Street Railway Journal

Vol. XIV. *NEW YORK AND CHICAGO, JULY, 1898.* *No. 7.*

THE HULL ELECTRIC RAILWAY

By F. C. Armstrong

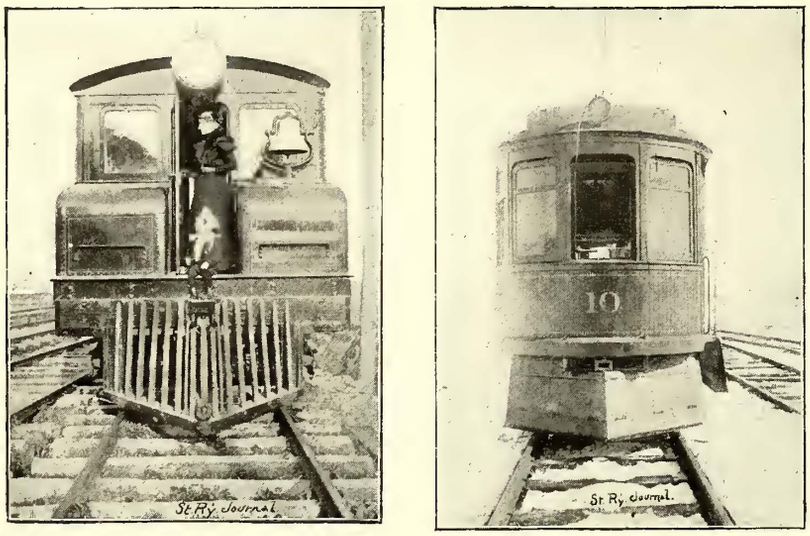
At the present stage of electric railway development, there is no subject more attractive to the electrical engineer, or which more seriously demands the consideration of the steam railroad manager, than the possibility, as yet mainly undefined, of the profitable conversion to electrical operation of existing roads operated by steam. In the street railway field, the success of electric traction has been of the "veni vidi vici" order; the mule, the horse and the cable are in process of becoming memories within the short stretch of less than one decade. A similarly successful attack on the larger field at present occupied by the steam locomotive, is another matter. For one thing, the steam locomotive is admittedly doing its work and doing it well and economically; for another, the transmission factor is at present, working it out in any way we choose, a serious limitation of range in the substitution of electricity for steam, even in suburban practice.

ELECTRIC FREIGHT AND PASSENGER TRAIN—HULL

The work of the past two or three years, however, has established certain important points, even to the mind of the most prejudiced steam railroad manager. The B. & O. installation at Baltimore has demonstrated the possibility of constructing and operating electric locomotives capable of exerting a greater tractive effort than the most powerful steam locomotives anywhere in use. The work on the New York, New Haven & Hartford branches, on the elevated roads in Chicago and elsewhere, and on the important suburban lines which control the local business centering in Cleveland and other cities, has shown clearly the commercial advantages to be gained by the conversion to electricity where quick and frequent service is demanded over distances up to 25 and 30 miles. There is no doubt that even with our present transmission limitations, a very large field exists for the electrical equipment of suburban and branch lines of steam roads, where the present or possible business is of such a nature that its full development can only be attained under the special conditions of operation rendered possible by the use of electric traction. An excellent example of the successful realization of this possibility is found in the case of the Hull Electric Railway.

The Hull Electric Railway runs from Hull, a city of 15,000 inhabitants, lying immediately across the river from Ottawa, the capital of the Dominion of Canada, to Aylmer, a village of 2,500 inhabitants,

Until June, 1897, the main line was known as the Aylmer branch of the Canadian Pacific Railway, connecting at Hull with the C. P. R. and at Aylmer with the Pontiac & Pacific Junction, a road running north some 70 or 80 miles, through the county of Pontiac. While operated as the Aylmer branch of the C. P. R., its business consisted of transferring passengers and freight from the Pontiac & Pacific Junction road to the Canadian Pacific main line, a considerable freight business in hauling lumber from some large mills, located midway at Deschenes, and also what passenger traffic existed between Aylmer and the city of Ottawa.



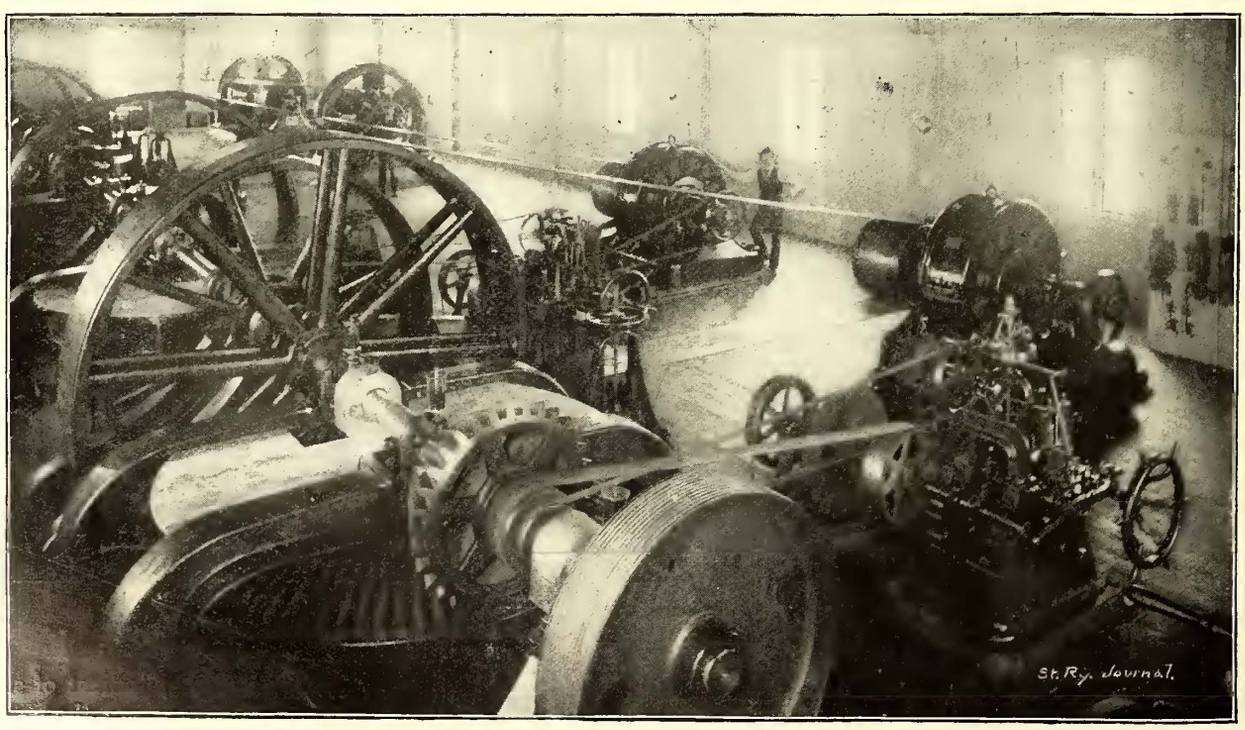
END VIEWS OF LOCOMOTIVE—SUMMER AND WINTER

Its operation under these conditions was unprofitable and the Canadian Pacific Railroad was quite willing, when approached by capitalists interested in lumber mills and water power along the line, to lease the property, consisting mainly of 10 miles of single track, for $5,000 per annum. The equipment of the road, for electric traction, was immediately proceeded with, the power house being located at Deschenes, midway between Hull and Aylmer, where an excellent and cheaply developed water power was available. The gentlemen interested in the property are among the most prominent in financial and business circles in Ottawa, and they have not spared any expenditure necessary to put the road in the best possible shape to handle the business and pay a return on the money invested.

The total length of track, including sidings, is 26 miles, the main line running from Hull through Deschenes and Aylmer to Queens Park being double tracked throughout. It was intended at first to operate the line as a single track road with turnouts, but this was found not to be feasible on account of the number of train units. The right of way was therefore purchased outright from the C. P. R. and a second track was laid down. The rails are of steel, weighing 56 lbs. to the yard; and the ties cedar, of the standard dimensions, and laid 2,640 to the mile. On the whole line the number of highway crossings at grade is three, one overhead and one grade crossing being made over steam roads. The heaviest gradient on the portion of the line used for freight is 2 per cent.; there is one short grade of 264 ft. to the mile, on the branch line running to the Queens Park, over which there is no freight service.

POWER HOUSE

In the power house located at Deschenes there are at present installed six 60 ins. new American vertical turbines, built by Kennedy & Sons, developing at the normal head of 9 ft. 6 ins. 1,000 h.p. the jack shaft speed being 165 r.p.m.



INTERIOR OF POWER STATION

The railway generators consist of two steel frame machines, of the Canadian General Electric Company's standard type, having a capacity of 325 k.w. each. Power is also furnished from the jack shaft to operate two 150 k.w. monocyclic alternators, from which current is furnished

for the extensive lighting business of the Deschenes Electric Light Company in Hull and the city of Ottawa. The difficulties usually experienced in speed regulation with water power are largely overcome by the use of an artificial load, thrown on and off the generators by a very simple and positive method designed by the electrical engineer of the company, J. E. Brown, the use of water wheel governors alone not having been found sufficient to give a reasonably constant speed under the violent load fluctuations experienced when operating the electric locomotives.

CAR HOUSES.

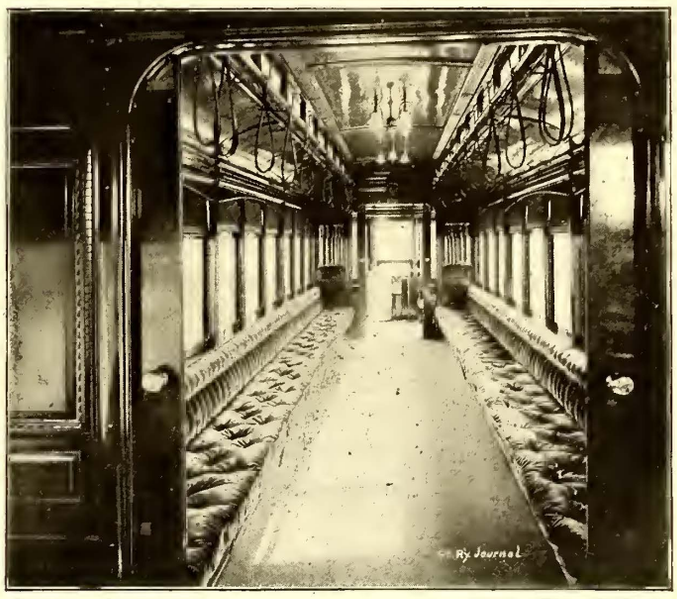
The car houses located alongside the main line at Deschenes are of stone, and consist of two buildings, each 150 ft. long by 70 ft. wide; each of these buildings contains four tracks, with pits continued throughout their full length; space is also given for an excellently equipped machine shop and for a tool house, store room and draughting room. A swinging crane is provided over the working pit and hydraulic jacks for handling the motors in the pits themselves.

ROLLING STOCK

The rolling stock consists of thirteen double truck motor cars, of which four are closed and nine open; also of two single truck 21 ft. cars for handling the local traffic in Hull. Four 13-bench open trailers are being added to the equipment this spring. The double truck closed cars are 40 ft. 2 ins. in length over all; vestibuled at both ends and finished both inside and out in solid mahogany; a special feature in the design of these cars is the use made for an observatory and smoking room of the vestibuled compartment at each end. The equipment for the double truck cars consisted originally of two 50-h.p. motors, but in practice these have not been found entirely satisfactory. The present standard equipment, both for the open and closed cars consists of four G. E. 1000 motors, geared to run at 25 to 30 miles per hour. This has been found by experience to be an admirable equipment for work of this class. The trucks used are of the Blackwell, Taylor and Brill make.

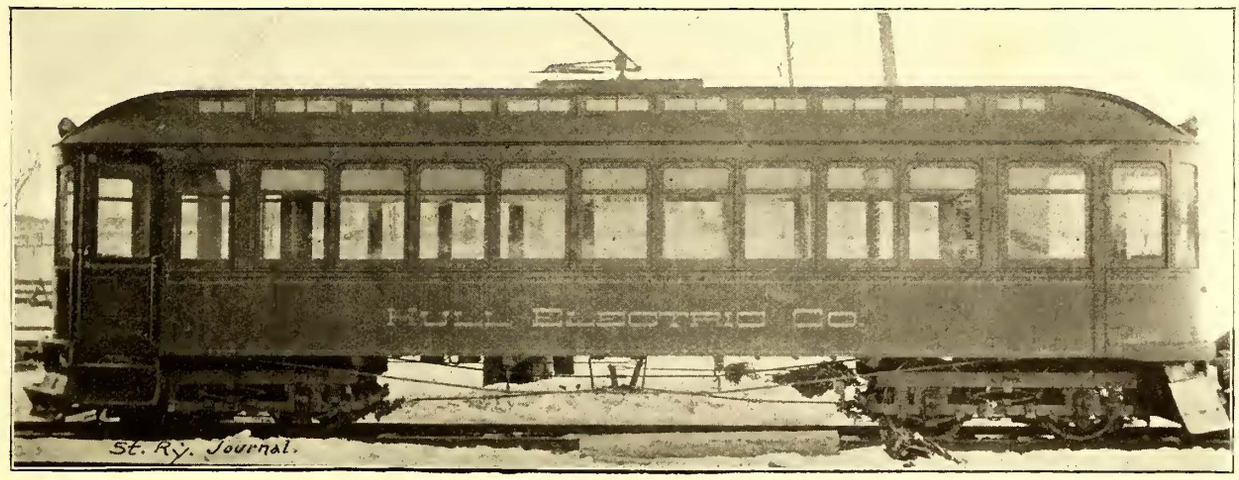
ficient aid in fighting snow, and one which has proved most effective during the past winter, even with storms that have stalled the steam roads for several days is the snow plow on each car, designed by Mr. Brown, and shown clearly in the engravings.

Of the two locomotives, both of which are in everyday use on the road, the first, which has been in operation since its starting up, two years ago, consists of a 22 ft. 8 ins. body mounted on heavy Blackwell trucks and



INTERIOR OF CAR

equipped with four G. E. 1200 motors, geared to run at 20 miles per hour. The operation of this locomotive has been exceedingly satisfactory, its usual load being five or six loaded freight cars. Locomotive No. 2, which was placed in operation last summer, is a much more powerful machine, the body being 26 ft. in length and the equipment consisting of four G. E. 51 motors, capable of



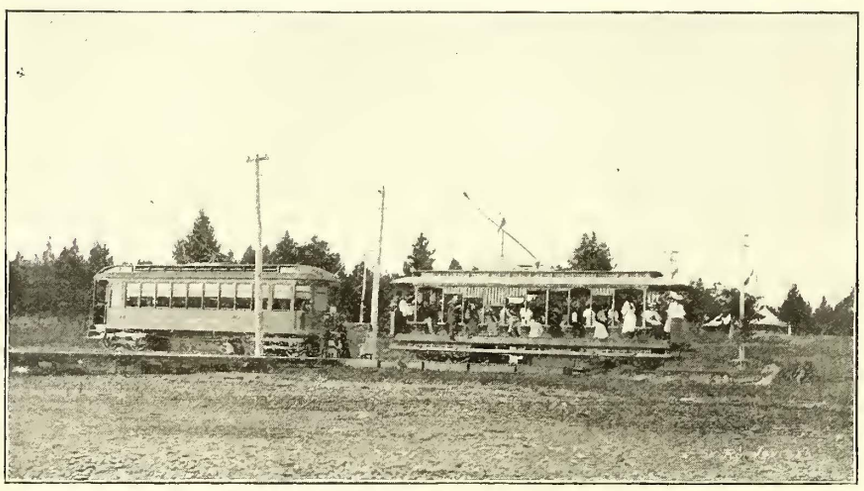
40 FT. DOUBLE TRUCK ELECTRIC CAR

In addition to the rolling stock mentioned above, which is required for the purpose of handling the passenger traffic, the company operates two electric locomotives, and an express, baggage and mail car, consisting of an ordinary closed body, mounted on double trucks, and equipped with two G. E. 1200 motors. The company has also a Ruggles rotary snow plow, and a snow plow manufactured by the Canadian General Electric Company. A most ef-

developing 80 h.p. each, mounted on McGuire "L" trucks with steel-rimmed wheels. Several improvements in the form of the body have been introduced, the most important being the lengthening of the cab and the placing of a door and passage at each end. The latter was rendered necessary by the inconvenience and danger experienced in handling the trolley where the ends are of the standard sloping style of the No. 1 locomotive. The No. 1

locomotive is provided with hand brakes only. The No. 2 machine is equipped with Standard air brakes, operated by a motor driven compressor placed in the cab. The larger locomotive has been found in operation to be an exceedingly powerful machine, as many as thirty-three freight cars having been handled on a shunt; the ordinary load is twelve loaded freight cars. The car bodies and locomotive bodies were manufactured at the shops of the Canadian General Electric Company, by whom the entire electrical equipment used on the road has been provided.

The following statement shows the amount of freight carried, and the nature of the business done by the No. 1 locomotive during its first season. This, it should be remembered, was the first in which business was done and did not include twelve months of time as the line was not put in operation until during the spring months. A very large increase in this business took place during the second season, rendering necessary the placing in service of the second and larger locomotive.



600 lbs. flour	60 tons.
88,200 bushels of grain	18,000 "
1,500 live stock	500 "
17,020,000 ft. of lumber	25,350 "
2,000 cords of fire-wood	3,000 "
Manufactured goods	408 "
Total	47,318 tons.

An important feature in connection with the handling of freight is the low cost of locomotive repairs as compared with a steam locomotive. An additional and important saving is the greatly reduced cost for cleaners and attendants in the car-house.

PARK SYSTEM AND OTHER ATTRACTIONS.

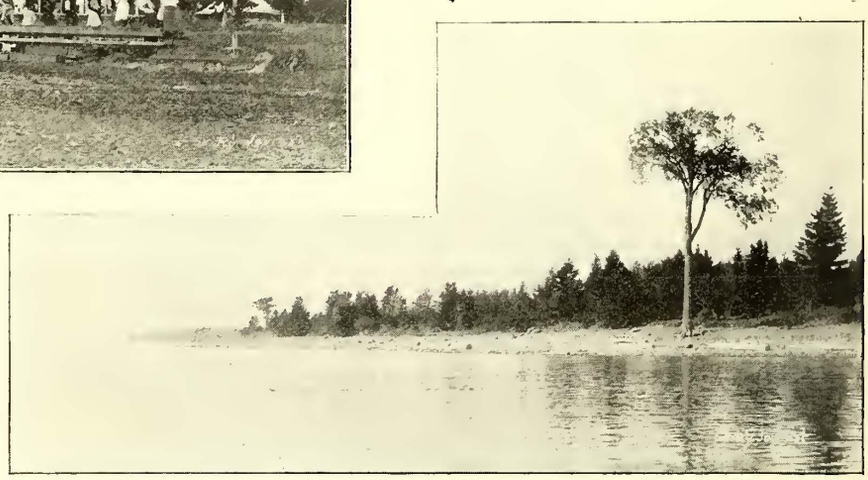
A special feature in connection with this road and one to which its money earning powers are largely owing, is the extent to which attention has been paid to developing special attractions. The principal of these is the extensive Queens Park at Aylmer, overlooking Lake Deschenes, a beautiful sheet of water 27 miles in length by 3 miles in width, which is in reality a widening out of the Ottawa River. The Queens Park has a total area of 200 acres, is beautifully wooded and along the lake shore has an excellent sand beach which affords first-class bathing facilities. In the park itself the company has erected a casino and refreshment booths, merry-go-rounds, bathing houses, a water toboggan, etc. During the past winter an ice toboggan slide has been the means of attracting a good deal of business. In connection with the park, the company has built a large summer hotel, the Victoria, which is now a fashionable resort for the people of Ottawa.

At Queens Park, the company's cars make connections with a line of steamers on the Upper Ottawa, offering a picturesque and most interesting trip as far as the Les Chats Falls. This line of steamers is controlled by the same people who are interested in the electric railway.

MISCELLANEOUS.

In addition to its normal use for operating and lighting, in the case of the Hull Electric Company, the abundant water power enables the use of electric current for many subsidiary purposes. The power house, car houses, cars and waiting rooms are all heated by electricity; the merry-go-rounds, hotel elevator, elevator for the toboggan slide, etc., are run by electric motors, and special attention is paid to decorative illumination in the park grounds at night.

The following are the rates of fare charged: Regular tickets, three for 25c.; white tickets (good between Aylmer and Deschenes, Tetreau and Hull, from 6:30 A. M. to 7:30 A. M., and between 5:00 P. M. and 6:30 P. M.), eight for 25c.; red tickets, good between the stations mentioned on Sunday only, eight for 25c.; commutation tickets, giving sixty rides per month, $5 for the first month, $4.60 for the second month, and so on down to $3 for the sixth month, and every subsequent month up to the twelfth; family tickets, fifty rides for $4; school tickets, good only in Aylmer and Hull, forty tickets for $1.



VIEWS IN QUEENS PARK

The officers of the road are as follows: President, Alexander Fraser; vice-president, W. J. Conroy; secretary, W. R. Taylor; mechanical and electrical engineer, J. E. Brown; purchasing agent, E. Seybold; trainmaster, C. Aird.

A Long Electric Railway Near Chicago

The Chicago & Milwaukee Electric Railway Company, which now connects Evanston and Waukegan, is being completed, and will soon be in operation. It will be about 40 miles in length, and will connect fifteen towns, those of the most importance being Evanston, Highland Park, Fort Sheridan, Lake Forest and Waukegan. The power station is at Fort Sheridan, on the line of the Chicago & Northwestern Railroad. The company proposes to use the three-phase system of transmission, establishing sub-transformer stations at different points on the line.

The road extends along the west shore of Lake Michigan, a well-populated section of the country, which contains the residences of many wealthy families. The road will carry a large pleasure traffic, although the business travel will also be quite an item, it is thought.

F. O. Rusling, formerly manager of the Rochester Railway Company, has recently been appointed general manager of this road.

An Interesting Interburban Road

The St. Louis, Belleville & Suburban Railway Company of East St. Louis, Ill., operating an electric railway between St. Louis and Belleville, a distance of 14 miles, opened its line on May 25, 1898, and the power station and cars are already taxed to their utmost capacity to handle the traffic.

The roadbed is built after standard steam road construction, 60-lb. T rails on standard oak ties being used. There being a double track all the way, the cars are able to make the run between the two cities in thirty minutes. The power station contains two Russell engines of 500 h.p. each, directly connected to two Walker generators of 300 k.w. each. The boilers were made by Rohan & Son. Eight double vestibule cars are now in operation and they are thought to be among the finest interburban cars in operation in this country. The cars are each 43 ft. long and seat 48 people. They were made by the Jewett Car & Planing Mill Company. Two 50 h.p. Walker motors are mounted on each car. The trucks were built by the Peckham Truck Company.

The copper wire was furnished by John A. Roebling's Sons Company, the trolley wire being No. 000, "Figure 8" type and the feeders No. 0000. The fare one way is 10 cents, which is said to be the lowest fare for the distance charged on any interurban road. The company expects to put eight more cars in service as soon as possible. An amusement park is situated midway on the road, and has proven a very strong attraction, as people visit it by the thousands on pleasant evenings, holidays and Sundays.

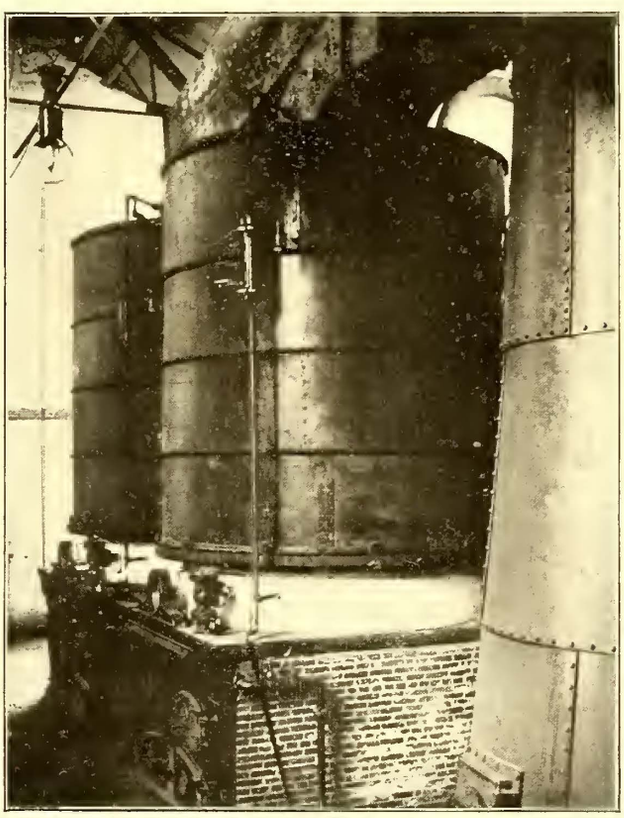
This entire road was promoted, financed and built by Townsend, Reed & Company, who are also the present owners.

Electric Railway System of the Meadville Traction Company

The electric railway system at Meadville, Pa., was opened to the public on April 14, 1898. This system runs through a prosperous section of the country and presents a particularly interesting study, as it is a thoroughly up-to-date road constructed according to latest methods. It comprises, including its suburban lines, 10⅝ miles of track. Of this length over 7½ miles are outside the city proper. The immediate plans of the company for future extensions include the construction of about 25 miles of new track in the valley of the French River to Edinboro.

The roadbed is laid with 70-lb. Cambria girder rail in the city and 60-lb. T rail outside the city, spiked directly to 5 ins. x 9 ins. x 7 ft. chestnut and white oak ties, spaced 30 ins. between centers. The rail on the suburban lines is the American Society of Civil Engineers' standard section, laid with broken joints. No ballast is employed, as the ground is largely a fine shale. The rails are bonded at every joint with the Johnston rail bond, No. 0000 copper wire being used. The track is cross-bonded every 300 ft. with No. 0 tinned wire. Octagon poles painted an olive green are employed. The span wire is 5-16-in. 7-strand galvanized steel cable. The trolley wire is No. 0 hard drawn wire, tested to a tensile strength of 4400 lbs.

The cars were built by the St. Louis Car Company and are mounted on Dupont trucks. The car bodies are finished in cream, red and black and silver trimmings; the numbers are in gold leaf and the words "Meadville Traction Company" in silver on the sides. The cars are equipped with the Syracuse changeable electric headlight and have eleven incandescent lights in addition to the headlights, and electric push buttons between the windows on a dry battery circuit. Each car is equipped with two G. E. 35 h.p. motors and is heated by American electric heaters. The seats are of split cane and the interior of the cars are finished throughout in hardwood. Each car is 20 ft. long by 7 ft. 4 ins. wide, and weighs about 15,000 lbs. They have a seating capacity of thirty people each. The company



VERTICAL BOILERS—MEADVILLE

begins operation with eight of these cars for city and suburban use, and will increase the number to thirteen.

The power house, car house and other buildings of the company are on Chestnut street and are of brick and stone. The car house is 130 ft. x 60 ft. with walls 20 ft. high. It has a gable roof covered with slate. Four car tracks enter this building, and each track has storage room for four cars, making the storage capacity of the building 16 cars in all. One of the tracks covers a long car pit for use in making minor repairs and for cleaning cars.

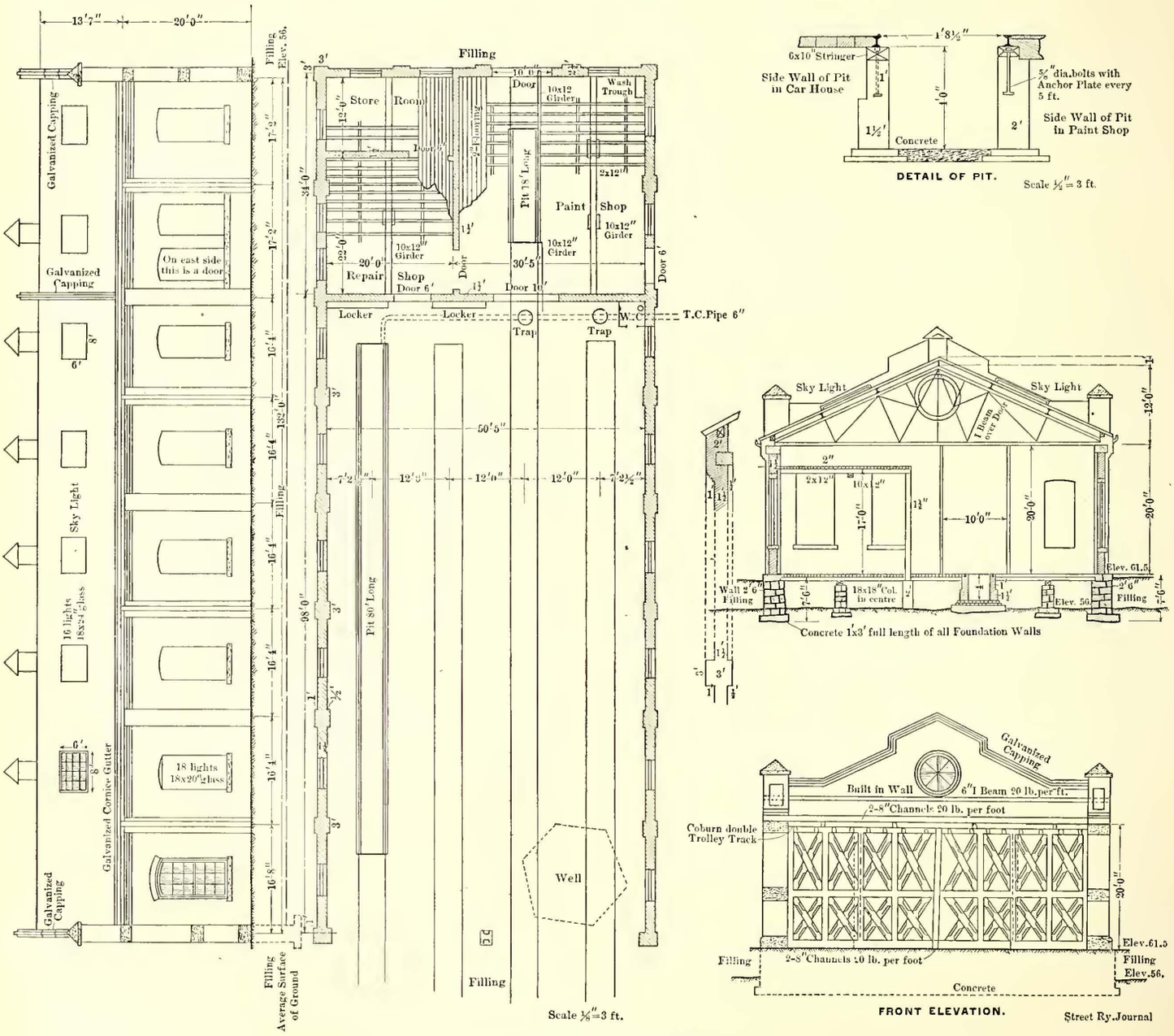
In the rear part of the building are two large rooms. One is fitted up as a complete machine shop for general repair work, and the other contains a track and pit well equipped for making repairs to the car body or truck.

The power house is 130 ft. x 95 ft., with 28 ft. walls, 18 ins. thick. It has a steel truss roof with sheathing of 2-in. Georgia pine, covered with slate. The engine room is 102 ft. x 60 ft. It contains two 250-h.p. high pressure condensing Corliss engines, running at a speed of 120 r.p.m. The fly wheels are 16 ft. in diameter and weigh about 15 tons. Directly connected to the engine is a 225 k.w. generator of the multipolar type. An interesting feature of

the engine room is the complete oiling system. Nickel-plated pipes convey the oil from a tank 12 ft. above the floor to every point in the room where lubrication is necessary. When the oil leaves the main carrying pipe it passes through a small tube into a glass gage, just before entering which there is a small feed regulating valve. By means of the glass gage and this regulating valve the engineer can regulate the lubrication at every point to the required number of drops per minute. After having accomplished its work the oil is carried by pipes to an improved oil filter, where it is purified by means of a small steam pump, and is forced back to the tank, from where it started.

on heavy iron brackets, which also carry an iron platform reached by iron ladders for the use of the firemen. Under these platforms there are two Worthington pumps for supplying the boilers, thus constituting a duplicate pumping system. The water is taken by the pumps from a 500 h.p. water heater which is fed by the exhaust steam from the condenser and water pumps. This heater is lined with copper water tubes. The engines, boilers and feed water heaters were made by Robert Wetherill & Company.

The switchboard in the engine room is composed of eleven Georgia marble panels, and is 18 ft. high x 18 ft. long. Six different feeders are employed.



PLANS OF CAR HOUSE—MEADVILLE

Between the two engines in the basement is a large Deane condenser. The connections are made in such a way that the engines can be run high pressure when necessary on account of loss of water, or an accident to the condenser.

The boiler room is 102 ft. x 28 ft. and contains two 250 h.p. Berry upright boilers. Each boiler contains 1596 flues, 2 ins. in diameter. Each boiler is connected by means of a 9-in. copper wire to the steam main, which is divided into a number of sections, so that either boiler can be used for either or both engines. This main is supported

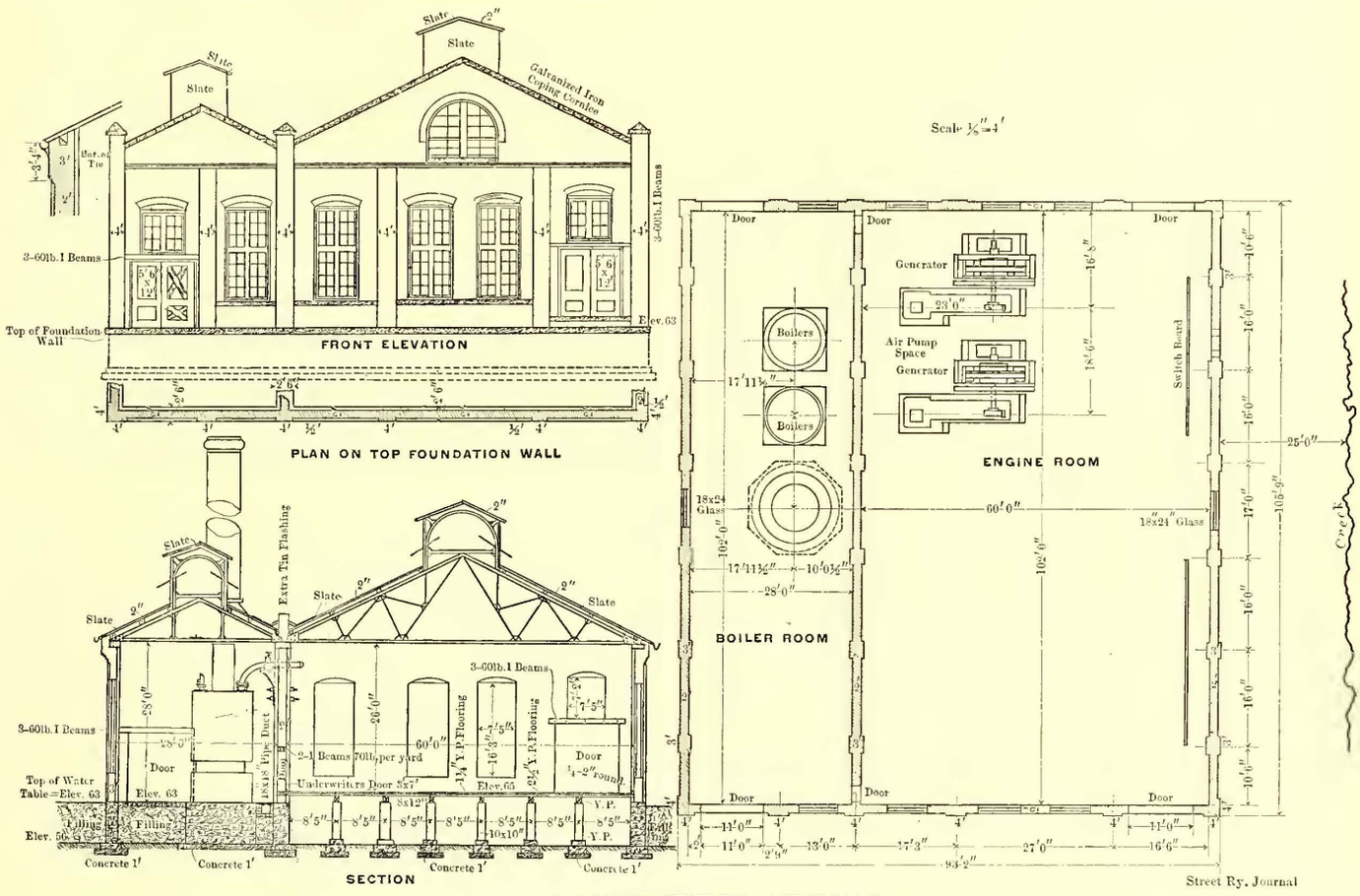
The plans of the company contemplate the distribution from the power station of current for lighting, as well as for railway service, and the space shown in the diagram of the engine room as vacant is that intended for the lighting machinery.

The entire electrical apparatus of this system was furnished by the General Electric Company. The overhead work was constructed by Smethurst & Allen, as contractors.

The officers of the Meadville Traction Company are: President, Frank R. Shryock; vice-president, George B.

Trawin; secretary, Cyrus See; treasurer, Charles Fahr. All the plans and specifications for this installation were prepared by, and the work was accomplished under the supervision of A. Langstaff Johnston, the company's consulting engineer. Mr. Johnston has had considerable experience in this line of work, having built the Hestonville, Mantua and Fairmount Park Electric Railway, and electric railways in Richmond, Va., New Orleans, La., and a number of other cities. The general contractors were Isaac A. Walker & Son.

After the opening of the line the citizens of Meadville were so well pleased with the operation of the cars that they extended a complimentary banquet, which was attended by about 400 persons, to the officials of the railway company.



PLAN OF POWER STATION—MEADVILLE

In the first place, we had everywhere enormous taxation, a taxation which produced a revenue sufficient, if it were honestly and wisely applied, to furnish every city in the land with every possible comfort and convenience, and even to adorn them with the triumphs of architecture and art. But all this was, in great part, misapplied; and the consequence was we had very little return for it. Our streets were miserably paved and everywhere in a filthy condition. The schools were poor; the police were corrupt from bottom to top, and in collusion with evil-doers. All departments of the government were affected by the demoralization, and the official force, from the mayor down, in our principal cities, was of a character which we could not exhibit in the face of the world without a feeling of disgrace. These were the consequences which flowed from this demoralization.—From report of committee on "Municipal Ownership of Street Railways," Niagara Falls Convention, 1897.

The System of the Schuylkill Valley Traction Company, Norristown, Pa.

The street railway system of the Schuylkill Valley Traction Company comprises 22.5 miles of track, and, as will be seen from the map on page 362, transverses the main streets of the boroughs of Norristown, Conshohocken, Bridgeport, Collegeville and Trappe, and in addition passes through various small villages. The main line of the system is about 16 miles long, and is comparatively straight, passing up and down the Schuylkill River from Norristown. A branch crosses the Schuylkill River bridge into Bridgeport, going through Swedesburg to Swedeland, where the immense blast furnaces of Heckscher & Sons are located. The main office of the company is at Norristown, which is the county seat of Montgomery County. Norristown is about 6 miles from Philadelphia, and it is thought that within the comparatively near future both Norristown and Conshohocken will be included within the limits of that city.

The Schuylkill Valley Traction Company is lessee of several underlying companies, including the Norristown Passenger Railway Company, Citizens' Passenger Railway Company, Conshohocken Railway Company, Montgomery County Passenger Railway Company, Ambler Electric Railway Company and the Collegeville Electric Street Railway Company. Most of these underlying companies own perpetual franchises, and these are now leased to the Schuylkill Valley Traction Company.

The line from Norristown to Collegeville passes through some very picturesque and historic territory, the scene of several battles and skirmishes between Washington's army and the British soldiers. The company has two parks on its lines, which are known as Skippack Park and Oakwood

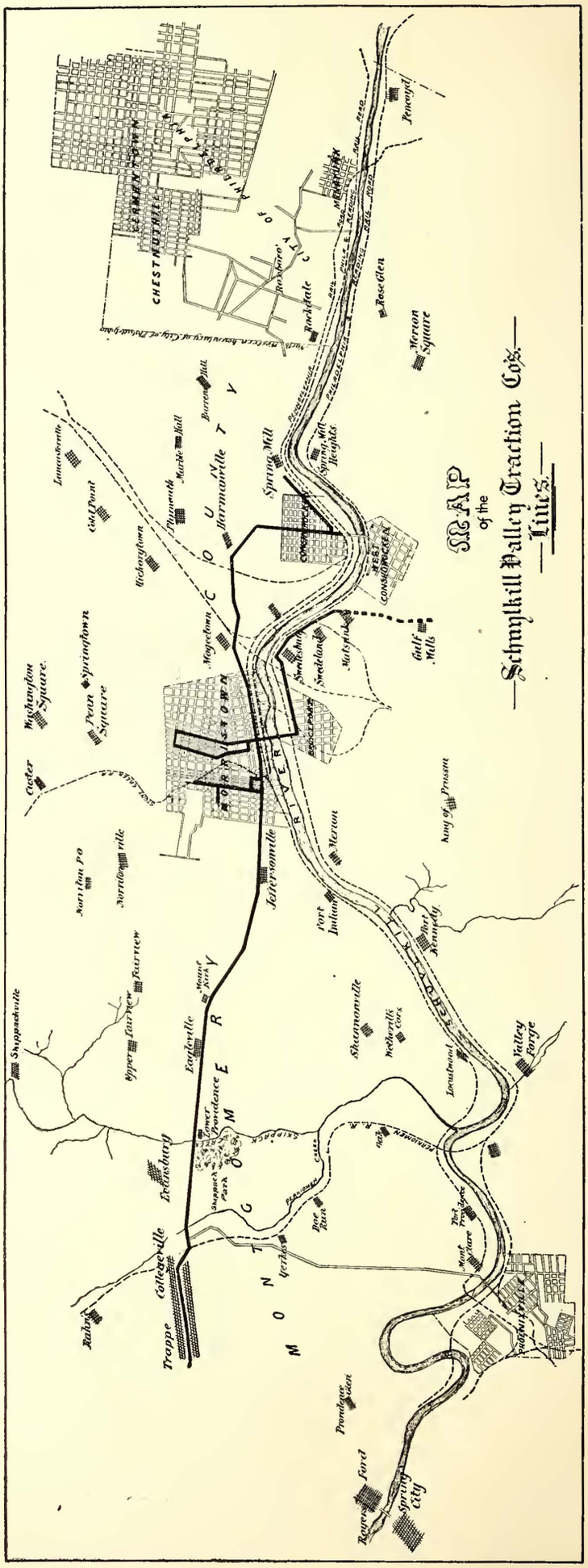
Park. The system serves a population of about 45,000 people located in the various villages, boroughs and surrounding country.

There is only one transfer point on the system, this being in Norristown at Main and DeKalb Streets. The company sells tickets, six for 25 cents or twenty-five for $1. It is intended, however, to abolish the use of these tickets as soon as practicable. Norristown, Conshohocken and Bridgeport being important manufacturing points, where many employees are working in blast furnaces, iron mills of all descriptions, cotton and woolen, hosiery and underwear mills, etc., the company has recently put into use what are called "factory employees' tickets." These are sold to the factories at 2½ cents each, and are good under certain conditions, namely, that they shall only be used by factory employees, and from 6 till 7 in the morning, from 12 to 1 at noon, and from 6 to 7 in the evening. These tickets are not good on Sunday and are not transferable, and the company's conductors will not receive them for a ride until they have been stamped across the face with the name of the factory company by whom the holder is employed. Although these tickets have been in use but a short time, they have proven to the management that they are a success, as they are within the reach of the factory hands, the idea of the company being to create new riders that could not and would not pay five cents for a ride. To keep these tickets in proper hands and within the regulation of the company, they are stamped and supplied to the employees by their employers, and it is left to the honor of the factory people to see that the special tickets are not abused. These cheap tickets carry the privilege of transfer the same as the regular fare.

The roadbed is of a very substantial nature, being laid with 6-in. and 9-in. girder rails within the borough limits, and 60-lb. T rails on the suburban sections. The track is bonded with No. 00 tinned copper bonds with channel pins. It is well cross bonded. One No. 0000 return feeder is used. The average drop on the return circuit is about 20 per cent, and the company has had no trouble whatever with electrolysis. Oak and cedar ties are employed and the track is laid with broken joints. There are two 9 per cent grades on either side of Eagleville on the Collegeville Division.

The overhead construction has been carefully attended to. The usual cross suspension method is used for supporting the trolley wire in the boroughs, but on the country sections side arm construction is employed. The trolley wire is No. 00. About 17 miles of feeders have been installed, No. 0000 wire being used for this purpose. The maximum drop allowed on the feeders is 10 per cent.

The power station is of brick and iron, and is at Bridgeport. The building is 112 ft. x 72 ft. 14 ins., and is divided into the engine room and the boiler room; the former is 56 ft. x 34 ft. 9 ins., and the latter 56 ft. x 38 ft. 5 ins. The engine room contains one Allis engine and one Buckeye engine. The power house is situated near the tracks of the Philadelphia & Reading Railroad, and a siding brings coal directly to the bins. One of the engines is belted to a General Electric generator, and the other to a Westinghouse generator. With ordinary traffic one of these units is sufficient to carry the load, and the average output is about 400 h.p. This is when about thirteen cars are in operation. During heavy traffic, however, both units are used, the output being about 925 h.p. This is sufficient to operate eighteen cars. The switchboard is situated in the engine room, and is built of heavy oak.



It contains all the necessary instruments for operating the different feeder lines.

In the boiler room are one horizontal National water tube boiler of 400 h.p. and two horizontal return tubular boilers of 125 h.p. each. One Berryman vertical feed water heater is used, and one injector. One Worthington pump and one Snow pump complete the equipment of the station. The company is at present using from 5½ to 6 tons per day of anthracite buckwheat coal, which costs $1.90 per ton, delivered at the station. The average daily car mileage of the system is 1550 miles.

The company has two car houses, one at the power house and one in Norristown. At this latter are situated the repair shops, the dimensions of which are 20 ft. x 15 ft. The shops are well equipped with all necessary tools, including lathes and drills, for making quick repairs on all parts of cars.

The cars at present in operation are 18 ft. long, and were built by the Jackson & Sharp Company and the Lewis & Fowler Manufacturing Company. It has been the experience of this road that 16 ft. to 18 ft. closed cars and ten-bench open cars are more economical than double-truck cars. The cars are mounted upon Peckham trucks and are equipped with Consolidated heaters. Westinghouse and General Electric motors are used with steel gears and pinions, and steel and composition trolley wheels are employed. The officers of the company state that they have found the average life of gears to be about eighteen months, and the life of pinions about eight months.

CROSSING WITH PENNSYLVANIA RAILROAD

Trolley wheels are usually good for about 30,000 miles. The cars are run on the country sections at a speed of 15 miles per hour.

There are now twenty motormen and twenty conductors employed on the different lines, and the men are paid 12½c. per hour. About five men are employed in the repair shops and car houses, and they are paid $45 per month. The men work 11½ hours per day.

It is the company's intention to build about 15 miles more of track in the near future, which will connect this system with the Union Traction Company's lines at Chestnut Hill in the city of Philadelphia. When the plans for these extensions have been fully determined, a rearrangement of the power house will be necessary, and probably two power houses of much greater capacity than the present one will be required.

The Schuylkill Valley Traction Company has had quite an interesting legal experience, and has been involved in some of the most widely known legal cases that have been tried in Pennsylvania. One of these cases in particular was of vital importance to the street railway companies of the State. This case was brought by the Pennsylvania Railroad Company against the Montgomery County Passenger Railway Company (one of the underlying companies of the Schuylkill Valley Traction Company) and the

SCENE ON LINE OF SCHUYLKILL VALLEY TRACTION CO.

decision of the Supreme Court, delivered by Justice Williams, established three principal points, namely: That passenger railways do not possess the right of eminent domain; that they could not build on the public highways through townships without having the consent of all the abutting property owners, as well as the municipal consent of the township, and that if the chartered route lay through several municipalities or townships, it was essential to have all of the consents before construction could be begun in either municipality.

The officers of the company are: President, C. D. Beebe, Syracuse, N. Y.; vice-president, N. H. Larzelere; secretary, treasurer and general manager, R. M. Douglass; general superintendent and electrician, A. J. Davids.

The Systematic Cleaning of Street Cars

By M. R. McADOO

The subject of the cleaning of street cars by improved methods is one to which street car companies have as yet given very little of their attention, so far as I am aware. While many of them still use the old-fashioned methods of employing soap and water at occasional intervals, with various forms of alkalies, the steam railroad companies have made a thorough study of this subject and by the use of newly discovered cleaners and antiseptics, have in certain ways revolutionized this important branch of railway operation. I firmly believe that an attractive, clean and sweet-smelling car adds largely to a railway company's traffic, and about a year ago I decided to introduce on the railway with which I am connected the regular steam railroad practice in cleaning cars. After having made a study of this subject, I established a department of car cleaning on the Paterson Railway, using steam railroad methods, and have found that while the direct cost for cleaning has been no greater than formerly, the cars have a better appearance, are more attractive, and the

actual saving in the cost of revarnishing and repainting has constituted an important item of economy in the operation of this road.

We divide the cleaning of cars on our road into two departments—that of cleaning the outsides of the cars and that of cleaning the insides. The latter is done at the car house, but the former is performed at the ends of the routes, during the daytime, as our facilities for this kind of work at our car houses are limited, the cars when in the car house being packed in close together.

As our car schedules are arranged, each car lies over at the end of its route about five minutes. This time is utilized for thoroughly washing the outside of the car. We have a force of two men who perform this service. They are first stationed at the end of one route and wash all the cars as they arrive at that point. On our longest route it takes about two hours before every car has reached the terminus and has been washed. The men then move to another terminus, and during the day every car has been washed. Plain cold water with an ordinary brush is used, except when the thermometer is below 40 degs. Fahr., when a dry rubbing with a waste mop is given.

The method employed is as follows: Each man takes one side of a car, washing from the top down. The sashes and glass are washed twice, the first time being scrubbed to get the dirt off and the second time quickly with a brush very wet, so that the glass is not left streaked. We have found that two men can clean the outside of a 35 ft. car, without trouble, in four minutes at the longest. By the time the car is ready to start, it is so dry that there is no danger of the dust sticking to it.

The final process of cleaning the exterior is done with Modoc soap, of which about one-quarter pound is required to a pail of water. This is only done once a week. After the car has been washed with this soap, it is wiped dry and then cleaned with Modoc liquid car cleaner, a compound applied on waste. The effect of this is to preserve the luster of the varnish and prevent it from cracking.

The cleaning of the interiors of the cars is done at night in the car house, and by a force of two men, who clean one-half of the rolling stock, or about thirty-five cars each night. This allows every car on the line to be cleaned once in two days. The car floors are furnished with the ordinary slat mats which roll up. These are first removed and the car is swept out by an ordinary broom. It is then mopped with plain water, first with the mop wet and the second time with a mop from which the water has been wrung out. This cleans all the dirt from the floor. The floor is then mopped with a disinfectant. For this purpose we have followed the general practice of the steam railroad companies in using formaldehyde. This is a German disinfectant, consisting of the gas of wood alcohol which has been passed through a platinum tube. The liquid solution used is about 40 per cent gas and 60 per cent water, and of this solution about four ozs. are used in a bucket of water. This disinfectant is far superior to any other with which I am acquainted in the agreeableness of its odor, which is very clean and resembles that of pine woods as much as anything else. It takes away absolutely the musty, close odor which comes in cars, especially in closed cars in winter.

After the floor has been thus cared for, the cleaners take care of the windows. The method employed is as follows: Each cleaner has in one hand a piece of waste and in the other a sponge, having upon it a cleaning compound made up of whiting and a little wood alcohol and water. This is spread lightly on the glass with the sponge, after which it is cleaned off with dry waste, leaving the glass perfectly bright and clear. After the interior of the car has been dusted with a feather duster, the wood work is cleaned with Brooks car renovator. This is applied with a piece of waste and afterward wiped dry with another piece of waste. It is remarkable how this material renews and cleans the interior wood work of the car. It is far better than soap and water and prevents the varnish from cracking.

It might be thought that these frequent rubbings of the varnished surfaces would wear away the varnish and paint, but it has the contrary effect. Our master car painter told me this year that the cost of revarnishing and repainting our closed cars this summer will be only about 50 per cent that of previous years. This saving is attributed by him to the cleaning given them during the past season and described above. This estimate was made after he had thoroughly washed and cleaned the cars preparatory to touching up and varnishing them. I might add that this painter was unfamiliar with the method of cleaning employed before it was adopted, and previous to its inauguration was opposed to it and condemned it.

Emergency Wagon Service

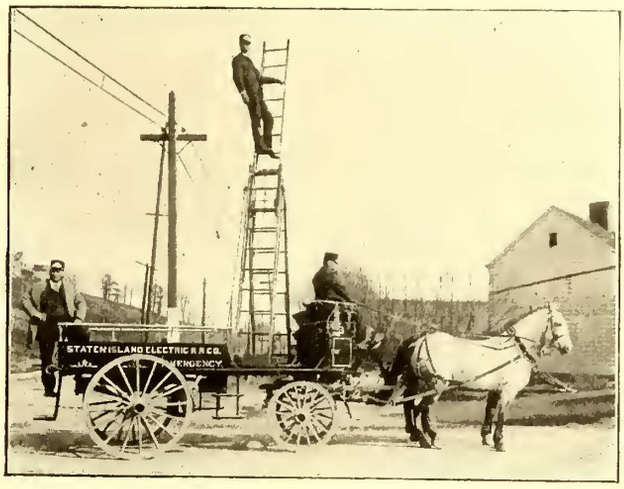
The necessity of relieving blockades which are apt to occur in electric railway operation is of great importance on a large system, and most railway companies have now a regularly equipped emergency service for answering calls for help whenever its assistance is required. These have gradually developed from modest beginnings to a regularly organized emergency corps, with all the facilities for quick answers to calls possessed by the best organized fire departments and ambulance services. Managers realize that especially in times of heavy traffic delays mean loss of money, as well as a disarrangement of the running time, and money spent in making preparations for reducing the danger of blockades is well expended.

Among those companies in which this service has reached a high state of perfection is that of the Staten Island Electric Railway, whose line extends along the northern shore of Staten Island. The road is double-tracked throughout, and on Sundays and holidays throughout the summer carries an enormous traffic to South Beach from the terminals of the New York ferry to Staten Island at St. George, and also from the Staten Island landing of the ferry to Elizabethport, while the daily traffic is also considerable.

The emergency station of the company is at the Brooks Street car house, about 5 miles from the western terminus of the line and 8 miles from the eastern. The emergency wagon, of which a full description will be given later, is housed in a special stable fitted with the latest appliances for quick service. Emergency calls are received by telephone at the office of the car house, which is connected by a special electric circuit with the emergency stable. As soon as a call is received at the car house the foreman presses a button adjoining the 'phone, which rings a gong in the stable and also at one or two other points around the car house where the emergency crew may happen to be. A branch of this circuit is connected also with gongs in the houses of all the emergency crew, all of whom live within a few hundred feet of the car house. The entrances

to the emergency stable are closed by doors which open automatically by gravity as soon as they are unlatched, heavy doors being provided for winter and open doors for summer. The horses are automatically unfastened in their stalls when an emergency call is received, and are trained to go to their places on each side of the wagon pole; the harness, which is suspended above them, is then dropped in place and fastened by snap clamps. At night the house is also automatically lighted as soon as the call is received.

WAGON WITH LADDER RAISED



WAGON WITH LADDER PARTLY REVOLVED

The emergency wagon employed is of a novel type, the design of the general manager, J. Bernard Brophy, and is illustrated in the engravings. It is quite light, weighing only 1,650 lbs., though built strongly and substantially. The center of gravity is kept low by the use of a collapsible ladder, which rests on the bottom of the wagon. The driver's seat is the highest part of the wagon. The wheel brakes are in duplicate, one for each pair of wheels, so that an accident to one brake gear will not interfere with the braking of the wagon. The wrenches for adjusting the brake gear are kept permanently hung on the brake rods, so that they can be always available. The ladder employed is of a special type and possesses a number of valuable features. It is of the kind shown in the engravings and is mounted on a turn table so that it can be set in any position desired and then clamped. It will support six men and reaches to a height of 22 ft. above the ground. If necessary, it can be easily detached from the turn table and placed on the ground near a pole or car, where it is self-supporting, as shown in one of the engravings. It can also be fitted with a platform near the top if desired.

Directly back of the driver's seat are carried two hydraulic jacks which can be instantly released from their position by the removal of a pin. Underneath the seat is a box containing rubber gloves, pliers, etc., for handling live wires. On each side of the wagon is a box. One carries line appliances, and is divided into twenty compartments, each containing a different form of insulator, such as a clip, pull-off, etc., so that there is no delay in selecting the proper insulator desired. In the other box are the crowbars, etc., used in quick track repair. Underneath the wagon is a box for carrying all kinds of wire. This is fitted with doors which open on each side so as to make the appliances as accessible as possible. At the side of the wagon is carried a 20-ft. extra trolley pole and wheel. Directly above the wagon is suspended a hose bridge, which can be dropped into the wagon in case of fire. The bridge is of somewhat novel construction, being all in four pieces, a bridge for each track, and two tie rods. It will accommodate three lines of hose.

LADDER REMOVED FROM WAGON AND ERECTED NEAR CAR

On days of very heavy traffic the company has an auxiliary wagon, which is located near the western end of the line, for use at that end. The conductors on the line are allowed to use any telephone which may be in the neighborhood of the accident to apprise the emergency department of a call, and are supplied with a telephone list.

Previous to the acquisition of the street railway by the municipality, July, 1896, private capital received from 5 to 8 per cent dividends from the operation of the property. Under municipal management there was a loss the first year, the road not even earning the interest upon the capital invested. And such results in a city which has over 17,000 persons per mile of track.—From report of committee on "Municipal Ownership of Street Railways," Niagara Falls Convention, 1897.

It seems to me that those who honestly advocate the acquisition and operation of street railways by municipalities do not look below the surface. They find that an occasional city abroad does such things, and they immediately jump to the conclusion that we should do likewise. They do not study the conditions with respect to accommodations furnished abroad, as compared with those in this country; the methods of administration there compared with those here, and the civil service abroad compared with ours.—From report of committee on "Municipal Ownership of Street Railways," Niagara Falls Convention, 1897.

The Promotion of Traffic By a General Passenger Agent

By H. Milton Kennedy

When President Rossiter, of the Brooklyn Heights Railroad Company, formerly of the New York Central Railroad Company, received a proposition from the writer, also having steam railroad experience, for the establishment by the Brooklyn Heights Company of a General Passenger Department, it met his views, and, as he expresses it, "being a young man himself, he favored an innovation that was for the good of the service and increased revenue." An agreement was soon reached and the new department was established April 2, 1896. The principle was that if steam railroads could induce their widely scattered patrons to spend dollars for excursion pleasures, etc., how much more readily could street railways induce the people of their easily accessible and densely populated communities to spend nickels. The detailed plan as submitted (never before published) was as follows:

PLAN.

1st.—New Business: To create passenger traffic which does not now exist, and which would not exist unless developed.

A—By judicious advertising, by canvassing, by the circulation of unique, artistic, interesting pamphlets among churches, schools, clubs, lodges, societies, etc., and in a general way by creating a popular enthusiasm for trolley party pleasures.

B—Contract with schools, religious and charitable organizations, for children's excursions by day, with special conventions of visitors, etc., to view the city and suburbs also by day.

C—Special "theatrical" parties for seaside attractions in season, and city theatrical trolley parties in winter.

D—Special "dancing" parties to various inns, gardens, etc., at terminal points.

E—Special "skating" parties in season.

F—Regular trolley parties, with music in special cars, for the pleasure of the trip only.

G—Other special features developing from these.

Most of this traffic would be created. There are thousands who would be induced in this way to ride over the lines to points that they would otherwise never think of.

The rates would also be higher per passenger than the regular rates. This would more than pay for the extra cost and maintenance of special cars for this purpose, in addition to using the cars otherwise for regular traffic when not specially engaged.

2d.—Popularity: Popularize the road with the public, so that passengers will afterwards go themselves to points with which they had not previously been familiar.

3rd.—Press: Secure a large amount of free press advertising of a favorable nature and of a character not now written.

4th.—Advertising: Cars can be rented at good figures for advertising purposes, under certain conditions if deemed prudent.

5th.—Attractions: This department would also take up the question of introducing, by co-operation and otherwise, new attractions at terminal points now in existence or to be established.

This general scheme has been followed out in all its details, and has been enlarged upon as new ideas suggested themselves from the practice of the original outline. In fact each year the business seems to approach more closely the nature of steam railroad traffic. It is also noticeable in this connection that most of the officials of this company, from the president down, were formerly steam railroad operators, and this may to some extent account for this tendency; but in any event, the railroad is conducted on general sound business principles, with a discipline, precision and catering for public patronage characteristic of our large trunk line systems.

The acquisition of the Sea Beach Railroad, a steam line formerly operating between New York and Coney Island, and the business which it naturally turned over to this company, also increases this tendency. It brings us into traffic agreements with other trunk line railroads, in this case the Pennsylvania Railroad and the Central Railroad of New Jersey, and with steamboat excursion lines connecting with Newark, New Brunswick, Perth Amboy and South Amboy, New Jersey, and with points up the Hudson and on Long Island Sound. These steamboat and railroad arrangements secure the advantage of having coupon tickets which insure the return of the passengers via the lines of this company, where otherwise they might return by other routes. While in this vein of the subject it might also be mentioned that the business of the passenger department in developing traffic, both special and regular, has carried it into the excursion territory of steam roads and steamboat companies. We have arranged in many cases with Sunday school parties and others, who have formerly taken their annual outings on excursion steamers or by rail, to charter special cars to convey them to one of the several beaches, parks, or picnic grounds reached by the lines of this company. In these cases a street railway company has the advantage over steamboat companies in that the total cost for transportation is less, and in the event of a day being rainy the cars are not sent out, there is no expense to either party, and the excursion is carried out another day afterwards mutually agreed upon.

For such parties we supply our large decorated excursion cars, which seat sixty persons each, for the round trip at $15, and a regular car of the same type for $12. This is, providing the excursionists are to be returned in time to allow the company to use its cars for evening illuminated trolley parties. For the latter we charge $20 for an evening service of six hours. These evening parties have the privilege of going to any one of the pleasure resorts of this company, such as North Beach, Bergen Beach, Ulmer Park and Coney Island, and out through the country to Jamaica or Flushing, within this time limit. As a rule, however, the service only means a round trip, as the excursionists usually select one of the above-mentioned points, for refreshments, dancing, etc.

To cater for the Sunday school parties, who frequently take exception to going on a trip to a resort which is too crowded, we arranged this year, through the kindness of the managers of North Beach, for the establishment of picnic grounds in a pleasant, well-shaded section of their property. They have fenced in about three acres of ground, and built a refreshment stand in the center, with tables, benches, etc., to accommodate picnic parties. No charge is made for these grounds; a permit only is necessary. The entrance is policed.

This brings us to the subject of the relation between railroad companies and park proprietors or owners of pleasure resorts on their lines. Being more fortunate than most street railway companies, who find it necessary to establish and maintain at their own expense parks and pleasure resorts to draw traffic over their lines, the Brooklyn Heights Railroad Company owns lines to four large pleasure resorts, including the world-renowned Coney

Island, free from all expense and responsibility of maintenance, and here is where the General Passenger Agent comes in. He has kept in touch with all the proprietors, owners and principal business men of these resorts, inducing them from time to time to strengthen their attractions, or even having them to do advertising in the form of large poster displays and other advertising novelties. The most notable cases were North Beach, which last year put out a twenty-four sheet poster in color, having a picture of the beach in the distance and a gay party of young folks "shooting the chutes" in the foreground. They were also induced to circulate 1,000,000 of a cut-out card in colors, giving reduced rate coupons for carousels, bathing and dinners. This advertising cost something over $5,000, toward which this company contributed $1,000, which was money well spent.

This year, in the same way, the management of Ulmer Park was induced to prepare a twenty-four sheet poster in colors, which is now on the boards, and which cost them several thousand dollars. This is being done without any aid from our company.

The case of Bergen Beach was somewhat different, as this resort owed its origin largely to a previous understanding between its owners and the railway company that the latter should extend its lines to that place. Being fully alive to the situation that their success depended upon advertising, it was not necessary to use any influence in this line upon the owners of this property, except that we had a hand in shaping the policy of such advertising and in specifying its extent. They have put out several posters and other smaller advertising matter in which this company has joined in a percentage of the expense, besides doing some special car advertising ourselves. They also maintain a regular press agent.

Speaking of press agents, we are now negotiating with the proprietors of the principal resorts reached by the lines

PAGES ADVERTISING EXCURSION CARS
(From pamphlet of Brooklyn Heights Railroad Co.)

of this company for the formation of a general pool to more thoroughly advertise them.

The idea is this: It is well known that the amount of "news items" or free advertising given in the columns of city newspapers is gaged to a great extent by the amount of paid advertising that is done by those advertised or "mentioned." Therefore the same axiom, that a consolidation of interests reduces expenses and produces greater results in general business holds true here. So that by pooling the advertising, better display and the lowest rates are obtainable and a press agent's expenses are maintained from the saving. This agent "covers" each resort every day, interviewing the proprietors as to any "special features," and by a previous understanding with the principal dailies in consideration of the regular advertising done, any amount of "news" is inserted.

There are other methods of obtaining business for street railway lines where the haul is shorter, and therefore, the profit greater, than to outlying pleasure resorts. Here are three cases in point in Brooklyn: The National League baseball grounds have been located for the last few years at a distance which was not easily accessible except by elevated railroad. This company took up with the management the question of changing the location of the grounds to a spot which would be more accessible, and therefore more profitable to the ball club, not overlooking, of course, its immediate location, on one of the lines of this company. Several sites were investigated, and finally one was adopted distant but twenty minutes from Brooklyn City Hall and but thirty-two minutes from New York City Hall, and fifteen minutes nearer that point than the New York Base Ball Club's grounds. The new grounds are located on the Third Avenue Line of this company, and but one block distant from the Fifth Avenue Line of the Nasau Electric Railway, which joined this company in an arrangement to erect the stands, etc., for the club. The necessary funds were advanced on a lease which will pay the principal and interest on the amount invested within ten years.

Another instance is the establishment of a bicycle racing track by the National Cycledrome Company. This track is used for bicycle meets, and as headquarters for the numerous bicycle clubs of this section and for general athletics. In assisting this enterprise the company will be enabled to run night events by electric lights as well as secure a large day traffic.

Another idea is the electric fountain which was built by the city upon an arrangement with the railway companies at Prospect Park. The companies paid a portion of the expense of building this fine attraction and supply the electricity to operate its powerful colored searchlights.

The locations for transient shows which come to town—Buffalo Bill's Wild West Show, Barnum's Circus, etc.—are always looked after, and this year, through the personal efforts of the General Passenger Agent, the Buffalo Bill's Wild West Show located at a point where our lines got practically all the business.

It will be seen, then, that one of the strongest points of a General Passenger Department is to increase the attractions and advertising of all pleasure resorts controlled by other capital, without expense to the company. The G. P. A. is also to solicit excursion parties among those who have previously patronized other transporation lines, and also to influence large organizations to visit parks or beaches on the lines of the company. As an instance of this, we recently met a committee of the Royal Arcanum, an order numbering 20,000 members in this city, in competition with representatives of a steamboat company and a steam railroad company, who desired the outing to go to another resort reached by their lines. By inducing the proprietor of the park on our line which we desired them to visit to make them a liberal offer, and by agreeing ourselves to advertise the affair on our cars, and to do the printing of tickets, circulars, etc., amounting to not over $50, in which another trolley company agreed to join us, we secured the excursion for the 23d of June, for which there have been 20,000 tickets printed.

This year we have what is almost a new field to work in, being New York proper, on account of the operation of our cars across the Brooklyn Bridge into that city. We can now take up trolley parties at Park Row and land them on the shores of the Atlantic, Jamaica Bay or Long Island Sound, without change of cars, so that there will be a field for considerable new advertising and new efforts. For, although the cities are geographically so close together, many of those living on the Island of Manhattan know little of the attractions and pleasures to be derived by a trip to Brooklyn and its suburbs and pleasure resorts.

For the past two years the business of this special excursion department has amounted to over $20,000 each season. We keep in stock fifteen of the decorated and illuminated trolley excursion cars and three parlor cars. The illuminated cars are arranged with portable frames, to which the colored bunting decorations are attached, so that during the "rush hours" these cars are operated on the road as are other cars, the frames being swung from the roof of the depots while the cars are out. The General Passenger Department is closely associated with the operating department, the General Passenger Agent being subject to the direction of the General Superintendent. During the dull season for trolley party pleasures the General Passenger Agent assists the General Superintendent in watching the operation of the road, in looking over the passenger returns, time-tables, etc., etc., and in a general way looking out for the best interests of the service, in addition to "prospecting" for the next season.

"Where and How to Go" is the title of a forty-eight page pamphlet 4 ins. x 8 ins. in size, printed in green and red, with a handsome lithographed cover of a conventional design, containing over fifty fine half-tone illustrations of points on the lines of the Brooklyn Heights Railroad. There were 100,000 of these printed. Free reading notices of the publication were given in the metropolitan dailies and trade journals, so that many were distributed through the mails. Others were circulated by persons calling at the offices of the General Passenger Department, and still others through the agency of the New York Railroad and Steamboat Time-Table Company, whose time-table racks occupy stands in all the principal hotels, steamship offices and railroad terminals.

The pages shown from this publication are meant to convey impressions upon the mind by illustration rather than by words; for example, the decorated and illuminated open excursion car is surrounded by summer scenes of children in the park, boating on the lake, bathing at the shore, a summer inn and a country dance.

The buffet parlor cars shown on the opposite page convey about them the idea of crisp winter weather amusements in the club house, skating parties, supper at a country house, the theatre, and other features of fun in the warm and comfortable car, where euchre parties, and even vaudeville shows with banjo and piano accompaniment complete the programme. Another feature of this booklet is that the advertisements therein nearly paid for its cost.

LETTERS AND HINTS FROM PRACTICAL MEN.

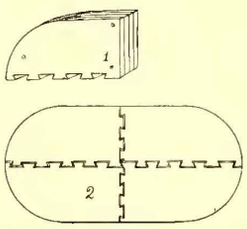
Preserving Patterns.

BOSTON, MASS., June 23, 1898.

EDITORS STREET RAILWAY JOURNAL:

There is very often occasion in the street railway repair shop to make and preserve patterns of various kinds. The West End shops of Boston have a cheap and effective way of putting a pattern up, by which warping and shrinking are overcome, as well as strength secured. The process is shown in the sketches. A common oblong pattern is used as an illustration, but the same principle is applicable to disc patterns and various other shapes. The proper wood having been selected, the pieces are cut to size, allowing sufficient margin for the dovetailing.

The pieces are now set up and held with small nails or screws. It is necessary that the parts be squared so that



METHOD OF FITTING PATTERNS

the edges can be marked off for the dovetailing. About a 5-8-in. dovetail is serviceable. First mark the gage line this depth on the edges to be cut, then divide off equally and cut out the work with a very true and perfectly sharp scroll saw. After the two edges are sawn as in Fig. 1, the pieces can be taken apart by drawing the nails, and put together in the pattern shape in Fig. 2. If the laying out of the work and sawing be true the pattern will be accurate in every detail. The parts require a little glue at the dovetailing to hold them together. B. F. F.

Mending a Pipe Break

PHILADELPHIA, Pa., June 18, 1898.

EDITORS STREET RAILWAY JOURNAL:

Station engineers know how much trouble is often caused in station operation by the breaking of some of the small steam or exhaust pipes for operating the pump and other parts of the machinery; and it always happens that these accidents occur at times when the traffic is heaviest and the day is most undesirable. I have found that some method of quickly repairing the break is often very convenient, and the accompanying illustrations show an easy method of accomplishing repairs of this character.

A lead pipe split by frost usually resembles Fig. 1, and it is only necessary to clamp a short length of the pipe in order to make it tight. A couple of pieces of spruce board, 3 ins. wide, grooved as shown by Fig. 2, and clamped over the rupture will stop the leak.

The best way to groove a pair of clamps is to run a saw kerf across both blades, as at a, Fig. 3, then clamp both pieces together and bore right through, as shown. It does not always happen that a bit of proper size is at hand, therefore it is necessary to work out the grooves. The way to do this is to saw down to the circle, as shown at a, Fig. 4; then split out the thin strips of wood, leaving a rough circle, as at b. A few clips with a chisel will smooth up the groove enough to make it answer all purposes, after which it is daubed with putty, elastic cement, or white lead, as shown in Fig. 2, then the two pieces are placed over the break and screwed tight with a pair of carriage bolts.

Once the writer tried it and found he had no bolts or long screws. A couple of clamps, as shown by Fig. 5, were sawed out of hardwood (spruce will do, but will not last long). If one bolt can be found, the clamp, Fig. 5, is

FIG. 1.—SPLIT PIPE

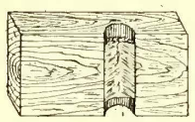


FIG. 2.—GROOVE FOR PIPE

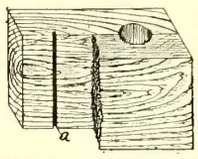


FIG 3.—BORING THE GROOVE

all right, as illustrated by Fig. 6, where the clamp is shown in position on the pipe.

A clamp like that in Fig. 6 was put on the exhaust pipe of a steam pump one cold day last winter. The rig has never leaked a drop, and is in place to this day, the services of a plumber having never been secured, probably on the principle of "letting well enough alone."

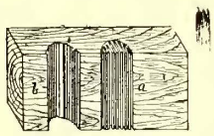


FIG. 4.—SAWING THE GROOVE

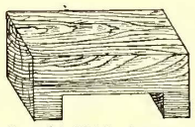


FIG. 5.—CLAMP FOR HOLDING GROUND PIECES

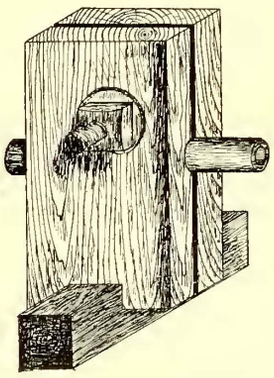


FIG. 6.—CLAMP IN POSITION

Some of these clamps might be made up in advance and kept in stock by the careful station engineer and found always ready when a pipe does burst. Half a dozen such clamps, made to fit as many sizes of pipe, and all furnished with bolts, in the store-room will save many a delay or even a shutdown. JAMES F. AUSTIN.

Cost of Feed Water

BOSTON, MASS., June 15, 1898.

EDITORS STREET RAILWAY JOURNAL:

There is an error in Mr. Francis' communication on the "Cost of Feed Water" in this month's issue. The horse power is not 223, but 223 divided by 60, or 3.71. If he uses the unwarranted expression of "223 h.p. per hour," he should be consistent and say 60,000 h.p. per hour for the main engine. He will then find the ratio about 270, instead of about four. Quite a difference!

ALBERT F. HALL.

Track Joints

NEW YORK, June 21, 1898.

EDITORS STREET RAILWAY JOURNAL:

It is very interesting and instructive to once in a while take a look into the dear old scrap book. We see therein thoughts expressed and theories advocated, and make our deductions from their practical results. In an editorial in May, 1890, on "The Proper Weight and Design of Rails," you speak of heavy rails with a web 10 ins. in depth and

a base 10 ins. wide, weighing 114 lbs. to 125 lbs. per yard as being suggested by an important street railway company " . . . the object being to get a rail that could be spiked directly to the ties to resist side pressure, prevent knuckling and give rigidity as well—a construction that will endure without constant attention. The theory is that a heavy rail will support the load out to the end without depending so much on the joint plates."

That is what theorists advocated in 1890. Practice, the tester, in 1898, has smashed these theories into smithereens; practice has demonstrated that the heavy rail will carry the load to the end of the rail, but there dump it. Practice has demonstrated that the theorists' double-decked, fish-plate, bridge-joint does not adequately support the rails at the joint, and practice fifty years ago demonstrated and demonstrates to-day that rigidity and bad joints are the niggers in the coal pile, the batterers of rails, rackers of cars, causing passengers' teeth to chatter as with ague.

If anyone doubts this assertion, let him go over Third Avenue or any other avenues using these ponderous rails and joint fasteners, and he will see and feel laminated rails. Let him go to Brooklyn, and he will see low joints and laminated rails as frequent as in tracks laid with a lighter weighted rail and fish plates. If he wants further evidence, look in every city and hear the managers' plaintive cry: "What can I do to be saved from low joints and laminated rails?" The heavy rail and double-decked, fish-plate, bridge-joint device is a total failure; low joints and laminated rail still exist.

There are progressive cities who have had their travails with the heavy rails and joint monstrosities, and in their despair have welded their rails, and the rails unweld, and so the battle goes on and ever will under such a miserable makeshift.

To those afflicted with the welding craze, I would suggest (and, believe me, this is their only remedy, although temporary) first, smooth out Mother Nature's winter and summer ruffles; this can be done by having on one end of the car a sprinkler supplied with pure cold water, to cool the parched and thirsty rail in summer and on the other end of the car a blast furnace well charged with heat; this would warm the frozen rail in winter. This process if properly administered would smooth Nature's ruffles, and an even temperature and smooth rail joint would be attained, but even then, they must not forget there's a good (or bad) time coming, when the twelve pounds of metal from this ponderous rail is worn off the head. Then must come the renewal, and they might now ask themselves (as did Hamlet of old under sore affliction) the question, whether it would be nobler to suffer bad alignment, low joints and laminated rails without welding, or weld and wait until renewal, and then take up arms against that mighty sea of trouble, when the streets would yawn and give up the worn out rails to the army of men with picks, shovels, hammers and saws.

Can anyone picture such a scene as on that day of renewal? Miles of heavy rails welded together, armies of men, with picks, shovels, saws, chisels and hammers, some blasting the rails out of the concrete bed, some sawing rails into convenient lengths to be handled conveniently, teams waiting to take away the scrap rail and debris, and after this canal has been dug and scrap removed a new track to be built. Martin's canvas "Day of Judgment" would be a Turner's summer landscape in comparison.

You have known me, Mr. Editor, many, many years, and your scrap book will reveal many of my thoughts, observations, theories and practical results of those theories. Time, the tester, will bear witness that I have not written one thought or put in practice one theory that was not a step in advance for a permanent track, giving equal transmission and smoothness of rolling load. Mark the words equal transmission, it means much; nay, it means all, for a perfect track cannot be obtained without it. As I have said years ago through your columns, so I say now, that a heavy rail with ponderous, double-decked, fish-plate bridge-joint is wasteful in metal and poor in design, and will never make a track free from low joints or laminated rails, and I further state that no single girder fish-plate device, however heavy or light, will remove the joint difficulty.

When an engineer designs his rail so it can be laid as a mason builds a wall, or weaver weaves his cloth, or a sailor splices his rope, then a 60-lb. per yard rail will suffice for the heaviest motor car and a low joint or laminated rail will not be known. Smoothness and equal transmission of load and economy in operation will be attained.

T. H. Gibbon, C. E.

Preserving Iron from Rust.

Boston, Mass., June 15, 1898.

Editors Street Railway Journal:

I have found the following receipt for cleaning away rust so convenient that your readers may like to have it. Melt a little lump of camphor in some lard and color the mixture with black lead till it resembles the color of iron. Clean away all rust that is causing difficulty, or clean up the iron parts that it is desired to treat, and then rub on this mixture. After it has remained for a day the parts should be cleaned up again with a cloth, and there will be no more trouble from rust. To make the mixture, use a pound of lard to an ounce of camphor. A mixture of common rosin with pure olive oil and spirits of turpentine forms another material which will act very well toward preserving iron from the formation of rust.

It is always better and easier to keep the iron parts clean and clear from rust formation than it is to remove the rust once it has gotten a start. This hint ought to be enough to make every electrician careful in the management of all iron parts in his department.

Another very common cause of trouble in power houses is oil dropping from machinery, shafting, bearings or pipes. As soon as an oil box or can gets out of order there is trouble with oil at once. If bearings on machinery or on shaftings get badly worn or at all out of line the result is that they will throw off oil, which is liable to strike anywhere. Occasionally the babbit metal lining to oil boxes or bearings will wear away and the iron parts will then cut into the shaft. If this is allowed to happen the oil will be thrown out. The only way to avoid such a result is to keep all bearings and oiled parts in good condition.

In the West End shops here a new tool, which clamps on the pillow-block, is being used to turn off commutators. The drawing herewith shows a detail of the tool, which any mechanic can make, and he will find it very useful.

Frank Jones.

In a general way, the proper fuel to use is that which will evaporate the greatest quantity of water per dollar's worth of fuel. It does not pay to burn too poor a quality of fuel, however, because slack containing a great quantity of ash and sulpher will cake and clinker on the grate bars, make a great deal of work for the firemen, refuse to be forced when necessary, and make much ash to be removed.—From report of committee, St. Louis Convention, 1896.

Tramway Matters in Sydney

SYDNEY, N. S. W., May 23, 1898.

EDITORS STREET RAILWAY JOURNAL:

It is very much to be regretted that the communication which was signed "Veritas" should have appeared in your publication of April last. Had it not occurred to me that the writer might have meant to be satirical, I should pray to be saved from my friends in future.

Nothing worthy of praise in electric tramways has yet been achieved in New South Wales. Some interesting experiments have been carried out and some important work is in hand. If the results prove satisfactory, the praise will be due to the administration for instituting the system and engaging competent engineers to carry out the work.

P. B. ELWELL.

Important Construction Proposed in New York

As already outlined in the STREET RAILWAY JOURNAL, the Third Avenue Railroad Company is planning the equipment with the underground conduit system of all the lines owned and controlled by it in the Borough of Manhattan. This system comprises about 73.66 miles of track, and includes the present Third Avenue system, consisting of 28.5 miles of track at present equipped with cable. The other lines are now operated by horses. The present cable conduit of the company on its Third Avenue Division will be utilized, but that on its 125th Street and Amsterdam Avenut Divisions, being older, will be replaced by more modern construction.

The reasons of this change from cable to electricity, as stated by a prominent official of the company, are not expected economy of operation, but to secure pleasanter service, and also a uniform system over all the line, as the electric equipment of the horse lines is a manifest necessity.

The first line to be equipped will be the main line of the Third Avenue Railroad Company, and the engineers are now engaged in preparing the plans for this change. The most serious problem seems to be the joint question, and the experience of the company in this department is exceedingly interesting. The present track, when laid in 1893, seemed in the opinions of the engineers at that time, amply substantial for the service. It consisted of 7 in. 80-lb. rail, laid on the concrete structure of the conduit. The rail rested every 5 ft. upon the cast iron yokes of the conduit, but between these supports the concrete was packed tight under the base of the rail. The splice bars were 30 ins. in length, connected through the web with six $\frac{3}{4}$ in. bolts. The joints were suspended and broken.

In spite of this construction the joints have gone down in some places over $\frac{3}{8}$ in., showing that as a girder the rail was not strong enough to carry the load without sagging. The concrete below did not seem to support the rail sufficiently to prevent this, although it might possibly have done so had there been a uniform support of concrete under the rail instead of yokes every 5 ft. Where the low joints occur there seems a gradual drop of the head of the rail on each side from the yoke to within a few inches of the joint, the drop from the horizontal being about $\frac{1}{4}$ in. Then at the joint itself there is another short depression or "dig" about $\frac{1}{8}$ in. deep. On the other rail, at a point just opposite the joint, there is usually a corresponding or sympathetic "dig" about $\frac{1}{8}$ in. deep and several inches long.

In addition to this the rail itself has become worn greatly, not only on the head and tram, but also under the head and tram from the action of the splice bars. The base of the rail, where it rested in the pockets of the yokes, was also worn considerably, and a number of the splice bars have become broken. In addition to these other evidences of wear, a curious effect from traffic was noticed in some sections of depressions or waves in the head of the rail, in some cases every 10 or 15 ft. These were from 2 ins. to 3 ins. in length, and from 1-64 in. to 1-32 in. in depth.

It should be said in this connection that the number of cars which have passed over the track is estimated at 2,500,000. The cars are all mounted on single trucks, with 7 ft. 6-in. wheel base and measure about 30 ft. Their weight is about 14,000 lbs. without passengers. The percentage of carbon in the rail originally laid was about .45 per cent.

The management of the company has been giving very close attention to the method of improving this condition in its new construction. Owing to the yoke construction on Third Avenue the company is limited to a 7-in. rail, and by the yokes to a 4-in. base, but will lay one weighing 104 lbs. to the yard, and in 60 ft. lengths. The percentage of carbon in the rail composition will also be increased to from .55 per cent. to .6 per cent. The Broadway or Crimmins type of head will be used, but owing to the limit in height the web and base will be thickened. All the new construction of the company, viz., all that except on Third Avenue proper, will be laid with a 9-in. 112-lb. rail. The joint question has, of course, required special attention, and no form of bolted up joint was considered feasible on the Third Avenue line, first, because the cost of getting at a joint for the purpose of tightening up the nuts is estimated at about $1, and second, because of the long distance (5 ft.) between the yokes or points of support of the joint. For this reason the company's engineers have been very favorably disposed toward the cast welded joint, and will probably adopt that joint.

For power the company will probably put in a temporary direct current plant at its Sixty-fifth Street Station. Plans are being drawn up, however, for a large three-phase station to be located at Kingsbridge, for transmission of power all over the city for operating the several divisions. From six to eight sub-stations will be installed.

The company's standard car will be a double truck car with a 32-ft. body and 4-ft. 6-in. platforms. It is a modification of the existing type, and the company expects it will be popular with the riding public. In addition, the company is splicing together some of its short open and closed cars to make a combination car about 41 ft. over all. The car is mounted on double trucks, and the open compartment, which is always in the rear, is fitted with five benches. The company has been operating one of these cars during the past winter, and has found the open portion has been quite popular with smokers.

First, that we must keep more constantly before the people the perils to which we are exposed, and the menace to the safety of our free institutions, because of the corrupt governments of most of our large cities. In the light of the present day, was not Wendell Phillips right when he prophesied that the correct solution of the problem of our great cities would test our free institutions more severely than our struggle with human slavery?—From report of the committee on "Municipal Ownership of Street Railways," Niagara Falls Convention, 1897.

A Comparison of Gross Receipts for 1896 and 1897 of 175 American Street Railway Properties

The following figures are of general interest as an indication of the business condition of the country in 1896 and 1897, it being a well-known fact that street railways touch the people so closely that their gross earnings are an excellent gage of general prosperity. The figures are obtained from the 1898 edition of "American Street Railway Investments."

In these tables are shown the comparative gross receipts of 26 street railway properties earning $1,000,000 or more in financial years ending at various dates in 1896 and 1897; of 19 properties earning from $500,000 to $1,000,000; of 46 properties earning from $100,000 to $500,000; of 51 properties earning from $50,000 to $100,000, and of 33 properties earning from $25,000 to $50,000.

In the first group the average rate of increase in the earnings of 1897 over the earnings of 1896 is 2.20 per cent; in the second group there has been an average rate of decrease of 11 per cent; in the third group the average rate of increase is 1.87 per cent.; in the fourth group the average rate of increase is 1.61 per cent., and in the fifth group the average rate of decrease is .67 per cent.

The total receipts earned in 1897 by the 175 properties given in the tables are $113,394,903. Of this amount 75.2 per cent are to be credited to the 26 properties of the first group; 11.3 per cent to the 19 properties of the second group; 9.4 per cent to the 46 properties of the third group; 3.0 per cent to the 51 properties of the fourth group, and 1.1 per cent. to the 33 properties of the fifth group. The gross receipts of the 175 properties in 1897 were 1.9 per cent. greater than in 1896.

ROADS HAVING GROSS RECEIPTS FOR 1897 OF $1,000,000 OR OVER.

Name of Company.	Gross Receipts, 1896.	Gross Receipts, 1897.
Union Traction Co., Philadelphia	$10,210,026	$10,480,646
Manhattan Ry. Co., New York	9,313,885	9,477,052
Metropolitan St. Ry. Co., New York	9,322,331	9,436,333
West End St. Ry. Co., Boston	8,341,958	8,719,032
Chicago City Railway Co.	4,808,867	4,816,516
Brooklyn Heights R. R. Co.	4,604,392	4,696,419
West Chicago St. R. R. Co.	4,018,948	3,899,918
Consolidated Traction Co., Jersey City	2,800,618	2,993,452
North Chicago St. R. R. Co.	2,913,709	2,911,552
Third Avenue R. R. Co., New York	2,680,448	2,653,261
Consolidated Traction Co., Pittsburgh	1,963,529	2,463,247
Twin City R. T. Co., Minneapolis	2,059,218	2,009,121
Nassau Electric R. R. Co., Brooklyn	1,765,868	1,968,041
Buffalo Railway Co.	1,867,061	1,871,840
Metropolitan St. Ry. Co., Kansas City	1,780,940	1,774,892
Brooklyn Elevated R. R. Co.	1,719,398	1,694,358
United T. & Elec. Co., Providence	1,692,933	1,685,775
Cleveland Electric Railway Co.	1,634,841	1,632,024
National Railway Co., of Chicago	1,522,273	1,467,976
Lynn & Boston R. R. Co.	1,425,922	1,431,936
Montreal St. Railway Co.	1,265,898	1,342,368
New Orleans Traction Co., Ltd.	1,334,277	1,239,256
Louisville Railway Co.	1,234,526	1,238,042
Baltimore City Pass. Ry. Co.	1,060,418	1,135,500
Detroit Citizens' St. Ry. Co.	1,040,545	1,102,250
Toronto Railway Co.	997,273	1,077,612
Total.	$83,380,102	$85,218,419

ROADS HAVING GROSS RECEIPTS FOR 1897 OF $500,000 TO $1,000,000.

Name of Company.	Gross Receipts, 1896.	Gross Receipts, 1897.
Coney Island & Brooklyn R. R. Co.	$881,718	$927,245
North Hudson Co. Ry. Co., Jersey City	906,985	923,100
Capital Traction Co., Washington, D. C.	1,034,458	908,839
Rochester Ry. Co.	855,694	801,391
Kings Co. Elevated Ry. Co., Brooklyn	748,442	756,319
B'klyn. Queens Co. & Sub. R. R. Co.	725,366	755,626
Denver Consolidated Tramway Co.	752,290	726,106
The 42d St., Manhattanville & St. Nicholas Ave. Ry. Co., New York	715,626	724,496
Dry Dock, E. B'way & Battery R. R. Co.	728,879	698,502
Columbus (O.) St. Ry. Co.	631,324	611,318
The Albany Ry.	554,445	596,766
Lake Street Elevated R. R. Co., Chicago	573,669	579,961
Hartford St. Ry. Co.	531,388	576,993
Central Crosstown R. R. Co., New York	576,267	576,911
Springfield (Mass.) St. Ry. Co.	521,673	554,312
Union Ry. Co., of New York City	$525,800	$542,855
Hestonville, Mantua & Fairmount Pass. Ry. Co., Philadelphia	576,913	534,345
Worcester Consolidated St. Ry. Co.	492,796	508,856
Troy City Ry. Co.	520,171	506,298
Total.	$12,823,904	$12,810,239

ROADS HAVING GROSS RECEIPTS FOR 1897 OF $100,000 TO $500,000.

Name of Company.	Gross Receipts 1896.	Gross Receipts 1897.
Wilkesbarre & Wyoming Valley Trac. Co.	$507,862	$491,289
New York & Queens Co. Ry. Co., Long Island City	358,870	472,472
Pittsburgh & Birmingham Trac. Co.	412,288	457,622
Lowell, Lawrence & Haverhill St. Ry. Co.	410,001	426,657
Richmond (Va.), Ry. & Electric Co.	437,747	413,309
New Orleans & Carrollton R. R. Co.	431,414	382,106
Lowell & Suburban St. Ry. Co.	422,739	381,894
Nashville St. Ry.	322,566	350,426
Paterson Ry. Co.	319,085	347,023
Brockton St. Ry. Co.	306,865	332,256
Globe St. Ry. Co., Fall River, Mass.	323,521	312,035
Bridgeport Traction Co.	321,260	311,671
Fair Haven (Conn.) & Westville R. R. Co.	281,023	309,695
The Newark & South Orange Ry. Co.	291,515	297,472
Portland (Me.) R .R. Co.	251,425	276,858
Winchester Ave. R. R. Co., New Haven	251,314	248,320
Des Moines City Ry. Co.	239,511	233,080
Trenton Pass. Ry. Co.	228,356	225,075
The Ottawa (Ont.) Electric Ry. Co.	212,106	223,802
Union St. Ry. Co., New Bedford	224,144	220,626
Holyoke (Mass.) St. Ry. Co.	173,540	216,684
Galveston City R. R. Co.	212,661	215,299
Allentown & Lehigh Valley Trac. Co.	238,453	214,845
Chester (Pa.) Traction Co.	208,105	210,916
New Haven St. Ry. Co.	219,490	210,119
Pennsylvania Traction Co., Lancaster, Pa.	198,304	198,770
Pittsburgh & West End Pass. Ry. Co.	193,224	188,245
Wheeling Ry. Co.	167,993	170,318
Utica Belt Line St. R. R. Co.	170,256	166,793
Columbia Ry. Co., Washington, D. C.	149,270	162,497
Binghamton R. R. Co.	144,592	151,105
Manchester (N. H.) St. Ry. Co.	148,781	146,326
Waterbury (Conn.) Traction Co.	137,273	145,114
Worcester & Suburban St. Ry. Co.	144,635	144,756
Erie Electric Motor Co.	159,142	143,208
Fitchburg & Leominster St. Ry. Co.	128,187	133,770
Westchester Electric R. R. Co.	124,514	129,485
Easton (Pa.) Transit Co.	126,259	123,812
Camden, Glo'ster & Woodbury Ry. Co.	118,966	123,424
Quincy (Mass.) & Boston St. Ry. Co.	101,830	118,395
Meriden (Conn.) Electric R. R. Co.	104,641	111,437
Lehigh Traction Co., Hazelton, Pa.	124,565	109,618
Johnstown (Pa.) Pass. Ry. Co.	110,339	104,679
The Yonkers R. R. Co.	102,501	104,671
Dartmouth & Westport St. Ry. Co., New Bedford, Mass.	111,142	102,925
London (Ont.) St. Ry. Co.	94,194	101,366
Total.	$10,466,469	$10,662,175

ROADS HAVING GROSS RECEIPTS FOR 1897 OF $50,000 TO $100,000.

Name of Company.	Gross Receipts 1896.	Gross Receipts 1897.
Haverhill (Mass.) & Amesbury St. Ry. Co.	$99,047	$99,485
Norfolk Suburban St. Ry. Co., Hyde Park, Mass.	94,967	98,159
Northampton (Mass.) St. Ry. Co.	94,802	95,089
Newton (Mass.) St. Ry. Co.	86,464	94,072
Schuylkill Traction Co., Girardville, Pa.	96,809	93,444
The Niag. Falls & Suspen. Bg. Ry. Co.	77,100	89,320
The Jamestown St. Ry. Co.	91,905	86,708
Altoona & Logan Valley Elec. Ry. Co.	90,264	83,051
Bay Cities Consolidated Ry. Co.	90,552	81,904
Taunton (Mass.) St. Ry. Co.	85,897	81,632
Hoosac Valley St. Ry. Co., North Adams, Mass.	68,422	81,328
Chicago General Ry. Co.	96,251	79,821
Norwich (Conn.) St. Ry. Co.	84,715	79,502
The Springfield (O.) Ry. Co.	76,253	79,286

Name of Company,	Gross Receipts 1896.	Gross Receipts 1897.
Sioux City Traction Co.	$81,571	$78,336
Rockland & Abington St. Ry. Co., North Abington, Mass.	71,466	74,787
Macon Consolidated St. R. R. Co.	73,419	74,722
Ithaca St. Ry. Co.	61,426	70,935
Bangor (Me.) St. Ry. Co.	58,071	69,493
Elmira & Horseheads Ry. Co.	73,626	68,010
Williamsport Passenger Ry. Co.	76,902	68,146
Beaver Valley Traction Co., Beaver Falls, Pa.	69,346	67,888
Rockland (Me.), Thomaston & Camden St. Ry. Co.	67,288	66,782
Gloucester (Mass.) St. Ry. Co.	64,777	66,398
Delaware Co. & Philadelphia Elec. Ry. Co.	61,498	63,258
Schuylkill Valley Trac. Co., Norristown, Pa.	65,576	62,963
Pittsfield (Mass.) Electric St. Ry. Co.	37,641	61,168
Nashua (N. H.) St. Ry.	53,640	61,104
Newburyport (Mass.) & Amesbury H. Ry. Co.	67,614	60,897
Suburban Traction Co., Orange, N. J.	68,247	60,679
Norwalk (Conn.) Tramway Co.	50,161	60,670
Auburn (N. Y.) City Ry. Co.	47,604	59,849
City Pass. Ry. Co., of Altoona	62,884	58,275
Wakefield (Mass.) & Stoneham St. Ry. Co.	58,213	58,225
Shamokin (Pa.) & Mt. Carmel Elec. Ry. Co.	56,225	57,747
Glens Falls (N. Y.), Sandy Hill & Ft. Edward St. R. R. Co.	54,567	57,692
Lewiston (Me.) & Auburn H. R. R. Co.	55,758	56,771
West Side St. R. R. Co., Elmira	64,044	56,421
Kingston (N. Y.) City R. R. Co.	52,682	55,412
Montgomery (Ala.) St. Ry. Co.	57,291	54,914
New London (Conn.) St. Ry. Co.	53,162	53,822
City Electric Ry. Co., Port Huron, Mich.	52,500	52,565
York (Pa.) St. Ry. Co.	57,623	52,398
Charlotte (N. C.) Elec. Ry., Light & Power Co.	52,977	52,376
McKeesport (Pa.), Duquesne & Wilmerding Ry. Co.	38,295	52,376
South Middlesex St. Ry. Co., Natick, Mass.	51,009	52,074
Schenectady Ry. Co.	52,122	51,961
Woonsocket (R. I.) St. Ry. Co.	42,158	51,305
Brightwood Ry. Co., Washington, D. C.	53,862	51,080
Norwalk (Conn.) St. Ry. Co.	53,521	50,834
Plainfield (N. J.) St. Ry. Co.	39,797	50,604
Total.	$3,392,011	$3,446,535

ROADS HAVING GROSS RECEIPTS FOR 1897 OF $25,000 TO $50,000.

Name of Company.	Gross Receipts 1896.	Gross Receipts 1897.
Concord (N. H.) St. Ry. Co.	$50,650	$49,779
Middletown (N. Y.) & Goshen Trac. Co.	54,003	47,910
Rochester & Irondequoit R. R. Co.	67,284	47,760
Derby (Conn.) St. Ry. Co.	55,853	47,545
Anacostia & Potomac River Ry. Co.	46,230	46,834
Salem (Ore.) Light & Traction Co.	40,594	45,028
Natick (Mass.) & Cochituate St. Ry. Co.	38,040	45,739
Newton (Mass.) & Boston St. Ry. Co.	33,026	44,542
Hartford & West Hartford Horse R. R. Co.	51,959	42,089
Marshalltown (Ia.) Light, Power & Ry. Co.	38,822	41,607
Herkimer (N. Y.), Mohawk, Ilion & Frankfort Elec. Ry. Co.	42,382	41,348
Augusta (Me.), Hallowell & Gardiner R. R. Co.	41,117	40,840
Leominster & Clinton St. Ry. Co.	25,234	40,588
Stamford (Conn.) St. R. R. Co.	30,392	40,426
Buffalo, Bellevue & Lancaster Ry. Co.	43,752	39,749
Amsterdam (N. Y.) St. R. R. Co.	41,069	39,408
Lebanon (Pa.) & Annville St. Ry. Co.	44,634	38,167
Braintree (Mass.) St. Ry. Co.	30,139	38,150
Plymouth (Mass.) & Kingston St. Ry. Co.	34,937	37,888
Newport (R. I.) St. Ry. Co.	40,429	37,375
Cortland (N. Y.) & Homer Traction Co.	34,535	36,885
Manistee (Mich.), Filer City & Eastlake Ry. Co.	35,257	36,159
The Bridgeton (N. J.) & Millville Traction Co.	33,300	35,055
Marlborough (Mass.) St. Ry. Co.	34,865	34,766
Citizens St. Ry. Co., Fishkill, N. Y.	36,356	34,616
Athol (Mass.) & Orange St. Ry. Co.	37,833	32,550
Van Brunt St. & Erie Basin R. R. Co., Brooklyn, N. Y.	35,082	31,390
Phillipsburg (N. J.) Horse Car R. R. Co.	27,686	29,614
Wissahickon Elec. Pass. Ry. Co., Philadelphia.	31,667	27,684
Utica (N. Y.) & Mohawk R. R. Co.	29,005	27,359
Biddeford (Me.) & Saco R. R. Co.	25,461	26,383
Olean (N. Y.) St. Ry. Co.	27,789	26,180
Dunkirk (N. Y.) & Fredonia R. R. Co.	26,868	26,123
Total.	$1,265,950	$1,257,535

The Cost of Hired Electric Power

The following interesting figures upon the cost of electric power for street railways are taken from the columns of the current issue of the "American Electrician." Much of this information was given in confidence and the names of the companies reporting are, therefore, withheld. The figures refer only to companies that rent their power, either from another electric railway or from an electric lighting company. It is, of course, well to remember when reading the figures that a number of the companies are closely associated with the companies from which the power is bought, and this undoubtedly has an influence upon the prices paid.

The companies reporting and the cost per unit are as follows:

A company in Georgia operating 24 motor cars and 9 trail cars on 18 miles of track pays $.011 per k.w. hour.

A company in Ohio operating 5 cars on 6 miles of track rents power from an electric light company at $1.80 per car per day of 18 hours, the street railway company owning the generator and the electric light company paying all expenses of running it. The street railway company states, however, that it has recently been notified that this rate will be raised to $2.10 per car per day, as the present figures do not cover the entire cost.

A company in Kentucky operating four motor cars daily and on extra occasions 6 motor cars and occasionally trailers, and owing 6 miles of track, pays $2 per day for each of the 4 motor cars and $1.50 per day for each additional motor car and 50 cents per day for each trailer in excess of 12 days in each month. This street railway company states that its contract for power has been in force four years with satisfaction to both parties, and the company thinks this arrangement cheaper than owning and operating its own plant for so few cars.

A company in Maryland operating about 5 cars pays a fixed charge of $12.50 for 5 cars or less per day, and $2 for each additional car above that number.

A company in New York State operating 10 motor cars on 6½ miles of track purchases its power from a lighting company on a car mile basis paying $.015 per car mile.

A company operating in Texas reports as follows: "We rent our power from the city on contract for five years, the rate being $.015 per k.w. We, however, put up the feeders for a distance of 3¼ miles, using the city's poles to string them on. Our meter is at the power house end, and the expense to operate 11 cars, 18 hours per day, runs from $660 to $680 per month. We have a great many steep grades and our main line is up grade for over two miles. We operate eight cars per hour over this grade, and on another line we operate four cars per hour over a grade of 1½ miles in length; on still another line we have a very steep grade, but only about 1500 ft. long;

over this line the cars make a round trip in 51 minutes, there usually being three cars on the line. We have a number of slight grades on other parts of our line, and taking everything into consideration, we have quite a hard street railway city, but we consider our rate reasonable."

A company in Texas operating 14 motor cars and 2 trail cars on 7½ miles of track purchases power from an electric light company, paying $3 per car per day. The electric light company is owned by the same interests that control the street railway company.

A company in Massachusetts reports as follows: "Our company owns its own generators and a gas company furnishes us with steam power, together with the necessary labor to operate the generators. For two of the generators our company pays $19 per day of 19 hours; for three others, $7 each per day and for four others, which is the extent of our contract, $6 each per day. Our power bill last year based on the number of car miles was $.02125 per car mile, this amount including heat and light for the cars, also light for the stations. No extra charge is made for snow plow service."

A company in New Hampshire operating 60 motor cars and 12 trail cars on 20½ miles of track buys power for less than $.03 per k.w. hour.

A company in Ohio operating 4 cars about 17 hours per day, and owning 3½ miles of track, has a contract with an electric light company by which it pays $50 per month for power. The average ampere load at 500 volts is about sixty.

A company in Pennsylvania operating 14 motor cars on 8 miles of track reports that it pays on one of its lines $3 per car per day, which includes maintenance of lines, and on the other branches $2.50 per car per day, which does not include the cost of maintenance.

A company in Massachusetts reports that it furnishes power to a number of street railway companies, a uniform charge of $.03 per car mile being made to all.

A company in Vermont reports that it pays $10 a day for power for 3 cars from 6 A. M. to 11 P. M. These cars run about 425 miles in that time. For extra cars it pays $1.50 per half day, or if only one trip is made, $.25 an hour.

A company in Pennsylvania operating 7 motor cars on 7 miles of track reports that it rents power from an electric lighting company and pays $2.75 per day of 18 hours for each car operated.

A company in Michigan operating 10½ miles of track, places its own dynamo in the power station of an electric light company, the electric light company furnishing the power and attendance and caring for the machines. For this the street railway company pays at the rate of $2 per day of 18 hours for each of 5 motor cars, with the additional right of attaching two trailers without cost. For all additional motor cars a charge of $1.85 each per day is made, and for additional trailer cars, $1 per day. This amount also includes light for the cars.

A company in Illinois owning 4½ miles of track pays $200 per month for its power and operates daily 5 cars and on some occasions as many as 9 cars. The company states, however, that the power is rented from a company very closely connected, and that the cost for power is considerably less than it could be purchased from outside parties.

A company in Florida owning 3 miles of track pays for its power $6.50 for 2 cars per day; some parts of the year one S.R.F. 30-motor and one G.E. 800-motor are run and at other times two S.R.F. 30-motors.

A company in Alabama owning 7.5 miles of track has a contract with another company for all its power used. This contract calls for a minimum payment of $12 per day for a maximum number of 4-cars, operating 16 hours, Eight-bench open cars and 16-ft. closed cars are used, each car being equipped with two Thomson-Houston S. R. G. 30 motors with old style controller and rheostat.

A company operating several large lines in Michigan reports that the approximate charge for power is about $2.50 per car per day for a certain number of cars, and this amount less 10 per cent for additional cars. A trailer is allowed to one or two motor cars under certain conditions.

A company in Nebraska operating 3 motor cars on 1½ miles of track reports that up to a short time ago it paid from $4 to $4.50 per car per day for power.

A company in Tennessee owning 4 miles of track pays an electric light company $6 per day of 15 hours for power for 2-cars with double 30 h.p. motors each.

Meeting of the Ohio Street Railway Association

The regular annual meeting of the Ohio Street Railway Association was held in Columbus, Ohio, on June 8, 1898. The meeting was well attended, although no regular papers were presented. There was, however, a very interesting discussion on general street railway matters and a number of helpful points were brought out by different members.

After the meeting adjourned the delegates were entertained at the park of the Columbus Street Railway Company by W. F. Kelly, general manager of that road. After visiting this park, the delegates were taken by special car to Minerva Park for dinner. This park is owned by the Columbus Central Railroad Company, and the party was entertained by F. N. Bendelari, general manager of the company.

The following gentlemen were elected officers of the Ohio Street Railway Association for the ensuing year: President, S. R. Nelson, Springfield, Ohio; vice-president, John F. Flood, Steubenville, Ohio; secretary and treasurer, Charles Curry, Lima, Ohio; executive committee, A. A. Anderson, Youngstown, Ohio; W. A. Lynch, Canton, Ohio, and Thomas H. McLean, Toledo, Ohio. The next meeting of the association will be held at Springfield, Ohio, June 14, 1899.

Meeting of the Illinois Street Railway Association

The convention of the Illinois Street Railway Association opened at the Great Northern Hotel, Chicago, on Tuesday, June 7, but, owing to a very light attendance, only a very short executive session was held the first day. On June 8 the association convened, some twenty or thirty persons being present, and papers were read by C. L. Bonney on "The Rights of Street Railways Under the Constitution," by E. X. Lesseure on "Operation of Street Railways in Small Cities," and by W. L. Ferguson on "A System of Collection of Fares and Checking Employees."

After the papers had been read, Albion E. Lang of Toledo made a very interesting address. He spoke of the relation existing between the citizen and the company, stating that the company must remember the rights of the people, and should be satisfied with reasonable profits; whenever the growth of traffic or a reduction in operating expenses which promised permanence warrants a reduction in fare charge, the demand of the people should be anticipated, and the excess over a reasonable

profit should be employed in extensions, arranging for increased comfort of passengers, and to the reduction of the price for a ride. By reference to the large central plant at Toledo, Mr. Lang showed that a great saving could be effected by a combination of power houses and management; in Toledo he stated that since the lighting and railway power houses had all been collected into one, the cost of power had been reduced to $.0025 per k.w. hour.

The members of the association were cordially welcomed by the street railway fraternity in Chicago, and a number of pleasant excursions were enjoyed.

The following officers were elected for the ensuing year: President, W. H. Patterson of Bloomington; vice-president, D. B. Sherwood of Elgin; secretary and treasurer, C. K. Minary of Springfield; executive committee, D. B. Sherwood, C. K. Minary, Walter Barker of Peoria, W. P. Cannon of Danville, D. F. Harris, Jr., of Champaign, D. F. Belden of Aurora. A special meeting of the association will be held at Aurora on Sept. 20, 1898.

Collection of Fares and Checking Employees*

BY W. L. FERGUSON

I believe that tickets sold at a small reduction will increase riding and that is what we, as street car men, want. If a man has some tickets in his pocket he is pretty sure to use them, but if he has to pay out the cash every time he is not so likely to ride, especially if he is going a short distance. Then again, they often have no small change at the time, and will not break a bill just for a ride. Another reason is, that if a mother has some tickets she will give them to her children to use when she will not give them the money; and then they are so convenient. I have known patrons of the line to buy tickets, saying they like to use them as they then never need to bother with change, making it more convenient to them and the conductor as well. It also saves time and that is quite an item to many people. Then again, in selling twelve tickets for 50 cents, they make two rides, which is quite a saving to people who ride a great deal. You all know people who save a street car fare whenever they can. Merchants also often buy tickets to give to their customers, claiming it is a good advertisement. I think a school ticket sold at about 2½ cents, or $2.50 per 100, will induce parents to allow their children to ride to and from school. I found it increased our business, but you must limit these books, not selling to children over fifteen or sixteen years old, and make them not transferable, that only the persons to whom the book is issued can use the tickets.

The subject of transfers has given me a great deal of trouble as I am running a line which has seven different branches starting from one place, called the Transfer Station, and a great deal of our business is transfers. My first plan was to have one man issue all transfers. This man's duty was to be at the transfer station and give transfers to parties who wanted them as they came in on the different cars. I soon found this would not do, as when business was at all heavy people would come and ask for transfers that had not been on any cars, consequently we were carrying people and getting nothing for their ride. I then abandoned the transfer man and had the conductors issue them. This went along nicely for a while, but I soon found we were getting a great many transfers and could see no real cause for it. I commenced to investigate; in a few days I found we had men who were working us for from 50 cents to one dollar per day; they did it in several ways. First, they would date the transfers to suit and give them to their families or friends; this would be done while they were being relieved for their meals or at home. Second, they would get together and exchange transfers. For instance, two conductors would meet at meal time, each punching say five or ten transfers at different hours through the day, then take the same number of cash fares from their receipts for the day, and then turn in the transfers instead of the cash. We, of course, could not stand that kind of business. I then tried the plan I am now using, and find it very satisfactory. I now use a transfer, having them printed so the conductor has only two punches to make and they can be made quickly. They are numbered consecutively in books of one hundred. I charge every conductor with a book in the morning when he starts out for the day; he returns what he has left on his last trip. He must issue them in rotation; the conductor who takes them up turns them in at the transfer station upon his arrival there, putting them in an envelope, marking his badge number and the time he took up the transfers on the back of the envelope. The clerk in the office takes the envelope, opens it, examines the transfers to see they are punched correctly and the time not expired. The clerk then places them on file to the credit of the conductor who issued them, so when the day's business is over we have every transfer that has been issued during the day on file, charged to the man that issued them, and then in order to see they are not dated ahead, the clerk runs them over in rotation and examines the date. In order to prevent the exchange of transfers, I have the conductor collect fare and give transfer before collecting another fare, and no transfers are issued off the cars. This plan gives the men to understand you are watching them, and if a mistake is made we know it and who made it. After I adopted this plan it was surprising how our transfer business dropped off. This system is not expensive, it takes only one clerk. I have a lady clerk and in addition to looking after the transfers she makes change for the men, receives and counts the daily receipts and does other work about the office. In addition to this, I use the envelope the conductor turns in as a trip sheet, having him put down the number of passengers carried each way. I have all transfers rung up the same as cash. If you don't ring transfers you cannot check your line.

Checking of conductors can be done in a great many ways. I think no person should ride without paying a fare of some kind. Never allow your officers or directors to ride without paying something for their ride. I would advocate a pass book and have a ticket taken out by the conductor and registered. You must have something for every ride if you want to check your line satisfactorily and have every fare registered, whether it be pass, ticket, transfer or cash. I know some lines do not register their transfers. You cannot watch men too close. It is a great temptation for men to take all they can get from a street car company, thinking they are working long hours and are not getting enough pay for their services, and again the public feel considerably the same way. I know of cases where passengers have said to the conductor: "Don't ring them all up, I will not give you away." I consider the stationary register the best, as every one can see if their fare is registered. The register should always be set back at zero at the end of the line.

* Paper read before the Illinois Street Railway Association, June 8, 1898.

Operation of Street Railways in Small Cities*

BY E. K. LESSEURE

Let me say that the operation of a street railway in a small city, viewed from any standpoint, is beset with many petty annoyances and difficulties, and that consequently a paper on the subject cannot be expected to be entertaining, and also that difference conditions existing in different small cities render theoretical operation from a general standpoint out of the question. I will therefore confine myself largely to the operation of one street railway in one small city, namely the one with which I am connected, in Danville, Ill. Perhaps it would be proper at this time to state that Danville is a city of about 18,000 inhabitants, rather compactly built up, and that we have about 8 miles of track.

In no place more than in a small city is the rule true that the "best is the cheapest." We cannot afford to spend one cent unnecessarily on repairs. It is the matter of repairs and renewals that hurts the small roads. Most any of us can scrape together enough money to pay running expenses, and perhaps enough to pay interest on the investment. To reiterate, the only way I see for a street railway in a small city to be successfully operated, is to buy the best, and take care of it afterwards.

As to the question of power, it must again be the local conditions that govern the matter. I believe that when a street railway company does no lighting or power business that an arrangement should be made with the local lighting company for power. Such an arrangement should be made whereby a small saving would be made to the street railway company, and also allow a small profit to the lighting company.

In our own case, owning the lighting company as well as the street railway, we simply allow to the electric light department a fair price for power, and charge same to the operation of the street railway.

Now comes the question, how many cars shall be run and how

* Paper read before the Illinois Street Railway Association, June 8, 1898.

shall they be operated? As to the number of cars my answer would be to run as many as possible where distances are short. We have one line on which we find a 20-minute service ample, the people who ride at all being so far from the center of the city that they are glad to wait rather than walk. We have another line running through a part of the city more thickly populated, on which we find a car every 10 minutes is none too frequent. We have tried on this line both 10 and 20-minute service, with the results showing that the more frequent service is the more profitable; people not being inclined to wait long for a car where distances are short, as they are apt to be in a small city.

We have another line on which I think one car a week would be sufficient, but as we are compelled under our franchise to run a car every hour, I am unable to give you any data on the subject. Fortunately for us the line is a short one and inexpensive to operate. In a small city we must never lose sight of the fact that distances are such that the people are not obliged to ride, and consequently we must give them every possible opportunity.

In regard to operating these cars, I would say that I am a firm believer in the system of passing up the nickel. First, on account of the expense of conductors; and in the second place, to maintain discipline, men must be kept busy, and with a conductor and a motorman, with now and then a passenger, it is a hard problem. A good motorman can get practically all the fares, and I think in most instances, if good service is maintained, that the people will not complain at the small inconvenience of putting their fares in the box. On big days, of course conductors will be necessary, but by a little care, good men may be found for these occasions, who are ambitious to blow a whistle and say "Fare."

On our own road we operate eleven cars, and in the operation of same employ seventeen men; the superintendent, eleven motormen, one car barn man, two car men, a teamster and a track man. The car barn man is the first man down, and he sees that all the cars get out all right, cleans up the barn, and helps relieve. Any spare time he may have, he puts in working on repairs to cars, etc. The two car men go to work in the morning in time to relieve for noon, and during the afternoon work at repairs. These three men, therefore, do all the relieving for meals.

After the supper relief, the two car men take the cars as they come in, put them over the pits and go over them thoroughly to see that they are in good shape. Any car that is not in perfect repair is not allowed to go out the next morning, but another car is substituted. We are particular in having this rule enforced, always with the view to keeping down repairs and renewals.

The motormen run last in, first out, work about twelve and one-half hours, and are paid by the day. Our teamster is at the same time our lineman, and does all the work on the line, although we arrange to have the car barn man also a lineman, so that in case of emergency he can take this work. The track man goes over the track day after day cleaning the curves and crossings. We use a T rail and I am quite sure he saves his wages in the wear and tear on cars, besides the saving in power.

We go over the line every spring taking up low joints, and we endeavor to keep them in as good shape as possible. We try to do all our car repairing and armature winding with our own men; by that I mean that we do not keep any skilled workmen for this work.

We do all our own painting of cars, by borrowing a good car painter from the railroad shops, and he, with two cheaper men, does our work. We go over our cars every spring, touching them up and giving them a coat of varnish, repainting them thoroughly when they first begin to show need of it.

In case of heavy snows we open the track with snow plows and endeavor to get the best paying lines open as quickly as possible, leaving the others until the last, hoping that nature will come to our aid and bring us a thaw.

The selection and discipline of men connected with a road in a small city is a very important matter, and in our case is left entirely to our superintendent, and upon his judgment depends largely the question of the successful operation of the street railway. His men must be selected not so much for their ability to do one thing, but for their ability to do a variety of things. A man might be a careful motorman and able to run a car economically and safely, and at the same time be totally unfit for a motorman in a small city where no conductors are used.

Our motormen must be able to run their cars, make change, which is furnished them in packages in amounts from 10 cents to one dollar, answer questions, look out for passengers getting on and off, see that he gets all his fares, keep order in the car, and make himself generally useful and agreeable. If he has any time at the end of his line he is expected to sweep out his car and get it clean for his return trip.

The motormen must be firm in enforcing rules and regulations and at the same time be polite enough not to give offense.

In a large city, where everything is bustle and hurry, people expect to have rules enforced; they realize that business could not otherwise be carried on. In a small city we are obliged to have the same rules and discipline, but people are inclined to take advantage of the fact that at times some of the rules seem unnecessary and try to impose on the motormen. Our superintendent, however, maintains a severe discipline; quite as severe, I presume, as on many larger roads, and I think it is a great advantage to us in dealing with the public. The public soon learns to respect your rules, if it knows that you enforce the same with your employees as well as with the public.

The manager of a street railway in a small town comes in contact with his patrons every day, learns to know them, and considers them his customers, and has to treat them much in the same manner as a merchant in a small city treats his customers.

In regard to the matter of providing some sort of attractions at the end of the line, in the hope of increasing travel, I would say it is a matter which has been tried in several small cities with varying success. We have tried it wherever we could without going to any great expense, and have managed to increase our revenue a little, but generally speaking, I doubt whether the plan is feasible. I remember on one occasion we gave a concert at one of our city parks and in point of attendance it was a success. I think we must have had three thouance it was a success. I think we must have had 3000 people, and my recollection is that we carried but 300 people each way, or about one-tenth of the people in attendance.

I could go on indefinitely relating the trials and tribulations of the manager of a street railway in a small city, but I know that each man has "troubles of his own" without being asked to listen to those of another.

In conclusion let me say that I believe from personal experience that a street railway can be successfully operated in a small city, but only by giving the same careful attention to detail as is applied on the larger roads.

Some Phases of the Rapid Transit Problem *

By Albert H. Armstrong.

The rapid transit problem, in congested districts, has to deal with the transportation of passengers at a high average speed with frequent stops, and even in suburban traffic where the stops are less frequent the schedule speeds have been so increased by the ability of the electric motor to accelerate rapidly, that trains hardly reach full speed before it is necessary to apply the brakes. As running at a constant speed does not occur in rapid transit service where stops are at all frequent, it becomes of the greatest importance to carefully investigate the subject of train acceleration in order to determine the method of running a train from station to station with the least expenditure of energy.

Problems in train acceleration may be divided into two broad classes: 1. Where the road is level, and

2. Where grades exist or where an artificial profile is made in order to take advantage of down grades at starting.

Modern passenger cars demand a dead weight of approximately 550 lbs. for each passenger carried, or, in other words, only 20 per cent of the total weight of a loaded motor car is a paying load. When it is considered that in rapid transit service with frequent stops, over 80 per cent of the total energy output of the motive power on level roads is required to accelerate the train, it is evident that in this class of service the rolling stock requires the greatest attention.

To avoid undue complication, the following discussion has assumed that train friction is a constant quantity at all speeds, as at the low maximum speeds—20 to 30 miles per hour—reached in practice with frequent stops of two or more per mile, the error introduced by assuming a constant friction rate will be small and will not at all alter the conclusions arrived at.

The following constants have been assumed as representing average operating conditions:

Length of run, 2000 ft.

Length of time train is in motion, 75 seconds.

Schedule speed, 16.05 miles per hour, including 10-second stops, or 85 seconds total time.

* Paper read before the American Institute of Electrical Engineers, Omaha, June 28, 1898.

Tractive effort, 100 lbs. per ton total, to be maintained uniform during acceleration of the train.

Braking effort, 150 lbs. per ton constant throughout the period of braking.

The train friction being 15 lbs. per ton, reduces the effective accelerating force from 100 to 85 lbs. per ton, corresponding to a rate of .927 miles per hour per second.

With this data a simple acceleration curve, as in Fig. 1, may be calculated, the train reaching a maximum speed of 28 miles per hour in 30 seconds, when power is shut off and the train allowed to coast with a retardation due to friction of .1635 miles per hour per second for 31 seconds to the braking line, when it is retarded at a uniform rate of 1.635 miles per hour per second and comes to rest in 75 seconds from time of starting.

Owing to the greater efficiency of the run, the train is allowed to coast after reaching its maximum speed rather than to allow it to continue at a uniform speed with just sufficient power supplied to overcome the train friction loss.

It is obvious that the train could be accelerated at a different rate than that corresponding to 70 lbs. per ton and still make the same length of run in the same time, the length of time occupied in coasting depending upon the rate of acceleration, being a maximum with an infinite rate, that is, with the train starting with a certain initial velocity. A minimum rate of acceleration is reached when no time is left for coasting, that is, when brakes are applied as soon as power is shut off.

In Fig. 2 such a set of curves has been prepared, showing a train covering a distance of 2000 ft. in 75 seconds, as before, but accelerating at various rates from that corresponding to 62.8 lbs. per ton as a minimum up to an infinite rate, or starting with an initial velocity of 25.2 miles per hour.

As the area inclosed by time as abscissæ and speed as ordinates represents the distance covered, this will be a constant quantity for the fixed distance of 2000 ft. assumed, and curves of Fig. 2 are thus constructed with the same inclosed area for each rate of acceleration. The fact is plainly brought out that with a low rate of acceleration a much higher maximum speed is demanded than would be the case if the rate had been increased, and a curve may be plotted by joining the maximum speeds reached for different acclerating rates, as shown.

A friction of 15 lbs. per ton has been chosen as being that of an average train composed of a motor car and three or four trailers and weighing about 120 tons. With heavier and longer trains this rate may be reduced to as low as 7 or 8 lbs. per ton, while for a motor car alone, the rate may be as high as 30 lbs. per ton, due to friction of motors and gearing. The braking effort of 150 lbs. per ton is also chosen as representing what can be done on an average by a train equipped with air brakes and operating at half the slipping coefficient of the wheels.

It is advisable in rapid transit service to keep the maximum speed reached by the trains as low as possible, as this class of work generally calls for a short time-interval between trains where the utmost precautions are necessary to keep the trains a safe distance apart. In fact, the maximum speed required for a given run practically determines the time-interval between trains, as the train headway should be at least five or six times the length of time required to bring a train to rest from its maximum speed with normal braking force applied.

A second reason for higher rates of acceleration lies in the fact that with rates of acceleration approaching the minimum no margin is left for errors of judgment of the motorman, as little or no time is left for coasting, and the rate of acceleration per amp. input is continually varying with the changing passenger load and hence with an overload it becomes difficult to maintain schedule speed.

A third and most important objection to the use of a low rate of acceleration lies in the saving of energy for the run by the use of a higher rate.

Neglecting $I^2 R$ and core losses of the motors, a set of energy input curves per ton weight of train may be plotted as in Fig. 2, assuming for simplicity that motors are series wound, operate all in multiple and are so geared that starting resistance is entirely cut out at the various maximum speeds reached in the various runs, that is, that no accelerating is done on the motor curve. A constant impressed e.m.f. is assumed, and starting resistance is supposed to be cut out proportional to the motor speed, thereby keeping the current and torque constant.

Thus it is seen that accelerating a train with the minimum rate calls for the highest maximum speed, demands nearly the least current input and also demands the greatest waste of energy in the brakes, as the speed is a maximum when brakes are applied.

The areas inclosed by the various energy time curves represent the comparative amounts of energy required for the run for the different rates of acceleration and these are plotted in Fig. 2, which compares the energy input and the average energy consumption for the run of 2000 ft. in 75 seconds for all rates of acceleration from the minimum corresponding to 62.8 lbs. per ton up to infinity.

For convenience the average energy rates are plotted in terms of watt hours, and the curve shows that while the minimum rate of acceleration corresponding to 62.8 lbs. per ton calls for an expenditure of 83.5 watt hours per ton weight of train, this is reduced to 56.5 watt hours by accelerating with a rate corresponding to 70 lbs. per ton, to 42.7 watt hours with 100 lbs., and finally reaches a minimum value of 32.5 watt hours if the accelerating rate is pushed to infinity.

Thus the energy required for the run of 2000 ft. in 75 seconds may vary from 83.5 to 32.5 watt hours per ton of train weight, a decrease of over 60 per cent, depending upon the rate of acceleration used.

The curves in Fig. 2 are worthy of careful study, and similar curves afford a means of determining the proper rate of acceleration and hence motor equipment, gearing, etc., to use for a given set of conditions. The limiting factor in the more rapid rate of acceleration of a train is the current input required. Thus, if the rate of acceleration be carried to abnormally high values, the local demand for current becomes so great that either the loss in the feeders more than offsets the reduction in energy consumption at the train, or else the interest on the increased feeder investment is not offset by this energy reduction.

There are other limiting factors governing the rate of acceleration in the size and weight of motors, which are limited in the current they can carry without undue sparking and heating. Thus it will be found that the rate at which a train accelerates largely determines the cost of feeders, size of motors and generators, both in regard to current and thermal capacity, and also fixes the safe headway between trains.

The error made in accelerating at or near the minimum rate is clearly brought out. For example, the current consumption

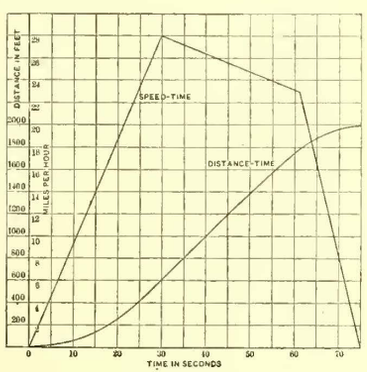


FIG. 1.—ACCELERATION CURVE

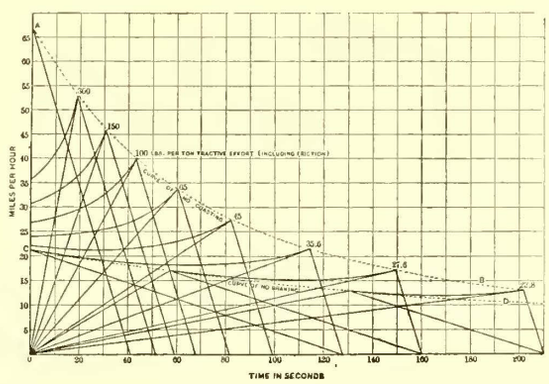


FIG. 3

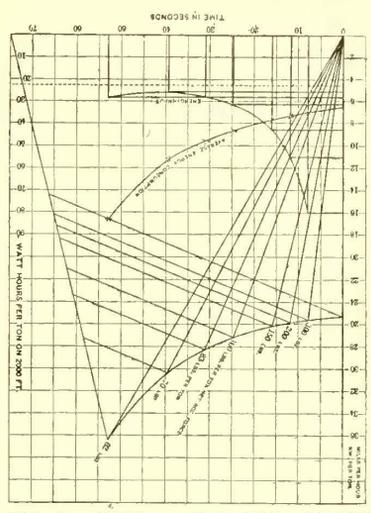


FIG. 2.—SPEED AND ENERGY CURVES

Distance, 2000 ft. Time, 75 secs. Tractive effort, 100 lbs. per ton. Friction, 15 lbs. per ton. Braking effort, 150 lbs per ton.

per ton is the same for 62.8 lbs. per ton or 85 lbs. per ton; as, although 85 lbs. calls for the greater tractive effort, the torque per amp. is so increased by the lesser maximum speed demanded that the current input is the same in each case, hence the feeder considerations are the same in both cases, while the energy consumption shows a reduction from 83.5 watt hours per ton, with 62.8 lbs. to 47.5 watt hours, or about half, with 85 lbs. per ton.

Referring again to Fig. 2, it is obvious that a similar set of curves may be plotted for a run of 2000 feet for any other length of time than 75 seconds, and Fig. 3 gives such a set of curves plotted for lengths of time ranging from 41 seconds, as a minimum possible, up to 210 seconds. The minimum time in which it is possible to make a run of given length is determined by the braking effort, in this case assumed to be 150 lbs. per ton, the train reaching a maximum speed of 66.5 miles per hour in zero seconds with an infinite accelerating force and being retarded throughout the entire running time of 41 seconds at the rate of 1.635 miles per hour per second, corresponding to a force of 150 lbs. per ton braking effort.

The constants assumed in these curves are the same as before, 15 lbs. per ton friction rate, and 150 lbs. per ton braking effort applied uniformly until the train comes to rest at a distance of 2000 feet from the start. While the braking effort determines the minimum length of time for the run, the friction rate imposes a limit upon the maximum rate of acceleration possible for lengths of time greater than 128 seconds for 2000-foot run. That is, a train accelerating with an infinite rate and coasting the entire length of 2000 feet, would come to rest in 128 seconds with no energy loss in the brakes, and any longer interval of time occupied in the run would require some finite rate of acceleration at a maximum. This is pointed out in Fig. 3, where for a run in 210 seconds the maximum rate of acceleration possible is .175 miles per hour per second, corresponding to 24 lbs. per ton. No train in practice would require such a long time as 210 seconds, nor would it be possible to make a run of 2000 feet in 41 seconds, but these curves have been carried out to show the limits for a given set of conditions.

As the energy lost in braking is proportional to the square of the speed when the brakes are applied, the curve A—B, Fig. 3, being the locus of the minimum rates of acceleration, that is, with no coasting, is thus the curve of maximum input for a run of 2000 feet for any length of time. Also the curve C—D, being the locus of the various coasting lines, that is, of no braking effort, is thus the curve representing the minimum possible input.

To compare the amounts of energy required for rates of acceleration other than the maximum and minimum, a set of curves has been prepared in Fig. 4 giving the energy consumption for a run of 2000 feet on a level track for any rate of acceleration and for any length of running time, the constants being 15 lbs. per ton friction rate and 150 lbs. per ton braking effort. For convenience in comparison, the energy consumption is reduced to watt hours per ton mile, and speed is expressed as average speed in miles per hour while train is in motion or equaling schedule speed if train loses no time in stopping. The dotted curve A—B is the maximum energy curve corresponding to the curve A—B of minimum rates of acceleration in Fig. 3, and the curve C—D represents the minimum amount of energy possible for the different speeds and is described by an infinite rate of acceleration.

The curves of maximum and minimum energy consumption approach each other and coincide at a speed of 33.3 miles per hour, corresponding to an energy consumption of 298 watt hours per ton mile, this value being the greatest amount of energy that can be expended on the run with 150 lbs. per ton braking effort.

All energy values are net; that is, they represent the amount of energy required to accelerate the train plus energy lost in overcoming friction, and hence take no account of any losses occurring in actual operation in the motors, rheostats, gearing, etc.

Fig. 4 shows the economy resulting from properly proportioning the accelerating rate to the schedule speed and distance traveled. For example, a train accelerating with a tractive effort of 100 lbs. per ton and making 20 miles per hour average speed, not including stops, will require 127 watt hours per ton mile, which would be reduced to 65 watt hours per ton mile if the tractive effort had been increased to 150 lbs. per ton, or, in other words, the generator capacity would be but half as large for the same service.

The curve of 300 lbs. per ton tractive effort is interesting, as it represents about the maximum speed attainable with modern apparatus for a distance of 2000 feet with the assumed constants of friction and braking effort. Assuming the entire weight of the car to rest upon drivers, about 300 lbs. per ton would be available for traction without slipping the wheels on an average track, so that an average speed of 26½ miles per hour is the highest that could be obtained over a distance of 2000 feet, not allowing any time whatever for coasting.

All previous curves have been based upon the assumption that trains are allowed to coast after reaching maximum speed, and also that acceleration is carried on at a perfectly uniform rate until power is shut off, but in practice this assumption may be modified somewhat, the starting resistance being cut out before the maximum speed is reached, and the latter part of the acceleration carried on at a constantly decreasing rate upon the motor curve.

Another method would be to accelerate at a constant rate until maximum speed is reached, then continue this speed constant by supplying motors with just sufficient power to overcome train friction. This latter method of train acceleration, however, demands such a considerable increase in the amount of energy required for the run that it has not hitherto been considered.

The three methods of acceleration are illustrated in Fig. 5, showing the three forms of speed curves, a—a accelerating at a constant rate and coasting after maximum speed is reached until brakes are applied, b—b accelerating at a constant rate and continuing at full maximum speed until brakes are applied, and c—c accelerating at a constant rate until starting resistance is cut out and further acceleration allowed to continue at a constantly decreasing rate with constant full line potential at motor terminals until maximum speed is reached, when train coasts until brakes are applied.

Curve a—a reaches the highest maximum speed but wastes the least energy in the brakes, and hence is the most efficient run mechanically, curve b—b, the constant speed method, being the least efficient.

As these three curves were plotted from the speed torque curves of an actual motor, it is instructive to compare the watt hours consumed for each run with series-parallel control, operating two motors in series, then in multiple. To this end a set of energy input curves have been plotted in Fig. 5, showing that curve c—c

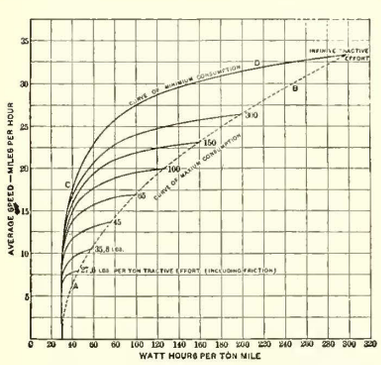


FIG 4.—SPEED-ENERGY CURVES
Distance, 2000 ft. Friction, 15 lbs. per ton.

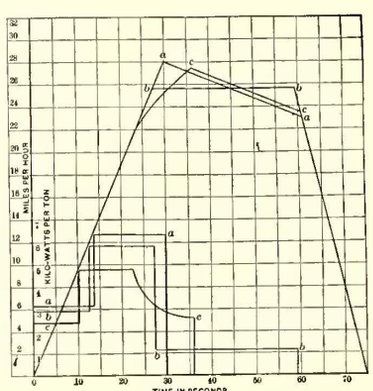


FIG. 5.—SPEED CURVES
Distance, 2000 ft. Time, 75 seconds. Friction, 15 lbs. per ton. Braking effort. 150 lbs. per ton.

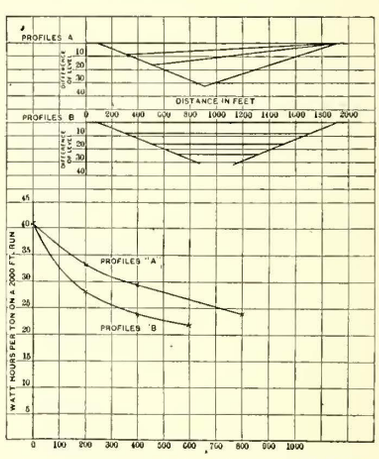


FIG. 6.—ENERGY CURVES ON ARTIFICIAL PROFILE
Distance, 2000 ft. Time, 75 seconds. Starting grade of 4 per cent. Tractive effort of motor, 100 lbs. per ton. Friction 15 lbs. per ton. Braking effort, 150 lbs. per ton.

requires the least maximum energy input, while curve a—a requires the greatest amount.

The area enclosed by the energy time curves is a measure of the average energy consumption for each run, and their respective values reduced to watt hours are:

a. Constant current and coasting, 147 watt hours per ton.

b. Constant current and no coasting, 160 watt hours per ton.

c. Constant current and acceleration on motor curve, 126 watt hours per ton.

Hence, of the three methods, curve c, making use of the acceleration due to a series motor curve, not only requires the least maximum current input, but also requires the least average energy input to the motors for a given run, and hence is the form of curve used in the majority of actual runs. Although the energy given out by the motors in run c is greater than in run a, as evidenced by the higher speed at which brakes are applied, yet this extra work is done so much more efficiently, owing to the smaller starting resistance loss, that the total watt hours input becomes less.

It will be noted that all curves of Fig. 4 approach a minimum value of thirty watt hours per mile; that is, the minimum energy expressed in watt hours per ton mile for a given run will be double the friction rate. The actual factor is 1.98 and forms a very convenient method of determining the net energy consumption for any speed and train weight if the friction rate be known. Thus, assuming the light load efficiency of a railway motor, including gear loss, to be 75 per cent, a friction rate of 15 lbs. per ton would demand an input of 40 watt hours per ton mile, corresponding to an input of 1200 watts per ton weight of train at, say, a constant speed of 30 miles per hour.

A number of interesting conclusions may be made from the foregoing investigation of the operation of trains upon a level track.

1. The rate of acceleration determines the energy consumption for a given run, and since this energy consumption decreases with increased rate of acceleration, the train should be brought up to speed as quickly as possible and allowed to coast to secure the minimum energy input.

2. The maximum current input during acceleration increases with the rate of acceleration, and hence limits the rate at which a train can be accelerated with a given feeder loss or feeder investment.

3. In order to reduce the average energy consumption and also the maximum current input to a minimum for a given run, a due amount of acceleration should take place on the motor curve after starting resistance is cut out, hence a motor should be carefully proportioned for the work it has to do.

4. A normal amount of coasting should be permitted after power is shut off, partly to provide a margin to allow for errors of judgment of the motorman, but largely because this is the most efficient method of accelerating a train. On no account should the maximum speed be continued by supplying the motors with just sufficient current to overcome train friction, as this method of accelerating is extremely wasteful and inefficient.

Having discussed various methods of accelerating, it is interesting to follow out the problem and determine the actual efficiency of transporting passengers by our modern methods of travel. It has been pointed out that only from 15 to 20 per cent of a fully loaded train consists of a paying load, and with an average load as carried throughout the day this percentage will be reduced to 10 per cent or less; that is, nine-tenths of the energy consumed in moving this train at a constant speed is wasted. But in rapid transit work a train seldom attains a constant speed, due to the frequent stops and high schedule speed, and at least ten times the energy required to overcome friction alone must be expended in accelerating the train, only to appear as heat in the brake shoes when bringing the trains to rest. That is, considering the friction work of the train as the only useful work done, an efficiency of only 10 per cent is reached in the average run. But only 10 per cent of this friction work is useful in moving passengers, hence the actual passenger efficiency is reduced to less than 1 per cent of the total energy delivered to the train during acceleration.

When it is considered that further losses occur in operation in the motors and their method of control, in the transmission lines and generators of an electric traction system, it will be appreciated that the present method of transportation, with its efficiency of a fraction of 1 per cent, opens a wide field for improvement. This applies with greater force to rapid transit service using steam locomotives as a motive power, as the dead weight carried per passenger is greater with a steam locomotive than with a motor car, and the efficiency from the coal pile is much less. Hence some means of reducing the large loss due to accelerating the train is desirable, and this is found in the adoption of an artificial profile, as followed out in a large underground road now building, using down-grades in starting and up-grades to retard the train when stopping.

The ideal profile would provide for a down-grade at starting sufficient to do the work of acceleration and with an up-grade to do the entire braking required, thus leaving only the friction energy to be supplied by the motive power. Such a road would operate at 100 per cent efficiency, neglecting the dead weight of train carried and considering total friction work as useful work.

Reduced to practice, this ideal grade must be modified considerably. The per cent grade used is limited partly by the rapidity of acceleration that may be imparted to the train without discomfort to the passengers, and partly by the available tractive effort of the motive power, which must be sufficient to haul the train up the grade in case of necessity.

A second modification occurs in the necessity of having stations placed on a level track, and since a train has an appreciable length it must travel its own length before the last car is off the level and the full effect of the grade is felt. Thus, during the first period of acceleration the rate is comparatively small and must be furnished by the motors, resulting in a material reduction in the energy gain in the theoretically ideal profile. An artificial profile can only be secured on elevated or underground roads, and a double-track road necessitates two separate overhead structures, and the underground road must consist of two separate tunnels with unlike profiles.

Assuming two stations to be on the same level, there are two forms of profile that may be assumed with a given maximum difference in levels, as shown in Fig. 6. Profile A consists of a down-grade with a level track at each terminus equal to the length of train operating over the road, while profile B consists of a down-grade and up-grade equal in length and percentage with a level track connecting them, and also a level track at each station equal to a train length.

In practice a perfectly symmetrical profile, as in B, will not be possible, as the level track connecting grades must be replaced by a slight grade to provide for drainage in tunnel roads, this grade preferably opposing the direction of movement of the train.

In order to ascertain the behavior of a train upon the two forms of profiles and to determine the most efficient form of grade, a series of curves have been plotted upon the following assumptions:

Length of run total, 2000 ft.

Train friction, 15 lbs. per ton constant.

Braking effort, 150 lbs. per ton during time brakes are set.

Running time, 75 seconds.

Length of train, 200 ft., corresponding to an average train of four to five cars.

Tractive effort, as supplied by motors, 100 lbs. per ton. (This effort being supplied irrespective of added effort due to grades.)

No running is assumed to take place on the motor curve, and train is supposed to coast after reaching maximum speed. Motors are controlled by the ordinary series-parallel method, starting with two motors in series and throwing them into multiple, the starting resistance being supposed to be cut out uniformly so that 100 lbs. per ton motor effort is maintained constant while current is on.

Due regard is paid to the fact that the tractive effort due to grade depends upon the proportional length of train off the level track at the stations, and hence is a constantly increasing quantity until the entire train is on grade.

A grade of 4 per cent has been chosen for the down-grade in A, and for both down and up-grades in B; and energy consumption plotted in Fig. 6 for different lengths of grade.

Thus, for a run of 2000 ft. in 75 seconds the energy input with series-parallel control is 40.75 watt hours per ton for a level track, which is reduced to 27.8 watt hours in curve A with a length of 500 ft., 4 per cent grade and 32.6 watt hours per ton in B, with the same length of 4 per cent grade; that is, with the same vertical fall.

A length of 500 ft. of 4 per cent. grade calls for a vertical fall of 20 ft., which is not excessive in practice; hence, by the use of a profile similar to B, Fig. 6, the energy consumption for a given run may be reduced as much as 40 to 50 per cent. from that required on a level track.

With proper proportioning of the gear ratio of the motor, allowing some acceleration on the motor curve, this saving in energy consumption could even be exceeded, so that a rapid transit road, especially a tunnel road, properly laid out with an artificial profile, could operate with a very much less energy consumption than an existing surface road.

STREET RAILWAY JOURNAL

JULY, 1898.

PUBLISHED MONTHLY BY
THE STREET RAILWAY PUBLISHING COMPANY,
HAVEMEYER BUILDING,
26 CORTLANDT STREET, NEW YORK.

WESTERN OFFICE:
MONADNOCK BLOCK, CHICAGO, ILL.
EUROPEAN OFFICE:
39 VICTORIA STREET, WESTMINSTER, LONDON, ENGLAND.

Long Distance Telephone, "New York, 2664 Cortlandt,"
Cable Address, "Stryjourn, New York."

TERMS OF SUBSCRIPTION.

In the United States and Canada..... $4.00 per annum.
In all Foreign Countries, per annum..... $6.00 / £1 5s 0 / 31 fr
Subscriptions payable always in advance, by check (preferred), money order or postal note, to order of C. E. WHITTLESEY, Treasurer.

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The Street Railway Publishing Co.,
Havemeyer Building, 26 Cortlandt St., New York.

It is evident from the figures of the comparative gross receipts of 1896 and 1897 given elsewhere in this issue, that the large increase in 1896 over 1895 has not been sustained in 1897, although the ground has just about been held, considered as a whole. The larger street railway properties, including those earning over $1,000,000 gross, showed receipts in 1896 over 6½ per cent greater than in 1895, but in 1897 they were only 2.2 per cent greater than in 1896. The street railways of the second class, earning from $500,000 to $1,000,000, show a decrease in 1897 of 0.11 per cent, as against an increase in 1896 over 1895 of 6½ per cent. The street railways of the third class, earning from $100,000 to $500,000, show an increase of 1.87 per cent in 1897 over 1896 as against 12 per cent increase in 1896 over 1895. The street railways of the fourth class, earning from $50,000 to $100,000, show an increase of 1.61 per cent in 1897 over 1896, as against about 9 per cent increase in 1896 over 1895. The street railways of the fifth class, earning from $25,000 to $50,000, show a decrease of 0.67 per cent in 1897 over 1896 as against an increase of nearly 16 per cent in 1896 over 1895. Taken as a whole, the 175 roads show an increase of 1.9 per cent in 1897 over 1896, whereas 195 properties last year showed an increase in 1896 over 1895 of 7.4 per cent.

Car mileage records are an essential element of street railway bookkeeping. Although the car mileage unit as a basis for comparisons is by no means perfect, it is the best we have for most purposes. To obtain car mileage with reasonable accuracy and without unreasonable expense is a problem of considerable difficulty, and some large companies are paying heavily for the necessary clerical assistance, fifteen clerks being employed on this work in one case which has come to our knowledge. A suggestion recently made to us by a prominent street railway manager, to the effect that the use of cyclometers ought to largely reduce this expense, seems worthy of careful attention. There is no mechanical difficulty in obtaining a cyclometer which will work continuously, irrespective of the direction of the car. There is probably no great difficulty in making such cyclometers at a reasonably low cost. Perhaps the most serious objection to their use is the possibility that a slippage of wheels may introduce errors of some magnitude into the results. It is difficult to predict, in the absence of experiments, what the percentage of such variations might become, but it would seem probable that a factor of correction could be employed which would enable a company to arrive at its car mileage by this means without serious error. On the other hand, the advantages of cyclometers for this purpose are considerable. For the purposes of the accounting department, the cyclometers of an entire system could be read in one night at the end of each month, or oftener, if desired, and at trifling expense. For the purposes of checking up repairs of all kinds, the cyclometer need be read only when the car goes out or comes into the shops. Wheel mileage could be obtained with such certainty as to practically estop manufacturers from alleging irregularities of records, and for this purpose no correction need be applied to cyclometer results for slippage, since the slippage involves even more wear upon the wheel than direct rolling.

One of the most crying necessities of the times in street railroading is a thoroughly sound, well built and "practical" car that can be converted at five minutes' notice from an open car to a closed one, and vice versa. To say nothing of the cost of duplicating motor equipment and interest upon the waste investment involved in keeping open cars housed and completely out of service during six or seven months of the year, and closed cars partially out of service during the remaining months, the difficulties of providing suitable cars for all kinds of summer weather, or preventing annoyance to passengers in open cars during summer showers, have never been completely solved, certainly on a large scale. The method employed on some of the Californian roads and elsewhere in building cars part open and part closed, so that choice of accommodations is allowed the passenger, is

only a partial solution of the problem, though it could be made in many places a good one. The St. Louis cars, with their cross seats and large windows, afford another partial solution, presenting many advantages. But more than one car builder, and perhaps more than half our street railway managers, are convinced that the types of cars in general use are by no means final or fully-satisfactory and that development may be expected along lines which will minimize the investment cost for equipment and provide the greatest possible convenience under all weather conditions to the passenger, who pays the nickel or does not pay it, according to his estimate of the convenience and pleasure of riding.

We are occasionally asked the question: "Does it pay to grind car wheels?" Many superintendents who ask this question say that their experience with wheels which have been reground has not been satisfactory; that such a wheel soon get flat again, and that its second life is usually so brief that the trouble and expense of placing the wheel in the grinder and truing it is not sufficiently repaid by the additional life secured from it in service. They therefore believe in keeping a wheel in use as long as possible and then discarding it. On roads where considerable braking is done the question is an important one, as flats are frequent and to a certain extent unavoidable. The trouble with reground wheels is usually due to one of two causes, or in some cases, to a combination of both. In the first place it is undoubtedly true that if the depth of chill is not considerable, the grinding of a wheel to take out a flat spot will remove so much of the diameter as to bring the tread to where the chill begins to blend into the gray iron. In this case, of course, a ground wheel soon develops a flat spot and has to be discarded. The usual depth of chill in the ordinary electric car wheel is $\frac{3}{4}$ in.; beyond this comes the intermediate part, which is useless so far as wear is concerned. As a rule the chill can be worn down $\frac{1}{2}$ to $\frac{5}{8}$ in. and sometimes deeper without danger of getting into the soft iron. A method employed by some companies to determine whether it will pay to regrind a worn wheel is to drill a small hole from the under side of the wheel near the throat toward the tread and under the flat spot. The resistance encountered by the drill when the chill is reached will show the depth of the chill at that point, and if there is still $\frac{1}{4}$ in. of chilled iron in the tread it will pay to regrind the wheel. But probably a more prolific cause of trouble with reground wheels than a lack of depth of chill is neglect in mating wheels after they have been reground. To secure good results the wheels to be placed on the same axle should be carefully measured so as to determine whether they are of exactly the same circumference. Lack of this precaution will result in the slipping on the track of one or the other of the wheels when they are in motion, as well as disastrous flange wear. The easiest way of measuring wheels is by a steel tape, passed around the tread of the wheels, and if there is a difference of one-thirty-second in. or more in measurements thus taken, there will be difficulty in securing good action of the wheels together. Some companies mate their wheels to one sixty-fourth in. in circumference.

Depreciation as a Factor in Four-Cent Fare Litigation.

In its legal contest with the city of Milwaukee, the Milwaukee Electric Railway & Light Company has done much to develop and establish a true theory of street railway finance, in which depreciation of plant and equipment is made an important factor. Its suit against the city was for an injunction restraining the city from putting in operation an ordinance reducing the rate of fare to four cents. Its main contention was that the fourteenth amendment to the Constitution of the United States, by which no State shall deprive any person or corporation of its property without due process of law, would be violated, inasmuch as by the operation of the ordinance the company's net earnings would be greatly reduced, if not wiped out, and its investment therefore rendered worthless. It being substantially agreed upon by both sides that the best legal precedents forbade the imposition of burdens such that a reasonable rate of return upon the investment could not be secured, the real question became one of rightly determining the true investment in the Milwaukee property, the true earnings from operation in the past, and the earnings probably to be expected in the future under the operation of the ordinance.

The company's estimates of investment included the cost of acquiring the original horse railway properties, the cost of equipping these properties for electrical operation at a time when prices were far greater than at present, and the cost of subsequent extensions and improvements. The city, on its part, contended that the cost of reproduction at present prices was the true measure of investment values. Judge Seaman decides that the value of the investment, and not the amount paid, must control. He expresses himself as satisfied, however, that the cost of reproduction alone should not be taken as the value of the investment in the enterprise, since it leaves out of consideration any allowance for the necessary and reasonable investment in the purchase of the old lines and their equipment, a purchase indispensable to the contemplated improvements, but of which a large part was of such a nature that it does not count in the final inventory. Moreover, he practically admits that some allowance should also be made for that portion of the original investment made necessary by the high prices charged during the then comparatively new state of the art of electric railroading, of which a striking instance appears in the fact that the electric motor equipment, which in 1891 cost about $2,500, can now be obtained for $800. Work of this class was evidently in the experimental stage in many resepects, and the expenditures by a pioneer may not fairly be gaged by the present cost of reproduction. At least $2,000,000 of these preliminary expenditures he decides entitled to equitable consideration as true investment beyond the reproduction value, if the latter is not otherwise found sufficient for the purposes of the case. This opinion is of great value as a precedent.

But it is in the determination of the true operating expenses and net earnings that the testimony in this case is of the greatest interest, and should be in every street railway company's library for the information of managers as well as of attorneys. The theory of operating expenses developed by the company has been more than

once urged by us as correct and reasonable. It is, in brief, that during the early years of any enterprise involving plant and equipment, such as an electric railway, the real operating expenses are much greater than the actual disbursements upon operating account, owing to the depreciation of plant and equipment constantly going on from the moment of commencing operation, but not involving cash expenditure until later years. In other words, the cost of replacing tracks, cars, overhead structure, power station and equipment, etc., at the end of their natural life is properly a charge upon annual earnings—not a charge to "construction" or "improvements" —and if this cost is not to be felt as a serious and perhaps crushing burden in any one year, provision for it must be made annually from the beginning of operation. Such provision may take the form of a renewal or depreciation fund, annual credits to which are chargeable to operating expenses.

Now, the Milwaukee Company, in common, it is to be feared, with a large majority of other street railway companies in America, has not, until recently, recognized the existence of depreciation as a factor in its earnings, although it has within the past eighteen months changed its bookkeeping methods to make regular provision for it. Frankly admitting in the trial of this case its lack of foresight in this matter, it produced expert testimony to estimate the charges which should have been made during the past three years to its actual expenditures on operating account. The city denied that any allowance should be made for depreciation, resting its contention solely on the books of account kept by the company, and upon the testimony of its expert accountant. By the testimony of the company's principal witness in the matter of depreciation, a street railway expert of wide experience and high standing, no less than from 25 to 30 per cent should have been added to the operating expenses of 1894, 1895 and 1896, in order to provide sufficiently for depreciation. These amounts will show the magnitude of charges frequently lost sight of entirely by managers.

The testimony of John I. Beggs, the Milwaukee Company's general manager, is quoted on the question of depreciation by Judge Seaman at some length and will be found particularly convincing.

The question of amortization of franchises was also dealt with by expert testimony, which was to the effect that in the case of limited time franchises losses of investment were possible, and indeed probable, at the end of the franchise period, and such losses, in common with all other contingencies possible to foresee, should be provided for by annual charges from earnings, upon the theory that—whatever happens—the investor must be guaranteed the return of his original investment intact before it is proper to declare annual returns upon investment.

Judge Seaman concludes that the element of depreciation must be taken into account before it can be determined that the apparent earnings derived from an operating enterprise are excessive, and that there is much force also in the argument of counsel that consideration must likewise be given to the question of amortizing losses from expiring franchises. He holds, however, that in the particular case of the Milwaukee Company's earnings, knowledge of these elements is not essential, as conclusions can be drawn quite safely regardless of depreciation allowances, so he leaves the determination of the latter so far open as to make them serve merely as an important factor of safety in deciding in favor of the company.

With respect to the effect upon gross earnings of the proposed ordinance, Judge Seaman decides that it must be taken as true that enforcement of the ordinance would operate to reduce materially the net revenues of the company, there being no reliable basis furnished by the city in support of its contention that there would be a probable increase of passengers through the commutation ticket method.

As a result of these preliminary decisions by Judge Seaman, his final conclusion is comparatively simple. He finds that the Milwaukee Company, upon any basis of computation, whether upon the city's estimates or the company's, is not obtaining an unreasonably large return upon its true investment. He points out the fact that, by uncontroverted testimony, 6 per cent upon loans upon real estate mortgages and similar securities is the ruling rate in the local market, and he rightly says "surely a better rate must be afforded for the risks of investment than can be accepted on securities of this class in which there is no risk." Upon the basis of $7,000,000 investment, which the court holds to be a logical and just minimum, the 5 per cent interest named in the bonds is clearly not excessive, and should be accepted by a board of equity as the minimum allowance. To enforce the ordinance would deprive the complainant of property rights by preventing reasonable compensation for its service, and he finally decides this to be a clear violation of the Constitution of the United States, and therefore invalid.

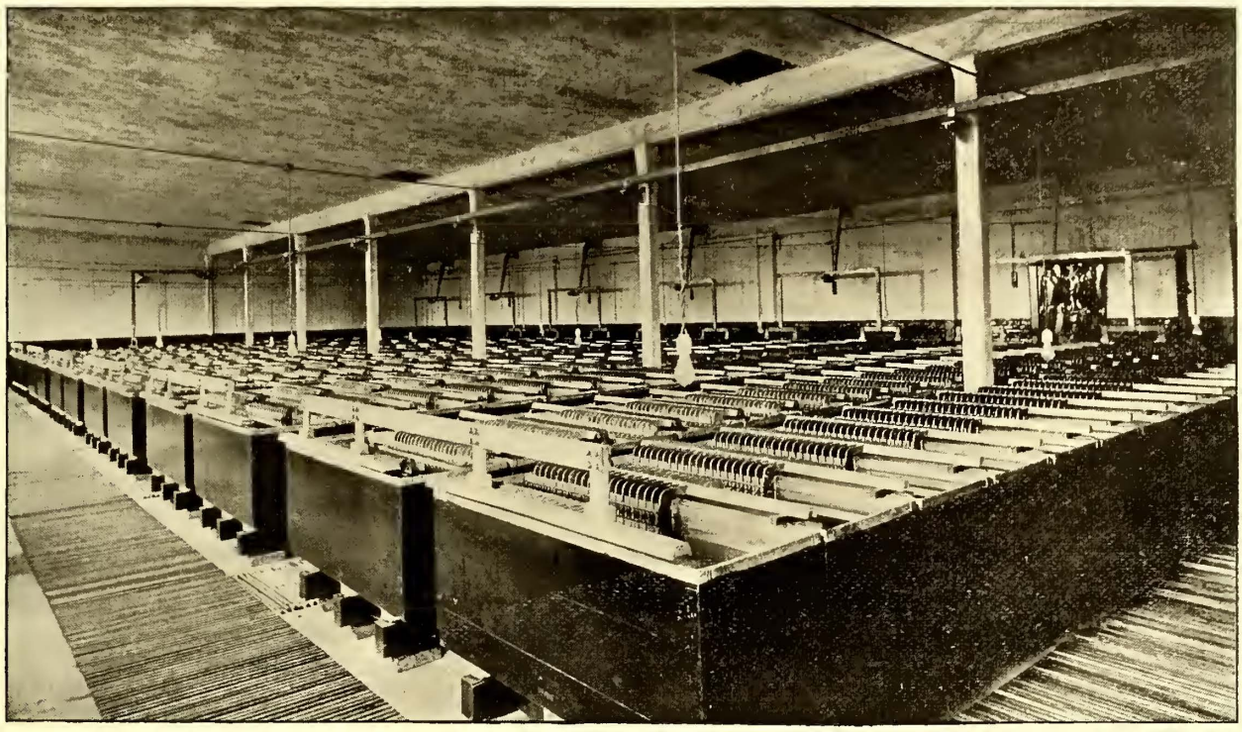
One other point brought out in the testimony and the decision remains to be mentioned. The court clearly calls attention to the immensely improved service and facilities given to the people of Milwaukee at present as compared with those which it obtained in 1891. The mileage has been largely increased through extensions, every section of the city being now reached with shorter and better routes than before; thirty-eight transfer points, with a universal transfer system, have been established, while in the old days several fares to different companies were paid; a maximum length of ride more than double that of 1891 is now given for five cents; the service is improved in speed and regularity 50 per cent or more with better cars and less inconvenience; and it appears beyond question that the facilities are generally more satisfactory and economical from the standpoint of the public. "In other words," says Judge Seaman, "the service is materially enhanced in its value to the public without any increase in either normal or maximum charges." He concludes, therefore, that an important preliminary question incident to the general discussion, namely, "are the terms and rates fixed by the company excessive demands upon the public in view of the service rendered?" should be answered in the negative.

The Brooklyn Heights Railroad Company has inaugurated a parlor car service from the Brooklyn Bridge to Coney Island by way of the Sea Beach route. The cars run daily leaving every hour. The parlor cars are handsomely decorated, and the fare will be twenty-five cents each way, including a seat in an easy upholstered arm-chair.

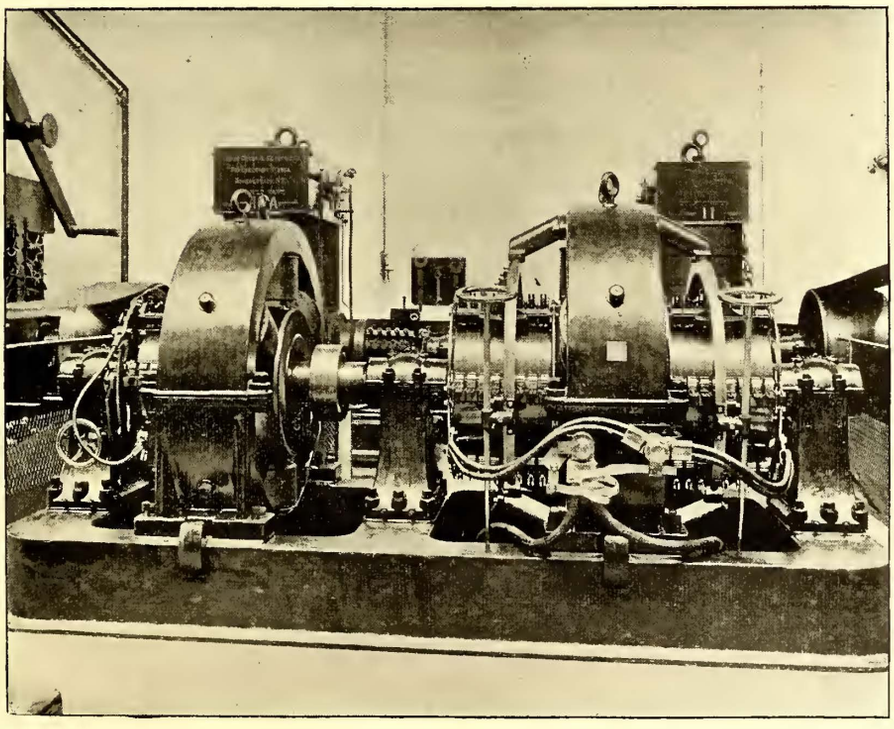
The Buffalo Railway Company's Storage Battery Plant

The Buffalo Railway Company has recently installed in its power house a large equipment of storage batteries for the purpose of regulating the fluctuating load due to the 300 or more cars operated from that point and to carry the peak of the load. The station contains steam generating units of a total capacity of 7000 h.p. and four rotary transformers, each having a capacity of 500-h.p. These are fed with alternating current at 25 cycles per second from the transmission lines of the Niagara Falls Power Company and deliver direct current at 550 volts to the railway circuits.

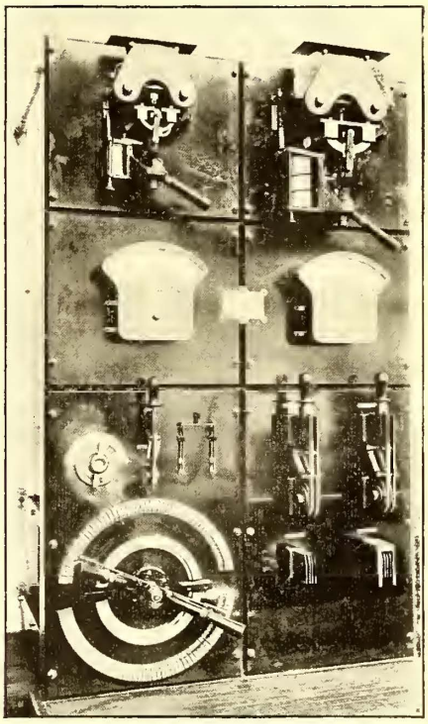
The storage battery consists of 270 cells of the "chloride" type, having a present capacity of about 1200 h.p. when discharged in one hour. As may be seen from the illustration, the cells are not completely filled with plates, but room has been left for the enlargement of the battery by the addition of extra plates, the ultimate capacity of the tanks being for plates sufficient to give 2000 h.p. at one hour's discharge. The tanks for the battery are made of ash, dovetailed together and lined with sheet lead. Heavy porcelain insulators mounted on wooden skids support the tanks, the whole resting on the concrete floor of the battery house. This is a one-story brick building, having a concrete floor and plastered ceiling, the roof being supported on iron columns. The floor slopes to one



STORAGE BATTERY PLANT—BUFFALO RAILWAY



175 K.W. BATTERY BOOSTER



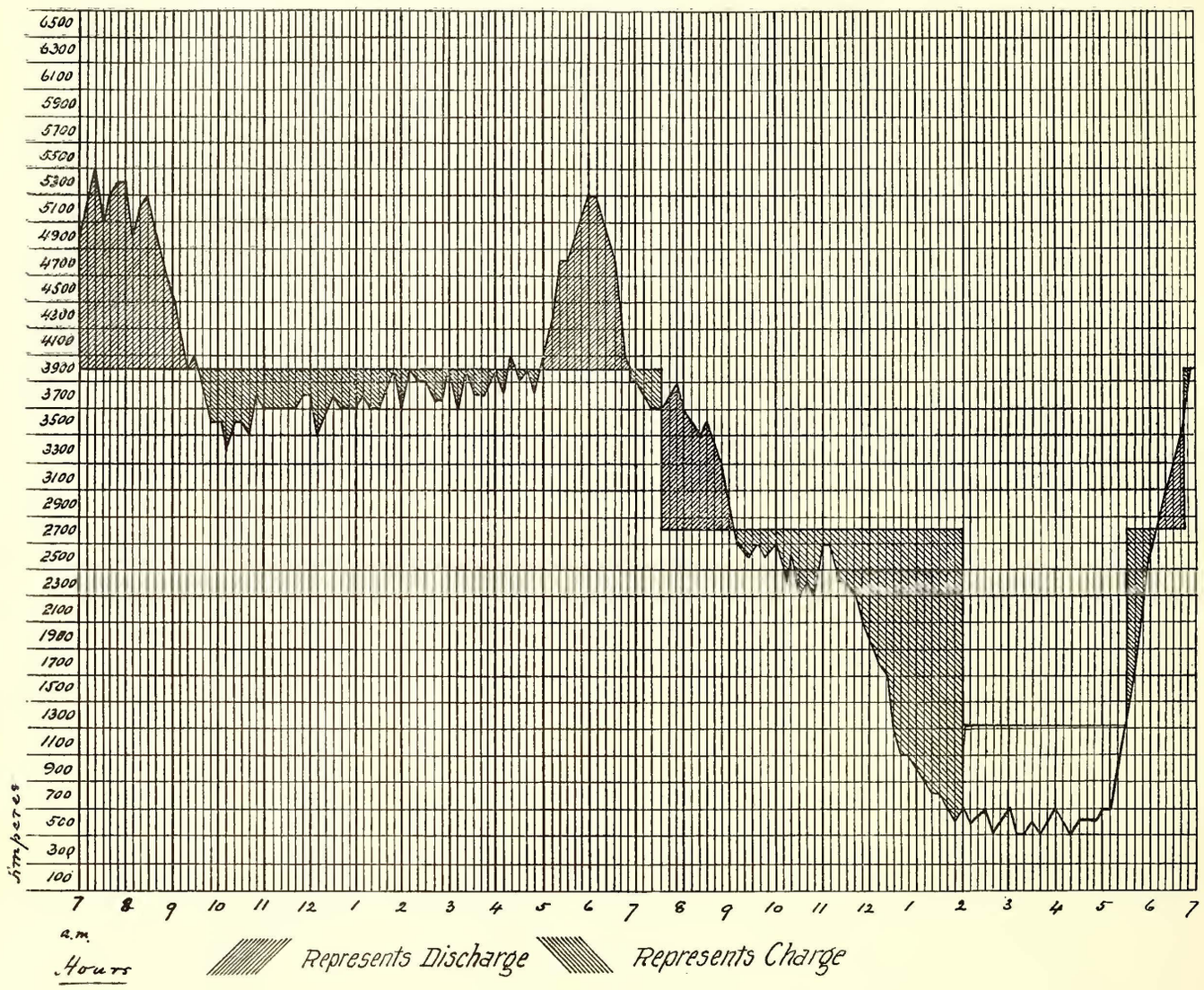
BATTERY SWITCHBOARD

side for drainage, and ventilation is accomplished by means of roof openings and windows. Wooden mats are laid in the aisles between the rows of cells as an insulation. As the illustration shows, all the cells are in one tier and on one level, and the arrangement of the conductors is the simplest possible. All the conductors are of copper, covered with lead by a process which results in a thin and firm coating.

The battery is connected at its positive terminal to the main positive bus of the station, and at its negative terminal through a motor-driven booster having a capacity of 2500 amps. at 70 volts, to the ground. The functions of this booster are various, and its construction worthy of special attention. The motor end is an ordinary six-pole type of motor, working at 500 r.p.m. from the main busbars. This is direct coupled to the compound wound booster, which has two commutators of very large size, each carrying six sets of eight brushes. By this arrangement currents as large as 3000 amps. have been sent through the booster without undue sparking. The machine is provided with a center bearing and the usual self-oiling arrangements and is, as the illustration shows, of very solid mechanical construction.

As the booster is used sometimes to assist the charging of the cells and sometimes to help their discharge, it is necessary to vary its terminal voltage from zero to a maximum in either direction. This is done by varying the e.m.f. at the terminals of the shunt winding by means of a very ingenious switch. In the central position of the switch the e.m.f. at its two points of contact with the resistance is the same and no current flows in the shunt. At either of its terminal positions the shunt is actuated by the full 550 volts, the direction of its magnetization depending on the position of the switch. The booster can thus be set to either charge or discharge the battery or in the position of neutral action by turning the switch lever on the battery switchboard.

During a 24 hours' run, the battery is fully charged by the rotary transformers at night and is switched in for service about 5:30 A. M. The peak at 8 A. M. is taken by the battery, which then runs practically as a regulator until the evening peak comes on. At about 7:30 P. M. the steam engines are shut down and the rotary transformers carry the load until the engines are started again at about 6:30 the next morning. Before the installation of the battery it was not possible to shut down the engines except from 11 P. M. until 5 A. M., when the load falls off to about 600 h.p. With the battery it is possible to shut down the engines and run on the rotaries alone for 12 hours in each 24, and for 18 hours on Sundays, while the engines are operated on a constant load while running —the condition of highest economy. During the night the rotaries in the station are kept running, charging the battery. From 2 to 5 A. M., two of them are shut down and the battery cut off to give an opportunity to clean the booster and the rotaries. At these



SAMPLE LOAD DIAGRAM

hours the two rotaries that are left running carry the whole load.

When the battery is completed by the installation of the remaining plates it will effect a still further reduction of the steam power consumption and add materially to the economy of the station.

This installation possesses a peculiar interest in being the first and largest user of Niagara power. The current is received as three-phase alternating current at 11,000 volts and 25 cycles per second, and transformed to the proper pressure for rectification by the rotary converters. In connection with the storage battery this system of supply is almost ideal for its flexibility and closeness of regulation. The voltage at the station does not vary more than 2 to 3 per cent under the extreme and sudden variations of load due to the exigencies of railway service, and shows a steadiness that would be regarded as excellent in a lighting station.

The storage battery was built and installed by the Electric Storage Battery Company of Philadelphia.

It is well to remember, however, that Glasgow boasts of a "continuity of existence of over nine centuries." We may, therefore, safely place it within the limits of possibility that when our American cities survive a "continuity of existence of over nine centuries," that they may be so far advanced in methods and morals that they, too, may be intrusted with additional power and responsibilities.—From Report of Committee on "Municipal Ownership of Street Railways," at Niagara Falls Convention, 1897.

Electrical Equipment of the Brooklyn Elevated Railroad

As already outlined in the STREET RAILWAY JOURNAL, the Brooklyn Elevated Railroad Company has been engaged during the past two or three months in connecting its tracks near the New York Bridge terminal with the existing cable railway tracks on the bridge, and on the electrical equipment of its line from the Navy Street Station to the bridge terminal. During the last month the connecting link between the elevated and bridge structures was completed, and on May 18 the formal opening occurred. A special train, consisting of five regular cars and one motor car and carrying a number of invited guests, was drawn over the bridge by electric power, suc-

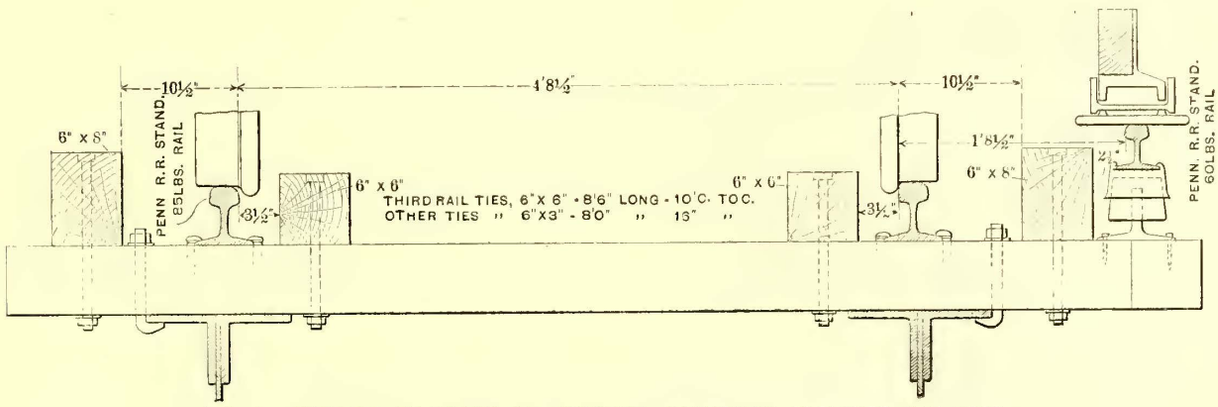
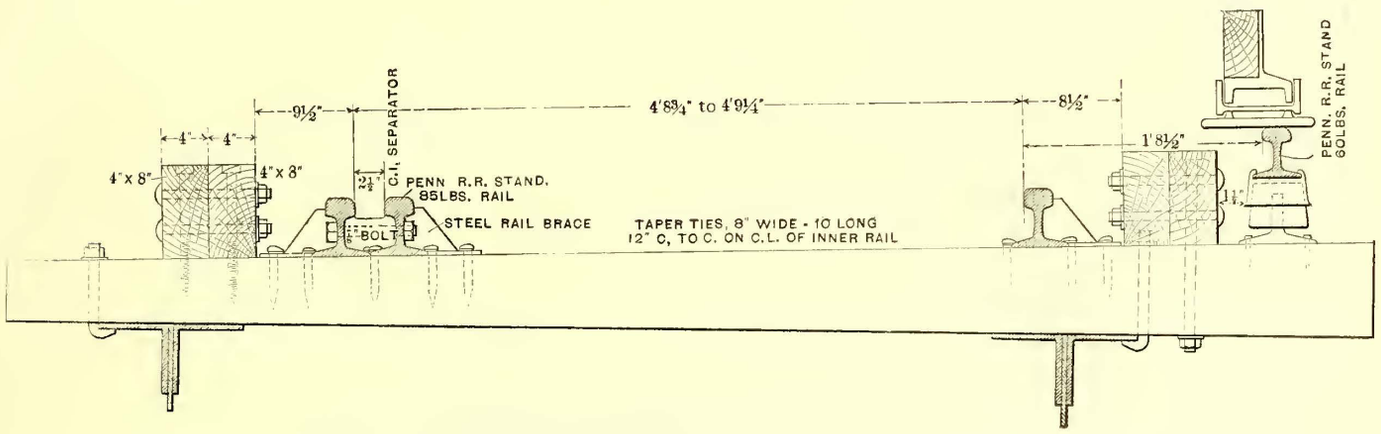


FIG 1.—SECTION OF TRACK ON TANGENT—BROOKLYN ELEVATED RAILROAD



SECTION OF TRACK ON CURVE—BROOKLYN ELEVATED RAILROAD

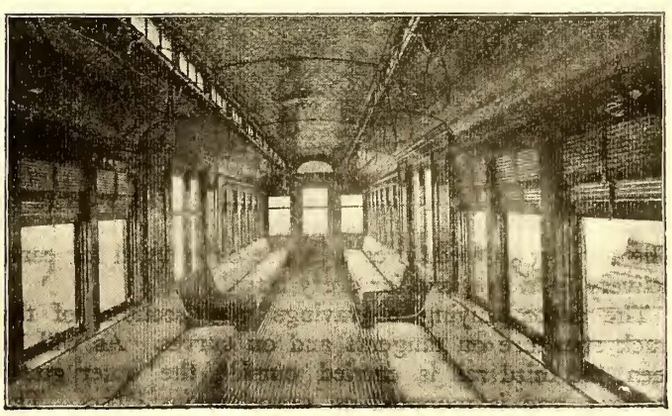


FIG. 3.—INTERIOR OF MOTOR CAR

cessfully and without delay. Afterward the party was taken by a steam locomotive to Manhattan Beach, where a fine banquet was served. Following the official trip regular operation of the trains on the Fifth Avenue line was commenced across the bridge.

As will be seen, the electrical equipment of the road comprises only a small part of its system. At present the

FIG. 4.—END VIEW OF MOTOR CAR

cars are taken over the bridge only, by electric power, the motor cars being connected to the passenger coaches at the bridge terminal on the Brooklyn side and being detached after the round trip to the Manhattan side is made.

The number of electric cars in use or ordered for early delivery is twelve, one for every train.

The accompanying engravings give sections of the track structure on tangents and on curves. As will be seen, the third rail is carried outside the outer guard stringer, and is mounted on porcelain insulators. The latter are spaced every 8 ft. and carry malleable iron caps with clips which are bent over the third rail to hold it in position. The porcelain insulator is held on its shank by Portland cement. and a fiber washer is placed under the third rail to remove some of the jar from the porcelain. Contact shoes, similar to those employed on the cars of the New York and Brooklyn Bridge, and illustrated in the Street Railway Journal for February, 1897, are carried on both sides of the car, and the third rail is alternated from one side to the other of the track to avoid complications at switches, etc. At present power for operating the road will be taken from the power circuit of the Brooklyn Heights Railroad Company.

The cars employed are illustrated in Figs. 3, 4 and 5. As will be seen, they have side as well as end entrances, and are very similar to the regular passenger cars employed on the Brooklyn Bridge. They were built by the Pullman Company, and are mounted on McGuire trucks. They are equipped with the Christensen air brakes.

The motive power is supplied by Walker 80 h.p. motors, four to a car. These motors were designed by S. H. Short, of the Walker Company, and embody a number of novel features, and were described in the Street Railway Journal for March. They have a high efficiency. The Sprague multiple unit system of control is used, and will be found especially useful, of course, as the electrical equipment of the road increases.

So much for the form of construction of a good type of four-wheel trucks, but what of the disadvantages of four-wheel trucks in general? Taken at its best, the four-wheel truck is an uncomfortable carriage and a veritable track destroyer, and should only be used, according to the best judgment of many of our wide-awake railroad men, where cars are run at comparatively slow speed, and with moderate length of car bodies. Where it is desirable to run at a higher rate of speed in suburban service, the damage to the track becomes so great that it should preclude its use. The increased length of wheel base made necessary makes it hard on curves. The only alternative is to use a double truck car with swivel or pivotal trucks. They

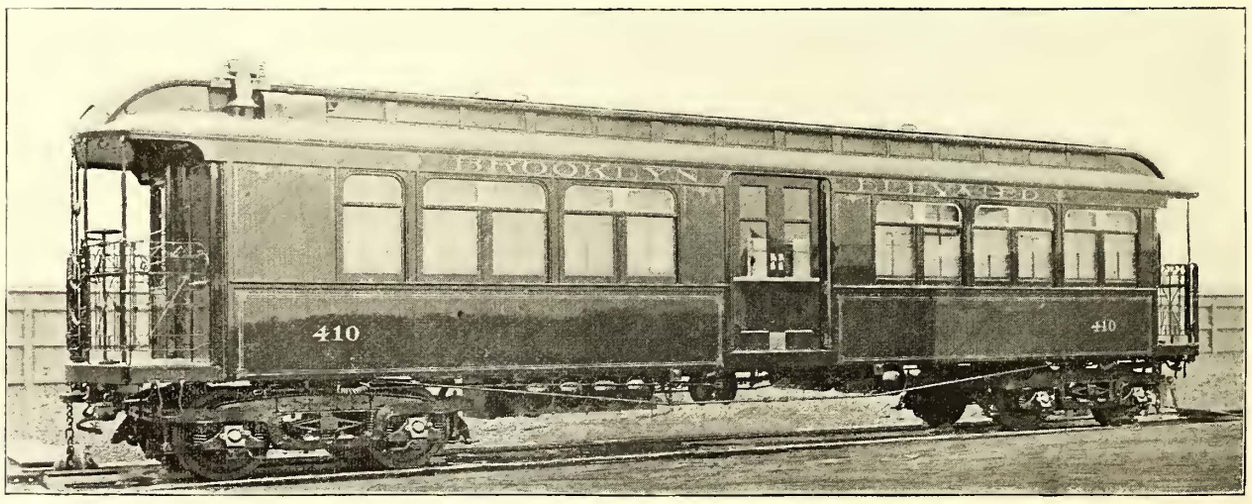


FIG. 5.—SIDE VIEW OF MOTOR CAR

are easy to curve to a degree that would hardly be credited by those who have only been familiar with four-wheel cars. The greater number of wheels not only reduce the weight on each wheel, but correspondingly reduce the blow when the wheels strike a joint, or a low place in the track. This is still further diminished by what is known as "equalization," which practically places the car body at the central point of the truck, so that each wheel in rising or falling, in passing over any imperfections in the track, elevates the load a distance but half as great as its own rise.—From paper read at the St. Louis, Mo., Convention, 1896.

Car Mileage Records

By A. O. KITTREDGE, F. I. A.

The keeping of car mileage records by street railway companies is by no means universal. Various large companies are entirely neglecting this branch of the statistics of their operations, while many of the smaller companies have not yet reached that point in their development where their managers assume that statistics of this kind would be sufficiently valuable to them to justify their cost. Among those companies which maintain careful systems for recording the mileage of their cars, several different reasons for doing so prevail. With some it has no other object in view than to record the life of wheels and other parts supplied by contractors and manufacturers, in order to be in position to hold them strictly to their guarantees. In other cases, while including this object, the reasons extend far beyond it. Where a complete car mileage record is kept, and properly systematized, so much light is thrown by it upon the operations of the road as to render it extremely useful in numerous directions. It becomes a most important part of the operating records of a road, affording the superintendent, and other officers as well, a basis for those calculations and statements of results that greatly influence the profits of the enterprise.

A brief survey of the practice of several companies may be of interest.

The basis of mileage in the Montreal (Canada) Street Railway Company is established by the car service called for, and the speed allowed under the company's franchise from the city. From this initial point the superintendent starts the work. He arranges his time schedule to meet requirements by placing on the different routes the necessary number of cars to furnish the service demanded. The engineer of the company having informed him of the exact length of each line that is operated, he is in position to accurately calculate the number of round trips a car should make at a given speed. In addition to furnishing the service required by the city authorities, which is called "regular," extra cars are placed in service at the busy hours of the day. The superintendent therefore arranges his schedule to show when these cars are to be put on, and when they are to be taken off. These schedules indicate what the car service should be, and, barring accident, what it is. By taking the number of cars and the trips, and the mileage per trip, the superintendent is enabled to arrive at what the mileage should be.

W. G. Ross, comptroller of the company, has sent for my inspection a number of the forms used by his company for recording mileage statistics. The actual number of cars, trips made and mileage are reported by the different roadmasters in charge, as well as by the timekeepers at the depots. The superintendent is also furnished with a report of the "pull-ins" during the day, and is always in position to furnish the comptroller's office with the actual mileage run, which mileage is checked in the comptroller's office and entered in the special record book provided. The blanks used include the roadmaster's daily report of the number of cars and trips for each line operated, the general report of "pull-ins," the daily report of rolling stock, the timekeeper's daily report, the report of cars and trips run, and the record of miles run by motors, extras, trailers and night cars. Another of the forms submitted is the daily comparative statement of earnings.

Mr. Ross has also supplied me with the superintendent's complete report for a day in the recent past. The first column on the left contains the names of the routes, with an indication of the miles per round trip. Then come the cars required and the trips required, following which are the cars actually run and the trips made, and the trips lost. Then is given the number of miles that were run, and finally a notation of the intervals maintained. Different sections of the report are devoted to regulars, extras, theatre extras, trailers, etc. The total miles run on the day that this report is dated is 21,598.

J. F. Calderwood, auditor of the Twin City Rapid Transit Company, Minneapolis, Minn., informs me that his company abandoned some four years since the keeping of the individual mileage of cars, except in instances where comparative tests or records of the efficiency of different kinds of apparatus, wheels, gearings, pinions, etc., are required, and where it is necessary to identify specifically with certain cars the kind of apparatus it is desired to test and to compute the individual mileage of those cars. He states that it is the rule with his company to figure each day the total mileage of the regular motors, extra motors and trailers of every line operated. From this there is determined the average earnings per car mile on each line, of the regular motors, extra motors, trailers, and all cars operated. The aim is to do this with the greatest possible accuracy.

From Mr. Calderwood's letter I gather that the car mileage of the Twin City Rapid Transit Company is figured by lines on the trip distances, which are obtained by actual measurements. The regular mileage, or the mileage of regular motors, is determined by multiplying the number of whole trips called for on the regular time card by trip distances, and adding thereto the distance of any parts of trips which are run to complete the regular time card. The foreman at the station makes out a report of each line daily, with the exception of the insertion of the mileage. As soon as these reports reach the general office, they are verified by the conductor's trip sheet and the several mileages are inserted in the mileage column. In case the time card is broken, the number of broken trips is checked by the conductors' trip sheets. The clerk who computes the mileage has several ways of verifying the accuracy of the report, and one of these is that the number of cars reported must agree with the number sent out on the register reports. In this way duplication is avoided.

I have the following from P. V. Burlington, secretary and auditor of the Columbus Street Railway Company, Columbus, Ohio:

"We treat our car mileage returns and account of mileage in a very simple way. The foreman of each line is furnished with exact measurement of distance constituting a round trip and with a blank sheet for reporting daily the number of each motor car and each trail car run, and the total mileage made, the mileage of the various cars added together making the total mileage of the line for the day. These reports are recorded at the office, using the totals only. To arrive at the actual number of cars run, the total mileage of that line is divided by the actual mileage made by one car in regular service, making the full schedule distance. The record book is footed at the end of the month, showing the total number of cars run. This total, divided by the number of days in the month, gives the average number of cars run daily. In like manner the total mileage, divided by days, gives the average daily mileage. Both of these are based on eighteen hours' service per day. The total mileage for the month is used in computing earnings and expenses per car mile."

I am indebted to N. C. Jelliff, auditor of the Denver Consolidated Tramway Company, Denver, Colo., for the following interesting particulars:

"I inclose you form No. 21, which illustrates our method of obtaining individual car mileage. For example, take Stout Street line for the day reported. Six and six-tenths is the average number of cars run for that day, eighteen hours being the car day. The length of the line is six and two-tenth miles. Thus 169 trips equal 1051 miles for the line on the said day. Now, for car No. 43, which made twenty trips of six and two-tenth miles each, the total is 124 miles. We keep the record of mileage by lines and by individual cars."

The practice of the Milwaukee Electric Railway and Lighting Company, Milwaukee, Wis., of which John I. Beggs is general manager and to whom I am indebted for general particulars, is as follows: The mileage is ascertained from the conductors' trip sheets, the total trips and fractional parts made by each conductor being carried from the trip sheet to an earnings statement. The latter groups the cars of the various lines. From it the returns are carried to the mileage record and also to an individual car mileage record. By this means there is shown the mileage of each car for the day, month or year, and the mileage of each line per day, per month or per year. The mileage record is in book form and the ruling and printing is somewhat peculiar. The heading of the different pages is left blank, thus making any page serve acceptably for any line. Each page is ruled vertically into five divisions for routes, spaces for the names of the routes being left blank, thus adapting it for any requirement. Down the first left hand column are enumerated the days of the month from 1 to 31 inclusive. In each route space is a column for regular cars, regular trips, extra cars, extra trips and trail cars and trips. Below the general form is space for a summary arranged under heads as follows: Mileage per round trip, time per trip, number of regular cars, regular trips week days, regular trips Sundays, miles by regular cars, miles by extra cars, miles by trailers and total miles. By this general arrangement of statistics the company is in position to make comparisons of any line with its record in previous years, and this, too, even though the route has been modified. The statistics also show the mileage of the trip which would give the difference in length of line operated between any given dates.

The Carbondale Traction Company of Carbondale, Pa., uses small printed forms which give the mileage from any one point on the road to any other point, and each conductor is supplied with a copy of such form. When a conductor takes a car and goes out on a regular run, he has a certain number of miles to make, but should he be delayed for any reason and get off his schedule time, or should an extra car be sent out for a special purpose, the conductor consults his mileage form and on his "conductor's report" notes the number of miles car has run. After his report is checked, it is copied on a daily passenger and car report book, and the total mileage of each car is placed in a special column thereon. The daily mileage record for each car is then posted in an ordinary time book opposite the car number and under the proper dates, and at the end of each week and month it is totaled up in red figures.

Standard System of Accounts

Late in May a circular letter was issued by the permanent committee of the Street Railway Accountants' Association having in charge the standard system of accounts. It was addressed, among others, to those who had replied to the postal card of the secretary of the association, sent out in January last, relative to the adoption of the standard system of accounting recommended at the last convention of the association. The letter set forth that thirty-one replies to the postal card were received by the secretary and turned over to the committee for its use. From these replies it appears that the standard system as recommended by the Niagara convention is in the main satisfactory, and that in its general features it very closely conforms to the system used by various street railway companies who are members of the Accountants' Association. This, together with the fact that a number of street railway companies, some of them among the largest in the country, put into practical operation on Jan. 1 last the standard system, as recommended by the association, and in the interval have found it practical and in the main satisfactory, is regarded as a cause for congratulation. This is also referred to as the first practical step taken to have a standard system of street railway accounting adopted and used.

The committee asserted in the letter that undoubtedly there is room for improvement in the system in some of the minor details, and mentions that some of those who replied to the inquiry have been so considerate as to point out in considerable detail their criticisms of and objections to the system, giving their reasons for the same, and that many also have presented ideas and suggestions of their own. In acknowledging this service the committee declare that it is just the kind of help that they most stand in need of. In the letter referred to they call upon those to whom it is addressed to co-operate with the committee and to give the members of it the benefit of their ideas and experience, with such criticisms as they may see fit to make. The committee assert that it is their ambition to do all in their power to perfect the standard system recommended by the association and to secure its adoption and use everywhere. They desire to have it indorsed and approved by the officials of every State in the United States who exercise any supervision over the books and accounts of street railway companies in their respective commonwealths.

C. N. Duffy, chairman of the committee, has called a special committee meeting to be held in New York (probably at the Waldorf-Astoria) July 18. It is probable that there will be in attendance at this meeting by invitation several representatives of State Railroad Commissions, whose co-operation in the establishment of a standard accounting system is earnestly desired by the committee.

A good idea of the inroads which are being made by interurban electric railways in the receipts of the steam railways, where the two compete for a short-haul traffic, is shown by recent statistics from St. Louis. The annual reports of the steam roads entering that city show, it is said, a reduction of 42 per cent over last year in the gross receipts from suburban and commutation traffic. This loss is attributed to the extension of electric railways into the territory formerly served exclusively by the steam lines.

The development of an active, intelligent, civic spirit, the practical exclusion of the most ignorant and purchasable classes from the lists of voters, and the absence of political influences in the matter of appointments, in foreign cities, are in brilliant contrast with our deficiencies in these respects.—From report of committee on "Municipal Ownership of Street Railways," read at the Niagara Falls Convention, 1897.

LEGAL NOTES AND COMMENTS*

EDITED BY J. ASPINWALL HODGE, JR., AND ROBT. H. ERNEST, OF THE NEW YORK BAR.

LIABILITY FOR NEGLIGENCE.

ARKANSAS.—1. Malicious Prosecution—Presumption—Principal and Agent.—A street car company is not liable for the acts of its conductor in prosecuting a passenger for violation of a city ordinance making it a misdemeanor for any person to ride on a street car without paying his fare, in the absence of express authority from the company to the conductor to make such prosecution.

2. It will not be presumed that because a street car conductor has authority from his company to put people off his car for refusing to pay fare, he has also authority to arrest and prosecute them therefor.—(Little Rock Trac. & Elec. Co. vs. Walker, 45 So. W. Rep., 57.)

GEORGIA.—1. Carriers—New Trial—Damages—Evidence of Similar Acts—Negligence—Stopping Cars at Crossing—Degree of Care by a Deaf Person—Appeal.—The relation of common carrier and passenger exists between a street railroad company and a passenger until he has reached his destination, and has had a reasonable opportunity to alight safely from the car; and the carrier, during this period, is bound to extraordinary diligence, on behalf of itself and its agents, to protect the life and person of the passenger.

2. This doctrine of extraordinary diligence is not only applicable to the agents of the carrier on the car on which the passenger is traveling, but also to its agents having control of another car, approaching on a parallel track, after the latter have discovered that the former car was about to stop for the purpose of discharging passengers, who might alight dangerously near such parallel track. It was therefore not error for the judge, in his charge to the jury, to apply this rule to the present case.

3. A harmless answer to an illegal question is not ground for a new trial.

4. For the judge to instruct the jury, in his charge, that he permitted such a question and answer for a certain purpose, without intimating what had or had not been testified to or proven upon the subject, is not reversible error.

5. In an action for damages for injuries to the person, where it is claimed by the plaintiff that his capacity to earn money has been diminished one-half, it is not error for the court to admit testimony as to the value of plaintiff's services, before the injury, in the particular occupation he was then following.

6. The habit or practice of the plaintiff in departing from the cars on other occasions, either before or after the injury complained of, is not admissible testimony for the purpose of illustrating his conduct at the particular time under investigation.

7. Where it was alleged by the plaintiff in his petition that "the defendant, well knowing that it was dangerous to allow passengers to alight from a car on the side next to that from which another car was approaching, nevertheless took no steps to prevent passengers from alighting," it was not error to admit testimony showing that the defendant had placed no ropes, guards, or other protection to prevent passengers from alighting on that side of its car next to said parallel track; the question as to whether such omission amounted to negligence being left entirely to the jury.

8. A rule of the defendant company requiring its motormen to keep their cars under full control on approaching all street crossings, and, when there is a car standing at a crossing, taking on or letting off passengers, or if they see that they are about to meet a car on a street crossing, to slow up and see that the track is clear before attempting to pass, was admissible in evidence, as tending to show that the company regarded such a point on its line, when being approached by one of its cars, as more or less dangerous to passengers and others.

9. Where it appeared from the testimony that the hearing of the plaintiff was impaired, and it was inferrable that for this reason he did not hear the approaching car that struck him, it was not error for the court to charge the jury that "the fact that he was partially deaf, if such was the fact, would not affect or lessen the degree of care required of him; that care being the degree of care that every prudent man would exercise under the same or similar circumstances."—(Atlanta Consol. St. Ry. Co. vs. Bates, 30 S. E. Rep., 41.)

LOUISIANA.—Injury at Railroad Crossing.—Persons manning and operating street cars are expected to be careful at the crossings. The company must exercise reasonable care to provide men enough to properly control a train consisting of a motor car and a trailer. At deep grades leading to railroad crossings, there should be a motorman and conductor aboard the train, and in charge. There was only a motorman. The injuries occasioned by the collision between the street cars and the passing train at the crossing were injuries for which the defendant company must be held responsible in damages.—(Flournoy et ux. vs. Shreveport Belt Ry. Co. et al., 23 So. Rep., 436.)

MAINE.—1. Collision with Traveler—Proximate Cause—Contributory Negligence—Question for Jury.—Generally, it is a defense to an action of tort that the plaintiff's negligence contributed to produce the injury. But, where the negligent acts of the parties are distinct and independent of each other, the act of the plaintiff preceding that of the defendant, it is considered that the plaintiff's conduct does not contribute to produce the injury, if, notwithstanding his negligence, the injury could have been avoided by the use of ordinary care at the time by the defendant.

2. The contributory negligence of an injured party that will defeat a recovery must be such as proximately contributed to the injury.

3. A person may recover damages for an injury caused by the negligence of the defendant, although the negligence of the plaintiff first exposed him to the risk of injury, if such injury was proximately caused by the defendant's negligent act, committed after he had become aware of the plaintiff's danger.

4. If one discovers another to be negligent, he must take precautions accordingly, omitting which he is liable to the other for the damages which flow from such new want of care.

5. In this case the jury found that, by the exercise of reasonable and ordinary care and caution on the part of the motorman a street railway car might have been so managed as to avoid a collision with the plaintiff's team. Held, that this finding is peculiarly a question of fact within the province of the jury; and the law court declines to set aside a verdict for the plaintiff.—(Atwood vs. Bangor O. & O. T. Ry. Co., 40 Atl. Rep., 67.)

MARYLAND.—1. Accidents to Persons on Track—Negligence—Questions for Jury—Trial—Instructions—Evidence.—A verdict cannot be directed for defendant, in an action for negligence, when the evidence would support a verdict for plaintiff, although such evidence is contradicted.

2. Where a street car approached at a high rate of speed the place where several boys were standing on the track in full view of the motorman, without giving an alarm, the question of the company's negligence was for the jury.

3. Where one injured by a street car near the intersection of a street had been standing in the center of the track for three or four minutes, and the motorman had had an unobstructed view all the way from the street last passed, the question whether the motorman used due care to avoid the accident was for the jury.

4. The negligence of plaintiff in an action for injuries will not excuse defendant if, by the exercise of due care, he could have avoided the accident.

5. If one standing in the street at the side of the track when a car approaches, and not in its way, stumbles and falls under the car the company is not liable, although the car approaches without giving alarm.

6. Where the court correctly instructed that defendant's failure to provide a fender on its street cars was no ground for holding it responsible for the accident, it was not error to refuse to strike out testimony that there was no fender on the car, brought out by defendant's cross-examination of a witness while endeavoring to cast doubt on her account of the accident.

7. Where plaintiff was injured by a street car through the alleged negligence of the motorman, it was error to reject evidence whether the motorman could see plaintiff in the position he was in before the accident.

8. In an action for injuries caused by being run over by a street car, where defendant's theory was that plaintiff was injured while attempting to steal a ride by hanging to the side of the car, it was error to refuse to allow the master mechanic of defendant's street car system, who had charge of the rolling stock, to testify that plaintiff could so ride on the car.

9. Evidence was not admissible, however, to show that one might so ride on other of defendant's cars than the one that ran over plaintiff.—Baltimore City P. Ry. Co. vs. Cooney, 39 Atl. Rep., p. 859.)

MASSACHUSETTS.—Collision—Contributory Negligence.—At 11 P. M. plaintiffs were driving in a wagon slowly through a

* Communications relating to this department may be addressed to the editors, Johnston Building, 30 Broad Street, New York.

street, alongside of the tracks, when an electric car came up from behind and struck the wagon, causing the injuries complained of. One of the plaintiffs testified that he saw the car coming and thought there was room enough for it to pass without striking the wagon, and another testified that he did not see or hear it till it was upon them; and there was evidence that the car came at a high rate of speed, without sounding the gong. Held, that plaintiffs were entitled to go to the jury on the question of their own due care.—(Raymond et al. vs. Lowell, L. & H. St. Ry. Co., 49 N. E. Rep., 927.)

MASSACHUSETTS.—Accident to Child on Track—Contributory Negligence.—Carelessness of child eight years old, who, with his view unobstructed, runs directly in front of approaching car, which could be plainly heard, prevents recovery for his death.—(Morey vs. Gloucester St. Ry. Co., 50 N. E. Rep., 530.)

MASSACHUSETTS.—Injury to Railroad Employee.—Laws 1887, c. 270, §1, cl. 3, making the employer liable for injuries to an employee resulting from negligence of a fellow employee in charge of a "locomotive engine or train upon a railroad," relates to those operated, or originally intended to be operated, to some extent by steam, and does not include electrically propelled cars on street railways.—(Fallon vs. West End St. Ry. Co., 50 N. E. Rep., 536.)

MINNESOTA.—1. Injury to Passengers—Care of Motorman—Damages—Permanent Injuries.—Held, the evidence will sustain a verdict for the plaintiff.

2. The plaintiff, a passenger, was injured while attempting to board one of the defendant's street cars, and claims she was injured by the negligence of the servants of defendant in charge of the car. Held, following Fonda vs. Railway Co. (Minn.), 74 N. W., 166, it was error to charge the jury that they may consider facts proven as to the competency or incompetency of the trainmen, which tend to show that the act in question was not done by the motorman in a reasonably careful manner.

3. Held, the plaintiff is not entitled to recover for permanent injury, unless there is reasonable certainty that the injury is permanent. Measured by this rule, a certain part of the charge is held to be erroneous. Whether such rule is a correct one to apply on the introduction of evidence, quaere.—(McBride vs. St. Paul City Ry. Co., 75 N. W. Rep., 231.)

NEBRASKA.—1. Injury to Passenger—Contributory Negligence—Diligence Required—Evidence.—One cannot recover for an injury received while a passenger on a street railway if the accident from which the injury resulted was due in part to his own want of ordinary care.

2. And in an action to recover damages in such case, an instruction which informs the jury that, the injury being shown, the carrier, to escape liability, must prove that the passenger was guilty of gross contributory negligence, is erroneous.

3. Street railways are common carriers of passengers, and as such are required to exercise the utmost skill, diligence, and foresight, consistent with the business in which they are engaged, for the safety of their patrons; and they are liable for the slightest negligence.

4. In an action for damages for an injury received while being transported by a common carrier, the injury being shown, the burden of proof is upon the carrier to show that it was in no wise at fault.

5. Section 3, c. 72, Comp. St. 1897, providing that "every railroad company, as aforesaid, shall be liable for all damages inflicted upon the person of passengers while being transported over its road, except in cases where the injury done arises from the criminal negligence of the person injured," etc., has no application to street railways.—(Lincoln St. Ry. Co. vs. McClellan, 74 N. W. Rep., 1074.)

NEW YORK.—Operation—Care Required.—The obligation of carriers of passengers to exercise the highest degree of care which human prudnce and foresight can suggest only exists with respect to those results which are naturally to be apprehended from unsafe roadbeds, defective machinery, imperfect cars, and other conditions endangering the success of the undertaking; but, in the operation of a street railway, such a carrier is required only to use that degree of skill and care which would be required of an ordinarily careful and prudent man.—(Stierle vs. Union Ry. Co., 50 N. E. Rep., 419.)

NEW YORK.—Injury to Foot Traveler.—At the trial of an action to recover damages for personal injuries due to the alleged negligence of the defendant, it appeared that the plaintiff, a boy five years old, in company with an older boy, was passing over Sixth Avenue at a crossing, and waited between the car tracks for a truck to pass. While thus waiting, one of defendant's cars, distant from 20 to 40 feet, approached, and one of its horses struck plaintiff just before he got across the track. There was evidence that the car was then still proceeding very rapidly, and that the driver was urging his horses on. Held, that the evidence would have warranted a verdict for plaintiff, and that the dismissal of the complaint was error.—(Gumby vs. Metrop. St. Ry. Co., 51 N. Y. Suppl., 553.)

NEW YORK.—Imputed Negligence.—A gratuitous passenger, riding with the owner of the vehicle, and taking no part in the management of the horse, is not rendered chargeable with the driver's negligence merely because he makes suggestions concerning the route to be taken.—(Zimmerman vs. Union Ry. Co., 51 N. Y. Suppl., 1.)

NEW YORK.—Personal Injuries—Damages—Evidence.—At the trial of an action to recover damages for personal injuries resulting from the negligence of defendant, the plaintiff, who was engaged on a somewhat extensive scale in manufacturing and selling mattresses and pillows and selling iron bedsteads, and who employed five workmen, was permitted, against defendant's objection, to testify to the gross receipts of his business the year prior to the accident, and to a subsequent reduction in his profits. Held, that as it was apparent that the business involved an investment of capital, and that the receipts or profits did not depend entirely upon plaintiff's personal services, and were necessarily uncertain and speculative, they furnished no basis for an award of damages resulting from his personal injuries, and the admission of the testimony was error.—(Blate vs. Third Ave. R. Co., 51 N. Y. Suppl., 590.)

NEW YORK.—1. Injury to Passenger—Presumption of Negligence.—In an action to recover damages for personal injuries suffered by the plaintiff while a passenger on one of the defendant's cars, it appeared that the accident took place at a terminal point of the road, upon a descending grade, at the foot of which another car was being shifted from one track to another, and where the two cars collided. Held, that the occurrence was in and of itself of such a character as to raise a presumption of negligence, without any further proof than that of the situation and of the occurrence itself.

2. Burden of Proof.—The court charged the jury that, under the circumstances, the law imposed on the defendant "the burden of showing to the jury such facts as warranted the jury in concluding that the defendant exercised due care in the construction of its road, in the management of its cars and horses, to prevent accidents." Held no error, certainly in view of the additional specific charge that the "burden of proof" rested on the plaintiff from first to last, and that she was bound to prove by a preponderence of evidence the existence of negligence on the part of the defendant, and that such negligence was the proximate cause of the injury.—(Kay vs. Metropolitan St. Ry. Co., 51 N. Y. Suppl., 724.)

NEW YORK.—Injury to Traveler—Contributory Negligence.—The plaintiff, a boy eleven years of age, attempted to cross a city street between street crossings. When he left the curb, a street car was only two or three houses away, and was approaching fast, and he was struck before he got across the track. The car was stopped almost instantly. Held, upon the evidence, that there was no negligence on the part of defendant, and that plaintiff was guilty of contributory negligence.—(Ledman vs. Dry Dock & E. B. & B. R. Co., 50 N. Y. Suppl., 896.)

NEW YORK.—Injury to Passenger—Instructions.—In an action against a surface railroad company to recover for injuries received by a passenger in alighting from one of the defendant's cars, the evidence was such that it inevitably followed either that the car had actually come to a standstill, and was then suddenly started as plaintiff stepped off, or that, without notifying the conductor, she tried to jump off while it was actively proceeding onward. The judge charged the jury that, if plaintiff attempted to alight "at a place where it was not usual to stop," while the car was in motion, she took the chances. Defendant's counsel objected to the qualification contained in the words quoted, and requested a modification in that respect, which was refused. Held, in view of the clear-cut issue presented, that this was error, as there was no intermediate status, as matter of fact, to which the charge could have applied.—(Kelly vs. Third Ave. R. Co., 50 N. Y. Suppl., 426.)

NEW YORK.—1. Defective Tracks—Injury to Pedestrian.—A pedestrian has a right to assume that street car tracks are in a reasonably safe condition at a particular point, where there is no defined crossing, though the railway company might not have anticipated that he would be liable to cross there; but in crossing he must use due care and caution.

2. Same—Duty of Company.—A street railway company must

lay and maintain its tracks in a reasonably safe manner at a particular point, though it might not have anticipated that pedestrians would be liable to cross there, and is liable for injuries resulting from a failure to do so.—(Wiley vs. Smith et al., 49 N. Y. Suppl., 934.)

NEW YORK.—Injury to Person on Track.—Contributory Negligence.—The plaintiff, an infant eight years old, in attempting to cross the easterly or uptown track of defendant's street railway, from the west, was struck by the westerly side of the front of the car just as he stepped on the first or westerly rail, and was injured. The car had been proceeding very slowly, behind a wagon, and just before the accident the wagon turned off from the track; and the motorman, while continuing an altercation with the driver of the wagon, and while looking to the east, suddenly increased the speed of the car, which shot ahead and struck the plaintiff. Plaintiff had been running diagonally across the avenue, in the middle of the block; and it was doubtful whether he saw the car, though there was nothing to obstruct his view. Held, that plaintiff was guilty of contributory negligence, as matter of law.—(Costello vs. Third Ave. R. Co., 49 N. Y. Suppl., 868.)

NEW YORK.—1. Injury to Passenger—Evidence.—In an action to recover damages for injuries received by plaintiff through the alleged negligence of the defendant, the plaintiff's version of the facts was that she was a passenger on one of the defendant's cars, and, upon her signal, the car was stopped, but that as she was alighting the car started suddenly, and threw her in front of a moving heavily loaded truck. Defendant's version was that she had completely alighted when the truck wedged her in, threw her down, and injured her. Held, on a review of the evidence, that the finding by the jury of defendant's negligence was sufficiently supported.

2. Same.—Held, further, that it could not be concluded, because the place where she endeavored to alight happened to be dangerous, that she was bound to know the exact location of the truck, and was obliged to proceed on the car to some other point.

3. Trial—Instructions—General Exception.—Where the trial judge, in charging the jury, clearly states the necessity of plaintiff's showing absence of contributory negligence, his mere failure to reiterate that principle, in stating the law in other portions of the charge, cannot be availed of under a general exception to the charge.

4. Same.—Where, upon a trial, no claim for punitive damages had been asserted or referred to, and none was within the issue and the judge more than once charged that the damages were to be only compensatory, and the amount of the verdict was moderate, held, that his refusal to charge, in terms, that punitive damages were not to be awarded, did not constitute reversible error.—(Norton vs. Third Ave. R. Co., 49 N. Y. Suppl., 897.)

NEW YORK.—1. Contributory Negligence—Evidence.—The absence of contributory negligence may be shown from facts and circumstances, as well as by direct testimony of a witness.

2. Negligence of Passenger.—It is not negligence per se for a passenger to ride on the front platform of a street-railway car.

3. Care of Driver.—The fact that a passenger is standing upon the front platform of a street-railway car, and thus exposed to the danger of being thrown off by the sudden striking of the car, in rapid motion, against a temporary turnout, requires the driver, advised of the situation, and having the car under his control, to use care for the safety of the passenger.—(Dillon et al. vs. Forty-second St., M. & St. N. A. R. Co., 51 N. Y. Suppl., 145.)

NEW YORK.—Injury to Child—Negligence.—In an action to recover for the loss of services of plaintiff's daughter, through injuries alleged to have been caused by the negligence of defendant railroad company, it appeared that an electric car belonging to defendant, in charge of a motorman newly employed, but not inexperienced nor incompetent, was approaching a crossing at the rate of speed usual in rural districts; that when about 50 or 75 feet from the crossing several little girls, including plaintiff's daughter, a child of 7 years, were seen near the crossing; that they immediately began to run over the crossing, and all reached the other side in safety, except plaintiff's daughter, who caught her foot or tripped, and fell; that as soon as she fell the motorman shut off the power, and applied the brake, and stopped the car before it had entirely passed the child, who lay beside the track, but that a part of the running gear struck and injured the child's foot. Held, that the evidence did not justify the submission to the jury of the question of defendant's negligence.—(Stableman vs. Atlantic Av. R. Co., of Brooklyn, 50 N. E. Rep., 277.)

NEW YORK.—1. Injury to Passenger—Contributory Negligence.—The plaintiff, while riding on a step of the platform of one of defendant's cars which was crowded with other passengers, was thrown off by a sudden lurch of the car in turning a curve at the foot of a sharp incline. Held, that whether it was contributory negligence, under the circumstances, for the plaintiff to assume the position that he did, was clearly a question for the jury.

2. Duties of Carrier.—Held, further, that the defendant, receiving plaintiff as a passenger, and permitting him to stand on the step, owed a duty to take reasonable care that he was not exposed to unnecessary danger.—(Schaefer vs. Union Ry. Co., 51 N. Y. Suppl., 431.)

NEW YORK.—1. Negligence—Evidence.—The bursting of a fly wheel purchased from manufacturers, and for two years used on an engine which generated electric power, is not prima facie evidence of negligence.

2. Same—Nuisance.—In an action for the death of plaintiff's intestate, caused by the bursting of the fly wheel attached to an engine used to generate electricity, where plaintiff attempts to show that the maintenance of the wheel was a nuisance, such evidence must in some way relate to the construction or maintenance of the machinery which caused the accident.

3. Same—Expert Evidence.—Where the general manager of an electric railway had devoted much attention to the operation of such railways, but had not given attention to the liability of fly wheels attached to engines, used to generate the electricity, to burst, an objection to his testifying to the cause thereof is properly sustained.

4. Same—Evidence.—In an action for the death of plaintiff's intestate caused by the bursting of a fly wheel attached to the engine, the mere fact that on the day previous to the accident the engineer carried a stick of timber into the engine house, and laid it alongside the engine whose fly wheel exploded, saying that he wished to prop the engine up, is too meager to permit an inference that the accident was caused by defects in the engine.

5. Nonsuit—Inference.—Where plaintiff is nonsuited she is only entitled to such inferences of fact in her favor as her evidence fairly tends to support.

6. Same—Inferences Against Prevailing Party.—In case of nonsuit, no inferences can be indulged against the prevailing party unless he has been called upon to produce evidence in his possession, and has refused to do so, or the case has assumed such an attitude that his silence may be attributed to fear to speak.

7. Negligence—Evidence.—Where plaintiff's intestate was killed by the bursting of a fly wheel attached to an engine in defendant's power house, used for generating electricity, the absence of an electrical engineer is no evidence of negligence, where there is no evidence to show that his presence would have prevented the accident.—(Piehl vs. Albany Ry., 51 N. Y. Suppl., 755.)

CHARTERS, ORDINANCES, FRANCHISES, ETC.

CALIFORNIA.—1. Municipal Corporations—Streets—Change of Grade—Damages—Agency.—In an action against a city for damages, expressly based on an alteration in the grade of a street made by the city, a recovery cannot be had for damages resulting from the construction of a street railroad by a railway company.

2. In an action against a city for damages to property caused by a change in the grade of a street, where a street railroad company had constructed its roadbed along the street with reference to such changed grade, in compliance with the requirement that its tracks should be constructed on the official grade, plaintiff's damages are limited to the difference in value of his property as it existed with the railroad on the street and as it existed when the grade was completed by the city.

3. Where a street railway company, for its own pecuniary advantage, lays its track on streets whose grade has been established by ordinance, but which the city is not prepared to grade, and perhaps will never have occasion to construct, the railway company is liable for damages occasioned by such work to abutting property.

4. A street railway company which constructs its roadbed in a street in accordance with the change of grade in the street for its own pecuniary advantage is not the agent of the city in such transaction.—(Bancroft vs. City of San Diego, 52 Pac. Rep., 712.)

ILLINOIS.—1. Injunction—Bill—Parties.—Where a bill to enjoin defendant from constructing an electric street railroad in certain streets in a city, though filed in form by the attorney-general in behalf of the people of the State, was not filed for the purpose of asserting any public right, or protecting any public interest in the street, but was filed at the instance of rival railway companies, it was properly dismissed.

2. To determine whether a bill for an injunction is properly brought, a court of equity may go behind the parties of record, to see who are the real parties prosecuting the proceeding, though

the proceeding is in the name of the attorney-general.—(People ex rel. Moloney, Atty.-Gen., vs. General Elec. Ry. Co. et al., 50 N. E. Rep., 158.)

KENTUCKY.—1. Eminent Domain—Turnpike Roads—Damages—Additional Servitude—Appropriation of Land.—The owner of land abutting on a turnpike road on which was constructed, at grade, a street railway track, was entitled to no compensation for such use of such turnpike road, merely because his property was affected by the proximity thereto of such railway track, without proof of special damage resulting therefrom.

2. It was proper, in an action for damages for the appropriation, by a street railway company, for the use of its track, of land belonging to plaintiff, where the proof was conflicting, to submit such issue to the jury.—(Ashland & C. St. Ry. Co. vs. Faulkner, 45 S. W. Rep., 235.)

NEW JERSEY.—1. Crossings—Injunction—Compensation—Notice.—One street car company cannot restrain another from crossing its track on the ground merely that the extension of defendant's street railroad on the proposed route is unauthorized by law.

2. A street railway company is not entitled to compensation for mere interruption of its road during the time another company is constructing a crossing over its tracks.

3. The question of complainant's right to compensation for the privilege of crossing its street car tracks will be determined on an application for a preliminary injunction to prevent its tracks being crossed by another company, where complainant was in actual use of the property, and all the facts relating to the existence of defendant's right to interfere were fully presented on the application.

4. A street railroad company operating the trolley system along a public street is not entitled to compensation for the construction of a crossing over its tracks by another company duly authorized, where such crossing, when properly constructed, will not interfere with the exercise of its franchise, although it neeessitates some actual interference with the tracks and wires as constructed, and changes complainant's exclusive use at the crossing.

5. Where the right to construct a crossing over the tracks of a street railway company exists, a court of equity will control its construction and operation on application of either party.

6. Where one has a right to construct a crossing over the tracks of a street railway company, he must give notice of the time and manner of its construction.—(Consolidated Trac. Co. vs. South Orange & M. Trac. Co., 40 All. Rep., 15.)

NEW JERSEY.—1. Franchises—Forfeiture—Use of Streets—Injunction—Adequate Legal Remedy.—A street railway company forfeited its right to use streets by failing to comply with an ordinance requiring that its plans for overhead wires be submitted to the township committee for approval, and that it complete its road within a year. It applied for a new franchise, and the committee assured the company that its consent would be granted upon certain terms to which the company agreed. Construction of the road progressed without objection, and poles were located with the consent of the majority of the committee acting individually. The company, fearing that a rival company would interfere, hurried its road to completion between Saturday night and Monday morning. Held, that further construction and operation of the road would be enjoined until the consent of the committee could be obtained.

2. Where a street railway company, without authority, seized a highway for the construction of its road, a remedy by indictment did not furnish such an adequate remedy at law as prevented the court from enjoining further construction and operation of the road until consent of the Township Committee could be obtained.—(Grey, Attorney-General, et al. vs. New York & P. Traction Co., 40 Atl. Rep., 21.)

NEW YORK.—1. Statutes—Title—Constitutionality.—Laws 1863, c. 361, authorizing the construction of street railways in certain towns, is not unconstitutional, as embracing more than a single subject, when but one section, which provides for the extension of the road, relates to a subject not mentioned in the title, and such section is capable of being declared unconstitutional independent of the rest of the act.

2. Same—Amendment.—Laws 1892, c. 340, amending Laws 1863, c. 361, entitled "An act to authorize the construction of railways and tracks in the towns of West Farms and Morrisania," by providing for the consolidation of railroad corporations authorized by the act of 1863, is not unconstitutional, as the amendment is within the reasonable scope of the subject contained in the title of the original act.

3. Same—Creation—Special Act.—Laws 1892, c. 340, providing for the consolidation of railway corporations, is not unconstitutional, as creating a railroad by a special, instead of a general, law.

4. Same.—An act creating a railway corporation is not rendered unconstitutional by the act of the corporation in constructing a road not authorized by its charter.

5. Same.—Corporations formed under Laws 1863, c. 361, were consolidated under an amendment thereto. Held, that the amendment was not unconstitutional on the ground that it dissolved the original company and created a new corporation with a different name.

6. Construction.—Laws 1863, c. 361, authorizing the construction of a street railway, required that the road be completed within twelve months. With the exception of extensions authorized by one section of the act, the road was completed as required. Held, that Laws 1850, c. 140, § 47, requiring railroads to be completed within ten years, had no application to those portions of the road completed as required by the act authorizing its construction.

7. Charter—Forfeiture.—A street railway company's charter was not forfeited because it failed to complete its line within ten years as required by Laws 1850, c. 140, § 47, when more than ten years after the passage of an act authorizing the construction of the road the legislature, by enactments, recognized the existence of a corporation formed under it, and ratified all proceedings of the company under the act and its amendments.

8. Operation—Local Authorities.—A railway corporation obtained the consent of the Common Council to operate its lines as required by Laws 1892, c. 676, §§ 91, 92. Held, that the company's existence was not affected by its failure to get the consent of a local authority which had not been created at the time of the passage of the act requiring such consent.—(Bohmer vs. Haffen et al., 50 N. Y. Suppl., 858.)

NEW YORK.—Nuisance—Evidence.—An indictment against a street railway for maintaining a nuisance, in that it ran its cars at a dangerous rate of speed around a curve at a street intersection, is not sustained by evidence that in the course of two years twelve or fifteen accidents occurred at such place, when there is nothing connecting defendant with the accidents.—(People vs. Metropolitan Traction Co. et al., 50 N. Y. Suppl., 1117.)

Thomas on Negligence *

The shelves of the loss department of a street railway company can have no better book upon them upon the subject of negligence than the work published some two years ago by Edward B. Thomas of the New York Bar. It has not heretofore been noticed in these columns, and we are the better able to give a deliberate judgment as well as a review of the work for that very reason.

The work is not equal to some of the learned treatises upon this subject which can be found in our law libraries and upon the shelves in our law offices, if measured by the standard of original thinking and logical discourse upon the fundamental questions involved, but the work is pre-eminently a practical one, which has been forged out of the daily experience of the author both in and out of court, and is constructed for everyday use.

It is a model of condensation, and, while no subject seems to have been omitted, there has been a careful study of proportion. The index is admirable, and this, for the uses to which such a book is ordinarily put, constitutes one-half the value of the volume.

That portion of the work which is especially devoted to streets and to street railways is especially to be commended for its thoroughness. Perhaps no other subject in the law is more difficult to fully present for use between the covers of a single work in practical form, because of the wealth of material in rules, decisions and opinions which crowd the pages of all the reports during recent years.

We have had occasion in a previous number of the JOURNAL to note the enormous increase in the number of cases brought against street railway companies on account of negligence. Many of these are utterly worthless, having been overruled or superseded, or growing out of such peculiar sets of facts that they do not form precedents for other cases, and here the herculean task of sifting the wheat from the chaff has been most ably performed in the work under consideration.

In New York the book is especially valuable, since the author has compiled a chronological digest and topical arrangement of all the decisions of the Court of Appeals of the State, together with all the unreviewed decisions of the General Term of the Supreme Court.

*Negligence, Rules—decisions—opinions by Edward B. Thomas, of the New York Bar. Banks & Bros N. Y.—Albany.

Meeting of the National Electric Light Association.

The twenty-first annual convention of the National Electric Light Association, which was held in Chicago June 7, 8 and 9, was one of the most successful and profitable meetings which the Association has ever held. About 250 delegates and visitors were present and they greatly appreciated the interesting papers presented and the valuable discussions which took place, and also enjoyed the kind hospitality of the fraternity in Chicago. The sessions of the Association were held in the banquet hall of the Auditorium Hotel, and a more suitable and attractive place could not have been selected for the meetings. The first day's session was called to order by President Samuel Insull, of Chicago. Mr. Insull delivered an excellent address, which was fully appreciated by the delegates, and a paper was presented on "The Cost of the Generation and Distribution of a Unit of Electricity," by Calvin W. Rice, of Brooklyn. Papers were also read on the following topics: "Prices and Discount for Electric Current and Methods of Applying Current to Customers"; "Public Lighting with Relation to Public Ownership or Control"; "Legislative Policy as to Public Service Corporations."

At the second day's session papers were read on "General Distribution from Central Stations by Alternating Currents," by Herbert A. Wagner, of St. Louis, and "General Distribution from Central Stations by Direct Currents," by Louis A. Ferguson, of Chicago. The papers were read by the respective authors. Following the reading of these papers a very interesting discussion took place, in which many of the prominent central station men took part. The general opinion of the convention seemed to be that it was best to use a direct current for distribution, but a great saving could be effected by alternating current transmission over considerable distances. The lack of a suitable motor was a serious barrier to the application of alternating current for power purposes. While it would hardly pay to change the machinery in the large central stations now furnishin gcurrent, the stations in the future will have alternating current generators and the current will be transmitted to the vicinity to be used, and there converted to direct-current for local distribution.

On the evening of the second day Joseph Wetzler delivered a lecture on "Electricity Direct from Coal," which was illustrated with stereopticon views.

At the third day's session a paper was read by W. McLea Walbank, of Montreal, on "The Cost of Producing Electric Power by Water Power from the Lachine Rapids, Canada." The discussion was entered into by a number of gentlemen, after which a paper was ready by Winder Elwell Goldsborough, on "Transformer Economy," which was also discussed at some length. At the afternoon's session of the same day the reports of committees were received, and the following officers were elected for the ensuing year: President, A. M. Young, of Waterbury, Conn.; first vice-president, E. H. Rollins, Denver, Colo.; second vice-president, F. A. Gilbert, Boston, Mass.; secretary and treasurer, George F. Porter; master of transportation, C. O. Baker, Jr.; executive committee, Samuel Insull, Samuel Scovil, E. H. Atkinson, F. A. Copeland, John A. Seely, A. J. De Camp, E. H. Stevens, W. W. Bean and W. McLea Walbank. The convention adjourned sine die.

SOME EXHIBITORS AT THE ELECTRIC LIGHT CONVENTION.

The Westinghouse Electric & Manufacturing Company had headquarters at the Auditorium, decorated in the national and Cuban colors. The exhibit consisted of a line of photographs of machinery installed by the Westinghouse Company. The representatives who helped to sustain the reputation of their house for hospitality were: F. H. Taylor, Arthur Warren, A. S. Morris, Maurice Coster, Henry Floy, W. S. Rugg, C. W. Regester and T. J. McGill.

The Electric Storage Battery Company, of Philadelphia, through its Western agent, Frank H. Clark, issued to all visitors and members attending the convention an engraved invitation to inspect the largest storage battery in the world, installed for the Chicago Edison Company.

The Rockwood Manufacturing Company, of Indianapolis, through G. O. Rockwood, showed the visitors some paper pulleys, for which this company is famous.

The Swarts Metal & Refining Company was very much in evidence, and members and visitors will not forget its genial president, Seymour Swarts. This firm, as is well known, handles large quantities of worn out trolley wire, all sorts of brass and copper scrap, and is the manufacturer of a high grade Babbitt metal.

A. O. Schoonmaker, of New York, was represented by John Childs, his Western agent. Mr. Childs displayed over the main stairway of the hotel an immense sheet of mica.

A. L. Ide & Son, Springfield, Ill., were present in the person of their Chicago manager, Enos Bookwalter, who cared for the interests of the well known Ide engine.

The Miller-Knoblock Company, of South Bend, Ind., that is making a specialty of street railway commutators and the winding of armatures for street railway motors, reported through its representative, A. W. Morrell, who spent a short time at the convention, that the company is running its works full time with more business than it can attend to with present facilities.

The Crane Company, Chicago, as usual, was represented by G. A. Hurd, so well known to convention goers.

The Dearborn Drug & Chemical Works, of Chicago, distributed a red, white and blue cap to convention goers. This is the largest firm in the world which is devoting itself to the prevention of scale in boilers, and by going into the subject in a scientific way has built up a tremendous business. They analyze the boiler feed water and discover what will neutralize the scale producing element in any particular kind of water and prescribe accordingly, just as a physician prescribes for a patient. They have long since exploded the old theory that one boiler compound will do for all kinds of feed waters.

The Central Electric Company had a goodly force present in the persons of George A. McKinlock, president; Charles E. Brown, secretary; Charles G. Burton, W. P. Upham and C. W. Cobb, who presented the visitors with an aluminum ash tray as a souvenir of the occasion.

Meysenburg & Badt, of Chicago, were represented by F. B. Badt, R. F. Schuchardt, William Goltz and O. W. Meysenburg. The firm name was new to convention goers; the representatives, however, have long been known in the electrical field and needed no introduction.

The Electrical Exchange, of Chicago, had its interests cared for by its president, T. S. Lane, and H. H. Hornsby. Mr. Lane has built up a very large business in second hand electrical equipment.

Leschen, Macomber, Whyte & Company gave their friends a neat notebook by way of a souvenir. George Whyte did the honors for the company.

The W. R. Garton Company, of Chicago, was another new firm, whose president. W. R. Garton, needed no introduction to convention goers.

The Valentine-Clark Company, of Chicago, who, as everybody knows, is one of the big producers of ties and poles, was in evidence in the persons of both Mr. Valentine and Mr. Clark.

The General Electric Company had a large number of representatives, including A. D. Page, J. Dalzell, H. H. Crowell, W. S. Andrews, F. M. Kimball, I. R. Prentiss, W. J. Hanley, W. F. Hays, J. H. Livsey, George D. Rosenthal, P. A. Clisdell, J. J. O'Brien, W. H. Colman, S. F. Dibble, H. T. Windsor, G. H. Atkin, A. J. Gifford, O. E. Turner, E. C. Noe, J. W. Johnson, J. W. Buel, G. J. Cadwell, W. J. Ferris, W. S. Arnold, J. Scribner, T. P. Bailey, F. N. Boyer and B. E. Sunny.

The Wagner Electric Manufacturing Company, of St. Louis, had headquarters at the Auditorium, and an exhibit of indicating instruments, etc. The company was represented by W. A. Layman, E. H. Abadie, S. E. Johannesen, E. S. Pillsbury, John Mustard and H. A. Wagner.

J. Holt Gates & Company, of Chicago, Ill., were represented by J. Holt Gates, George B. Foster and C. H. Philbrook. This firm handles the apparatus of the Walker Company, of Cleveland, Ohio; of the Wagner Electric Manufacturing Company, of St. Louis, Mo., and the Card Electric Company, of Mansfield, Ohio. It reports the sale last month of 1900 k.w. of generators, besides numerous switchboards, street railway equipment and other electrical details. The Walker, Wagner and Card companies have never before been so busy in their history as at the present time, working their forces day and night.

Eugene Munsell & Company, and the Mica Insulator Company, of New York and Chicago, were represented by Chas. E. Coleman, manager of the two concerns in the West. The companies' blotters were distributed freely at the writing rooms and various headquarters of the different companies represented at the Auditorium during the convention.

The Walker Company, of Cleveland, Ohio, was represented by J. Holt Gates, Geo. B. Foster, C. H. Philbrook and F. H. Talbot, of the Chicago office. Many of the delegates were interested in the new alternating system of the Walker Company, as well as in its new solenoid blow-out controller; also the "I," type of street railway motor of 150 h.p., twenty of which are being supplied to the Metropolitan Elevated Railway, of Chicago. Many of the visitors called at the new sta-

tion of the Chicago City Railway, which is designed for fifteen 880-k.w. Walker rope driven generators. The Walker Company is now supplying the Brooklyn Elevated Railway with 400 motors of 80 h.p. each, and is making a specialty of large motors for heavy interurban traffic.

Hotel Accommodations and Exhibition Space in Boston

The Hotel Brunswick has already booked a large number of reservations for rooms at the Boston Convention, and its accommodations will soon be exhausted. Other hotels in the neighborhood of The Brunswick are the Hotel Vendome, on Commonwealth Avenue; the Copley Square Hotel, and The Thorndike, at the Providence Station. One of the finest hotels in America is the newly opened La Touraine, at the corner of Tremont and Boylston Streets, while Young's Hotel, the Adams House and the Parker House are in the business heart of the city, within twenty minutes of the Convention Hall.

At The Brunswick five manufacturers only have been able to secure headquarters on the ground floor, namely, the General Electric Company, which has the main reception room; the J. G. Brill Company, directly opposite; the Peckham Motor Truck & Wheel Company, the Pennsylvania Steel Company and the Bethlehem Iron Works. On the second floor, headquarters have been secured by the STREET RAILWAY JOURNAL, the Westinghouse Electric Company and the Christensen Engineering Company.

The convention space for exhibition purposes is practically unlimited in amount, and manufacturers may feel confident of securing all which they may apply for. Applications should be sent to Charles S. Clark, chairman committee on exhibits, Mason building, Boston, Mass.

The street railway managers around Boston are taking a most lively interest in the coming Convention. A strong general committee has been appointed to take care of the Convention, with General William A. Bancroft, vice-president of the Boston Elevated Railway Company, as its chairman, and with a large number of sub-committees, whose chairmen form members of the general committee. The plans for entertainment of the visitors have already been partially formulated, and include a harbor excursion of the most interesting character.

There will be a great deal of important engineering practice to be observed in Boston, of which the most interesting, perhaps, will be the subway, which will probably be entirely completed and in running order to the Union Station by convention time.

Changes in General Electric Stock

A committee of preferred stockholders of the General Electric Company has issued a circular to preferred stockholders upon the subject of dividends and reduction of stock. In this circular it is stated that the last report of the company shows profits equal to 7 per cent on the preferred stock, and 3.88 per cent on the common stock. There are other features in the balance sheet which show that the company is thoroughly sound financially, and that profits should not be longer withheld from the shareholders.

To remove what directors regard as legal obstacles in the way of resuming dividend payments, the suggestion has been made to the committee that the nominal value of the capital stock should by vote of shareholders be reduced so as not to exceed the value of the assets of the company, and to this end a reduction of 50 per cent of the par value of the shares has been suggested, together with the payment of the accumulated dividends on the preferred shares to date of reduction, at the rate of 7 per cent on the present par value of $100 per share. By this plan, preferred stockholders will in future be entitled to dividends of 7 per cent on the $50 basis only, while holders of common shares will be entitled to all the remaining earnings, thus leaving the latter in a better position than their present one. The committee refuses to recommend to preferred stockholders a reduction in par value to any amount below $72 a share, as the company's assets amount to at least 72 per cent of the par value of all its shares.

Changes in New Jersey

The North Jersey Street Railway Company, which leases and operates the lines of the Consolidated Traction Company, of Jersey City, has elected the following officers and directors: President, E. F. C. Young; vice-president, David Young; auditor, E. H. Hibbs; treasurer, E. N. Hill; secretary, Wilbur S. Johnson; general superintendent, George F. Chapman; directors, F. Dryden, Leslie D. Ward, Peter Hauck, J. F. Kehoe, James Roosevelt Shanley, David Young, Abram Quarles Garretson, Geo. F. Perkins, Edward F. C. Young, A. J. Cassatt, T. Dolan, P. A. B. Widener, Wm. L. Elkins and John D. Crimmins. The lease of the Consolidated Traction Company to the North Jersey Street Railway Company provides as follows: "The lease is to run for 999 years from June 1, 1898, and the North Jersey Company assumes all the debts and obligations of the Consolidated Traction Company. On the execution of the lease the lessee was to pay to the lessor $1,000,000, and in each year following up to 1906 a yearly rent ranging from $300,000 to $600,000 is to be paid. After 1906 the yearly rental is to be 4 per cent on the $15,000,000 stock of the Consolidated Traction Company. The North Jersey Street Railway Company must maintain the sinking funds of the Consolidated Traction Company, but the latter will extend any bonds the North Jersey Street Railway Company may desire. The lessee must also pay $1,250 semi-annually to enable the lessor to keep up its corporate organization, and also pay the salary of its president—$10,000 a year. In case of default on any part of the agreement ninety days extra are allowed in which to fulfill it. In case of default after that the lessor may take possession of the property.

New Electrical Headquarters

Owing to the increase and extension of its business the Central Electric Company, of Chicago, one of the largest wholesale and retail electrical supply houses in the world, has been compelled to move its headquarters. This company's entire business will hereafter be carried on in the large building located between Jackson Boulevard and Van Buren Street, on Fifth Avenue. The building is of modern construction and was remodeled and specially arranged for the requirements of this company. Passing into the main entrance of the building the first room that is entered is the retail and house goods department. Here on an extensive system of shelves and counters can be found properly arranged and classified nearly everything that could possibly be called for in the way of electrical material supplies or similar apparatus. Various tables and platforms suitably arranged and displayed contain samples of motors, transformers and other apparatus. This department is in charge of F. M. Pierce. To the left of this room are the executive offices, and the accounting and general sales department, to which has been assigned the entire first floor front so as to secure an abundance of daylight and also to facilitate the handling of the business. The private offices are occupied in the order named, by Chas. E. Brown, secretary; George A. McKinlock, president, and S. R. Frazier, treasurer, with a commodious office intervening between the secretary's and president's office for the accommodation of the stenographic force. Toward the center of the store are the open offices of Chief Order Clerk T. D. Lempke, General Salesman and Advertising Manager Chas. C. Benton, and those of J. M. Knox and H. T. Conly, special and city salesmen. The stock department is located on the left of the retail store and occupies the balance of space across the building. Here an excellent system for the handling of the enormous variety of material known as electrical supplies is in force. In the basement are stored the heavier apparatus and material which the company handles.

Porcelain Insulators

Fred M. Locke, of Victor, N. Y., has recently been granted a patent for a new insulator. This insulator is made of porcelain or suitable insulating material constructed in three parts, fitted one into the other and fused together with glaze, the inner part being provided with a socket by which it is mounted, the said inner part or shell extending down to a point adjacent to the cross-arm, forming a sleeve for the purpose of protecting the pin from static discharge or arcing or leaking of the current around the insulator. Mr. Locke has found that in some types of insulators the static discharge from the surface of the insulator supporting the wire or the arcing of the current around the insulator sometimes burns the insulator pin off on a plane with the bottom of the porcelain partition extending the lowest. He has designed this new insulator to correct this difficulty. These insulators are made in several sizes for potentials ranging from 5000 to 50000 volts.

Foreign Notes

The preamble of the bill introduced to effect a connection between Clontarf, Eng., and the Hill of Howth by an electric tramway, has been passed by the Select Committee of the House of Lords.

At the Lockport, Eng., Town Council, it was reported that £22,100 had been offered by the corporation for the Lockport & Hazel Grove Tramways. The Mayor has given notice that he will propose that the corporation seek Parliamentary powers for constructing and working tramways in the borough by horse, gas, electric, or other motive power.

The preamble of the Dundee, Eng., Tramways bill authorizing the taking over and extension of the existing tramways by the Corporation has been approved.

At a recent meeting of the Parliamentary Committee of the Gateshead, Eng., Town Council, the question of the future tramway system was considered. Some time ago the British Electric Traction Company, Ltd., agreed to take over the present lines and establish others in the borough if the corporation would agree to give an extension of the present lease for 21 years. The overhead system of traction was proposed to be established and penny fares, a ten minutes' service and other improvements were promised. It was decided that a deputation should visit Leeds and inspect the electric system in operation there.

The Highways Committee of Salford, Eng., has passed a resolution declaring it to be essential that a clause be inserted in the new lease of the tramways to the Manchester Tramways Company enabling the corporation to relay the tramways for electrical traction during the renewed term of three years.

An exhibition is to be held at Grahamstown, Africa, from Dec. 15, 1898, to Jan. 21, 1899, to be known as the South African Industrial and Art Exhibition, and is guaranteed by the governors of Cape Colony, South African Republic, Orange Free State, and Natal, and the high commissioners of Rhodesia and Basutoland. Over $100,000 has been subscribed, and exhibits from all parts of the world have been asked. There are five classifications of exhibits, viz.: Raw materials; manufactures; mining and machinery; natural history and science; arts. To the manufacturers of agricultural implements, vehicles, electrical and other kinds of machinery, this exhibition will be invaluable.

The tramways manager and the borough electrical engineer, of Huddersfield, Eng., have been instructed to prepare a report as to the application of electric traction on one or more of the sections of the tramways, having regard to the utilization of the present rolling stock and capital expenditure.

At a special meeting of the shareholders of the Glasgow & Southwestern Railway, of Glasgow, Scotland, a proposal to apply to the Light Railway Commissioners for a light railway along the Ayrshire coast between the towns of Girvan and Ayr was adopted. The capital to be raised under the order for the works is £120,000, with borrowing powers amounting to £40,000.

The Federal Council of Berne has granted to MM. Bucher and Durer, of Lucerne, and Elie Frotron, of Meiringen, a franchise for the construction of an electric railway from Meiringen to Wassen. The line will have a length of 42.4 k.m. and a maximum grade of 10 per cent. The overhead system will be used and each car will be equipped with a rack brake.

At the last quarterly meeting of the Chesterfield, Eng., Town Council the question of electric tramways was gone into. The Mayor considered their introduction would prove a great benefit to the town. The matter was referred to a committee of the whole Council.

Definite and active steps have been taken to place the Borough of Southampton, Eng., in possession of its own system of tramways. The arbitration between the corporation and the present proprietors of the tramways was opened recently at the Westminster Palace Hotel. Sir Henry Oakley is the umpire, with Mr. George Hopkins, C. E., and Mr. Joseph Kincaid, C. E., as arbitrators, and Mr. W. Phipson Beale as legal assessor.

At the May meeting of the Tunbridge Wells, Eng., Council a letter was read from the secretary of an electric tramway construction company in London, pointing out the need of a tramway between Tunbridge Wells and Southborough, and expressing the desire to interview the Council on the subject. The letter was referred to the General Purposes Committee, to consider and report to next meeting of the Council.

The Lord Provost, Treasurer Bisset and Mr. Fleming have been reappointed by the Aberdeen, Eng., Town Council to take the necessary steps in connection with the hearing on the Tramways bill by the Parliamentary Committee.

The tramways service in the city of Coventry, Eng., will probably be improved by the adoption of the report of the Streets Improvement Committee. Lines are to be straightened, granite paving laid and trolley wire doubled to increase the speed.

There is again a prospect of arrangements being arrived at by the Chiswick District Council and the London United Tramway Company, on the subject of the company's bill now about to be considered by the Parliament Committee. It is stated that the Council agrees to assent not only to the substitution of electric traction or horse haulage, but also to the insertion of a clause extending the company's enjoyment of the benefits of the undertaking.

Messrs. Dick, Kerr & Company, of Glasgow, have submitted an important scheme to the Birmingham, Eng., corporation for the provision of a tram service upon roads in the city along which there is at present no such accommodation. They undertake to adopt either the underground electric conduit or the cable system of traction. The company stipulates that the term of concession must be for twenty-one years, and agrees that if the corporation purchase the business of the Electric Light Company as is proposed, they will become customers for their electric power. The Committee of Public Works have referred Messrs. Dick, Kerr & Company's offer to the City Surveyor for report.

The steam railway companies of Italy are investigating the subject of electric traction, and two of the largest have asked the consent of the Government to equip parts of their systems electrically. Those which request this permision are the Adriatic Railroad Company, which wishes to install electric traction on its Luques-Colico line, with branches to Sondrio and Chiavenna, and the Mediterranean Railroad Company, which proposes the electrical equipment of its Milan-Monza and that from Rome to Frascati.

NEWS OF THE MONTH

The Union Railway Company, of New York City, is installing in its power station at West Farms a new 1600-k.w. Walker generator, which will be direct-connected to a 2000-h.p. Allis cross compound engine. The flywheel will be 21 ft. 6 ins. in diameter and will weigh about 175,000 lbs. The rim will weigh 110,000 lbs. The speed will be 75 r.p.m. This unit will be one of the largest ever built and will nearly double the present output of the West Farms station.

The State Board of Equalization, of Missouri, has decided that all street railways in that State must be assessed for taxation under the law passed by the last Legislature. The board will require the companies to give all necessary information regarding their property so that the assessment can be made at the market or full valuation. The information required includes the total miles of track operated, together with all cars, buildings, real estate, and all other property, the amount of capital stock, paid and unpaid and number of shares, the amount of sinking fund, if any, and the amount of bonded indebtedness, if any, the rate of interest paid on indebtedness, and the gross receipts and operating expenses for the previous year. The companies must also send to the board a copy of all franchises or privileges that have ever been granted them. This decision is based on the opinion of Attorney Gen. Crow, of Missouri, and is very far reaching in its effect on the street railway companies in the State.

An ordinance has been passed in Baltimore, Md., giving the City Commissioner the power to enforce the law requiring street railway companies to keep in repair the paving between the tracks and for two feet on the outside of the outside rails. The ordi-

nance gives the City Commissioner the right to have the repairs made by the city workmen and to collect the cost of the same, with 10 per cent additional from the railway company having tracks on the street. The railway companies will also be liable to a fine of $20 for each day they fail to make repairs when notified to do so by the City Commissioner.

For the third annual time the women collected fares on all the cars of the Rockford (Ill.) street railways from early morning until midnight, on June 4, it being the trolley day of the Ladies' Union Aid Society, the proceeds going to charity. An unusually large number of fares were collected and a handsome sum realized.

A decision has been handed down by the court that the value of capital stock of the Union Traction Company, of Philadelphia, as represented by the value of its leased lines, is subject to taxation, but that portion of the Union Company's capital invested in shares of other companies paying the capital stock tax is exempt from taxation. A decision was also filed recently that the Electric and People's stock trust certificates, issued by the Union Traction Company, are not subject to taxation. Both suits were brought by the State's financial officers.

An interesting case has recently been decided in Rochester, N. Y. A man was expelled from one of the cars of the Rochester Railway Company for carrying a cigar stub which he refused to throw away. He brought suit against the company, but the case was thrown out of court, the judge granting a nonsuit. The judge stated that the smoking of a cigar, or the carrying of a half-smoked and dead cigar in a street car where it is expressly prohibited by the rules is a public nuisance.

The Mayor of Cincinnati, O., in a recent message to the Legislature, recommends that a bill be passed which shall provide for a three cent fare on all street cars, for passengers to whom no seats are furnished.

It is stated that the Brooklyn Heights Railroad Company has decided to erect a large car house at Myrtle and Gates Avenues, Brooklyn. N. Y., at a cost of $150,000. The building will cover an entire block, and will have accommodations for housing over 600 street cars.

The Comptroller of the City of New York has made a report to the Rapid Transit Commission on the cost in 1897 to the Metropolitan Street Railway Company, the Manhattan Elevated Railway Company and the Third Avenue Railroad Company, all of New York, of franchise percentages, car licenses, fees and real and personal taxes. According to these figures the Metropolitan Company paid $223,526.76 for franchise percentages, $42,550 for car license fees, $66,242.40 for real estate tax, and $317,659.17 for personal property tax, making a total of $649,978.33. The total number of passengers carried (exclusive of transfers) from June 30, 1896, to June 30, 1897, was 177,776,093, and the gross earnings were $8,888,804.66, making the tax and franchise cost .0731 per cent of the gross earnings and the average cost per passenger for tax charges nearly one-third of a cent. The Third Avenue road has paid nothing for car license fees and franchise percentages since Jan. 1, 1894. The total amount of taxes paid by it for real and personal property in 1897 was $72,687.98. The gross earnings for the year ending June 30, 1897, were $2,590,473.94. The number of passengers carried, exclusive of transfers, 51,809,480, making the average cost of a passenger in taxes nearly one-seventh of a cent. The Manhattan Company refused on Feb. 5, 1891, to continue franchise percentage payments pending the settlement of litigation. The gross earnings of the road for the year ending June 30, 1897, were $9,163,742.55, and the number of passengers carried 182,964,851. The average cost for each passenger for taxes was nearly one-third of a cent.

The Atlanta (Ga.) Consolidated Street Railway Company has been successful in winning the suit brought against it by the City of Atlanta to compel it to grant transfers to its different lines at all intersecting points. The decision is given by the Circuit Court of Appeals, and the judges hold that the City of Atlanta has no right to regulate the rate of fare or the transfer system on any street railway system in the city.

The Chicago City Railway Company has made a new record for rapid construction. Within fifty-five minutes from the time the company was notified by telephone that the court had refused to enjoin it from stringing temporary trolley wires in Michigan Avenue, electric cars were being run in that thoroughfare. In this time poles were set, trolley wires strung and rails bonded for about 3½ blocks. The rapid construction was necessary in order to get ahead of another injunction. This stretch of track completes the downtown electric loop and gives greatly improved terminal facilities.

It is stated that the Chillicothe (Ohio) Electric Railroad, Light & Power Company will hereafter employ only women as conductors on its cars.

It is stated that the Chicago City Railway Company will have to abandon its tracks for several months on Thirty-ninth Street from Halsted Street to Cottage Grove Avenue, on account of the laying of a very large sewer. This will leave that section of the city without a through cross-town line from Thirty-first Street to Forty-third Street unless the South Park Board permits the company to lay its tracks through Thirty-fifth Street.

The Court of Appeals has decided that the city of New York has no right to purchase the franchise of the Eighth Avenue Railroad Company. This is the final decision in this case, and it also applies to the franchise of the Sixth Avenue Railroad Company. The Metropolitan Street Railway Company can, therefore, proceed with the equipment of both these roads, below Fifty-ninth Street, with the conduit system.

The United States Circuit Court of Appeals of the State of California has held that the word "railroad," when used in the State laws, does not include street railways, unless it is clear from what took place when the laws were passed that the legislators definitely intended that they should apply to street as well as other railroads.

The Consolidated Traction Company, of Jersey City, N. J., has issued its rates for special and parlor cars for trolley parties during the coming season. The charge for a car seating sixty-five or seventy people for a four hours' run is about $17.50, or 25 cents for each person.

The Muncie (Ind.) Street Railway Company has made a voluntary increase in the wages of its employees.

Mrs. Dr. Emma Merritt has recently been appointed president of the Sutro Railroad Company, of San Francisco, Cal. Mrs. Merritt is probably the first woman that has ever served in the capacity of president of an electric railway.

The fifteenth annual report of the Bureau of Labor Statistics of the State of Michigan for the year 1898 gives the following interesting information concerning the street railways of that State:

Number of street railways canvassed	17
Number of conductors employed	999
Average rate of wages per hour	18.9
Average hours on duty per day	9.7
Number of motormen employed	1,046
Average rate of wages per hour	18.7
Average hours on duty per day	10.8
Number of shopmen employed	276
Average rate of wages per hour	19.7
Average hours on duty per day	10.2
Number of trackmen employed	329
Average rate of wages per hour	14.1
Average hours on duty per day	10
Total number of street railway employes	2,650

It is interesting to note that the managers of the street railways of the country were among the first business men to notify their employes that all places would be held for men that enlisted for war service in the present crisis with Spain.

The North Chicago Street Railway Company is cast-welding the joints on its Wells street cable line.

Construction Note

ALBANY, N. Y.—Work has begun on the construction of the Albany, Helderberg & Schoharie Railroad Company's proposed electric railway, to extend from Albany to Middleburg and Schoharie. The directors of the company are Charles E. Bibber, Herbert Smith and Charles Perkins, of Boston; Benjamin M. Secor, of Albany; Thomas Wood, of Berne; C. G. Kromer and M. Twitchell, of Schoharie, and J. M. Borthwick and R. J. McAuley, of Albany.

ANDERSON, IND.—The Alexandria & Elwood Electric Railway Company has been granted a franchise in Anderson.

ASBURY PARK, N. J.—The Asbury Park & Sea Girt Railroad Company has been incorporated with a capital stock of $100,000, of which $25,000 is paid in. It is proposed to acquire the property of the Asbury Park & Belmar Street Railway Company and operate the line from Wesley Lake bridge to the Borough of Belmar. The incorporators are John E. Comins, of Arlington, N. J.; Daniel H. Shea and H. B. Perine, of New York.

BRADDOCK, PA.—The Braddock & Duquesne Electric Railway Company has accepted the franchise granted by the Council and given notice of its intention to commence work on the line immediately.

CANANDAIGUA, N. Y.—The Canandaigua Electric Light & Railroad Company proposes to extend its lines to Manchester, a distance of seven miles.

CHATTANOOGA, TENN.—An ordinance has been passed granting the Chattanooga Electric Railway Company the right of way over certain streets in the city.

EAST ST. LOUIS, ILL.—The St. Louis, Belleville & Suburban Railway Company has applied for a franchise over a part of Rock Road, within the city limits. The company has just placed in operation a 10-mile line of electric railway between the city limits of East St. Louis and of Belleville.

FAYETTEVILLE, W. VA.—The Fayetteville County Electric Railway Company has been incorporated with a capital stock of $30,000, to build an electric railway from Fayette station to Fayetteville. The incorporators are Joseph F. White, A. D. Preston, Morris Harvey, L. G. Gains and A. W. Mamilton of Fayetteville.

GALENA, KAN.—The Southwest Missouri Electric Railway Company has been granted a franchise in Galena.

IOLA, KAN.—The Iola Rapid Transit Company has been incorporated with a capital stock of $10,000 to construct a street railway from Iola to Moran. The directors are Wm. J. Evans, Geo. A. Bowlus, Wm. S. Hendricks, J. Earl Chastain, Lewis L. Northrup, Alfred W. Beck and Eugene K. Taylor.

JERSEY CITY, N. J.—The Jersey City Street and Water Board has adopted an ordinance permitting the North Hudson County Railway Company to substitute electricity for horses as the motive power on its Grove Street line, which extends from Jersey City to Hoboken.

LIBERTY, N. Y.—It is stated that Rossiter, McGovern & Company, of New York City, have purchased the property and franchises of the Liberty & Jeffersonville Electric Railroad Company, and that the construction of the proposed line will be begun at once and pushed to an early completion.

LONG ISLAND CITY, N. Y.—A resolution has been adopted by the local Borough Board of Queens limiting the speed of electric cars in that borough to 8 miles an hour, and also directing that fenders be attached to each car.

LOS ANGELES, CAL.—A. B. Patton has been granted a franchise for an electric railway to extend from Los Angeles to Whittier.

MYERSVILLE, MD.—It is reported that Contractor Douglas, of Millersburg, Pa., has been awarded a contract for the construction of the Myersville & Catoctin Electric Railway; work is expected to begin by June 1 and to be completed within sixty days. The line will be 5½ miles long and will extend from Myersville through several villages, connecting with the Frederick & Middletown Electric Railway, about half a mile east of Middletown. C. F. Flook, of Frederick, Md., is president of the company.

NATCHEZ, MISS.—The Natchez Power & Transit Company has been incorporated by Maurice Moses, Abraham Moses and others, of Natchez, to build a street railway in the city and furnish electric light and power.

NEW YORK, N. Y.—The State Railroad Commission has granted the application of the Metropolitan Street Railway Company for permission to use the underground conduit system on Columbus Avenue from Fifty-seventh to Sixty-fifth Street, and from One Hundred and Sixth to One Hundred and Tenth Street.

NEW YORK, N. Y.—The North End Street Railway Company has applied to the railroad commissioners for permission to construct a street railway 13 miles in length, with termini at the intersection of Manhattan Avenue and One Hundred and Sixteenth Street, and at the intersection of Kingsbridge Road and the northerly line of New York City, with numerous branches. The Fort George & Eleventh Avenue Railroad Company has applied for permission to construct a road 1500 ft. long on Eleventh Avenue, between Kingsbridge Road and One hundred and Seventy-fifth Street. The Kingsbridge Railway Company has made application for permission to construct a road about 8 miles long from the intersection of Manhattan Street and the Boulevard to and along Riverdale Avenue to the city line.

PLAINFIELD, N. J.—Reports state that the Plainfield Street Railway Company has obtained a sufficient number of consents of the property owners on East Second Street for the construction of a street railway thereon. The company has applied to the Council for a franchise to extend its lines so as to connect with the proposed electric railway to be built by the Elizabeth & Westfield Street Railway Company, through Scotch Plains.

PORT CHESTER, N. Y.—The Port Chester Street Railway Company has certified to the Secretary of State a proposed extension of its line from Port Chester to Rye Beach, a distance of 2¼ miles.

VICTOR, COLO.—It is stated that the proposed electric railway to be built by the Victor & Canon City Electric Railway Company is now a certainty; that the defunct organization has been revived by the purchase of its right by a new company having sufficient capital to complete and fully equip the road.

UNDERCLIFFE, N. J.—The Bergen County Traction Company has accepted the franchise granted by the Leonia Borough Council, and a survey of the route from Leonia to Hackensack has begun.

WATERLOO, IA.—Plans are rapidly being perfected for work to begin actively on the proposed electric railway from Manchester to Colesburg, in which J. H. Rafferty and L. S. Cass, of Waterloo, are interested. The line is to make a junction with the Great Western and Milwaukee roads at Oneida, and proceed thence north to Colesburg.

WESTFIELD, N. J.—The Westfield Township Committee has granted a franchise to the Elizabeth & Westfield Street Railway Company, which proposes to construct an electric railway between Plainfield and Elizabeth.

The Milwaukee Four-Cent Fare Decision

The Milwaukee Electric Railway & Light Company and the Central Trust Company of New York, as trustee of mortgage, filed bills in the United States Circuit Court for the Eastern District of Wisconsin, for the purpose of determining the validity of the Milwaukee four-cent fare ordinance, and prayed for an injunction against the enforcement of the provisions of said ordinance on the ground that it was unreasonable, in that it would deprive the railway company of its right to charge five cents per passenger for a continuous ride upon its cars, and also upon the ground that the City of Milwaukee did not have the power under its charter to pass an ordinance regulating the fares of street railways in the City of Milwaukee. A preliminary injunction was obtained upon the filing of the bills, testimony was taken and the cause submitted after argument on final hearing to Hon. William H. Seaman, United States District Judge, who rendered an opinion as follows:

The main controversy in each of these actions is whether the ordinance of June 11, 1896, unreasonably fixes rates of fare which would deprive the complainant of its property without due process of law, and thus violate the Fourteenth Amendment to the Constitution of the United States. A further question is raised by the bill filed on behalf of the bondholders, and is pressed by argument in support of both bills, whether the municipality had power to regulate rates beyond the provisions contained in the several franchises, which are vested in the complainant street car company limiting only to a five-cent fare. Both contentions are of serious import, involving on the one hand consideration of the rights of the community in respect of a great public utility and interference with acts of municipal control, which are presumptively

inviolable, and on the other hand affecting the preservation of private rights of property where investment has been made in a great undertaking of public nature on the faith of existing and probable conditions, and where, by reason of its nature, there can be no withholding of operation by the company, even if unremunerative.—(Ames vs. U. P. R. R. Co., 64 Fed. Rep., 165, 177; Wright vs. Milwaukee Electric R. & L. Co., 95 Wis., 29, 36.)

Further investigation has confirmed the impressions stated at the hearing that the constitutional question was so clearly presented by the pleadings and testimony, and was so distinctly of federal cognizance, that it should be first considered. Certain rules to interpret and apply the limitations of the Constitution in this class of cases are well settled by decisions of the Supreme Court. If the state of facts shown by the evidence clearly establishes a case of impairment within these rules, it will be unnecessary to pass upon the complicated question of general power as one of first instance, calling for the interpretation of various statutes and ordinances.

The ordinance under consideration provides that tickets shall be sold, good for one fare, including one transfer, "in packages of six for twenty-five cents, and twenty-five for the sum of one dollar," thus making a reduction of the regular five-cent rate to all who so purchase tickets. Assuming, therefore, without so deciding, that the general power to fix and regulate the terms and rates to be charged subsists in the municipality—namely, that by deeegation it became vested with, and still retains, the full extent of legislative power possessed by the State—there can be no inquiry here as to the wisdom or good policy of exercising the power so delegated, that being a matter of municipal discretion, over which the courts have no right of supervision or review. Nor is it open to inquiry in this case whether there is a public demand or need for the enactment, or whether it is just and reasonable in all its provisions, except for the single purpose of ascertaining its infringement of rights which are guaranteed to the complainant by the Constitution.

Upon this record it must be taken as true that enforcement of the ordinance would operate to reduce materially the net revenues of the street car company. There is effort on the part of the defendant to show that the probable increase of passengers through the method of commutation tickets would make up for the reduction in rate, but no reliable basis is furnished and the argument is too speculative for acceptance; while on the part of the complainant the testimony is founded upon practical and varied experience, and clearly shows it to be improbable than any increase in travel would yield receipts over and above the additional expense necessarily entailed to offset the decrease in gross receipts appearing prima facie from the reduction in fares. The claims are that a loss of income would result of "somewhere between 10 and 15 per cent of the gross earnings," and estimates are presented by several witnesses of a net loss ranging from $87,000 to $140,000 per annum. It is sufficient for the present consideration that the ordinance must be regarded as a measure which reduces the rates of fare materially and consequently would impair materially the net revenue produced by the property, and no analysis of the testimony upon that point is necessary; nor is any attempt required to state, even approximately, the amount of loss.

The law which must govern when the facts are determined is concisely and pertinently stated in the opinion of Mr. Justice Harlan, speaking for the Supreme Court in Smyth vs. Ames, 18 Sup. Ct., 418, 426, as follows:

"In view of the adjudications these principles must be regarded as settled:

"1. A railroad corporation is a person within the meaning of the Fourteenth Amendment, declaring that no State shall deprive any person of property without due process of law, nor deny to any person within its jurisdiction the equal protection of the laws.

"2. A State enactment, or regulations made under the authority of a State enactment, establishing rates for the transportation of persons or property by railroad that will not admit of the carrier earning such compensation as, under all the circumstances, is just to it and to the public, would deprive such carrier of its property without due process of law, and deny to it the equal protection of the laws, and would, therefore, be repugnant to the Fourteenth Amendment of the Constitution of the United States.

"3. While rates for the transportation of persons and property within the limits of a State are primarily for its determination, the question whether they are so unreasonably low as to deprive the carrier of its property without such compensation as the Constitution secures and, therefore, without due process of law, cannot be so conclusively determined by the Legislature of the State, or by regulations adopted under its authority that the matter may not become the subject of judicial inquiry."

And this opinion reviews the line of decisions upon the subject and clearly approves the application of the same doctrine to legislative reduction of charges, over toll-roads, in Covington, etc., Turnpike Co. vs. Sandford, 164 U. S., 548, 594.

Therefore is must be regarded as established beyond question that the power to regulate the rates of fare, which is here assumed to rest in the municipality, is subject to these limitations: (1) That there is reasonable need on the part of the public, considering the nature and extent of the service, of lower rates and better terms than those existing. (2) That the rates and terms fixed by the ordinance are not clearly unreasonable in view of all the conditions. Neither of these considerations is independent of the other and, although the public interest is of the first importance, the test is not what is desirable upon the part of either, but what is reasonable in respect to the rights of both. As stated in Smyth vs. Ames, supra: "What the company is entitled to ask is a fair return upon the value of that which it employs for the public convenience. On the other hand, what the public is entitled to demand is that no more be exacted from it for the use of the public highways than the service rendered by it is reasonably worth." So in Covington, etc., Turpike Co. vs. Sandford, supra, it is clearly held, in the same view of mutual consideration, that it is neither the right of the corporation to subject the public "to unreasonable rates in order simply that stockholders may earn dividends," nor of the public to have the use of the conveniences thus furnished, except "upon payment of such tolls as in view of the nature and value of the service rendered by the company are reasonable;" but that "each case must depend upon its special facts;" and the reasonableness of rates must be measured by all the conditions, including, of course, the reasonable cost of operation and of maintenance "in good condition for public use, and the amount which may have been really and necessarily invested in the enterprise."

The difficulties presented in this case do not therefore rest in any doubt as to the general principles which must be observed, nor in ascertaining the actual facts disclosed by the testimony as a whole, so far as material to this controversy. Although the testimony on the part of complainant makes a volume of 1445 printed pages and that of the defendant 163 pages, the only substantial contentions of fact relate to items of expenditure and claims of credit, by way of depreciation presented on behalf of the complainant, as entering into the showing of net revenue, and to the present or reproduction value of the plant. And it may be remarked in passing that this testimony is so well classified and indexed with such fair summaries in the briefs that the task of examination has been materially lightened. But the sole embarrassment in the inquiry arises from the wide divergence which appears between the actual and undisputed amount of the cash investment in the undertaking and the estimates on either hand of the amounts for which the entire plant could now be reproduced, in view that the line of authorities referred to do not attempt to define or specify an exact measure or state of valuation, and leave it within the principles stated, that "each case must depend upon its special facts." Therefore, the two-fold inquiries of reasonableness above indicated are of mixed law and fact and start with the presumption in favor of the ordinance (1) that the prevailing rates exacted too much from the public, and (2) that these prescribed are reasonable.

1. Are the terms and rates fixed by the company excessive demands upon the public in view of the service rendered? The Milwaukee Street Railway Company, of which the complainant is the successor in interest, was organized in December, 1890, for the purpose of establishing an electric street railway system which should cover the entire field for the City of Milwaukee. There were then in operation five distinct lines, owned separately, operated mainly by horse or mule power, each charging separate fares and having no system of transfers. It is conceded that the service was slow and antiquated, was not well arranged for the wants of the city, and was generally inadequate and unsatisfactory. As the old lines occupied the principal thoroughfares, and the public interest prevented the allowance of double lines in such streets the improvement could not be made effective unless those lines were purchased or in some manner brought into the proposed system. They were gradually acquired, at prices which may appear excessive when measured by results, and during the ensuing period of about three years the work of installing the new system was carried on, involving an entire reconstruction and rearrangement of the old lines and extensions, new and improved equipments throughout, at an expenditure of over $3,000,000, aside from the cost of the old lines. As a result, at the time the ordinance was adopted, the mileage of tracks had increased from the previous aggregate of 110 miles to 142.89 miles, reaching every section of the city with shorter and better routes, and furnishing

thirty-eight transfer points, with a universal transfer system—a feature of special value to the public, as a single fare of 5 cents gave a maximum length of ride more than double the old arrangement; the service was improved in speed and regularity 50 per cent or more, with better cars and less inconvenience, and it appears beyond question that it was generally more satisfactory and economical from the standpoint of the public. In other words, the service was materially enhanced in its value to the public, without any increase in either normal or maximum charges, affording rides for five cents which had previously cost two, and even three, fares; and against all these advantages there appears only a single benefit extended by three out of the five constituent companies which is not given under the new arrangement—namely, in the sale of commutation tickets—an omission for which there seems to be plausible excuse and offset in the universal system of transfers, aside from the other advantages. Surely, therefore, no imposition upon the public appears through any comparison between the old and the new service and rates. Nor does it find any countenance in comparison with either service or rates which prevail in other cities, for it is shown in this record, and is undisputed, that the five-cent rate is almost universal; that commutations are exceptional in cities of like class, and arise out of exceptional conditions which are not fairly applicable here; and that instances of lower rates are so clearly exceptional that they cannot have force for any affirmative showing of reasonableness in the instant case. Nevertheless, with the burden of proof on the defendant, these considerations are not controlling, unless it further appears that the earnings of the company are insufficient, in view of the amount which may justly be regarded as the investment in the undertaking to warrant the making of rates and terms which are more advantageous to the public. The interests of the public in its highways are paramount, and, if the service can reasonably be afforded more cheaply in Milwaukee than in other cities of like class, the community is entitled to the just benefit of any possible conditions which may tend to that result. The issue in that regard must be met under the second branch of inquiry, but I am clearly satisfied that this first question must be answered in favor of the complainant, if the evidence sustains its claim that lower rates would be confiscatory, and not compensatory.

2. Are the earnings of the property insufficient, in view of all the conditions, to justify this reduction in the rates of fare? Solution of this inquiry depends upon the showing (1) of earning capacity at existing rates and (2) of the "amount really and necessarily invested in the enterprise," and upon the conclusion (3) whether the ratio of return upon the investment is excessive. In the statements which are referred to both parties have adopted a ratio, so far as necessary, to separate the electric-lighting plant owned by the complainant, so that the statements which follow relate exclusively to the street railway plant, except where otherwise mentioned.

(1) The question of earning capacity is confined by the testimony to the results of three years' operation, being after the system was fairly installed and inclusive of the year in which the ordinance was adopted—namely, 1894, 1895 and 1896. It is suggested on behalf of the defendant that these years were exceptional, for one cause and another, and are not a fair criterion for future earnings under more favorable circumstances, but the suggestion is without force in this case, because the ordinance operates upon these very conditions, and must, of course, be predicated upon them—upon existing facts and not upon mere future possibilities—and so determined the instant case cannot affect rights under new conditions.

The proofs on the part of the complainant furnish in detail from the books of account the gross earnings, the various items of expense and of charges for which deduction is claimed, excluding any payments of, or allowance for, interest on the bonded indebtedness, and state the net earnings as follows:

In 1894	$64,868.77
In 1895	269,202.30
In 1896	100,628.81

For this showing, it appears that deduction of $247,324.88 is made in 1894 for "depreciation," being the amount apportioned to that year to meet the alleged annual loss by physical depreciation of the plant to keep the capital intact. No such deduction is made in 1895 and 1896, because not shown in the books, although it is insisted that like credit is due in each year for the purposes of this case.

The defendant conceded the correctness of the showing as to the gross earnings, but disputes certain large items, for which deductions are made in the above statement, corrects some items and denies that any allowance should be made for depreciation. Aside from the fact that reports and statements of financial condition made from time to time by the company omit many of the deductions here asserted, these contentions on the part of the defendant rest solely upon the books of account kept by the company and the testimony of Mr. DeGrasse, stating his conclusions as an expert accountant from examination of such books, with the following result as to net earnings:

In 1894	$387,074.70
In 1895	479,621.11
In 1896	66,520.99

But this total for 1896 erroneously includes an allowance of $160,550 paid for interest on bonds, which should be excluded on the basis assumed, and would make the net earnings for that year, on his computation, $227,070.99. In this statement, the allowance for depreciation in 1894 is excluded by Mr. DeGrasse, because that item was, in fact, charged off upon change in the system of bookkeeping. He also excludes large amounts of undoubted expenditures, upon the hypothesis that they belong to "construction account"; as covering permanent improvements, and not to "expense of maintenance," as stated; rejects certain payments as accruing on account of previous years; and certain sums apportioned and charged off to meet damage claims; and makes corrections as to taxes, for which the book entries were made in advance upon estimates by way of apportioning the expenses of the year, or pending litigation and other causes. However valuable this testimony is for analysis of the bookkeeping methods and for correction of certain charges, it is clearly insufficient, without other support, to contradict the undisputed testimony, both positive and expert, on the part of complainant, which verifies substantially its contention upon the disputed subjects of deduction; namely, that the expenditures so charged were largely, if not wholly, of such a nature as to justify deduction for "maintenance;" and that depreciation is a well-recognized fact in all such plants, for which allowance must be made to save the capital from impairment, without regard to any question of its entry upon the books.

Making allowance for maintenance alone in accordance with the analysis presented by the expert witnesses Goodspeed, Coffin, McAdoo and Beggs, taking in each instance the estimate most favorable to the defendant, I am satisfied that the defendant's claim of net earnings must be materially reduced, and that the largest amounts which can be assumed upon its theory excluding any allowance for depreciation, except that for 1894 the "maintenance" allowance is increased as indicated by all the witnesses, was necessary, would be approximately:

In 1894	$230,000
In 1895	340,000
In 1896	115,000
	$685,000

making the average earnings per year, say, $228,333.

In reference to the element of depreciation, the witness Beggs gives the following lucid explanation: "I think experience has demonstrated that the utmost life that can be expected from the best roadbed that can be laid to-day would be, at the outside, ten to twelve years, when it would have to be almost entirely renewed. The Milwaukee Company is in that condition to-day, which, because of the different periods that their track went down, and due to the fact that it was nat all put down at one time, that it would now commence—must of necessity commence—to lay about 12 miles of track annually, being about one-twelfth of its total mileage, and will be required, whether they wish to or not, to lay that amount annually hereafter, and will thereby be keeping their tracks fairly up to the standard. The same applies, I might say, to the equipment; in my estimate I have calculated that the Milwaukee Company must do this year which, as a matter of fact it is doing, what it did last year, in other words, put on not less than twenty of the most modern, best-constructed equipments, thereby keeping its standard up to the minimum it has now, of 240 equipments; because I think it is fair to assume that the average life of the double equipment taken as a whole will not exceed twelve years, the life of the motor being somewhat less than that, and that of the car we hope may exceed it possibly several years; I mean the car bodies, but that, in the main, we hope that we will get an average life of twelve years out of them; so, taking twenty equipments annually, you would keep to your standard of 240 equipments, which is absolutely necessary to maintain to operate the Milwaukee Street Railway; I mean, cars complete with motors and complete electrical equipment."

For the causes thus stated, within general rules which are well known, it is manifest that this element must be taken into account before it can be determined that earnings derived from a plant are excessive; and in the same line there is much force in the argument of counsel that consideration should also be given to the factor of depreciation by amortization of franchises, as all the franchises in question terminate in the year 1924. The latter, if

allowed, would be a matter of simple computation, but a just measure of physical depreciation seems, to some extent, although only partially, involved in provisions for maintenance; and, while the testimony is very full and instructive upon this subject, it does not save from serious difficulties in the way of stating a definite ratio or sum for such allowance. I am, however, clearly of the opinion that neither of these elements is essential to the determination of this case, upon any aspect presented by the testimony, and leave it so far open that it may serve as an important factor of safety in either view.

(2) As to valuation: For purposes of the company the value of the property, including both railway and lighting plants, appears to have been placed at $14,250,000, represented by the issue of bonds for $7,250,000, preferred stock, $3,500,000, and common stock, $3,500,000; but this aggregate was clearly excessive, after excluding the electric lighting department, and on no view can it be taken as the basis for the present consideration. The statements of the actual cost of the constituent street-railway properties, including the cash investment for improvements, are necessarily complicated from the fact that payments were partly made in stocks and bonds, and the aggregate amount varies according to the ratio of valution placed upon the bonds alone, in two statements, on which the stock is excluded, and in one statement which values both stock and bonds—the minimum being $9,024,-107.85, and the maximum $11,313,829.84. The former amount was subsequently modified, making the statement of cost $8,885,644.17, and as this excludes any valuation of stock, and places the value of the bonds at a discount which was agreed upon between the parties, and which also seems fair, it may justly be taken as representing the true amount invested. But adoption of this purchase amount does not meet the issue, as it is the value of the investment, and not the amount paid, which must control. On the other hand, both parties introduce testimony placing valuations upon the various items of the plant as it exists in fact, upon the basis of its reproduction value. This amount, as stated by the witnesses for complainant, aggregates $5,153,287.76; while on the face of defendant's proofs the value of the tracks and equipment is placed at $2,358,799, the real estate and buildings being valued separately, and the highest valuation of the real estate being $236,949, and of the buildings $208,449, making the aggregate $2,804,197. It appears, however, that these estimates on behalf of the defendant omit 27 miles of track, many parcels of real estate, and other items so that counsel for defendant concedes that this aggregate should be increased to $3,679,631. The wide difference in these amounts is mainly due to divergence in the estimates upon tracks and equipment, as the amounts on real estate and buildings, after allowance for the omissions, would appear higher on the valuations submitted by the defendant than those of the other side. For the valuation of tracks and equipment the defendant relies upon the estimate made by Mr. Partenheimer, a witness of apparent ability and experience as a street-railway contractor engaged in business at Chicago, but his examination of the plant was cursory, being made within three days, and could not give the detailed information upon which a just estimate for this inquiry must be based, and it is conceded that he left out of consideration many important items (aside from the error in mileage), which should enter in and would greatly increase his amount. Both upon its face and by reference to other sources of information this estimate is far below any fair valuation for the purpose in view, either at the sum stated by the witness, or with the additions conceded on behalf of the defendant, the former amount being in fact $320,000 short of the actual cash expenditures by the company for construction and equipment. Opposed to this the estimate for complainant is made by Mr. Clark, an expert of distinction in this line, who gave weeks to the examination, with the aid of a corps of assistants, and presents the results in detailed statements, so that his testimony and estimates impress me as well founded; and they are supplemented and supported by the testimony of Mr. Coffin, Mr. Payne and other witnesses, and by comparative showing of mileage valuation in Massachusetts which appears in the noteworthy system of reports published by that State. I am satisfied that the property of complainant represents a value, based solely upon the cost of reproduction, exceeding five million dollars. And I am further satisfied that this amount is not the true measure of the value of the investment in the enterprise, which now furnishes the public with its superior street-car service. It leaves out of consideration any allowance for necessary and reasonable investment in the purchase of the old lines and equipments, which were indispensable to the contemplated improvement, but of which a large part was of such a nature that it does not count in the final inventory. No allowance enters in for the large investment arising out of the then comparatively new state of the art of electric railways for a large system, having reference to electrical equipment, weight of rails, character of cars and the like—of which striking instance appears in the fact that the electric motor which then cost about $2,500 can now be obtained for $800; so that work of this class was in the experimental stage in many respects, and the expenditures by the pioneer in the undertaking may not fairly be gaged by the present cost of reproduction. Of the five million dollars and over paid for the acquisition of the old lines it would be difficult, if not impossible, from the testimony, to arrive at any fair approximation of the share or amount of tangible property which enters into the valuation in this inventory. It does appear that the roadways required reconstruction with new rails and paving; and that the amount stated was actually paid by the investors is undisputed, making their investment nearly nine million dollars. How much of this may be defined or apportioned as the amount which was both "really and necessarily invested in the enterprise" (vide Covington, etc., Turnpike Co. vs. Sanford, supra) I have not attempted to ascertain, except to this extent, that I am clearly of opinion that at least two million dollars of these preliminary expenditures are entitled to equitable consideration, as so invested beyond the reproduction value, if the valuation of the investment is not otherwise found sufficient for all the purposes of this case; but no opinion is expressed in reference to the remaining $1,885,644.

(3). The final inquiry whether the net earnings shown are in excess of or equal to a just return upon the investment, presents no serious difficulty under the premises above stated.

Assuming five million dollars as the basis of investment the ratio of earnings would be as follows: (1) At the extreme computaions of defendant the yearlv average would be $364,000, which would yield 7.2 per cent; (2) at the complainant's figures, after adding the corrections for taxes, the return would be 3.3 per cent; (3) at the amounts which are above stated as my deductions from the testimony, the yearly average being $228,333, would make 4.5 per cent.

Assuming seven million dollars as the basis, the ratio of earnings would be upon each of said versions as follows: For the first, 5.2 per cent; for the second, 2.3 per cent; for the third, 3.2 per cent.

The interest rate fixed in the bonds issued by the company is 5 per cent; the rate which prevails in this market, as shown by the uncontroverted testimonv is 6 per cent for real estate mortgages and like securities. If the five million basis be adopted, surely a better rate must be afforded for the risks of investment than can be obtained on securities of this class, in which there is no risk. Upon the basis of seven million, which is more logical and just, the 5 per cent named in the bonds is clearly not excessive, and should be accepted by a court of equity as the minimum of allowance; and even upon the defendant's partial showing the return would be less than one-quarter per cent above that with the large margin for depreciation left out of account.

I am of opinion that the testimony is not only convincing in support of the material allegations of the bill, but is uncontradicted and conclusive that the improved service received by the public, with the universal system of transfers, is well worth the five-cent fare charged therefor; that the company has not received earnings in excess of an equitable allowance to the investors for the means necessarily invested in furnishing such service; that enforcement of the ordinance would deprive complainants of property rights by preventing reasonable compensation for its service; and that, therefore, the ordinance clearly violates the Constitution of the United States and is invalid. Decree must enter accordingly, and for an injunction as prayed in the bill.

Patent Decision on the Regulation of Compound-Wound Dynamos

The patent suit brought by the General Electric Company against the Siemens & Halske Company for the alleged infringement of a patent referring to the regulation of compound-wound dynamos has recently been decided in favor of the defendants. The defendants claim that a patent granted to Brush preceded any work of Edison's on commercial dynamos, and the court has found that this patent anticipated the Edison patent. The judge in dismissing the case stated that even were there any doubt as to the correctness of the priority of the patents the court would still hesitate to enforce a patent in the sixteenth year of its age and thus lay the entire art under tribute, when the public has had the right to assume that such a system as the defendants are using would not be molested.

The Large Unit for Street Cars

By JOHN A. BRILL

The general tendency and practice of the last few years among the large street railway companies has been in the direction of the largest street car unit that could be handled by two men. Since the first introduction of power for street car propulsion there has been a steady increase in the size of the car body. With the introduction of electricity a distinct gain in economy was made by the substitution of 18-ft. bodies for the old 16-ft. horse cars, which had been for years the standard. Now the 18-ft. car is almost standard for ordinary traffic. The larger car gives a greater seating capacity and as it requires no larger crew than the other there is a distinct gain in this direction. It is also found that the cost of operation depends practically upon the number of units to be propelled rather than on their size. Where two motors are employed the cost of running the largest cars is sensibly the same as that of the smallest and lightest, while the proportion the wages of the crew bears to the number of passengers shows a material advantage in favor of the large capacity.

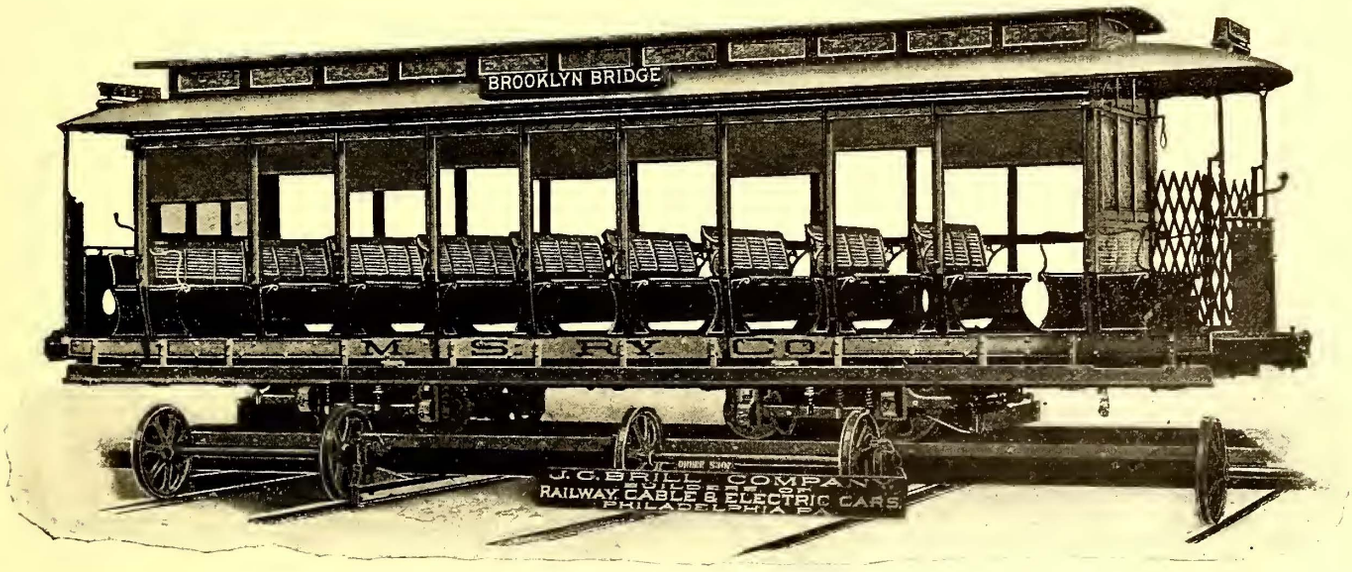
The largest car which two men can handle has for the heaviest city traffic other material gains. The short rides are encouraged because the passenger has at all times a reasonable assurance of a seat. In European practice this is even a stronger inducement than in America, since with a large seating capacity there would rarely or never be a case where a passenger would be excluded from a car for want of room. In the rush hours there is also more standing room available without crowding.

The adoption of the large unit is going on rapidly among the larger and more important roads of the country.

But it is by no means confined to them, however; it has been found that in some cases a small road by using a larger car can seat nearly all of its passengers at the rush hours without any material increase of expense. This is an advantage which managers are not slow in seeing.

Among the notable instances where the capacity of cars has been greatly enlarged is the Consolidated Traction Company of Jersey City. This road, after using a 20-ft. body for some years, has now adopted 32 ft. as its standard length. This is, perhaps, going to an extreme for city service, for the car measures 43 ft. 2 ins. over the buffer irons. There is, however, an excuse for the practice on the part of the Consolidated, because its territory embraces five large cities with a thickly populated country between, so that there is an extensive and rapidly growing interurban as well as city service. The Buffalo Street Railway is another road that has found a large car with longitudinal seats advantageous. The Hartford Street Railway is trying a 29-ft. body. The Portland road (Portland, Maine) is using cars 25 ft. long over the end panels, and the Newark & South Orange line has found that a 28-ft. body, 39 ft. 6 ins. over the buffers, is giving satisfaction on the long run through Newark, Roseville, etc., to Orange. The West End road, of Boston, now under the control of the Elevated, uses 25-ft. closed cars for its winter service. In summer they put on a nine-bench open car mounted on four wheels. This is rather a mistake, because if the large car is suitable for the winter when the traffic is smallest a larger car is needed in the summer season when the traffic is at its height. The probable reason for this state of things is found in the type of double truck cars used by them. The trucks have a bolster and wheels of equal size and cannot be employed under open cars, for the body would be raised as high as to call for two steps or else would have to be made very wide to accommodate them, and a wide body could not be used on the streets. The Maximum

DOUBLE TRUCK CLOSED CAR—METROPOLITAN STREET RAILWAY COMPANY, NEW YORK



DOUBLE TRUCK OPEN CAR—METROPOLITAN STREET RAILWAY COMPANY, NEW YORK

Traction trucks would obviate these difficulties, but for some unexplained reason the authorities are opposed to this truck.

The Brooklyn City and the Brooklyn & Coney Island roads are using cars with 25-ft. bodies and are finding them profitable and satisfactory. Several of the roads in St. Louis, Mo., for a number of years have been using long cars. Even in the city they have in many instances used cross seats in their closed cars, a feature due to the proportion of long rides.

The large unit is no doubt one very easy and satisfactory solution of the "no seat no fare" question. The large cars, with their great seating capacity, which can be made double that of the ordinary car, can on many lines easily supply seats for all. Since the cost of operation is not increased the roads will probably find this an inexpensive way out of the trouble.

Among the other roads adopting a large car comes lastly, but not the least, the Metropolitan Street Railway Company, of New York, which is a road that is probably better known than any other railroad in the world and whose practices are studied by more street railway men than any other railway. Since the introduction of its electric lines which are using the underground trolley, the company has ordered both large and small cars, the number of the large exceeding the small, as the company has found by both theory and experience the greater advantages which are gained by using the larger car. This company has now three types of cars in use, the short, or small car, a long combination car with a 10-ft. closed compartment, and the large open and closed cars shown in the illustrations. The combination cars are of the California type. They are twenty-five in number and are used to enable the road to comply with the requirements of the law which makes it necessary to have every fourth car a closed car.

The J. G. Brill Company is now completing an order for 475 of the cars shown in the engravings. The striking feature of these cars is their large size. The open car is 35 ft. 11 ins. long over crown piece, or 37 ft. 7 ins. over all; 6 ft. 5 ins. wide at the sills, and 7 ft. 2½ ins. at the widest point. There are twelve cross seats, giving a seating capacity for sixty persons, and as the seats are spaced 2 ft. 11 ins. centers there is ample standing room as well. The roof is of the monitor pattern, with ten deck sash on a side, four of which pivot. The ends of the car are closed by the usual bulkheads fitted with the drop sash and blinds. There are eight reversible seats and four stationary, two of the latter facing on the platforms. The platforms are 3 ft. 10 ins. long from the center of the corner post over the crown piece. The seats and backs are of ash slats. The interior finish is white ash except the ceilings or headlinings, which are of birds-eye maple. Each seat has foot rests, with a 10-in. division board between them. Round corner seat end panels are used and are standard with the road. The spring roller curtains have three battens and come down to the floor; they have three battens each.

The cars have folding steps extending the whole length. The width over them when closed is 7 ft. 2 ins., and when open 8 ft. 2 ins. The platforms are fitted with folding gates of the Brill pattern. A very neat device has been introduced to get rid of the water in rainy weather. It consists of a regular galvanized gutter extending the whole length of the car. Four leader pipes carry the water to a point below the running board or step.

These pipes form grab handles and merely show above and below the grab handle brackets on the posts. On account of the speed and weight of the cars a powerful brake is needed. For this purpose the Sterling is used. It has the advantages of extreme power and a small amount of slack, and can in consequence act very quickly and make short stops.

The closed cars are 28 ft. long over the end panels and have 4-ft. platforms. Total length over the angle iron bumpers, 37 ft. At the sills they are 6 ft. 6 ins. wide and over the body rails 7 ft. 6 ins. The gage is standard, 4 ft. 8½ ins. They can seat forty persons by close sitting. The underground trolley is used and hence no trolley boards are necessary on the roof. Truss rods are introduced inside the car, a feature made necessary by their length.

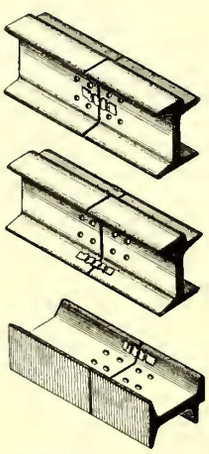
All of these cars are mounted on Eureka maximum traction trucks. With only two motors they provide ample cohesion for fast work when the number of stops per mile are greater than in any other service. Although these cars complete weigh about 21,300 lbs., the load on each driving wheel is only, say, 4,300 lbs. This is not materially more than would be given by a short body on four wheels.

The smoothness with which the double truck carries the car cannot be compared with the destructive pitching and rolling which is so constant with four-wheel cars. The Maximum Traction truck really makes the large unit a practicable matter for street railways of to-day. For the fast city service it is indispensable. I think in the future the large street railway companies will order double truck cars exclusively. Many of the smaller companies are now converting their 18 and 20 ft. four-wheel cars into double truck cars, by lengthening them, a sufficient indication of the general tendency.

Welded Bonds

Since the introduction of electricity on street railways there has been a continued effort to reduce the losses on the return circuit due to imperfect rail bonding. The advantages of a welded bond are numerous, and include excellent mechanical and electrical contact with the rail, with all the benefit which these conditions secure, and ability to attach the bond to any part of the rail, viz., the web, base, or below the head or tram.

The Payne welded bond, which is manufactured by the Payne Welded Bond Company, of New York, is made of copper, and can be placed under the fish-plate, as shown in the engravings on this page. It has been in use on the Brooklyn Heights Railroad for two years, and it is on 100 miles of its line to-day. The Payne bond is also being used on the Brooklyn, Queens County & Suburban Railroad, and the Brooklyn Bridge.



WELDED BONDS

Before its adoption the Brooklyn Heights Company had an exhaustive series of tests made to determine its efficiency. In a test made Feb. 19, 1896, the engineer reports that the drop at the contact was so small that it could not be measured with a voltmeter reading as low as .002 volt.

The readings of a drop through the contacts and copper with 545 amps. were as follows: Total drop, .053 volts; drop through copper, .053 volts; showing that the drop was due to the resistance of the copper, and not to the contacts.

The bond was also tested in connection with one of the best known mechanically attached bonds; 750 amps. were passed through the rails in each case, and the loss in volts read at the joints by the voltmeter as follows:

Mechanical bond, 0000 wire, loss	.09	volts
Two feet of rail	.096	"
Welded bond and two feet of rail	.014	"
Welded bond	.008	"

The comparison with the new mechanical bond shows the resistances stood as .008 to .09; or that the welded bond had only 8.8 per cent of the resistance of the mechanical bond. The latter contained 38 oz. of copper, while the Payne bond weighed 8 oz. The Payne bond in use on the Brooklyn Heights Railroad consists of ten pieces of No. 34 copper, 2 ins. wide x 5 ins. long, area of contact, 2 ins. x 1 in. Those on the Brooklyn Bridge were corrugated to allow for expansion.

Judge Holcomb, of the Circuit Court of the United States for the Eastern District of New York, in a suit brought by the Paynes for infringement, upheld the patents, and a decree was entered to that effect, so that the company's patents are well established.

The Duplex Car

One of the most interesting exhibits at the Niagara Falls Convention of the American Street Railway Association was that of the "duplex" convertible car, built by the Duplex Car Company, of Boston. This car is made on the principle of the roll-top desk, its sides running up or down into the roof in such a way as to make the car an open one of the usual type or a closed one, at will. In the roof the two sides roll past each other, and, the windows even being jointed, there is practically no difficulty in making the change quickly, five minutes being ample allowance.

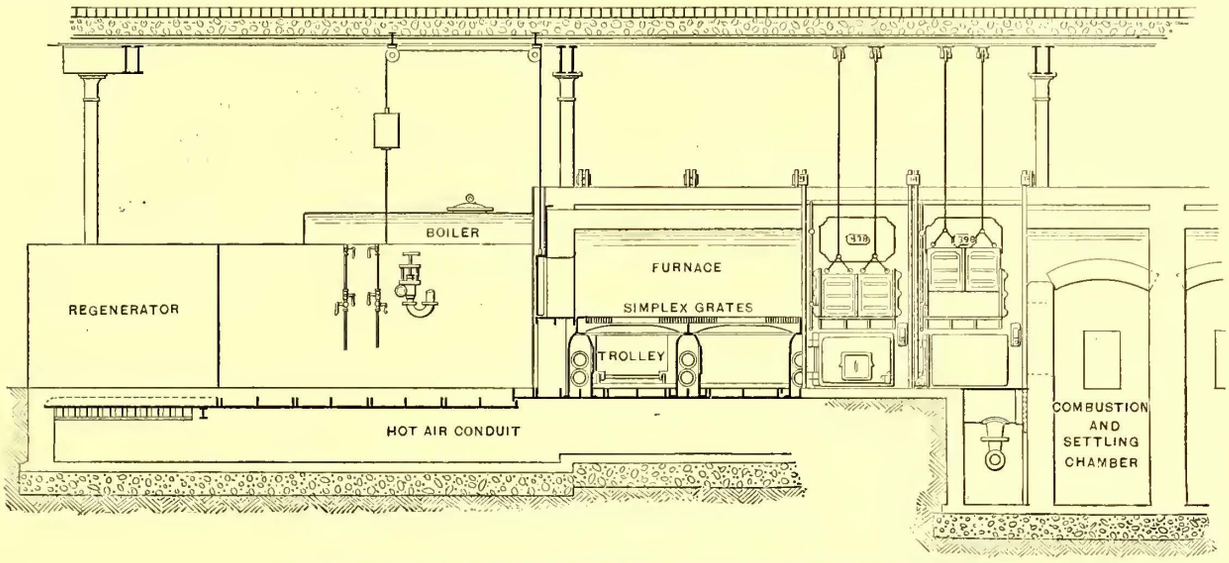
From the results shown at Niagara Falls, duplex cars have been ordered for various roads, among others, the Bergen County Traction Company, where a car is now in regular operation, with results understood to be entirely satisfactory. The Niagara Falls car itself was sent to Newton, Mass., for a service test, and has been running regularly on the line of the Newton & Boston Street Railway Company.

The Duplex Car Company has manufacturing arrangements such that it is now able to build on orders of considerable size and to make prompt deliveries. The company's main office is in New York.

Furnace for Burning Refuse

The ability to use ordinary town refuse and garbage for fuel in generating steam power has been demonstrated by steam engineers, but as yet but little attempt has been made in this country to apply the principle. On the other hand, this fuel has been used to a considerable extent abroad, showing the system is quite feasible and practicable. The chief advantage, of course, lies in the fact that this material can be usually secured from the city authorities for nothing, or, in some cases, a price might be secured for carting away and disposing of it.

To effectually destroy refuse it is necessary that complete combustion take place in the furnace, and no gases or vapors distilled from the freshly charged material should leave the furnace without being rendered totally innocuous; the heat in the escaping gases can then be used for generating power. Messrs. Meldrum Brothers, whose furnaces for low-grade fuels were described in the May issue of THE STREET RAILWAY JOURNAL, having had an experience in burning low-class fuels with their patent system of forced draught, and noting that the results obtained in the ordinary destructor cells were in the majority of cases unsatisfactory, were eventually led to make some preliminary tests. Their



FIG, 1.—FRONT ELEVATION OF BOILER WITH REFUSE DESTROYER

Many opinions have been expressed as to whether the amount of power obtained warrants the increased outlay such a plant would entail. Some have advocated, as the most economical method, burning the refuse at the temperature required to render all fumes harmless, as the wear and tear on the furnace is then very small and the cost of repairs a minimum. Until the past two or three years practically all the furnaces erected in England have been constructed on this principle. They have in all cases had a high chimney to carry away any fumes that escaped cremation, but so numerous were the complaints made by those living in proximity to the works that it was found necessary to furnish some means to abolish this nuisance. To meet this difficulty, the fume cremator was invented. This consists of a reverberatory arch with baffle brick ribs projecting from it, serving to deflect the gases on to the top of a red-hot coke or coke breeze fire. This adds to the cost of destruction about 6½ cents per ton of refuse.

first attempts were made in the ordinary types of Lancashire and Cornish boilers; that the results were satisfactory the following test, made at Salford Sewage Works, will show:

Boiler—Lancashire, 28 ft. long, 7 ft. diameter, 2 ft. 9-in. flues. Fuel used—Unscreened refuse. Duration of test—14 hours 10 min.:

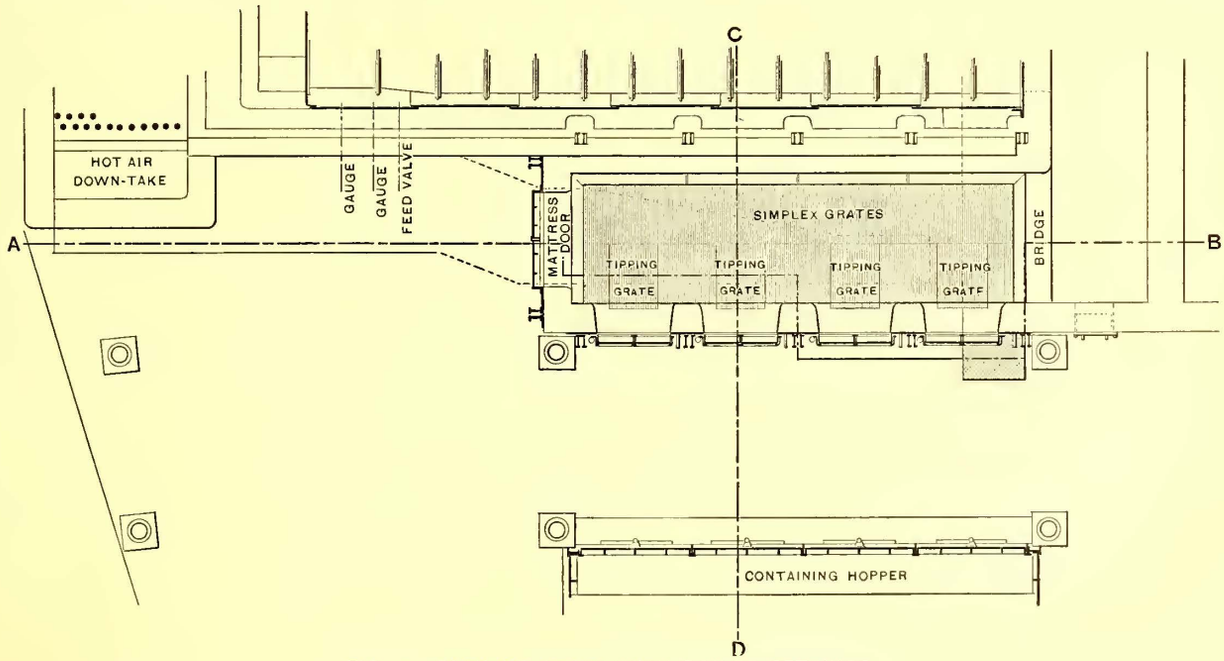


FIG. 2—PLAN OF GRATE WITH BOILER SETTINGS

Weight of unscreened refuse burned, lbs.	18,704
Average steam pressure, lbs.	50.5
Temperature of feed water, degs. F.	42.9
Water evaporated during test, lbs.	36,000
Refuse burnt per hour, lbs.	1,320
Water evaporated per hour, lbs.	2,540
Water evaporated in lbs. per lb. of refuse from feed.	1.9
Water evaporated per lb. of refuse from and at 212 degs. F..	2.28

It follows that to destroy a considerable quantity in this manner would require an extensive outlay in plant; neither could it be expected that the high temperature necessary for the total destruction of the fumes could be obtained in the ordinary boiler

furnaces, owing principally to the large quantity of clinker, small grate area and limited space above grate level. Having satisfied themselves that power could be obtained from ordinary unscreened town's refuse, and that such results had not been previously equaled, they designed a furnace which should destroy a large quantity of refuse and conform with all the requirements of an efficient destructor. Naturally, there were many preliminary difficulties and prejudices to contend with. The old type had a great hold, and many were too incredulous to believe such results as those given could possibly be obtained.

The first destructor to generate steam as well as consume the refuse was erected at Rochdale. It consisted of two cells, each having a grate area of 45 sq. ft., which was again divided into two separate or smaller grates by means of brick division walls built in the ashpits and carrying cast iron division Ts—with their thin

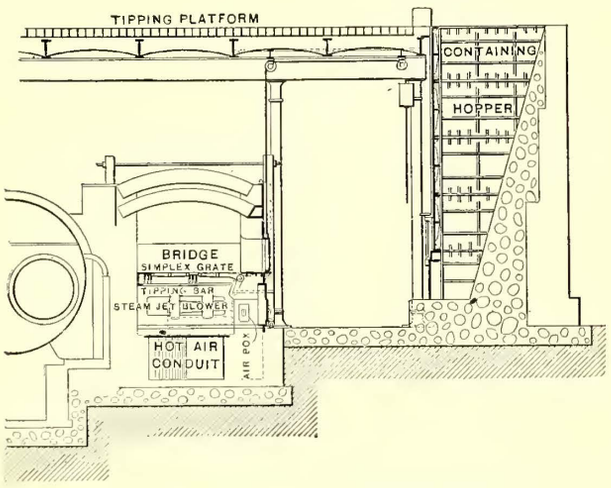


FIG. 3.—ARRANGEMENT OF FEED SUPPLY

edges level with the top of the firebars. This enables one-half of the grate to be cleaned while the other half is in full work, consequently the temperature of the furnace is reduced very little, and all noxious fumes mingling with the gases from the incandescent fire are entirely destroyed. At the back of these grates, behind the bridge, is a combustion chamber common to the two cells, serving as a settling pit for the fine dust, and in which the gases are further mixed. From this chamber the gases are led to the boilers. The latter are of the Lancashire type, one to each cell, 8 ft. dia., 30 ft. long, flues 3 ft. dia., set in the ordinary method. The following test, taken in the presence of a well-known engineer, will vouch for the efficiency of the plant:

Evaporative test of unscreened ashpit refuse burned in Meldrum furnaces fitted in front of two Lancashire boilers 30 ft. by 8 ft., with two flues 3 ft. in diameter, at the Rochdale Sanitary Works, March 1, 1895:

Duration of test, hours	6
Average steam pressure, lbs	113
Average temperature of feed water, degs. F	53
Total water evaporated, gals	4,207
Total refuse burned, tons	11.4
Total residue (clinker), tons	4.15
Temperature in combustion chamber at 4 o'clock, tested with Siemens' pyrometer, degs. F	1,988
Temperature at 4:30 after clinkering and feeding	1,290
Water evaporated per boiler per hour, gals	350
Refuse burnt per hour, lbs	1,280
Water evaporated per lb. of refuse (actual), lbs	1.64
Water evaporated from and at 212 degs. F	1.97
Percentage of clinker to refuse, per cent	36

Moisture not known.

Blowers supplied with steam at 55 lbs. pressure from separate range of boilers.

Two destructor furnaces on similar lines were erected in front of two Galloway boilers at the Sewage Outfall Works, Hereford. Here each cell was separated entirely, although provision was made to have the combustion chamber common to both furnaces if required. The Galloway boilers are each 22 ft. long, 7 ft. dia., 2 ft. 9 in. flues, and the steam generated is used for pumping 1,250,000 gals. of sewage effluent per day of ten hours, sludge presses, lime mixing and other auxiliary plants. Tests made by Jno. Parker, the City Engineer, have satisfied him that the evaporation obtained is quite 1½ lbs. of water per lb. of refuse, and, since the furnaces commenced working, no coal or coke whatever has been required. That the temperature is high may be judged when it is stated that the copper balls of a Siemens water pyrometer were melted in the combustion chamber, indicating that there was a temperature of at least 2000 degs. F. Here and also at Rochdale there is a stalactitic formation on the brickwork which serves to protect the structure. Analyses of the gases taken gave an average of 16 per cent by volume, though readings up to 20 per cent CO_2 were taken. These were given by Arndt's reconometer and checked at the same time by the Orset apparatus. There was also an entire absence of CO. Forced draught on the well-known system of Meldrum was used in all the previously mentioned tests, and the results seem to prove that a perfect system of forced draught is absolutely necessary. It is unnecessary here to enter into the details of this system, as the reader may gain all information he requires from the article which appeared in the May number of this paper, already referred to. So successful have the Rochdale and Hereford destructor plants proved that Meldrum Brothers have received orders to erect plants of larger capacity from two municipal authorities, both orders being the result of deputations to see the destructors mentioned. Both these new plants will be of the construction shown in Figs. 1, 2, 3, 4 and 5, and in each case they have to provide steam, one in conjunction with the electric light station, and the other in pumping sewage effluent. They will have Meldrum's patent simplex system of grate, the construction of which will be readily followed on reference to Figs. 1, 2, 3. The plant consists of simplex grate, Lancashire boilers, settling combustion chamber, continuous tubular regenerator, this combination being termed a unit. The simplex grate is divided into four separate working grates by means of cast iron division boxes in the ashpit, on the top of which are carried the cast iron T pieces ⊥ with their thin edges level with the top of grate bars. Each portion of grate so divided has separate firing doors; there will also be noticed at the end grate a large door, through which mattresses, diseased carcasses, etc., will be charged. There is also a portion of the grate for about 2 ft. in width of the front bars made to tip so that all clinkers may be raked through the opening thus formed into the ashpit or

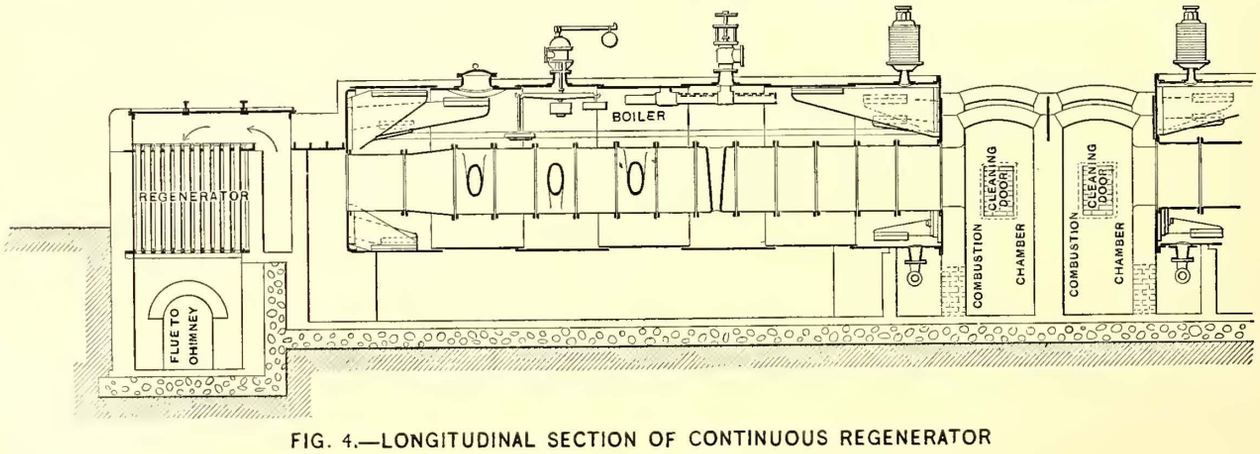


FIG. 4.—LONGITUDINAL SECTION OF CONTINUOUS REGENERATOR

into a trolley introduced there. The spaces between the bars will be narrow, about ⅛ in., as is the custom in this system of forced draught. The furnace and ashpit fronts will be substantially constructed, the ashpit being entirely closed, so that all the air for combustion will be supplied by means of the steam jet blowers of the Meldrum type, projecting inside the cast iron division boxes, which are carried by air boxes connected with the hot air conduit from regenerator. The ashpit front has a large hinged door, so that an ash car may be introduced to receive the hot clinkers, which while cooling give up their heat to the air and can afterward be wheeled away without inconvenience to the fireman. As an alternative to the tipping grate, the dead plate may be made to tip and the clinker dropped on the ashpit to cool. With the grate described it follows that an evenly high tempera-

ture may always be maintained by careful and systematic firing, one grate being cleaned while the others are in an incandescent and semi-incandescent state. Thus all noxious fumes must be destroyed, and no paper or other light material can pass unburned to the chimney. The gases of combustion will pass over the bridge into the combustion chamber, where the major portion of the dust will settle through openings in the combustion chamber along the flue tubes of the Lancashire boiler, which is set in the ordinary method. After leaving the boiler the gases pass through the regenerator tubes to the chimney flue. This continuous regenerator (Figs. 4 and 5) is a new departure in the destruction of refuse. It has proven successful in many cases, and will, no doubt, be of inestimable benefit when the fuel is damp or of low calorific value and varying quality, as refuse, insuring an increased rate of combustion. It will be constructed of a number of cast iron tubes suitably carried on cast iron plates, allowance being made for their free expansion. The gases from the boiler pass down the tubes to the chimney flue. The air to be heated will be drawn from the tipping floor overhead, circulated around the tubes, and be led away to the hot air conduit, which runs under the ashpit floor of furnace, suitable openings being left for the air to pass to the air boxes, carrying blowers. The engravings show an overhead platform and portion of another unit. As the platform will be of an ordinary construction, it is unnecessary to describe it. The method of firing will be by hand, the refuse being tipped from the cart into the containing hopper (Figs. 2 and 3), which will have a capacity equal to a day's supply.

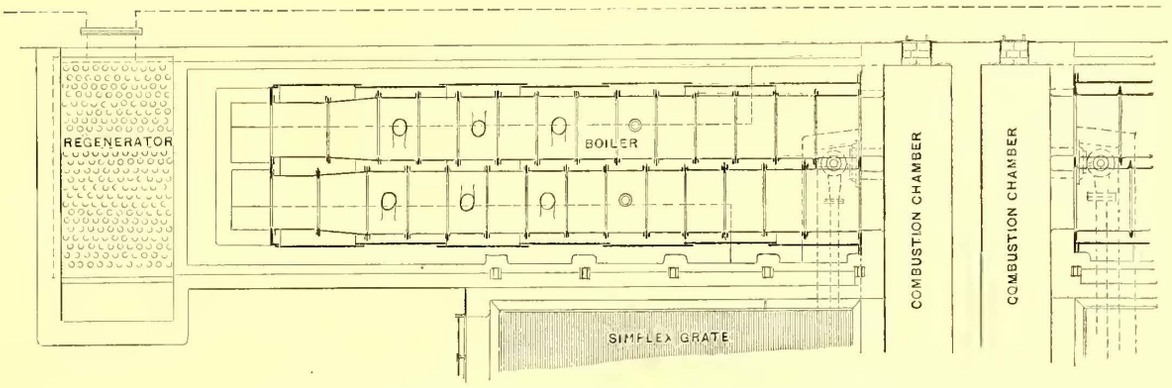


FIG. 5.—PLAN OF CONTINUOUS REGENERATOR

In charging destructors many favor the hopper method of feeding on to a drying hearth, but if it is carefully considered it will be seen that hand firing is to be preferred at the same time, and gives the better result, necessitating only two handlings of the refuse as against three by hopper charging, viz., charging and clinkering in the former case, and charging, shaking down and clinkering in the latter.

It will perhaps be interesting to see what power can be obtained from a plant of this type. The boiler adopted is of the Lancashire type (Figs. 4 and 5), 8 ft. dia., 30 ft. long, and flues 3 ft. 2 ins. in dia., constructed for a working pressure of 200 lbs., which is to be reduced down to 150 lbs. The heating surface of such a boiler may be taken at 1050 sq. ft.; this, at a rate of evaporation of 6 lbs. of water per sq. ft. of heating surface will evaporate 6300 lbs. of water per hour from feed at 160 degs. F., or assuming 20 lbs. of steam per i.h.p. will be equal to 315 i.h.p. Now the grate area will be 95 sq. ft. and the rate of combustion may be taken at about 42 lbs. per sq. ft. of grate under normal working conditions, although no difficulty need be experienced in increasing this up to 52 lbs. or 56 lbs. per sq. ft. of grate. If the evaporation per pound of refuse be taken at 1½ lbs. of water per lb. at 42 lbs. per sq. ft. of grate, this would give an evaporation of 5985 lbs. of water per hour, and if the increased rate of 56 lbs. be taken at the same value the evaporation will be 6175 lbs. of water evaporated per hour.

It will also be interesting to note that if power in excess of this be required and the working pressure is taken at 150 lbs., there is an amount of heat stored in the body of water contained in the boiler, the highest water level being taken within 15 ins. of the boiler crown for 200 lbs. pressure, which heat is given out in the form of steam when reducing from the 200 lbs. pressure to 150 lbs. There is also the heat contained in the water between the highest and lowest water gage levels, which is at the temperature equal to 150 lbs. pressure, viz., 366 degs. F. This quantity of water will consequently require less heat to evaporate it at 150 lbs. pressure than from the feed. This heat storage may be accumulating during the light load period in readiness for a heavy load period, which, extending over say 3½ hours, would materially increase the evaporation, thus:

Temperature of water at 215 lbs. pressure, abs.....388 degs. F.
" " " " 165 " " " .....366 "
Heat units given out due to fall of pressure from 215 lbs. to 165 lbs. abs. = 46,990.
Maximum total weight of water, lbs. = 22.
Total heat units given out by water at 215 lbs. absolute, falling to 165 lbs. abs. = 46,900 × 22 = 1,031,800
Extra total heat of iron, 52,180 × .12 × 22 = 137,767
" heat in brickwork setting..... 137,767
1,307,334

$$\frac{1,307,334}{858} = 1523 \text{ lbs. extra evaporation.}$$

In addition to this there is the heat stored in the water between the highest and lowest water levels at 165 lbs. pressure absolute, or 366 degs. F., instead of feed perhaps at 160 degs. F., = 20,563 (weight of water) × 200 = 4,112,600 heat units; 20,563 ÷ 3½ hrs. =5875 lbs. water requiring less heat; $\frac{5875 \times 200}{858}$ = 1368 lbs. per hour, where 200 = difference in temperature of feed and water in boiler already heated; 858 = latent heat of steam at 165 lbs. absolute pressure. Then the evaporation of 6300 lbs. of water per hour can be increased by the heat and water storage to 8100 lbs. water per hour.

The few facts and figures submitted indicate fairly conclusively that power can be and is obtained in large quantity from the refuse of towns without sacrificing the efficiency of destruction. That the essential point in the design of such furnaces is simplicity, absence of moving parts, as movable grates which quickly clog and become unworkable, and a properly designed system of forced draft, which should be self-sustained and not rely on the working of machinery liable to breakdown seems also evident. These points Meldrum Brothers claim to have in their types of destructors, and the claim seems to be justified by the figures given.

Mechanical Stoker

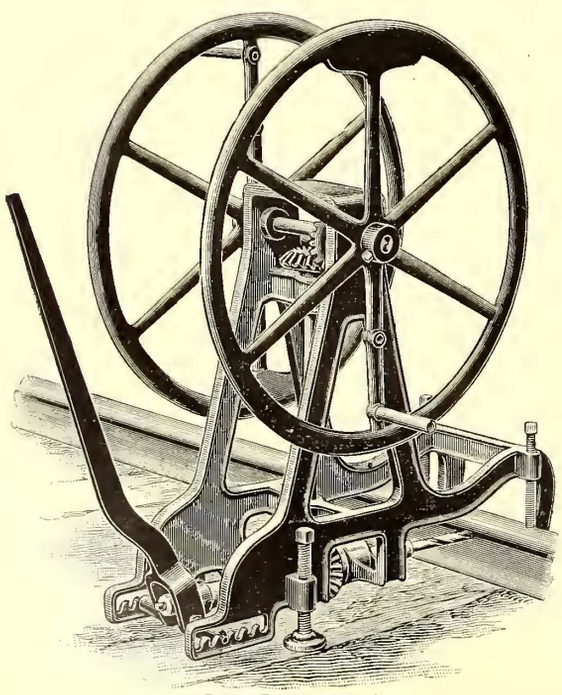
A mechanical stoker employing the underfeeding principle is manufactured and sold by the American Stoker Company, of New York. In this stoker the conveyor pipe is placed immediately between the coal hopper and communicates with it, the hopper in turn communicating with the coal magazine. A screw conveyor or worm is located in the conveyor pipe and extends the entire length of the magazine. Immediately beneath the conveyor pipe is located the wind box, having an opening beneath the hopper. At this point is connected the piping for the air supply, furnished at low pressure by a volume blower. The other end of the wind box opens into the air space between the magazine and outer casing. The upper edge of the magazine is surrounded by tuyeres or air blocks, these being provided with openings for the discharge of air inwardly and outwardly. The American Stoker Company has recently issued a very attractive and comprehensive catalogue, which will be sent upon application. The catalogue fully describes and illustrates this appliance.

Negotiations are in progress whereby the tramways of Nice, Villefranche, Monaco and Mentone will be worked together and equipped as one electrical tramway, thus joining together the most popular winter resorts of the Riviera.

New Track Drill

The Michigan Manufacturing Company, of Ypsilanti, Mich., is placing upon the market a new track drill, which will drill a straight or tilting hole from the smallest possible size to 1 in. in diameter, and on actual work this machine has drilled three ½-in. holes in ⅝-in. web in 1 minute and 4 seconds, and on a road recently constructed one man with this machine drilled 6500 13-32-in. holes for bond wire in 65-lb. T rail in nine days. The drill is known as Sweet's track drill.

This device is designed to be locked over the rail from either the inside or outside, and when it is necessary to allow cars to pass the drill can be thrown over on to the balance wheels shown in the illustration, giving a clearance of 29 ins. The balance wheels can also be used as trucks when the machine is moved, and this is an advantage which will be appreciated by both operator and contractor. The height of the drill is 32 ins.; length over all, 29 ins.; diameter of balance wheels, 25 ins.; weight, complete, 160 lbs.

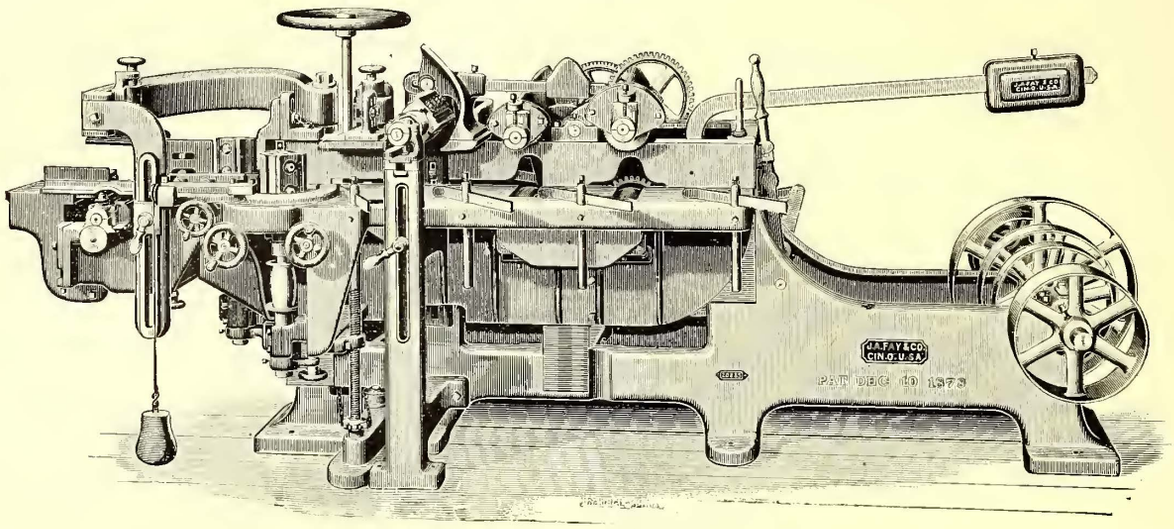


NEW TRACK DRILL

The handles of both balance wheels are adjustable for high or low speeds, and the machine can be set five times without moving, giving a total drill distance of 6½ ins. The drill used is the standard Morris taper shank, for girder rails a 7⅜-in. drill being used, and for T rails a 9⅛-in. drill. The Sweet's track drill is fitted with a new type of bearing, which has been carefully designed, and which the manufacturers think will give entire satisfaction.

New Extra Heavy Moulding Machine

The moulding machine illustrated herewith is one of recent design, and is claimed to be exceptionally strong and substantial in all of its working parts. It is manufactured by J. A. Fay & Company, of Cincinnati, Ohio. The framing is massive, and all the joints planed and accurately fitted and bolted together. The bed is wide and heavy, and is gibbed to the frame with provision for taking up wear, and it is raised and lowered by means of three screws, two inside the frame and one outside, supporting the bed at the front, rendering it easy of adjustment. When set to any required position it is clamped securely by a lever in front. The adjustable throat piece is located beneath the main cutter head to admit of working cutters the full thickness of the material. The extension after the lower cutter head is hinged and swings aside when it is necessary to adjust or sharpen the knives, and it also swings down for the same purpose when material is on the bed.



NEW EXTRA HEAVY MOULDING MACHINE

The cutting spindles are large in diameter, and run in long bearings. They are lead ground, and each one is fitted regularly with a four-side slotted steel forged head and pair of straight knives. The feeding mechanism consists of four rolls, two above the bed and two in it, all driven by a powerful system of expansion gearing. The upper rolls are mounted in strong frames, and always raise parallel with the bed, and are weighted to secure uniform pressure. Four speeds of feed are provided, namely, 10 ft., 16 ft., 24 ft. and 36 ft. per minute.

Testing Car Wheels

The P. H. Griffin Machine Works, of Buffalo, N. Y., have recently issued a pamphlet which contains very interesting information as to the methods of testing car wheels before they leave the foundry. One of the most interesting tests is the one called for in the German state railway specifications. In this test the wheel is placed in a horizontal position on wooden blocks which are supported by heavy iron and stone foundations. The hub is carefully bored, and in it are placed conical steel sections with an interior steel wedge having a taper of 1 in 20, all machined and accurately fitted. The wedge is driven home by dropping a weight of 440 lbs. from varying heights, commencing at 1½ meters (about 5 ft.), and increasing by half-meters to 4 meters (13 ft. 1 in.), the object being to burst the wheel. The specifications require the wheel to stand six blows in succession without bursting. The test called for in the Belgian state railway specification is also interesting. This test is intended for steel-tired wheels. The wheel is placed upright on heavy iron and stone foundations, and a weight of 2200 lbs. is dropped from varying heights, beginning at ½ meter (1 ft. 7 in.), and increasing by half-meters. The wheel is required to stand five blows in this way without breaking in pieces. The pamphlet also contains a description of the Pennsylvania Railroad thermal test, which is unusually severe. This test requires that the wheel be laid flange down in the sand, and a channel way 1½ ins. wide and 4 ins. deep be moulded with green sand around the wheel. The tread of the wheel must form one side of this and the flange part of the bottom. The channel way is then filled to the top with molten

cast iron. Two minutes later an examination of the plates is to be made. The wheel to be accepted must not be broken in pieces, and cracks, if any, must not extend through the tread. A number of other tests are also described.

The pamphlet also contains several interesting records which were made by Griffin wheels under these different tests. In all cases the wheels were found to exceed the requirements which were demanded.

Lap-Jointed Track

The joint problem is undoubtedly one of the most important which faces railway managers, and the wasted energy and repairs to rolling stock and motors caused by defective track joints make heavy demands upon the company's treasury and the good temper of the traveling public. Among the methods proposed to obviate this trouble is the lap joint. A track made on this principle does not present at any one place, as with the ordinary fish-plate construction, a complete break in the carrying girders which make up the supporting structure of an electric railway track, and so avoids the break-down possible at such points.

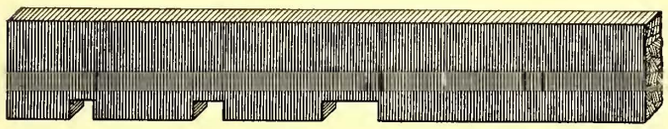


FIG. 1.—END OF TIE BAR

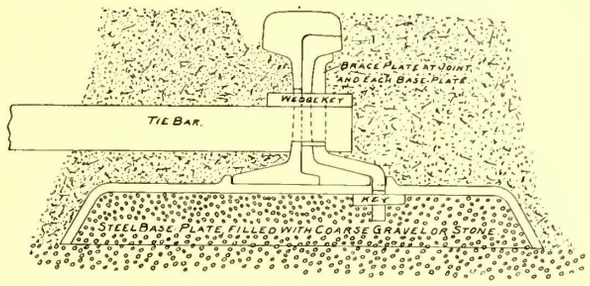


FIG. 2.—CROSS SECTION OF T RAIL AT BASE PLATE

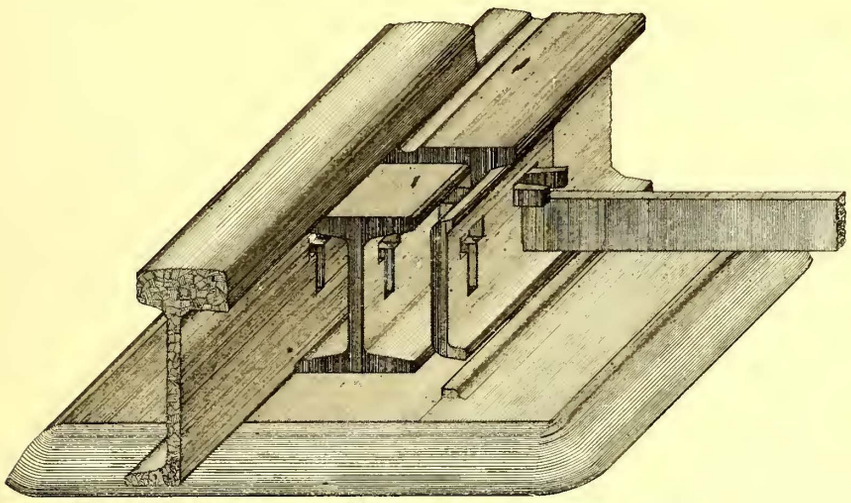


FIG. 3.—PERSPECTIVE VIEW OF RAIL AND BASE PLATE

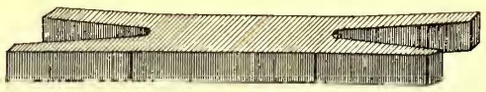


FIG. 4.—WEDGE KEY

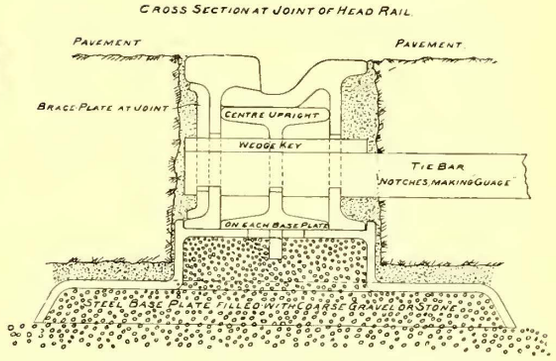


FIG. 5.—CROSS SECTION OF GIRDER RAIL AT BASE PLATE

The best known advocate of the system in this country is T. H. Gibbon, whose early invention in this line gave the first all-metal track laid on this continent, at Fulton, N. Y., 1885, and still doing service. His duplex rail and cast iron chair system, brought out in 1892, is still in use in Astoria, Brooklyn, N. Y., Baltimore, New Orleans and other cities, and the lap-joint system, composed of all rolled steel, which is his latest, contains a number of points of improvement.

The system consists essentially of the use for a track rail of two members, a head rail and a tram rail, as shown in Fig. 3, which is the style adapted for the ordinary girder type of rail head. These members are rolled in 30 ft. or other convenient lengths and break joints. Ties are discarded, and the rail rests upon steel base plates, which carry a third upright supporting member, which is keyed to the plate, and butts up against the lower flange of the tram rail, as shown. The construction is then tied together by tie bars every 6 ft. The tie bars are notched to gage, and are held in place by wedge keys, avoiding all use of bolts and nuts. The keys are of soft steel, and after being driven in place the ends are turned over so they cannot work loose.

The base plates are concave on the under sides, and so compress the earth as weight is put upon them; this prevents them from slipping.

The system, it will be seen, has in actual number far fewer pieces than with the ordinary joint-plate construction, when the bolts and nuts of the latter are considered, hence is simpler, and, as the tie bars are cut to any required gage, there is no danger of the track getting out of line. Any part subject to special wear, such as the head, can be replaced easily if desired, hence track renewals do not require the scrapping of any considerable quantity of metal. Expansion and contraction are fully provided for, and the total weight of the construction is no more than with the ordinary single web pattern of rail. Fig. 2 shows a modification of the system adapted to T-rail construction.

The system of laying the track is as follows: Longitudinal trenches 18 ins. wide and 1 in. deeper than the depth of the rail are excavated to receive the base plate, and a narrow lateral trench every 6 ft. for the tie bars. This avoids the expense of deep excavating the width of timber ties, an important item. The base plates, with uprights, are then placed in position in the trenches, 3 ft. apart; then a flange rail 30 ft. in length, the foot resting on the base plate, and the tram resting on the face of the upright, followed by a series of 30-ft. flange rails, are put in place. The next step is that of placing the 30-ft. head rails on the flange rail. After the two sections of the rails on both sides of the track are in proper position the notched tie bars are passed through the mortises in the rail and upright and hooped thereto, then keys are driven over the tie bars, through the mortises in rails and upright, and all the parts are locked together. Finally the constructor lines and tamps up the base plates, firmly filling the hollow, and the track is complete.

The special work is either made up or solid, as may be desired. In the latter case cast steel with hardened centers or other styles of solid special work may be used, so arranged that the rail lap joints even at the frogs and crossings. The system is being placed on the market by the Lap Joint Railway Track Company, of New York.

A Well Designed Steam Engine Indicator

The Crosby Steam Gage & Valve Company, of Boston, Mass., has had upon the market for some time a steam engine indicator which was designed to meet the requirements of modern practice. The manufacturers of this indicator think that to obtain trustworthy results on a high speed engine an indicator must have extreme lightness, a nice adjustment of all the moving parts and fine workmanship. To these indispensable qualities should be added simplicity of construction and convenience of manipulation. All these requirements are claimed to be included in the Crosby indicator.

Electric Locomotives for Hauling and Switching Purposes

A striking instance of economy in actual money and elimination of trouble and delay induced by supplanting a steam haulage service with electric traction is afforded by the installation recently made by the General Electric Company for the Arlington Mills, Lawrence, Mass. These mills have about 2 miles of track running from the main line of the Boston & Maine Railroad into the yards and throwing off spurs into the alleys between the different buildings. Previous to the change to electrical service the haulage of the entire output of the mills to the main line, the haulage

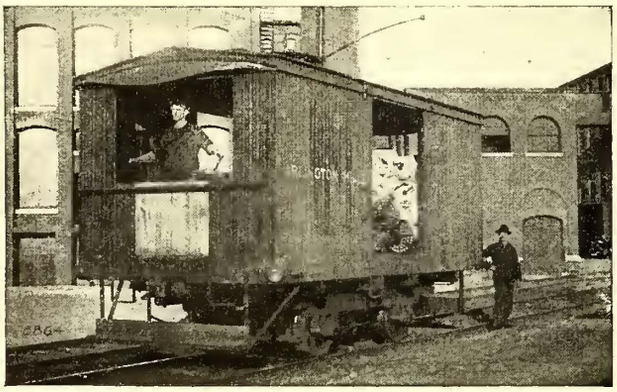


FIG 1.—BOX CAR ELECTRIC LOCOMOTIVE—LAWRENCE, MASS.

of the material from building to building as well as the necessary switching about the yards, was done by a steam locomotive rented from the railroad. For this service the Arlington Mills paid an annual rental of several thousand dollars, and were, moreover, frequently put to great inconvenience and delay on account of the unavailability at times of any locomotive.

The electrical installation consists of a small generating plant and two electric locomotives, one of the box type and the other a platform car. The generating plant consists of a standard G. E. 75-k.w. 500-volt railway generator driven by belt from an Armington & Sims high speed engine. The generator readily answers all calls upon it with absolutely no heating or sparking, although it is occasionally subjected to very heavy overloads when both cars are handling a train of more than the usual number of loaded cars.

The box car locomotive used for hauling material about the yards is shown in Fig. 1, and is equipped with two G. E. 800-27-h.p. motors and series-parallel controllers. The platform locomotive is used to haul trains of loaded cars from the yards to the main line, and empty cars from the line to the mill tracks, and to do all the drilling in the yards. The equipment of this locomotive consists of two 50-h.p. G. E. 1200 motors, with the necessary series-parallel controllers. In hauling heavy trains it is assisted by the box car locomotive. Together they are able to handle trains of thirty to forty empty cars, or twelve to fourteen loaded cars, with comparative ease and celerity. To give the necessary adhesion to the more powerful locomotive to enable it to handle heavy loads, about six tons extra is placed on the platform.

Perhaps the most interesting feature is the comparison between the cost of the electric plant and the expense formerly entailed by the use of the superseded steam locomotive. The cost of the entire electric plant was very little in excess of one year's rental of the steam locomotive. No more men are employed about the electric locomotive, the labor cost has not risen and the consumption of coal is scarcely felt on the main plant. Furthermore, the plant being always ready, cars may be shifted at any time during the day or night.

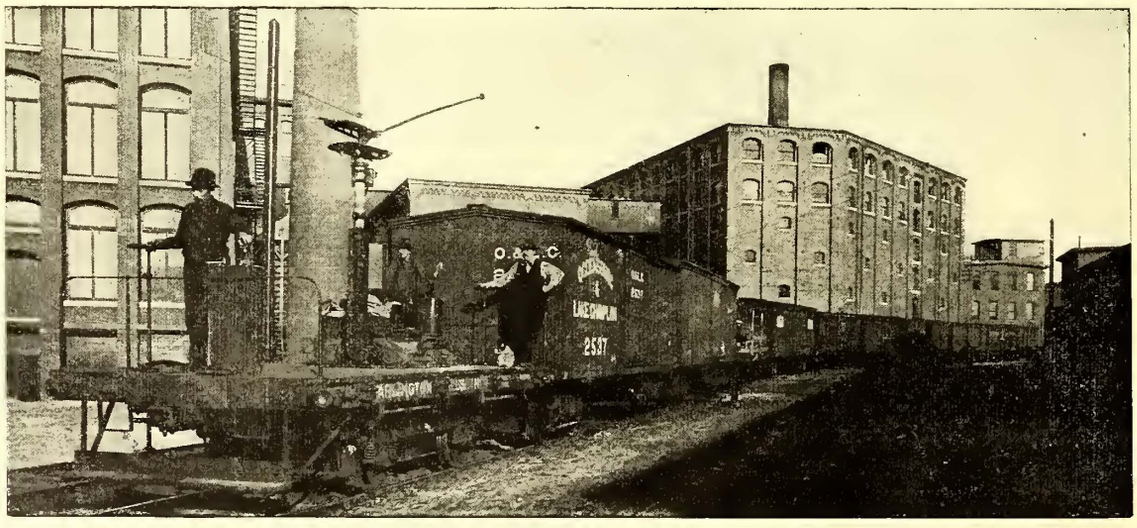


FIG. 2.—PLATFORM CAR LOCOMOTIVE—LAWRENCE, MASS.

Annual Election of the Siemens & Halske Company

The annual meeting of the stockholders of the Siemens & Halske Electric Company of America, was held on June 16, at their offices, Monadnock Block, Chicago. Nearly the entire capital of the company was represented at the meeting and the following gentlemen were elected directors of the company: Charles T. Yerkes, Martin Maloney, Jno. R. Bartlett, R. Suydam Grant, Charles E. Yerkes, E. A. Moore, B. W. Grist, Howland Coit and W. L. Elkins, Jr. The new board of directors was organized, and the following gentlemen were elected officers of the company: Charles E. Yerkes, president; W. T. Block, secretary and treasurer; C. F. Marlow, assistant secretary and assistant treasurer; B. W. Grist, general manager. The following gentlemen compose the executive committeee: Martin Maloney, Charles E. Yerkes and J. R. Bartlett.

An Electric Railway Near London

The Electricitäts-Gesellschaft Wandruszka & Cie, of Berlin, the general European agents for the Steel Motor Company, and Johnson Company, in Johnstown and Lorain, Pa., U. S. A., have recently built and are operating an electric railway in "Alexandra Park," situated in the north of London, near "Wood Green," a station of the Great Northern Railway. The road was opened for traffic on May 15, 1898, and the results of operation thus far have been very satisfactory to the public and to the owners.

The line is one-half mile long and four motor cars, each having a seating capacity of fifty persons, are in operation. The average receipts up to the present time have been about $60 per day, a result which is very gratifying.

The road is double track and of standard gage, and center-pole construction is employed to support the overhead wires. The average gradient of the total line is 1 ft. in 13 ft. The motor-cars are fitted with double equipments of Steel motors, type 18. The company operates its own power house, which is equipped throughout in duplicate, one-half of the plant being held in reserve.

The Thomson-Houston Electrical Company, of the Mediterranean, has been formed, with a capital of 5,000,000f. This company proposes to work in Italy, Greece, Spain, Portugal. and their colonies.

Forged Steel Split Axle Gears.

In the accompanying engravings is shown a forged split axle gear which is manufactured under patents by the Duquesne Forge Company, of Pittsburgh, Pa. The method of making these wheels is briefly as follows:

The flange or tire of the wheel is a rolled steel channel section; these are produced from large steel ingots, one-third of the material of which is discarded, thereby giving a rolled section with a large amount of work and thoroughly homogeneous. The advantage in thus procuring tires of uniform quality is apparent. The class of material used in the tires has been determined after careful examination of other wheels which have given the best service and longest life.

Fig. 1 shows a cross section of the steel channel bar, together with one of these channel sections as it comes from the dies, bent to the desired curvature. Fig. 2 shows the steel cross arms employed in making these wheels, and also shows one of these arms bent under the hammer. Such a test will certainly convince the most careful manager that any possibility of breaking arms which will submit to such a test is altogether removed. Fig. 3 shows the combination of tire and cross arm in Figs. 1 and 2. These cross arms are placed in position after the tire shown in Fig. 1 comes from the dies. They are forced into position and permanently set at the hammer; when the forging cools these cross arms are practically iron, and iron at the joints, and held so tightly in position that they can only be removed by reheating the tires. These sections are next taken to machines and faced off, after which they are placed in special machines, where each section is bored and countersunk, after which bars of ¾-in. cold rolled steel are driven through them and headed up, as shown in Fig. 3; the joint thus secured, first by sinking the cross arms into the tires, and second by these finished rivets driven cold with a strong driving fit, makes a joint which is solid beyond question and which cannot be disturbed in service. These joints have been submitted to the most severe tests under heavy hammers without disturbing them, and it is said that wheels which have been in operation fifteen months are as tight as when first put on the car. Fig. 4 shows the wheel complete and ready for service. The manufacturers of these wheels claim many advantages for them, the chief of which are the following:

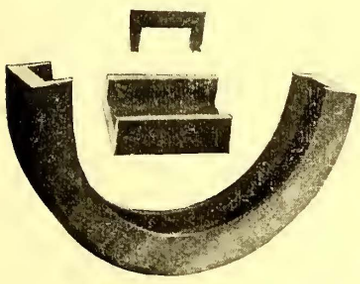


FIG. 1.—STEEL CHANNEL BAR

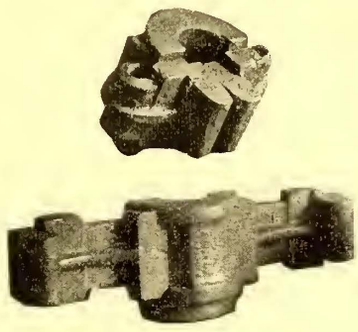


FIG. 2.—STEEL CROSS ARMS

FIG. 3.—CROSS ARM AND TREE COMBINED

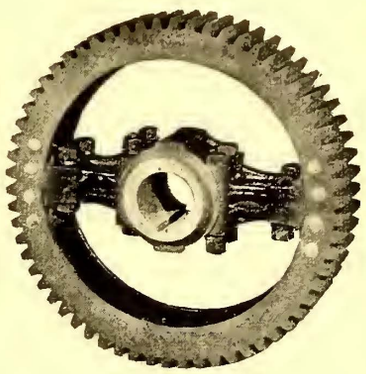


FIG. 4.—WHEEL COMPLETE

The wheels are stronger and 15 to 20 per cent lighter than corresponding cast wheels. Owing to the manner in which they are made, it is impossible to have defects in the tires, which are uniform in quality, whether furnished in large or small lots, and will wear evenly. The absence of the two extra spokes, present in all cast wheels, is more than compensated for in the additional strength in this wheel by its depth of flanges in the tire section; besides it is claimed the absence of the spokes gives greater freedom in use of the wrench in adjusting the wheels on the axles. The manufacturers say that by actual test it has been found that these wheels make less noise, when in motion, than a casting.

The first wheels put in service, after more than a year's steady running, show scarcely any wear and tear, and the manufacturers expect that the wearing qualities will prove superior to the best casting that can be made on account of the ability to secure the same uniform quality of material in the teeth at all times.

Another Engineering Corps.

Captain G. A. Hurd, mechanical engineer, the well known representative of the Crane Company, of Chicago, has applied to the Adjutant General, United States Army, for permission to raise a regiment of engineer troops. Captain Hurd writes that he has the major part of seven companies enlisted and as soon as the War Department gives him authority to proceed will have no difficulty in securing the required number of men. Captain Hurd has had a wide military experience, having been an officer in State and independent organizations for twenty-two years. He organized and drilled the famous Aurora Zouaves, who have never been defeated but once in the numerous interstate competitive drills since 1887 (the year of their organization). He is also an officer in Company D, Third Infantry, Illinois National Guard, which company is now at the front under Colonel F. D. Bennet, of Joliet.

New 3000-K.W. Generator for Boston

The Boston Elevated Railway Company has contracted with the Walker Company, of Cleveland, to furnish it with the largest railway generator yet built—a generator capable of delivering in regular service 6000 amps. at a voltage of 550, and capable of delivering upon overload about 9000 amps. The generator will be rated at 3000-k.w., and will be direct-connected to a 5000-h.p. engine. It will have twenty-four poles, will stand 20 ft. high, and will weigh 300,000 lbs. Its armature will be 15 ft. in diameter, and will alone weigh 125,000 lbs. The commutator will have 1200 bars, each 2 ft. long and 4 ins. deep, and the armature shaft will be 3 ft. in diameter. The unit will run at 75 r.p.m. The machine will have an adjustable compound winding, by which its rate of over compounding may be changed at will to provide for variable loads at different times of the day.

Altogether this machine will represent a development in railway practice to higher things than have yet been attained, and the best results are expected. The contract was placed with the Walker Company after a careful inspection by the engineers of the Boston Elevated Railway Company of the large Walker generators in the Kent Avenue station, in Brooklyn, which have been giving very good service. These generators were put through some of the severest tests possible to devise, such as breaking circuit instantly on full load, and no trouble whatever was found, the brushes even remaining practically sparkless at the break.

New Car Trust

Tate & Jones, of Pittsburgh, Pa., have made an arrangement with a trust company whereby they are enabled to extend to electric railways the services of a car trust in financing the purchase of rolling stock. Car trusts of this kind have been in operation among steam railroad companies for a long time, and the same general plan with certain modifications is now to be put in operation for street railway companies. The trust will enter into an agreement with a street railway company desiring to purchase cars to pay cash for the cars to be bought, taking on their delivery the obligation of the road for the same and attaching a small name plate on each car, truck and motor, showing that the ownership rests in the trust, the road agreeing to make a payment to the trust of at least 10 per cent of the purchase price on delivery of the equipment and monthly instalments extending over a period of two or three years to complete the payment, with interest at 6 per cent on the deferred amounts. For their service the trust will charge 10 per cent of the purchase price. When consideration is taken of the cost in keeping in repair worn or obsolete types of equipment and the manifold advantages in the way of better schedules, increased patronage, etc., that new equipment always brings, it would seem that any road can well afford to renew or extend its rolling stock on the above plan. The promoters of the plan will be glad to furnish further information and details.

A Patent Decision

Judge Lacombe, of the United States Circuit Court for the Southern District of New York, on May 26 handed down a decision in a plea for a preliminary injunction in the case of the Consolidated Car Heating Company vs. the Gold Car Heating Company for infringement of the electric heater patent of the former company.

The injunction is suspended until Nov. 1, until which time the defendants are required to give bonds in the usual form.

Personals

MR. J. BERNARD BROPHY has recently resigned from the Staten Island Electric Railroad Company.

MR. PAUL SEEVERS, superintendent of the Muscatine (Ia.) Electric Railway Company, has resigned his position.

MR. R. C. BROWN has left the Halifax (Can.) Electric Tramway and has accepted the position of assistant chief engineer of the Metropolitan Street Railway, of New York.

MR. R. L. RAND has arrived in New Brunswick, N. J., to take up his position as superintendent of the Brunswick Traction Company.

COL. A. C. WOODWORTH, president of the Consolidated Car Fender Company, of Providence, R. I., is making an extended Western trip.

MR. I. R. NELSON, superintendent of the Milwaukee, Racine & Kenosha Electric Railway, has resigned that position and is succeeded by Mr. John Blott, of Cleveland.

MR. W. E. PEGGS, for some time past connected with the Niagara Falls & Lewiston Electric Railroad, is now with the Lewiston & Youngstown Frontier Railroad Company.

MR. CHAS. N. WILCOXON has resigned his position as general manager of the Citizens' Railway Company, of Muncie, Ind., and has been appointed manager of the Decatur (Ill.) Street Railway Company.

MR. J. W. GARDNER, recently connected with the Stirling Boiler Company, and for a long time Western manager for Manning, Maxwell & Moore, has accepted a position in the sales department of the Sargent Company, Chicago, Ill.

MR. F. C. ARMSTRONG, the well known Canadian electrical engineer, has recently severed his connection with the Canadian General Electric Company, and has joined the staff of Dick, Kerr & Company, of London, which city he will make his headquarters.

MR. A. A. ANDERSON has been elected manager of the Trumbull Electric Railroad, connecting Niles and Warren. Mr. Anderson is also general manager of the Mahoning Valley Railway Company, of Youngstown, O., and will continue to operate both roads.

MR. F. H. TALBOT, formerly superintendent of the mechanical and electrical departments of the shops of the Lake Street Elevated Railroad, Chicago, has connected himself with the Walker Company as constructing engineer, and now has charge of the equipment of the new motor cars of the Metropolitan West Side Elevated Railroad.

MR. CHARLES E. A. CARR, manager of the London (Ontario) Street Railway Company, has just been appointed to the position of manager of the Montreal Park & Island Railway. Mr. Carr has made a splendid record in London, and the Montreal Park & Island Railway Company is to be congratulated on securing his services.

MR. DANIEL COOLIDGE, of the Johnson Company, whose home is at Elyria, O., was married June 1 to Miss Lillian Rosensteel, of Johnstown, Pa. The couple will visit many of the principle cities in the East and will then make their home in Elyria. The many friends of Mr. Coolidge and his wife extend to them their heartiest congratulations.

MR. I. E. WINSLOW, engineer of the New General Traction Company, of London, has been spending a brief vacation in America. The New General Traction Company is the owner of valuable tramway properties and concessions in Coventry and Norwich, England, and upon these two systems electric traction is being introduced as rapidly as possible.

MR. H. C. GARFIELD, superintendent of the Greenfield & Turner Falls Street Railway since that road was opened, tendered his resignation and will accept the position of superintendent of the Pittsburg & Suburban Street Railway Company. Mr. Garfield has been very popular in Greenfield, and received a number of tokens of the esteem in which he is held upon his departure.

MR. R. H. IRVINE, who has had charge of the Lock Haven (Pa.) Electric Railway since its construction, has resigned his position and will go to St. Louis, Mo., where he will assume control of the construction of extensive lines of electric road. Mr. Irvine was very successful in his management of the street railway at Lock Haven, and his departure is very much regretted by the officers and employees.

MR. GEORGE F. CHAPMAN, who for some time has been superintendent of the Elizabeth division of the Consolidated Traction Company of Jersey City, now leased by the North Jersey Street Railway Company, has been made general superintendent of the entire system. He succeeds Frank Ellmaker, who has resigned. Mr. Chapman has been connected with this system for a number of years and his promotion comes as a reward for his faithful service to his company.

MR. HENRY G. ISSERTEL, who was connected with the New York office of the Walker Company, has been appointed manager of the Walker Company's New England office, with headquarters at 53 State Street, Boston, Mass. This territory is not exactly new to Mr. Issertel, as he received his initial training in street railway work in that section, having been one of the corps of experts of the old Thomson-Houston Company in the construction of the West End Street Railway system.

MR. J. W. MORDEN, until recently superintendent of motive power on the Fitchburg Railroad, has been promoted to the position of superintendent of rolling stock, and will hereafter have charge of the construction, maintenance and inspection of locomotives and cars. Mr. Morden has been connected with the Fitchburg Railroad for many years and has remained through many changes in administration. He has earned the confidence and respect of the officials and employees of the road, and his hosts of friends will wish him abundant success in his new position.

MR. THOMAS AHEARN, of the well-known Canadian firm of Ahearn & Soper, has just returned to this country after a trip eastward around the world, during which he spent some time in India, Singapore, China and Japan. At Hong Kong he saw the American fleet under Commodore Dewey just before it sailed for Manila, and in Yokohama had news of its victory several days before it became known in America. He speaks with much pleasure of the great increase in prestige which the United States has gained by the Manila victory, and predicts that it will have a great influence upon our future trade.

MR. GEO. E. PRATT, who is so well and favorably known throughout the street railway field, has been appointed representative of the Ajax Metal Company, Philadelphia, and has taken in connection therewith the agencies of the Forsyth Brothers' Company, Chicago, and the Jackson & Sharp Company, Wilmington, Del. Mr. Pratt has opened an office in Room 1103 Betz Building, Philadelphia, where he will be ready to give full information or receive orders for any of the above companies' products, which include journal bearings, trolley wheels, harps and electric metal supplies, car curtains and fixtures, and steam and electric cars. Mr. Pratt's many friends will congratulate him on his new business arrangements and will wish him abundant success.

MR. WILLIAM BANKS, who has recently been appointed excursion and entertainment manager of the Toronto Electric Railway, is a newspaper man of many years' standing. He has held the highest positions in the news departments of the leading Canadian newspapers, and in this connection has traveled a great deal. He has frequently advocated the popularizing of city electric railways and their extension to pleasure resorts and business districts wherever possible at reasonable cost. He has written several short stories and sketches, and is a recognized authority on municipal affairs. He has often been consulted by electric railway and pleasure steamboat companies on questions of popular fares, as encouragement of traffic, amusements for the people, and kindred subjects, but, although frequently offered important positions with railway and steamboat companies, he has always preferred his newspaper work until now. The chief inducement in deciding him to accept the present position was the permission the company gave him to write whenever he chose to the papers on any of his favorite subjects. Mr. Banks possesses considerable organizing ability, energy and determination, which, with his popularity, will doubtless add considerably to the business of the company he represents.

Obituary

DR. AZARIAH EVERETT, of Cleveland, O., whose name is closely associated with the street railway history of that city, died at his home on June 17, after a short illness.

AT THE moment of going to press it is learned that E. H. Bennett, president of the Babcock & Wilcox Company, and treasurer and general manager of the Singer Manufacturing Company, died on June 27 at his residence, Plaza Hotel, New York. No further particulars are obtainable.

MR. JOHN J. SHIPHERD, at one time owner of the old Metropolitan Street Railway, of Toledo, died very suddenly at his home in Cleveland, June 1. He had been at various times interested in street railway enterprises in Fort Wayne and Cincinnati, and was a large holder of street railway stocks in Cleveland. Mr. Shipherd died from a complication of stomach trouble and bronchitis, followed by heart failure, his illness being brought on, it is thought, by recent financial reverses.

MR. S. GRINNELL, counsel for the Chicago City Railway Company, died on June 8 of heart disease as he was completing a business transaction which was to be his last work before a trip to Europe, advised by his physicians as necessary to save his life. Mr. Grinnell was State Attorney of Illinois for a long while, and his career is closely woven with Chicago history. His name is perhaps best known in connection with the prosecution and conviction of the Chicago anarchists. He was a member of the Chicago Union League, Iroquois and Chicago Athletic clubs, and of Apollo Commandery K. T. and Consistory.

DR. CHARLES E. EMERY, a well known consulting engineer of New York, died very suddenly at his home in Brooklyn after an illness of several weeks from heart disease. Dr. Emery was born in Aurora, N. Y., on March 29, 1838. He entered the naval service in 1861 as third assistant engineer, and was sent to the warship "Richmond," which took part in the fight at Pensacola, and was with Farragut in all his engagements on the Mississippi River. In 1862 he was promoted to second assistant engineer and took part in the blockade of Charleston. In 1867 he resigned from the service and was appointed consulting engineer in the United States coast survey and revenue service. In 1879 he had the degree of Doctor of Philosophy conferred upon him by the University of New York. About ten years ago he received the Tilford prize for the best paper read before the British Society of Engineers, London. Dr. Emery was a member of the American Society of Civil Engineers and was a vice-president of the Institute of Electrical Engineers. He was also a non-resident president of Cornell University and had lectured in many cities of this country. In the last ten years Dr. Emery has made many interesting experiments and has been a frequent contributor to the columns of the STREET RAILWAY JOURNAL.

AMONG THE MANUFACTURERS

THE WALKER COMPANY, of Cleveland, O., has issued a descriptive catalogue showing some of the lighting plants which it has recently installed.

MAYER & ENGLUND, of Philadelphia, have been appointed agents of the American Rail Joint Company for New Jersey, Pennsylvania, Maryland, Virginia and District of Columbia.

THE HOPPES MANUFACTURING COMPANY, of Springfield, Ohio, has issued a pamphlet describing the Hoppes live steam feed water purifiers and exhaust steam feed water heaters.

S. FLORY MANUFACTURING COMPANY, of Bangor, Pa., makes a specialty of supplying suspension cableways and hoisting engines for mines, quarries, etc. Their catalogue will be sent on application.

THE OKONITE COMPANY, of New York, is sending to its friends a most beautiful and artistic picture, elegantly mounted in a gold frame, and forming an ornament worthy of a place in any private drawing room.

WENDELL & MACDUFFIE, 26 Cortlandt Street, New York, and 53 State Street, Boston, have been appointed agents for New York and New England for the American Rail Joint & Manufacturing Company, of Cleveland, Ohio.

THE AMERICAN IMPROVED RAIL JOINT COMPANY, Monadnock Block, Chicago, has been awarded the contract for cast welding between 7000 and 8000 rail joints in Kansas City, Mo. The work will be done on 103-lb. rails.

THE WESTINGHOUSE COMPANY have on hand a large orders for motors for Ghent, in Belgium. These trams are going to be run by accumulators. This is the only feasible system, as the city engineer would not tolerate overhead or conduit.

THE ADAMS BAGNALL COMPANY, of Cleveland, has been awarded a contract for 500 inclosed arc lamps by the Board of Public Works of Grand Rapids, Mich., at a price of $8,500. The type selected was the constant circuit series inclosed arc lamps.

LITTLEFIELD & MEYSENBURG, Western agents for the Johnson Company, of Chicago, have recently sold a large order of 60 ft. rails, which will be used on a steam road in the West. It is said that this is the first lot of 60-ft. rails ever used on a steam road west of Chicago.

THE WARREN-MEDBURY COMPANY, of Sandy Hill, N. Y., is now manufacturing a full line of Medbury switches and switchboards in various styles, and will shortly be able to furnish the market with the celebrated Medbury insulation, which is so widely and favorably known.

THE FOSTORIA INCANDESCENT LAMP COMPANY, of Fostoria, Ohio, manufacturer of standard incandescent lamps, has recently issued an exceedingly artistic catalogue of its standard type of incandescent lamps. The catalogue contains full descriptions, and a number of colored plates are included.

ROBERT W. BLACKWELL, of London and Liverpool, has recently opened a new office in Paris, at 50 Boulevard Haussmann, where all Americans will be welcomed by the manager and where they can have their mails addressed. Mr. Blackwell reports that he is now welding by the Falk method 1200 joints at Coventry, England, and 5000 joints at Norwich, England.

THE MARK EQUIPMENT COMPANY, C. E. Mark, manager, has opened offices in the Monadnock Building, Chicago, and will handle the same class of equipment as Mr. Mark has handled in the past, including rail joints, brace plates, rail chairs, and in fact all lines of track specialties. Mr. Mark has been in the supply business since 1892 and is well known to the trade.

THE NORTH AMERICAN RAILWAY CONSTRUCTION COMPANY, Monadnock Block, Chicago, has the contract for all overhead work in connection with the conversion of the Fifth Street cable line in Kansas City, Mo., to electricity. The company has already purchased all ties, poles, hangers, feeders, trolley wire, etc., to equip 5 miles of double track, and will begin work immediately.

THE JOHN A. WHITE COMPANY, of Dover, N. H., has published its new catalogue for 1898. The catalogue contains views and descriptions of the numerous styles of woodworking machines which this company carries in stock. The John A. White Company aims to give entire satisfaction to all its customers, and every piece of machinery which it builds is fully tested under operating conditions before leaving the works.

THE NEW HAVEN MANUFACTURING COMPANY, of New Haven, Conn., builders of machine tools, is distributing a new catalogue describing its extensive line of machinery. This company's products include engine lathes, pulley turning lathes, iron planers, shapers, upright drilling machines, horizontal drilling and boring machines, bolt cutters, friction pulleys, cut-off coupling, etc.

THE PHOSPHOR BRONZE SMELTING COMPANY, of Philadelphia, Pa., has recently published a very comprehensive price list of the different metals and alloys which it manufactures. This company's products, including sheet metal, wire, rods, etc., are now used throughout the country by street railway companies and electric light plants and have won for themselves an enviable reputation.

THE PANTASOTE COMPANY, of New York City, reports good sales of "Pantasote" cloth for curtains, etc. It is claimed for this cloth that no material, not even leather, is as satisfactory. "Pantasote" is water-proof, grease-proof, stain-proof. Contains no rubber or cellulose. Is not inflammable. It is not affected by heat, cold or climate. Does not peel, crack or rot, and wears like

iron. Looks exactly like leather, and is made in plain grains or richly embossed designs, in all standard colors.

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., are now placing on the market a solid belt dressing in round bars, about 8 ins. long and 2 ins. diameter. It makes a package convenient to the hand, and easy to apply even to fast running belts. The company does not claim that the solid dressing is as good a preservative of the life and elasticity of the leather as the Dixon paste, but it is quick to apply and quick to act, and that is what is wanted by the general run of belt users.

THE J. G. BRILL COMPANY, of Philadelphia, Pa., is sending out a catalogue describing the Brill standard sprinkling cars. This company claims to have built the first sprinkling car ever used upon a street railway, and since that time it has kept abreast with all the improvements of the day, and is now constructing sprinklers which, it is claimed, contain all the necessary and desirable features for doing the work in the most satisfactory manner.

THE ELECTRIC STORAGE BATTERY COMPANY issued from its Chicago office in charge of Frank H. Clark, to delegates and visitors of the National Electric Light Association a beautifully engraved invitation to inspect the immense storage battery installed by that company for the Chicago Edison Company. This is one of the largest batteries ever set up, and the opportunity to see it was taken advantage of by many of the visitors.

THE STANDARD FIREPROOFING COMPANY, of Perth Amboy, N. J., is manufacturing salt glazed conduits from the finest quality of fire clay, mixed and prepared in machines especially constructed for its use. These conduits are properly dried, thoroughly burnt, heavily glazed inside and out, and are perfectly waterproof. This company has recently issued a neat catalogue describing these conduits. The catalogue will be sent on application.

THE AJAX MANUFACTURING COMPANY, of Cleveland, Ohio, has issued a very neat catalogue substantially bound in blue cloth, and containing illustrations and full information regarding the Blakeslee improved bolt headers, rivet headers, upsetting machines, general forging machines, hot pressed nut machines, and bending machines, forming machines and special nut and bolt machines which it manufactures. In all of these machines the strictest attention is paid to the workmanship and materials used, and all the different parts are thoroughly guaranteed.

JACKSON & SHARP COMPANY, of Wilmington, Del., is just completing a number of nine-bench open motor cars for the New Castle Traction Company, New Castle, Pa., and is also furnishing a number of double truck closed cars and one special double truck car for the Sea View Railway Company, at Narragansett Pier, R. I., and it is just shipping twenty double truck, double deck cars to South America. This company also has a number of fifteen-bench open motor car bodies entirely completed and ready for immediate delivery.

THE HARRISON SAFETY BOILER WORKS, of Philadelphia, Pa., are sending out quite an elaborate catalogue describing the Cochrane separators. These separators are made in several different forms for purifying exhaust steam from cylinder oil, for taking water out of live steam and for removing oil, grease, etc., from ammonia currents, compressed air, etc. A number of fine drawings and engravings are contained in the catalogue, showing the construction of the different types of separators. The Cochrane heaters are also fully described.

THE THOMSON ELECTRIC WELDING COMPANY, of Lynn, Mass., is sending to the trade its catalogue of apparatus for electric welding, tempering, annealing, brazing and shaping metals. In the Thomson process of welding the heat is immediately generated at the abutting ends or surfaces of the pieces to be welded, and nowhere else. When the metal reaches a welding heat at the joint, current is instantly cut off, suitable pressure applied, and the weld completed. The metal cannot be injured and the possibility of an imperfect weld is reduced to a minimum.

THE GOUBERT MANUFACTURING COMPANY, 14 and 16 Church Street, New York, has secured from the Metropolitan Street Railway Company of that city the contract for feed water heaters for the mammoth power station being erected at Ninety-sixth Street and East River. The first installment consists of 30,000-h.p. in six heaters, horizontal type, and rated at 5000-h.p. each. They are to be placed between the low pressure cylinders and the condensers. It is said to be the largest single order for feed water heaters ever placed in this or any other country.

THE CRANE COMPANY, of Chicago, through its agent, G. A. Hurd, has recently closed some very fine contracts, among them being a contract for piping, etc., from the Bluff City Electric Railway Company, the Indianapolis Electric Light & Power Company, and a large sugar factory to be erected by Dyer & Company, engineers, at Cleveland. The company has also taken orders for material from the North American Chemical Company, Bay City, Mich., and for all the valves for the Imperial Electric Light Company, of St. Louis; also material for Matthiesen & Hegeler Zinc Company, of La Salle, Ill., and the Deering & Harvester Company, Chicago.

THE C. W. HUNT COMPANY, of New York City, has issued two very attractive catalogues describing the Hunt cable and the Hunt automatic railway for handling coal, merchandise, etc. This company for many years has made a specialty of coal handling machinery, and is therefore well qualified for designing appliances of this kind. The Hunt automatic railway is the outcome of this experience, and the manufacturers claim that it is as near perfection as it is possible to make it. Special attention is paid to all the details and the mechanical features have been very carefully worked out. The catalogues contain very fine illustrations and diagrams of recent installations of the Hunt railway, together with views of the different parts.

THE HAMPDEN TOY COMPANY, of Westfield, Mass., is making a specialty of supplying store windows, street railway parks and places of amusement with a very novel attraction. This consists of a glass cage containing from three to ten trained mice. In the center of the cage is a round disc, pivoted at the center, which turns very easily and on which the mice seem to delight to run for hours at a time at their topmost speed. The mice running upon the disc, of course cause it to revolve very rapidly ,and the antics of the little creatures in jumping on and off are very amusing. This attraction is undoubtedly well adapted to entertaining and amusing visitors at a street railway park or pleasure resort.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, of Pittsburgh, Pa., has sold seventy-six double equipments of type 49, 35 motors, to the Cleveland Electric Street Railway Company. Westinghouse street railway motors have achieved a degree of success that has made them standard. Charles H. Smith, superintendent of the Lebanon & Annville (Pa.) Street Railway Company, writes: "On June 20, 1895, one of the Westinghouse 12-A, 30-h.p. equipments was put into service on this road. Since that time it has made 592 days, 200 miles per day, a total mileage of 118,400, without a single repair to any part of the machine, save renewal of brushes and bearings. The motors were put under a Jackson & Sharp 30-ft. closed body car, running over the hardest part of our road, with less than five minutes' lay-over at either terminal from 6 A. M. to 12 midnight. Wish all our equipments were Westinghouse 12-A."

MEYSENBURG & BADT, of Chicago, contracting and consulting engineers, in addition to their independent work, are also representing manufacturers as follows: Weston Electrical Instrument Company; Helios Electric Company, arc lamps; Hugo Reisinger "Electra" carbons; Ward Leonard Electric Company, rheostats, dimmers, circuit breakers, etc.; Excelsior Electric Company, electrolytic dynamos; K. & W. Company, Hardy incandescent lamps, K. & W. specialties, and handling the Edison-Brown plastic rail bond and the Badt hermetic cell. The members of the company are experts in patent causes, with twenty years' experience, and are also prepared to furnish estimates, plans, specifications, supervision, tests and reports in connection with electric railways, lighting, power and mining. While the company itself has been in existence but a few months, its members have been long and favorably known in the electric and allied industries.

THE AMERICAN WHEELOCK ENGINE COMPANY, of Worcester, Mass., builders of the Greene-Wheelock engine, with Hill valve gear, reports the following orders on hand or recently installed: Six 1500-h.p. engines for the Chicago City Railway Company, with rope drives; one 600-h.p. single cylinder, condensing engine for the Worcester Wire Mill; one 200-h.p. for Hammond Reed Company, Worcester, Mass.; one 1000-h.p. for B. B. & R. Knight, Providence; one 550 single and one 550-h.p. cross compound, with rope drives, complete, for Syracuse Construction Company; one 400-h.p. for the Willamette Pulp & Paper Company, Oregon City; one 300-h.p. and one 350-h.p. for Pejepscot Paper Company, Brunswick, Me.; one 750-h.p. direct connected, for the New York Heat, Light & Power Company; three 350-h.p. direct connected for J. G. White & Company, New York; two 500-h.p. cross compounds, direct connected, for Poto-

mac Electric Power Company, this being the second order from this company, previous order being two 750-h.p., direct connected. The American Wheelock Engine Company has recently issued a very fine catalogue, giving a number of fine half tones and diagrams, showing the Greene-Wheelock engine and its different parts.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., is furnishing all the structural steel work for the extensive plants now being installed by the United Gas & Improvement Company, of Philadelphia, Pa. These plants are known as the Twenty-fifth Ward and Point Breeze locations. At the Twenty-fifth Ward Gas Works the company is building a new scrubber house 45 ft. wide and 120 ft. long, and a purifier house 86 ft. wide and 180 ft. long. At the Point Breeze works it is erecting a new boiler and engine room 220 ft. long and 55 ft. wide; a condenser building 40 ft. wide and 105 ft. long; a purifier building 86 ft. wide and 180 ft. long; a generator house 100 ft. wide and 184 ft. long; a meter house, with additions for exhaust and valve room, having a width of 70 ft. and a total length of 223 ft. All of these buildings are of steel frame construction, brick side walls, and slate roofs supported on metal purlins carried by clear span trusses. The Berlin Iron Bridge Company has also secured the contract for the steel work on the new power house now being erected by the Port Chester Street Railway Company, of Port Chester, N. Y. This is a building 45 ft. x 84 ft., and consists of a boiler room, engine and dynamo room. The building has brick side walls, in which are built steel columns supporting steel truss roof. In the engine room is a traveling crane arranged so that any part of the engines or dynamos on the floor below can be readily lifted and moved from one place to another. The power house is built in a substantial manner, and is a well designed modern station in every respect.

New Publications

The Storage Battery. By Augustus Treadwell, Jr., E. E. 257 pages. Illustrated. Price, $1.75. Published by Macmillan & Company, New York and London.

The importance of this subject is so great that electric railway engineers are fortunate in having at their disposal now such a complete and carefully written treatise on the storage battery as that by Mr. Treadwell. The scope of the book is quite wide, taking up descriptions of important installations and of the principal types of cells, as well as the chemistry of the battery, while the commercial side of the subject is carefully considered.

Machinists and Engineers' Pocket Manual. Edited by D. B. Dixon. 381 pages. Illustrated. Leather with rubber band, price, $1. Published by Laird & Lee, Chicago.

This forms another of the admirable collection of technical reference books published by Laird & Lee, and should be found most useful by practical mechanics. It includes a compilation of rules and solved problems pertaining to steam engines, boilers, pumps, etc., based on plain arithmetic, and free from algebraic difficulties, together with necessary tables and data, also a dictionary of terms used in steam engineering and electricity; the construction and operation of dynamos and motors, a treatise on the steam engine indicator, gearing, shafting, etc.

Derrah's Street Railway Guide. 178 pages. Price, $0.15. Published by Robert H. Derrah, 115 Devonshire St., Boston, Mass.

This is the third edition of a street railway guide which is practically unique. It gives full and valuable information about the street railways of Eastern Massachusetts, covering no less than sixty-eight companies, operating 1368 miles of track, and carrying 312,000,000 passengers. The information is well arranged, and the illustrations of views in the beautiful suburban towns of Massachusetts add to the value of the publication. The book has the indorsement of the Massachusetts Street Railway Association. The author has been connected with the West End and Boston Elevated companies for the past nine years.

Trade Catalogues

Hunt Cable Railways. Published by C. W. Hunt Company, New York City. 18 pages. Illustrated.

"Ajax." Published by the Ajax Manufacturing Company, Cleveland, Ohio. 115 pages. Illustrated.

Electric Welding of Metals. Published by Thomson Electric Welding Company, Lynn, Mass. 32 pages. Illustrated.

Hunt Automatic Railway. Published by C. W. Hunt Company, New York City. 24 pages. Illustrated.

Standard Woodworking Machinery. Published by John A. White Company, Dover, N. H. 108 pages. Illustrated.

Machine Tools. Published by New Haven Manufacturing Company, New Haven, Conn. 70 pages. Illustrated.

The Fostoria Lamp. Published by the Fostoria Incandescent Lamp Company, Fostoria, Ohio. Illustrated.

Tests on Car Wheels. Published by P. H. Griffin Machine Works, Buffalo, N. Y. 21 pages. Illustrated.

Brill Standard Sprinkling Cars. Published by J. G. Brill Company, Philadelphia, Pa. 6 pages. Illustrated.

The American Stoker. Published by the American Stoker Company, New York City. Illustrated.

Price List. Published by the Phosphor Bronze Smelting Company, Ltd., of Philadelphia, Pa. 20 pages.

Cochrane Separators. Published by the Harrison Safety Boiler Works, of Philadelphia, Pa. 48 pages. Illustrated.

Some Lightning Plants. Published by Walker Company, Cleveland, O. Illustrated.

Feed Water Purifiers and Heaters. Published by the Hoppes Manufacturing Company, Springfield, Ohio. 56 pages. Illustrated.

The Greene-Wheelock Engine. Published by the American Wheelock Engine Company, Worcester, Mass. 20 pages. Illustrated.

Standard Self-Centering Underground Conduits. Published by the Standard Fireproofing Company, Perth Amboy, N. J. Illustrated.

List of Street Railway Patents Issued

U. S. PATENTS ISSUED FROM MAY 31, 1898, TO JUNE 21, 1898, INCLUSIVE.

May 31.

Electric Railway.—John H. Guest, Boston, Mass. No. 604,747.

The combination with trough-shaped contact-rail forming a working conductor, supplemental contact-rails or conductors within the same, metal cross pins or bars mounted in the side of the trough and passing through said rails but insulated from them, and a filling of insulating cement or concrete in which the rails and pins are anchored.

Car Truck.—Edgar Peckham, New York, N. Y. No. 604,784.

In a car-truck, the combination with side frames, of a car-body-supporting bolster, a spring-plank suspended by links below the bolster, a half-elliptic spring and a pair or spiral springs arranged on the spring-plank and supporting the bolster, the ends of said half-elliptic spring bearing on the spring-plank toward its ends and at its middle supporting said bolster, and the spiral springs also bearing on the spring-plank near its ends.

Signal for Electric Railways.—William H. Jordan, Brooklyn, N. Y. No. 604,866.

In an electric railway, the combination with main or working conductors, of an electromagnetic signal-controller connected between one of the main or working conductors and two distant contact-plates located in close proximity to the same conductor, and which contact-plates are adapted to be electrically and successively connected with the other main or working conductor through the contact devices and circuit connections of a moving vehicle.

Car-Fender.—George O. Spencer, Manchester, N. H. No. 604,910.

Electric Railway.—Frederick D. Sweet, Elyria, Ohio. No. 604,911

In an electric railway, in combination, a motor-car, a runner flexibly suspended beneath the car and extending longitudinally thereof, centering-springs, guy wires and a series of insulated contact devices secured in the road-bed.

Street-Car Fender.—George H. Smith, Lowell, Mass. No. 604,944.

Third-Rail Underground Electric-Railway System.—Louis E. Walkins, Springfield, Mass. No. 605,066.

June 7.

Rail-Bond.—George Moffat, New York, N. Y. No. 605,115.

A rail-bond comprising two telescopically-connected members, the said members adapted for engagement with openings in adjacent rail-sections.

Trolley-Switch.—Jacob H. Vanasselt, Seattle, Wash. No. 605,211.

In a trolley-switch, the combination of a suitably-supported switch-plate provided with a keeper, a guide arranged at the under side of the plate, a movable, spring-pressed switch-point ar-

ranged at the under side of the switch-plate and normally bearing against the guide, and a latch also arranged at the under side of said plate and connected with the switch-point and adapted to engage the keeper and hold the switch-point away from the guide.

Trolley-Wire Hanger.—George E. Johnson, Los Angeles, Cal. No. 605,251.

In a trolley-wire hanger, the combination of an insulator; a stud fastened within said insulator, one end of the stud being formed into one-half of a hinge; a clamp for clamping upon a trolley-wire, composed of one piece with its upper portion formed into one-half of a hinge to unite with the half-hinge of the stud; a pintle for pivoting the members of the hinge together; and screws for drawing the clamp tightly upon a trolley-wire.

Insulator.—Ralph D. Mershon, Colorado Springs, Colo. No. 605,256.

An insulator for high-tension circuits having a long, tubular petticoat adjacent to the supporting-pin and a short outer petticoat of much greater diameter, the edge of which is approximately the same striking distance from the cross-arm and the supporting-pin.

Mounting for Third Rails.—Sidney H. Short, Cleveland, Ohio. No. 605,260.

In a mounting for third or contact rails, the combination with standards, a bar supported by but insulated from said standards; an insulating strip or board supported by said bars and arranged to extend lengthwise with respect to the third or contact rail, said rail being arranged to rest on said strip or board.

Third Rail for Electric Railways.—Sidney H. Short, Cleveland, Ohio. No. 605,261.

In an electric railway the combination with standards; a bar supported by but insulated from said standards; a third or contact rail supported upon said bar, said rail presenting a side surface for contact with the shoe or collector, and a strip or plate laid lengthwise upon said rail and extending over the top edges thereof.

Car-Fender.—George C. Hutcheson, St. Louis, Mo. No. 605,284.

Controller.—Thorsten von Zweigbergk, Cleveland, Ohio. No. 605,304.

In a controller, the combination with the controller-shaft of a collar tightly surrounding the shaft and a trough below the collar and adapted to receive water passing from it and convey it beyond the controller.

Trolley Connection for Electric Cars.—John G. McLaughlin, Brooklyn, N. Y. No. 605,326.

The combination of a trolley-pole; a swing frame having cheeks extending upward above and beyond the extremity of the trolley-pole, and a wheel mounted between the upwardly-projecting cheeks of the swinging frame.

June 14.

Brake for Trolley-Cars.—Aloysius H. Klingler, Ridley Park, Pa. No. 605,485.

A combined brake and fender, comprising standards adapted to be secured to a car-truck frame and having slots of different radii as to the upper and lower portions thereof, brake-shoes provided with cross-bars to form a fender and said shoes having grooves or recesses in the walls of the same of different radii as to the upper and lower portions thereof, pins carried by said shoes and standards for engaging and moving in the slots and grooves respectively of said standards and shoes and means for actuating said brake-shoes in the slots of said standards.

Electric Railway.—Arthur J. Moxham, Lorain, Ohio. No. 605,503.

Electric Railway.—Charles H. Davis, New York, N. Y. No. 605,663.

Trolley-Wheel.—Alexander F. Humphrey, Allegheny, Pa. No. 605,716.

Trolley-Pole.—John N. Prisk, Johnstown, Pa. No. 605,796.

The combination with a suitable support and trolley, of means for retaining the trolley in contact with the wire either from above or from below.

Electric-Railway System.—Henry A. Chase, Boston, Mass. No. 605,814.

In an electric railway, the combination of a pilot-car and a self-propelled railway-car adapted to be operated as a train; a controller on the self-propelled railway-car to govern the speed of the electric motors thereon; a fluid-pressure device for operating the controller; an electromagnetic device for governing the operation of the controller, and an electric circuit leading from the electromagnetic device to the pilot car for governing the operation of said electromagnetic device from a distance.

Electric Railway.—Rudolph M. Hunter, Philadelphia, Pa. No. 605,824.

June 21.

Truck for Motor-Cars, Etc.—Horace L. Gee, Kingston, N. Y. No. 605,952.

In a motor-truck, a side frame formed by the combination with two duplicate frames comprising each two bar members rigidly secured together at a point midway in the length of said frames and having their outer end portions extended horizontally forward, and the bar members at an angle to the outer end portions of bar members, and having each an extended horizontal end portion arranged parallel with portion of bars, with the lower edge of the latter bearing against the upper edge of the former; of pedestals rigidly secured by their outer and inner side flanges to the respective bar members of said duplicate frames, spring seating-blocks serving as ties between the horizontal end portions of the said bar members of said frames, and spring-blocks serving as tie-pieces between the inclined portions of the bar members.

Electric Controller.—Marshall W. Hanks, Madison, Wis. No. 606,009.

In an electric controller, the combination with a contact-cylinder mounted on a rotatable shaft, of a second shaft provided with actuating means, and mechanism, interposed between the actuating means of the contact-cylinder, comprising a projecting part on the cylinder-shaft engaging with a spring on the second shaft whereby the contact-cylinder may be instantaneously rotated, in either direction, to its consecutive positions regardless of the velocity of the actuating means.

Emergency-Brake for Street-Cars.—Hermann Loeffler, Pittsburgh, Pa. No. 606,065.

Draw-Bar for Railway-Cars.—William T. Van Dorn, Chicago, Ill. No. 606,105.

In a draft appliance for railway cars, a combined bracket and buffer-sleeve integral with each other; a suitable supporting bar secured to the bracket and pivotally connected to the car at one end to move on a horizontal plane; a draw-bar having its stem projected through the buffer-sleeve, and formed with an annular collar; a buffer-spring on the draw-bar between the collar and the front end of the buffer-sleeve; a relief-spring on the stem between the rear face of the buffer-sleeve and the end of the draw-bar stem, and a key projected through the rear end of the draw-bar stem.

Device for Attaching Fenders to Cars.—Christian Sauerbrey, Owego, N. Y. No. 606,156.

Electric Brake.—Ernst W. G. C. Hoffmann, Charlottenburg, Germany. No. 606,167.

In an electric braking system, the combination with a dynamo suitably mounted to be driven by the movement of the controlled wheel or wheels; of an electromagnetic brake appliance connected with said dynamo; a controlling-circuit, and an electromagnetic controlling device connected in said circuit adapted to secure the transmission of current from said dynamo to the brake appliance when the said device is actuated.

Two Handsome Trains

The two splendid trains known as the "Pioneer Limited," which the Barney & Smith Car Company, of Dayton, Ohio, has constructed for the Chicago, Milwaukee & St. Paul Railway Company, are now in service between Chicago, Milwaukee, St. Paul and Minneapolis, and it is undoubtedly true that these trains are among the finest products of the car builders' art ever yet exhibited. These duplicate trains consist of the usual mail, express and baggage cars (the latter furnished with bicycle racks and carrying a Westinghouse engine and dynamo to furnish power for the electric lighting of the entire train), buffet, smoking and library cars, standard sleepers, compartment sleepers, dining cars, parlor cars, day coaches and reclining chair cars. The entrance to each car is by way of massive "flush" vestibules finished in San Domingo mahogany, the elegance of which is but a taste of the splendid display within. All of the cars are electric lighted, steam heated, and the metal finishings are in handsome old bronze made to special design. The method of electric lighting is unique; for emergency and in addition to the regular dynamo, under each car is located an auxiliary battery sufficient to light a dozen or more lamps in each car. The exterior of these trains is unusually beautiful, all of the cars being painted a deep, rich yellow in different shades and finished in gold. The fastest and most powerful locomotives in America are used to haul these superb trains over the Chicago, Milwaukee & St. Paul Railroad, which owns one of the finest roadbeds in the world.