting routine business the rest of the day was spent in studying the various changes noted in the Interstate Commerce Commission's Tariff Circular 18-A.

Electric Railway Journal

A CONSOLIDATION OF

Street Railway Journal and Electric Railway Review

VOL. XXXVII. NEW YORK, SATURDAY, APRIL 22, 1911 No. 16

PUBLISHED WEEKLY BY

McGraw Publishing Company

239 WEST THIRTY-NINTH STREET, NEW YORK

JAMES H. MCGRAW, President.
HUGH M. WILSON, 1st Vice-President. A. E. CLIFFORD, 2d Vice-President.
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TELEPHONE CALL: 4700 BRYANT. CABLE ADDRESS: STRYJOURN, NEW YORK.

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CLEVELAND OFFICE............................1021 Schofield Building
PHILADELPHIA OFFICE......................Real Estate Trust Building
EUROPEAN OFFICE....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION:

For 52 weekly issues, and daily convention issues published from time to time in New York City or elsewhere: United States, Cuba and Mexico, $3.00 per year; Canada, $4.50 per year; all other countries, $6.00 per year. Single copies, 10 cents. Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. Date on wrapper indicates the month at the end of which subscription expires.

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to Tuesday noon of the week of issue.

Entered as second-class matter at the post office at New York, N. Y.

Of this issue of the ELECTRIC RAILWAY JOURNAL 8500 *copies are printed.*

NEW YORK, SATURDAY, APRIL 22, 1911.

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Specifications for Car Wiring

While the biennial revision of the code of installation rules of the National Board of Fire Underwriters which was completed recently did not result in any changes in the special rules affecting the wiring of cars or carhouses, the new specifications for rubber-covered wire which were adopted have an important bearing on the safety of car wiring, inasmuch as all wire used must be of an approved brand. The new specifications are much more severe in their test requirements than those which they supersede, since they embody not only mechanical and electrical tests, but chemical tests as well. It is well known that rubber compounds containing only a small percentage of pure rubber can be made up so that they will pass either a mechanical or a chemical test, but it is far more difficult to make an inferior compound which will stand both tests. The effect of putting the new specifications in force will be to insure a much better grade of rubber-covered wire at an increase in cost of not more than 15 per cent for the smaller sizes and less for the large sizes. While the use of any grade of wire which conforms with the new specification will be permissible for car wiring, too much dependence should not be placed on the label showing that the wire is of an approved brand. It pays to use the very best insulation on car wiring, exposed as it is to moisture and the flow of heavy currents. The cost of the wire is only a small part of the total cost of wiring a car, and long life of the insulation is essential for safety, reliability and low maintenance cost.

Comparative Statistics

It is needless to say that in a comparison of the service of two or more railway properties, or indeed in the comparison, on any unit basis, of two dissimilar things, all of the circumstances affecting the service or things compared should be taken into consideration if complete knowledge is desired. The car mile in a small city with light grades is a unit of an entirely different value from that in a large city with steep grades and considerable street obstruction, and each of these car miles is apt to differ widely from the car mile on a high-speed interurban road. Similarly, comparisons of pull-ins per 1000 car miles will be but a slight measure of the operating and mechanical efficiency of a company unless many of the elements which affect the number of pull-ins form part of the comparison, such as the extent of the defect which the company regards as sufficient to warrant it in withdrawing a car from service, type of equipment used, the extent to which repairs are allowed on the road and many other attendant circumstances. These remarks are made because in some quarters there seems to be a tendency to place undue emphasis upon the comparative pull-in defect records of the electric railway companies in New