Street Railway Journal

VOL. XXIII. NEW YORK, SATURDAY, MARCH 19, 1904. No. 12

PUBLISHED EVERY SATURDAY BY THE
McGRAW PUBLISHING COMPANY

MAIN OFFICE:
NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.
BRANCH OFFICES:
Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York."—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues)..... $3.00 per annum
Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum
Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy) .....$6.50 per annum
Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues) postage prepaid..... $6.00 / £1-5s / M 25 / Fr. 31
Single copies, first issue of each month, 40 cents; other issues, 15 cents.
Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Light-Weight Wheels

To some railway companies a wheel is a wheel, whereas to others there are wheels and wheels. The former view may have been true to a certain extent in horse car days, when there was comparatively little weight to be supported, but in modern electric cars the design, as well as the composition of the material in a wheel, counts for everything, not only so far as its life is concerned, but for the safety of the car as well. A broken wheel is a serious thing, and wheels which have proved strong enough for 18-ton cars, operating at 12 m. p. h., should not be used under heavier cars, or even the same car when running at 25 m. p. h. or 30 m. p. h., unless care is taken to ascertain that the wheel is amply strong enough for the service. Two recent instances of broken wheels caused by using light-weight wheels under heavy cars have occurred during the last two or three weeks, and emphasize the importance of the injunction laid down.

We believe that if accurate records were kept of the performance of individual wheels for different service, a great deal more discrimination would be exercised in their purchase, but if the official in charge of this department does not know what mileage the wheels are making, it is perhaps not reasonable to expect that the purchasing agent will not buy the cheapest wheels that he can, pound for pound. There is no doubt that wheel makers can make a cheap wheel if they desire to do so, and if there is no demand for any other. But this kind of wheel is the most expensive in the end, and the sooner this fact is realized the better.

Coke in Heaters

Just now at the close of another winter (and a severe one at that), during which coke has probably been used in more electric railway stoves and hot-water heaters than ever before, it would be interesting to compare notes as to the results. Coke has the well-deserved reputation of being a fuel which, when once started, makes such an intensely hot fire that it is likely to do damage to the fire pots of stoves in which it is burned. As the stove on an electric railway car is likely to be neglected at times, there would seem to be an excellent chance for overheating and the burning out of fire pots. Nevertheless, it has been used on at least one very large city system the past winter, and apparently without excessive stove repairs. It should be said, however, that this city is one where the thermometer seldom goes far below the freezing point, and both conductors and passengers are likely to demand that the stoves be kept considerably below white heat.

In more northern latitudes, where fires would be forced harder on cold days, coke would not work out as well. When it comes to using coke in hot-water heaters, the proposition would appear to be less risky, as the fire-bed is always surrounded with water, and the temperature is not likely to get so high as to destroy the fire pot. In most cities west of Pittsburg, coke is decidedly cheaper than hard coal. It gives an equally smokeless fire, but is a little less cleanly as far as handling is concerned. Its cost makes it well worth considering as a substitute for hard coal, providing repairs on the heating apparatus can be kept within reasonable bounds.

Fires on Motor Cars

The number of small fires on electric motor cars, due to electrical causes, taken the country over, is remarkable, but the greater number of them are undoubtedly due to carelessness in the car wiring or its maintenance. Indeed, even the number of fires on motor cars in elevated service, where such fires would be least expected, is great enough, so that it is not altogether to be wondered at that steel cars are receiving serious consideration by at least two of the large elevated railway companies in this country. On elevated roads these fires would often be of little importance were it not that the public seems to be in a peculiar frame of mind, in view of the terrible disaster on the Paris Underground road and the Iroquois Theater fire in Chicago. Recently the daily press has helped to increase, rather than reduce, the public fear of fire. The other day two very small fires, one in New York, the other on one of the elevated roads of Chicago, as described in the daily papers of those cities, were very dramatic incidents, in which the motor car, which, in each instance, had taken fire, raced for several

miles, full of panic-stricken passengers, until finally it got to a station where a fire engine was waiting for it. These reports, if simmered down to the actual facts, would become very tame reading, but the reading public does not know this.

To illustrate the panicky feeling which exists a recent incident will suffice. A Chicago elevated train stopped an unusually long time at a certain station the other day, until the passengers began to wonder at the cause of the delay. Some one called "fire," and in an instant nine-tenths of the people in the car were upon their feet, rushing frantically to the door. They sheepishly returned to their seats after the alarm proved to be a fake.

Single-Phase Railway Systems

We earnestly hope that during the coming season there will be an opportunity to try out the various forms of single-phase motors on a practical scale. Several contracts for single-phase equipments have already been reported in our columns, and more are likely to come on. We trust that no untoward circumstances will prevent the prompt equipment of these roads so that the whole matter of alternating motors can be given a trying out that will amount to something. We have plenty of respect for shop tests, and do not in the least sympathize with the feeling of those who denounce as "experimental" every improvement with which they are not personally familiar. Nevertheless, there are some matters with respect to single-phase railway motors which cannot readily be settled by shop tests unless they cover a long period. The two questions which the practical railway man asks about the single-phase motor are: "Will it give trouble from sparking?" and "Will it, as a practical matter, operate well on a direct-current system?" As to the first count, one can only get a crude idea from shop tests, since the sparking trouble is to a considerable extent cumulative, appearing very slightly at first and then gradually with more and more severity as the commutator gets out of condition. How much can the commutator of an a. c. railway motor get out of condition before serious trouble begins? Nobody yet knows. How well will such motors perform under large variations of current and voltage after the commutator has begun to wear? As to the second matter there is no reason to doubt that the a. c. motors can be made to work on a d. c. system, but the quality of the service is another matter. Will it be good enough to permit a. c. cars running freely in a press of d. c. cars on a crowded system without running chances of a blockade, or will parallel trolley wires be used, one for each kind of current? These are questions which are of great practical importance, and can be answered only by working the motors day in and day out under severe practical conditions. Hence, we hope to see the alternating-current motor cars put promptly into service and kept at it.

Police Whistles for Motormen

In view of the various "hold ups" which are being reported from outlying districts in different parts of the country it would seem advisable to provide the motorman or conductor with a whistle to summon the police, if necessary. Probably the motorman would be the better one to entrust with the signal, as the conductor, being the fare collector, is usually the victim of the highway robbers. By conference with the police department it is probable that an arrangement could be made by which either member of the crew, or both, of those cars which have to traverse dangerous sections of the city, would be permitted to carry these whistles, and the cost of providing them would be trifling.

The Sociological Value of the Interurban Railway

A great deal has been said, and justly, as to the sociological benefits conferred by the modern electric railway. Probably no other recent agent of modern civilization has exercised a greater influence upon the domestic habits and happiness of a large number of the denizens of our cities. It gives the wage earner an opportunity to live and bring up his family in the suburbs, under conditions which are conducive to his and their moral and physical welfare. It changes the environment of the home from one of brick and stone with little light and air, and still less freedom, to a place where the wife and children are permitted to breathe pure air, enjoy plenty of room and live a more wholesome life. It converts the narrow tenement into a suburban cottage with ground around it, and confers all the benefits which sanitary conditions and healthy surroundings can impart to the individual and indirectly to the community. All this has been done and is being done on an increasing scale by the modern electric railway. It has been described and extolled by writers and thinkers on social questions, and its manifold benefits have been proved by statistics over and over again.

It is not our purpose, however, to refer here at any greater length to this phase of the situation, but to mention one result in the development of interurban electric roads, which seems to have escaped the attention of many writers on the subject. This is the somewhat corresponding but no less important benefit which is conferred upon the country dweller by the electric road. Fifteen years or so ago, the story was told throughout the country of the Virginia darkey, who, seeing the new electric cars mounting the hills of Richmond, exclaimed upon the mighty power of the Yankee who had "first freed the black man and now had freed the mule." The interurban electric road has performed even greater wonders than its predecessor at Richmond, for it has emancipated the farmer and his wife in more ways than one.

In the first place it has brought to their doors, or within easy reach, a convenient and cheap means of access to the outer world, which, independent of the material advantages which it confers, cannot but exercise an important effect upon their intellectual growth. The crushing monotony and mental starvation of country life to adults can be appreciated only by those who have lived for a considerable length of time isolated, or practically isolated, from all contact with considerable numbers of one's fellow beings. While the city is dependent to a certain extent for mental development on the country, the latter can be benefited to a still larger degree by a means of access to the educational and other advantages which the city affords. In fact, one of the chief drawbacks to country life is the fact that the children especially are deprived by this isolation of these educational privileges which those in the city enjoy.

Still another phase of the situation, and one entirely apart from that of transportation, is the possibility which the installation of an interurban electric railway, or of a power transmission circuit, affords in the farmers' homes of an easily available and convenient source of power. We may be too sanguine as to the future of the electric motor in farm life, especially as comparatively little so far has been done in this direction. Nevertheless, we believe the time will come when electric motors will be as much of a reliance in country work as horses are now. They will not necessarily supplant the horse, for a great deal of the work which the latter does, but they will do a great deal of which he is not capable.

As a substitute for manual labor they can perform many of the chores, such as pumping water, sawing wood, churning butter and other duties inseparable from farm life. Cheap available power will "free" the farmer's wife as well as the farmer himself of a great deal of the work which now renders their life a burden, and afford them an opportunity to devote their energies to other pursuits which are both less arduous and more inspiring.

Again, when we consider the facilities for the cheap transportation of produce afforded by the interurban lines, we expose a new vista of their usefulness. In the regions in which interurban electric roads have been built, they not only can but are through this very reason effecting a change in the agricultural products of the territory through which they run, at the same time giving the farmer opportunity to produce from his land what it can yield with the greatest profit.

Take, for example, the dairy districts of Ohio. Each creamery is, or was, before the introduction of the electric road, surrounded by a certain limited district, say, 10 miles in radius, within which farmers could dispose of their milk, but to one customer only. The advent of a trolley road through this district immediately extends the area of marketable milk to within 5 miles of the trolley line and also gives the farmer two customers—the creamery and the city or town supply. It betters the price received and reduces the cost of delivery. A somewhat similar change, but in another way, has been effected in the small fruit section in Michigan. The process of hauling this fruit over country roads is to make it deteriorate rapidly, and the distant grower cannot deliver his fruit to the city markets at a profit in competition with the fruit growers adjacent to the steam road lines. On both sides of the new Michigan interurban electric lines the traveler can now see new peach orchards set out and extensive berry patches on land whose profitable utilization was previously prevented by lack of transportation facilities. The farmer can now pick his fruit in the afternoon and can have it offered for sale the next morning in Chicago or Milwaukee. The same is true of grape culture along the lake shore in Ohio, from Toledo to Cleveland. The electric road permits the transportation of grapes to points of distribution and consumption under better conditions than were before possible, and with a larger profit than when they are converted into wine or vinegar.

Every road in the suburbs of towns or cities runs through a truck farming district, which in some cases extends many miles distant. The old way of transporting this produce was to load the wagon the night before, and start to drive for market anywhere between midnight and early morning. How the trolley roads can best secure the haulage of these goods is worthy of careful study. The character of this form of traffic is such that can be done at hours when the railway property is idle. The fixed and operating expenses to be charged against it would not be large, and profits could be made at a low rate of cost if it could be handled with despatch and with a small amount of labor. One method which has been tried is to put the loaded wagons on a flat car, and deliver them in town, but there are difficulties at the city terminus which make the plan an objectionable one in some particulars. Any method which could be devised by which the trans-shipment of the produce could be avoided, and in which the difficulties present in the plan of loading the wagons themselves on flat cars would be eliminated, is certainly worthy of careful consideration.

We expect to refer to this subject at greater length in a later issue. In the meantime it is well for interurban railway managers to remember that the swift moving passenger trains on steam railroads are not the dividend earners of the property. It is the facility for handling freight and long, slow-moving freight trains that determines the possible profits derived from the operation of the steam railroad. The interstate laws and merger cases are the results of strenuous efforts made by the steam railroads to gain this class of business at fair prices, while the electric roads are, as yet, just feeling their way into this class of business.

Widening the Streets

Most of the larger cities on this continent, and all of the older ones, were laid out at a time when no one had any idea of the density of the street traffic which the needs of a modern city require. In some instances broad boulevards were wisely provided by our forefathers, but in most cases the attempt to force the traffic of a large city through streets designed for the needs of a frontier village, as most of our streets were, is about as satisfactory as that of leading the proverbial camel through the eye of a cambric needle. If cities could easily be redesigned, the solution of the question would be a simple one, but as this is impossible the only other recourse is to utilize such space as is available. In many cases we believe that a narrow and crowded thoroughfare, such, for example, as Broadway in New York, could be very easily widened, without serious inconvenience to anyone, by a slight encroachment upon the sidewalk space. As a rule, the sidewalks in our American cities are more than ample in width, and a few feet taken from each side to add to the street would hardly be noticed by pedestrians. On the other hand, this same space in the width of the street would add greatly to the facility of movement of the vehicles on it. At any rate, the plan is worthy of consideration in some instances.

A still more radical solution of the problem would be to throw into the street the entire sidewalk width and provide for the sidewalk by taking a strip of the necessary width from either the ground floors of the abutting buildings, or from the second-story, as in Chester, England. We are inclined, however, to favor the ground floor plan, and a proposition of this kind is not so impracticable as it might appear at first thought. The front and side walls of the buildings would not have to be changed above the first story, and there would be no encroachment upon any of the renting space within the building except upon the ground floor, whose entrances would be moved back a distance of 15 ft., or whatever the width of sidewalk selected should be. Those who have visited certain of the Italian cities where this style of street construction is common, such as Sienna, Pisa or Padua, or are acquainted with the colonnade construction of such streets as the Rue de Rivoli, in Paris, know that these covered sidewalks are not only practical from an engineering standpoint but provide an ideal passage for pedestrians, being shady in summer and protected from rain in bad weather.

It is true that there are probably very few, if any, streets in this country where such a radical innovation is at present necessary. But with the increase in travel upon our public streets, cases may arise, as, for instance, on Fifty-Ninth Street, in New York, where, by a combination of circumstances, an exceptionally narrow street is being made to serve as a great artery of trade. In such an instance an improvement of the kind mentioned, even if confined to one side of the street only, would not only be not difficult, but would be of tremendous benefit to the city at large.

REPAIR SHOP PRACTICE OF THE PACIFIC ELECTRIC RAILWAY COMPANY

On account of their size and completeness the shops of the Pacific Electric Railway Company possess many points of interest to street railway men. Los Angeles is far removed from the large manufactories of street railway material, and when Mr. Huntington began to build up his interurban system, he realized that it would be necessary to carry in stock extensive standard supplies as well as to have facilities for making all kinds of repairs, and even for building complete cars, if necessary. Accordingly the present plant was laid out, it being completed in the summer of 1902. Since then it has been running steadily, frequently with night crews. It handles all the repairs for the Pacific Electric Railway Company, as well as all the important repairs for the Los Angeles Railway Company, besides doing a great deal of job work for all the electric railways in Southern California. The shops are equipped to build and repair cars from the trucks up, all the parts being manufactured on the spot with the exception of the car wheels. As yet only work and construction cars have been built completely in the shops, but the equipment and facilities are ample for constructing the largest double-truck passenger cars used on the system. With a force of 400 men constantly employed the shops present a busy aspect.

FIG. 1.—PANORAMIC VIEW OF PACIFIC ELECTRIC RAILWAY COMPANY'S SHOPS AND YARDS, LOS ANGELES

In the Street Railway Journal of Aug. 23, 1902, was given a brief description of the shop buildings as they then were, although they had hardly been occupied at that time. Now that the shops have been in successful operation for several months the following description of the leading features is timely. Special attention will here be given to the arrangement and simple design of the buildings, the system of making car repairs, methods used in the armature shop, manufacture of car axles, special work yard, machine, wood and paint shops, electroplating department, oil storage, shop orders and general methods.

LOCATION AND ARRANGEMENT

The yards and shops are well situated on an irregularly shaped tract, 30 acres in extent, at the corner of Seventh and Alameda Streets, in the center of the city, and about a block from the company's power house just described. The arrangement of the buildings and the yards for supplies is indicated on the plan, Fig. 25, in the last issue, while Fig. 1 is a general view of the grounds from the corner of Seventh and Alameda Streets. Connection with the narrow-gage tracks of the Los Angeles Railway system is made at the north end from Central Avenue, while the standard gage Pacific Electric Railway tracks come in from the south along Tennessee Street. Facilities for steam road shipments are provided by the Southern Pacific Railroad tracks on Alameda Street by means of a spur into the yards connecting with the company's own standard gage tracks.

The general arrangement and design of the shop buildings is such as to expedite and concentrate the work as much as possible. There are six buildings, five of which are devoted to shop purposes, the sixth and smallest being used for oil storage. Each building contains more than one department or shop, with the exception of the paint shop, which occupies an entire building by itself. The four principal buildings are arranged in two rows with a pit between for a transfer table, which connects with all the shops and the store room. The buildings are simply and substantially constructed of red brick with combination wood and iron roof trusses. The machine shop building is built in three longitudinal bays.

The car repair shop building is 360 ft. long, 100 ft. wide and 22 ft. high in the clear. At the south end 80 ft. is partitioned off for the armature shop. In the repair shop there are eighteen tracks connecting with the transfer pit and extending across the entire width of the building, while four of them are carried out on the west side for connection with the narrow-gage tracks of the Los Angeles Railway. One of the tracks in the shop is narrow-gage, five are standard gage, and the other twelve are of the four-rail combination gage, the narrow-gage rails being equally spaced between the standard-gage rails. For all the shop and transfer-table tracks the company has used the center-

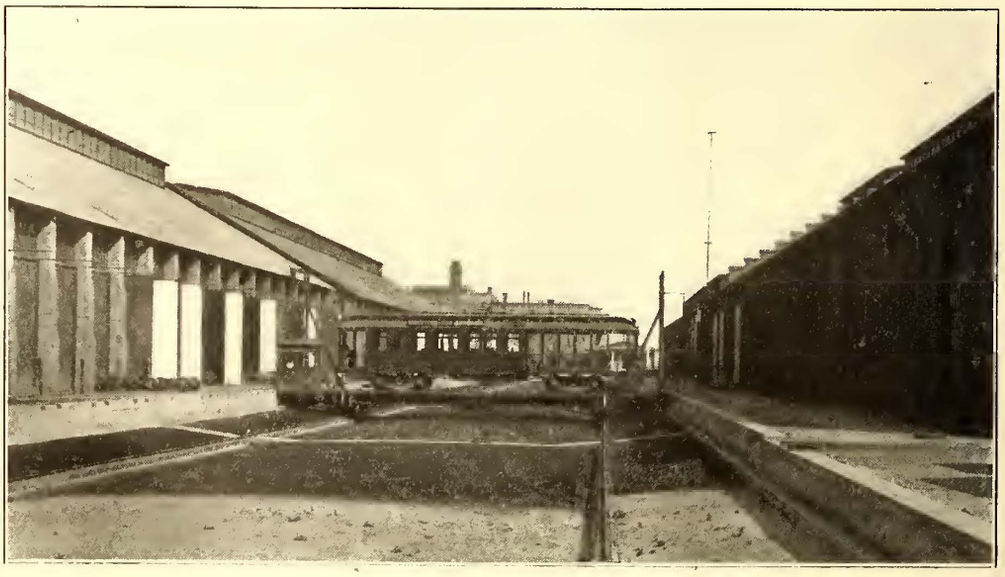


FIG. 2.—TRANSFER TABLE BETWEEN ROWS OF SHOP BUILDINGS

slot rails that were removed from the old cable tracks in the city. Through the center of the armature shop is run a four-rail combination gage track. At the north end of the building are some storage tracks, and one of standard gage for connection with the Pacific Electric car house described above.

South of this building is one devoted to the paint shop, 300 ft. long, 100 ft. wide and 22 ft. high. This shop has twenty tracks, of the four-rail combination gage, which cover all the floor space except that devoted to the upholstering and finishing departments and the stock room.

The carpenter shop building, across from the paint shop, is 380 ft. long, 100 ft. wide, and 22 ft. high in the clear. At the north end is a store room, 100 ft. square, with a track through the center for handling heavy supplies. In the carpenter shop are ten combination-gage tracks, and at the south end, in a space about 100 ft. square, is located the mill machinery.

The machine shop building, north of the carpenter shop and across from the repair shop, is 276 ft. long and 100 ft. wide. At the south end is a blacksmith shop, 76 ft. long, with one track connecting with the transfer pit. The machine shop is divided into three bays, the central one, 35 ft. wide, being traversed by a 10-ton electric crane. Three tracks near the south end afford facilities for handling car trucks and cars if necessary.

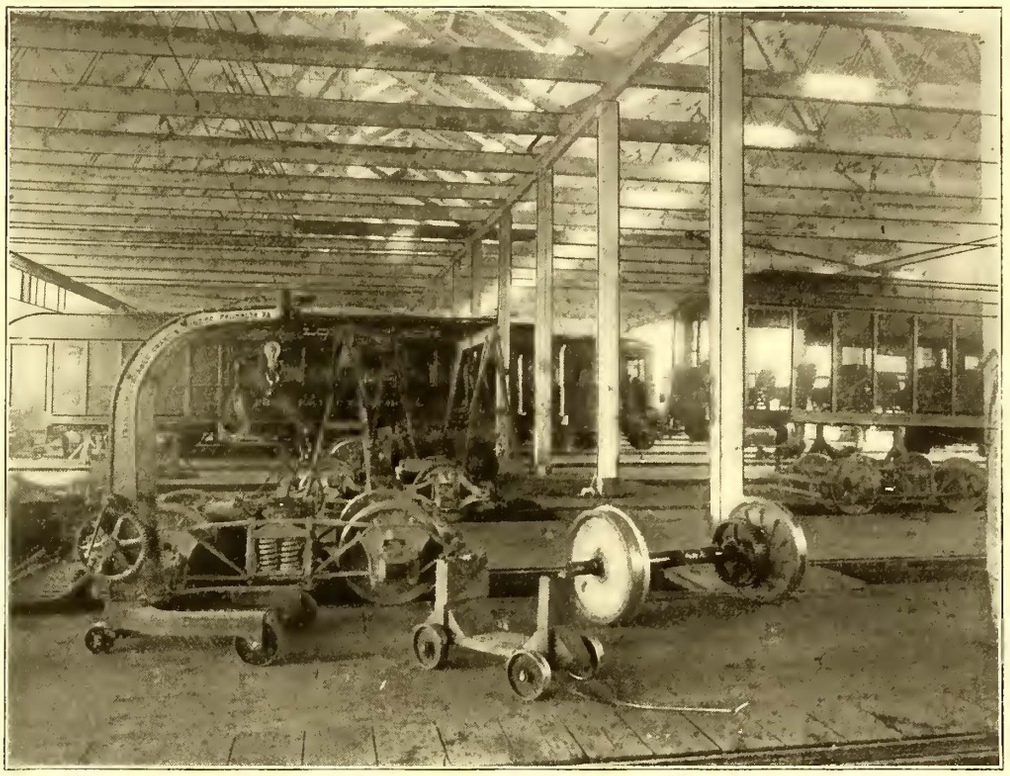


FIG. 3.—VIEW IN CAR REPAIR SHOP, SHOWING PORTABLE CRANE AND HOIST, ARMATURE WAGON, STANDARD "P. E." TRUCKS, "A" HORSES FOR SUPPORTING CAR BODIES, ETC.

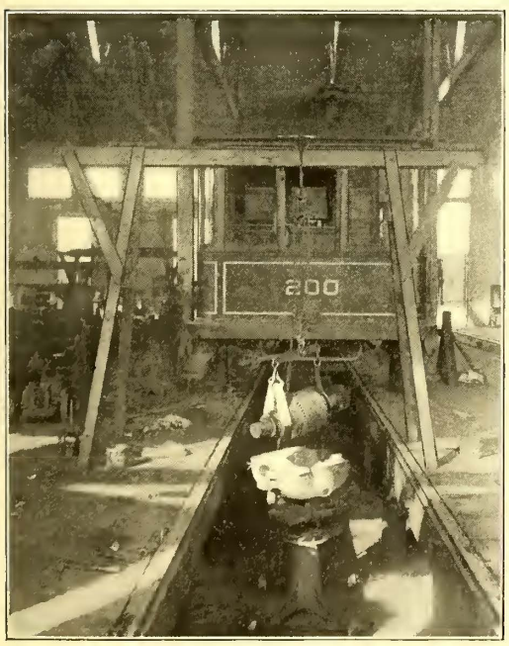


FIG. 4.—CAR REPAIR SHOP, SHOWING METHOD OF REMOVING ARMATURE

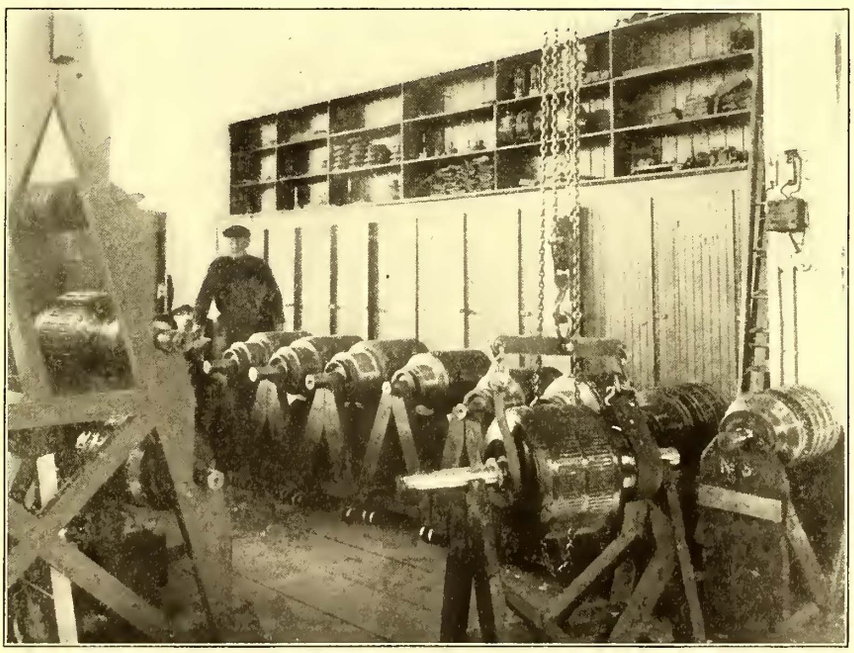


FIG. 5.—ARMATURE SHOP, SHOWING ARMATURE HORSES FOR DIFFERENT SIZES OF ARMATURES, ALSO ARMATURE RACK AT LEFT

West of the carpenter shop is a building 200 ft. long, 60 ft. wide and two stories high, with a boiler room and lumber storage below and an electroplating room and pattern and cabinet-making shops above.

The group of six buildings, already described, is completed by the oil house, which is 40 ft. long by 34 ft. wide, and is provided with a 10-ft. basement.

TRANSFER TABLE

The transfer table mentioned above and shown in Fig. 2 has a run of 866 ft., and is of a novel construction in that it has only four wheels, traveling on two rails, spaced 40 ft. apart. The table is 60 ft. long and 13 ft. wide, and has a four-rail combination-gage track. Its construction is similar to a girder bridge, the weight being carried by two box girders, which run the entire length of the table. Each girder is formed of two 15-in. I-beams and ½-in. plate, which are supported near each end by two 15-in. I-beams, to which are fastened the bearings for the wheels. These wheels have steel tires, and are 48 ins.

in diameter. On the axles of two of them are mounted large gears which engage with pinions at the ends of a long shaft. Near the center of the table and under the platform is mounted a 12-A Westinghouse motor whose pinion engages with a large gear on this long shaft for propelling the table. At one end of the table is a small house, from which it is operated by means of a standard controller, current being taken from an overhead wire through an ordinary trolley pole. No brake is used on the table, dependence being placed on reversing of the controller for braking purposes. The table is provided with a live trolley wire, and connection is made at each track with a T-iron, which is fastened to a trolley wire inside the building. This table was built by the Llewellyn Iron Works, of Los Angeles, and is designed to carry a load of 160,000 lbs. It is in constant use transporting cars, trucks and axles among the different shops as well as supplies to and from the store room. The transfer pit has walls and cross-walks of concrete, and is nicely sodded.

FIG. 7.—ELECTRIC DRYING OVEN IN ARMATURE SHOP, WITH TYPE OF ELECTRIC CAR HEATER SHOWN ON FLOOR

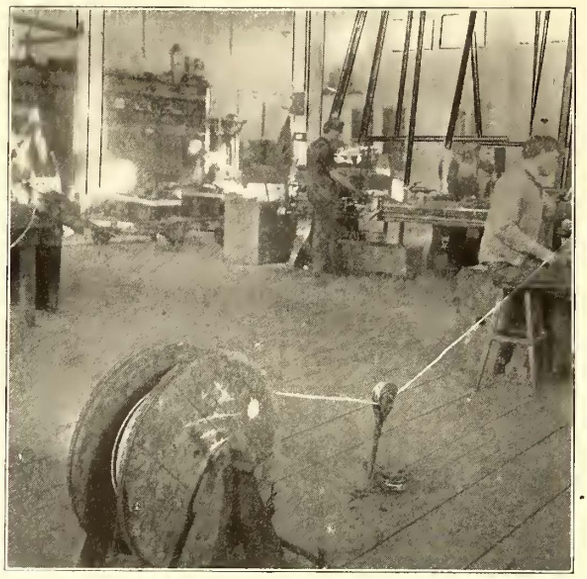


FIG. 8.—VIEW IN ARMATURE SHOP, SHOWING APPARATUS USED FOR WINDING FIELD COILS

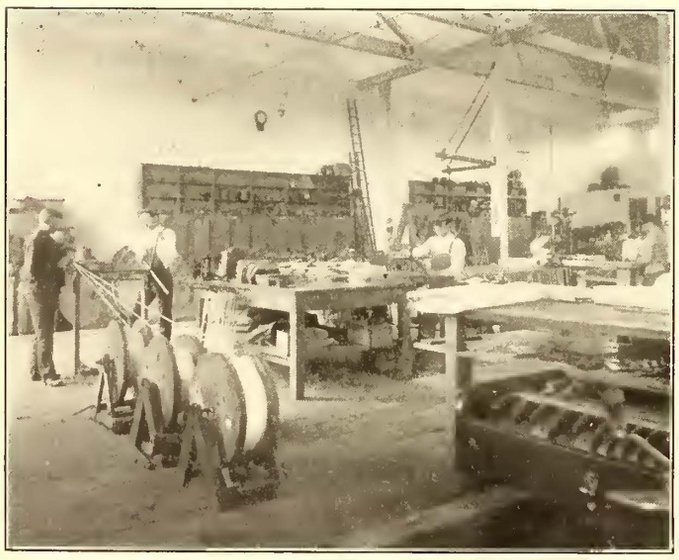


FIG. 6.—ARMATURE SHOP, SHOWING ARMATURE COIL WINDING

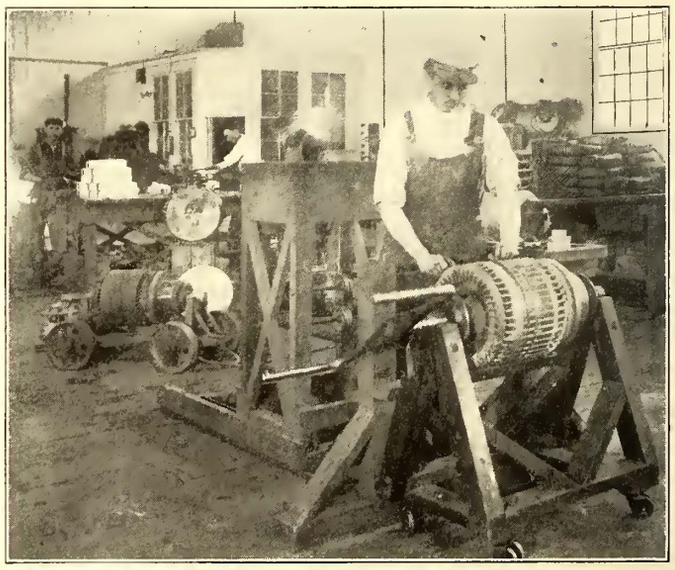


FIG. 9.—ARMATURE SHOP, BAND WIRING APPARATUS AND ARMATURE HORSES AND WAGONS, IN BACKGROUND FIELD-COIL DEPARTMENT

CAR REPAIR SHOP

The system for the repair of property is as follows: All wrecked or damaged cars go first into the car repair shop, where they are dismantled, and if the damage is slight the repairs are made there and the car sent out again. When a car needs general repairing, however, the car body is sent to the carpenter shop, the motors to the armature shop, and the truck to the machine and blacksmith shops. The cars are assembled there after the repairs are made, and all new cars are passed upon by the foreman. No special hoists are used in this shop, ordinary lever jacks being used to raise the body off the trucks, unless the car is a heavy one, in which case hydraulic "whiskey" jacks are used. The entire repair shop has a concrete pit floor 4 ft. 3 ins. below the tracks and the wooden floor, which are supported by wooden posts resting on concrete foundations. Pit repair work is only done when necessary, as when the brake-shoes or motors can be repaired without taking the trucks out from under the car.

When it is desired to take both trucks out from under a car it is generally set up on wooden A-horses, such as those shown in Figs. 3 and 4. These horses are also used for supporting the car bodies in the paint and carpenter shops, as may be noted in Fig. 19. Iron sockets are provided also in the sides of the pits for supporting posts in case it is desired to build scaffolding under a car.

After a truck is removed from under a car a motor jack, or "pit wagon," such as that shown in Fig. 4 (manufactured by the Van Dorn & Dutton Company), is used to raise or lower the motors. The company has four of these pit wagons, and they can be readily moved over the concrete floor from one pit to another. To raise the armature from the motor, a horse, with block and chain, such as that shown in Fig. 4, is used. The armature being suspended at the pinion end by means of a thin steel hook, and at the commutator end by a leather strap, the whole being supported by a steelyard arrangement to the hook of the block. The block is suspended from a small grooved wheel, which rolls on an iron rod, placed on top of the horse. By means of this arrangement the workmen can readily raise an armature from its bearings and move it to one side of the pit. If the armature needs simply inspection or light repairs it

is not removed from this saddle device until it is replaced in the motor. As a rule, however, the armature is set on a special four-wheeled armature truck, which carries it to the armature room. One of these trucks is shown at the left in Fig. 4, while others are shown in Figs. 3 and 9. Fig. 3, which gives a general idea of the car repair shop, also shows a four-wheeled portable hoist, made by the Franklin Portable Crane & Hoist Company, that has been found to be of much use in handling armatures and other heavy pieces about the shop. The only machinery equipment in this shop consists of a drill press and emery wheel, belt-driven from an electric motor.

ARMATURE SHOP

It is in the armature shop that all motor repairs are made, switchboards built for power houses and sub-stations, electric heaters constructed, and general repair work done on headlights and controllers, as well as special work for the line department. This shop has about 1000 motors to keep in repair. When the armatures are received from the repair shop they are placed on wheeled horses, built in different sizes to fit all the different types of armatures used on the system. Each horse is marked on both ends with the number of the armature which it is supposed to carry, thus avoiding disastrous upsets likely to happen by using the wrong horse. These horses are used to carry the armatures while the bands are being put on them and while they are being painted. The armatures are also kept on them ready for use when completed, as shown in Fig. 5. Racks, such as that shown at the left in this illustration, are also used for holding completed armatures.

Fig. 6 shows the armature coil winding end of the shop. The coils are formed on wooden forms, which are turned by hand, as shown. For 12-A Westinghouse coils an iron form is used. For placing the paper insulation on the coils the hand machine shown in the center of the picture is employed. This consists of a screw press operated by a hand wheel, and an iron for holding the wires together that is worked by the foot. With this arrangement a very solid coil is formed, and its wearing qualities seem to justify the careful labor put on it. The use of power has been considered for the operation of this press, but it is believed that greater care is given to the work when it is performed by hand.

After the coils are taped with linen tape they are painted with armature compound and hung on rods in the drying oven, as shown in Fig. 7. Field coils are placed at the side of the oven, and completed armatures are run in on the wheeled horses spoken of above. This oven is built of brick and is heated electrically by two car heaters, whose construction will be mentioned later.

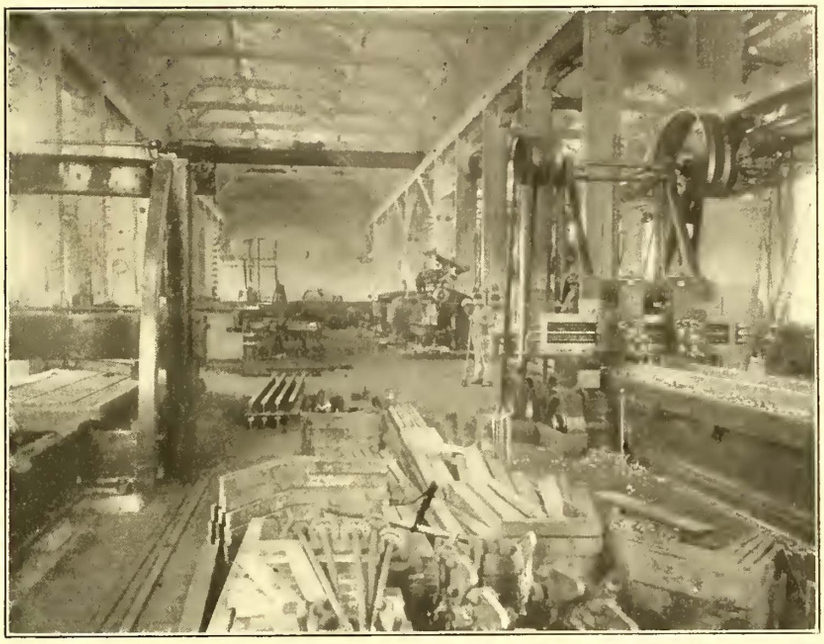


FIG. 10.—MACHINE SHOP, VIEW DOWN CENTRAL BAY, SHOWING TRAVELING CRANE, TWO PLANERS, ETC.

For winding field coils the apparatus shown in Fig. 8 is used. The form is mounted on a shaft, which is belt-driven by means of a motor in the basement. This belt is normally loose on the motor pulley, but is tightened so as to drive the machine when desired by means of a friction pulley controlled by a foot lever.

Several points in the construction of the motors most commonly used on the cars have been changed by special order with the factory, so that the motors will conform to the company's practice in repairing and maintaining its motors. One of these points was the low shoulders on the commutators of Nos. 49 and 76 Westinghouse motors. It was found that when these motors were run long distances at high speeds with little chance for inspection there was a tendency for the commutator to arc over the low shoulder to the windings. To remedy this the com-

FIG. 11.—MACHINE SHOP, MACHINE TOOL SIDE

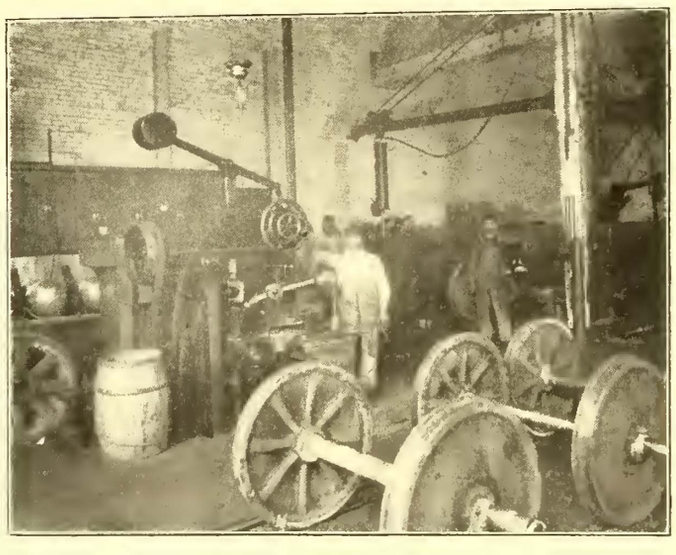


FIG. 12.—MACHINE SHOP, SHOWING WHEEL PRESS AND WHEEL BORING MACHINE, ALSO AT LEFT, TYPE OF WASH BASIN USED IN SHOP

pany has insisted on having the shoulders built 1½ ins. deep instead of ½ in., and in this way they are made to conform more with the commutator construction of other standard motors. Another point was the specification of heavier taping on the coils near the commutator end, where the wires cross and are apt to wear through.

FIG. 13.—SCRAP BIN AND PILES OF WROUGHT-IRON SCRAP READY TO BE FORGED INTO SLABS FOR CAR AXLES

Instead of winding the wire bands on the outside of the armatures the company has adopted the practice of slotting the core so that the bands can be wound flush with the armature surface, thus decreasing the tendency for the armature to hit the field coils when the bearings become worn. For this, band wiring No. 19 tinned-steel broom wire is now being used instead of spring brass or steel wire, and the results are said to be very satisfactory, while the cost is reduced. The apparatus employed in band winding is shown in Fig. 9. The reel of wire is supported in the wooden frame shown back of the operator, and the wire is run over pulleys to the armature, which rests on a horse that sits next to the frame. The wire is held taut by a weight supported by a pulley. In order to keep the weight from the floor when the sizes of the bands vary, the frame is arranged so that it can be moved back and forth on the base, and held in place by pegs at the desired point.

The company has recently standardized all its armature bearings, and in boring new boxes they are given the smallest size in use. Then in reboring the sizes are varied by thirty seconds of an inch or by sixteenths down to 3¼ ins. Every bearing is stamped with its size so that no calipering is necessary to find the required boxes.

The direct-current voltmeter test is used in testing for defective armature coils, the transformer test not being regarded as safe enough on account of the liability of spoiling good coils. No shop tests are used for repaired armatures, they being placed directly on the trucks and tested on the car in service. Cases of trouble with rebuilt or repaired armatures are very rare.

The electric car heaters mentioned above are built in the armature shop, and are said to be very satisfactory as well as comparatively inexpensive. They were designed by S. H. Anderson, chief electrician of the company, and consist of a slab of Catalina marble, 1 in. x 7 ins. x 15 ins. in size, wound with No. 21 tinned-steel broom wire. The marble is recessed slightly at the sides, so as to provide circulation for the air back of the wires. The heater is mounted vertically in iron castings, as shown in the foreground of Fig. 7. The mornings and evenings in Southern California are quite chilly, and four of these heaters are placed in every interurban car, one under each corner seat of the closed part of the car. For use in offices and buildings the company makes a heater 4 ins. longer than the car heater, and wound with more turns of wire.

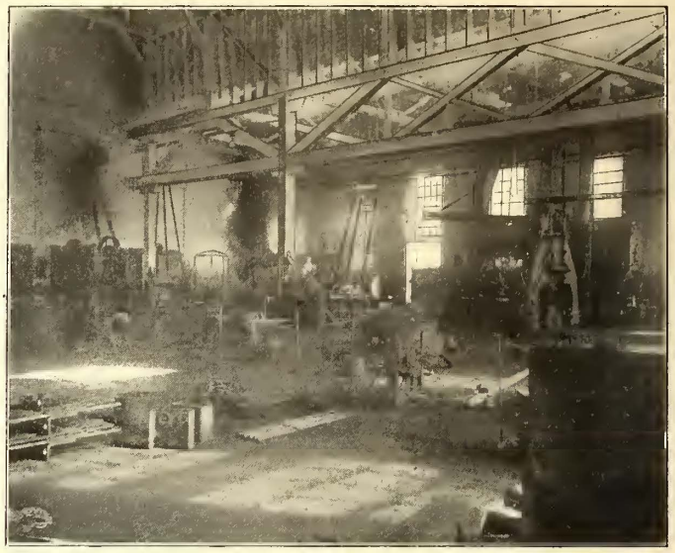


FIG. 14.—BLACKSMITH SHOP, SHOWING AT RIGHT 3000-LB. STEAM HAMMER, AND BACK OF THAT, OIL FURNACE FOR AXLE AND OTHER FORGINGS

It is in this shop that the Anderson & Smith arc head and interior lights have been developed, the inventor being S. H. Anderson. The headlights are being marketed by the St. Louis Car Company, but development work is being carried on in the Los Angeles shop, under Mr. Anderson's direction. The headlights are hung on two hooks on the dashboards of the cars, these hooks being connected to ground. The other side of the circuit is formed by inserting a plug attached to the lamp into a socket on the sill of the car. The resistance used on the Pacific Electric Railway cars for two lights consists of a 9-in. galvanized iron cylinder about 9 ins. long, wound with asbestos and fifty turns of No. 22 Climax wire.

FIG. 15.—SPECIAL TRACK WORK YARD

MACHINE SHOP

In the machine shop are made all the car repairs that require machine work; axles are turned and car wheels bored

and pressed on. The truck work is done there as well as all the machining on special track work. The pneumatic trolley controllers used on the Long Beach line are being made at present, and all brass and iron castings are finished in this shop. The equipment consists of about fifty machines, comprising the usual shop tools, such as lathes, shapers, milling machines, drills, planers, saws, etc. Fig. 10 is a view of the central bay of the shop, where the heavy work is handled, and shows a 36-in. and a 60-in. planer, both with 18-ft. platens. Fig. 11 is a view of the west wing, in which most of the machine tools are located, and Fig. 12 illustrates the hydraulic wheel press and 42-in. wheel boring machine. These last two views show the

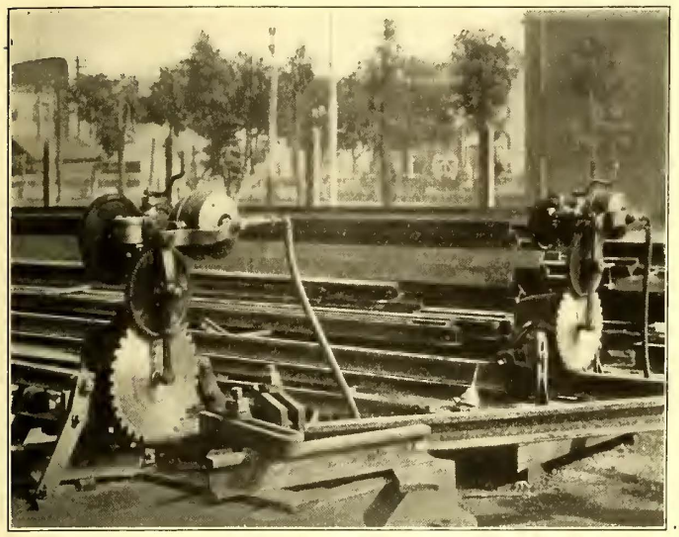


FIG. 16.—RAIL SAWS DRIVEN BY PNEUMATIC MOTORS IN SPECIAL WORK YARD

FIG. 17.—CABINET AND PATTERN MAKING SHOP

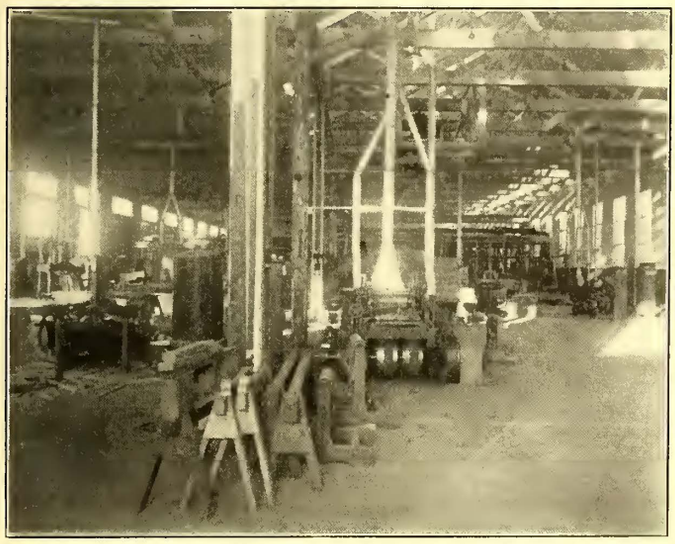


FIG. 18.—WOOD MILL AND CARPENTER SHOP

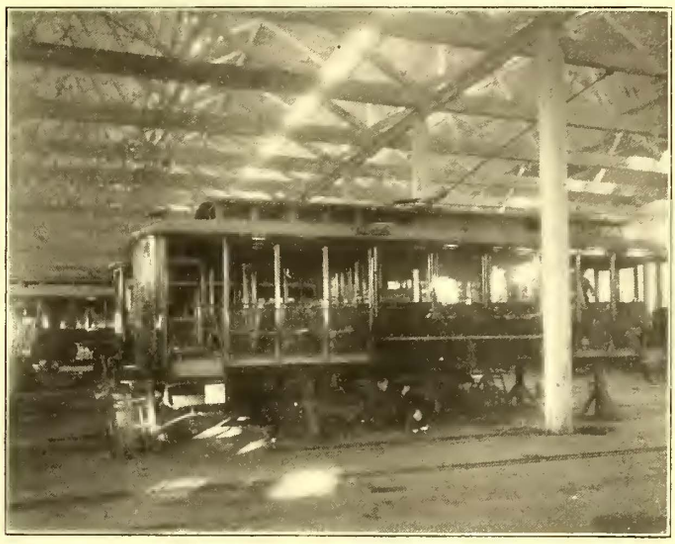


FIG. 19.—PAINT SHOP, SHOWING "A" HORSES USED IN SUPPORTING CAR BODY

FIG. 20.—STOCK ROOM IN PAINT SHOP

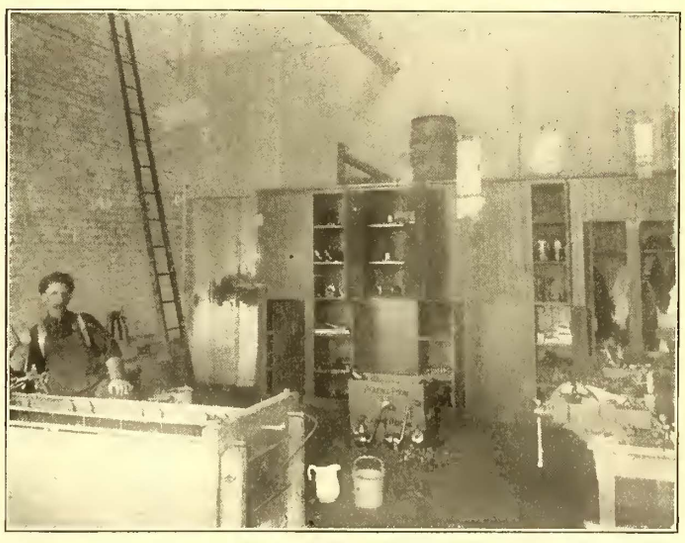


FIG. 21.—ELECTRO-PLATING DEPARTMENT

method of handling car axles and wheels by means of pneumatic lifts. When the machines in this shop were first installed the individual motor system of driving was used almost exclusively, but it has been found advisable to eliminate many of

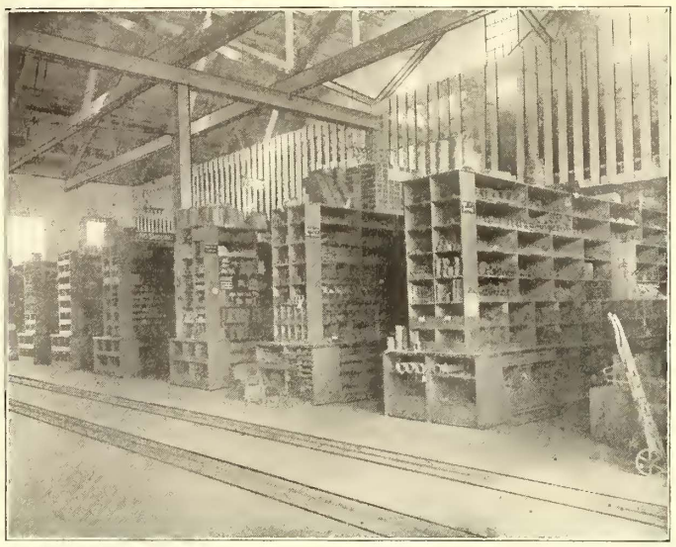


FIG. 22.—PORTION OF STOREROOM IN SHOPS

the smaller motors and make groups of several machines on a single motor. These changes to a combined motor-drive system have only recently been made, but they have been warranted by the economical results of operation since the alterations.

BLACKSMITH SHOP

The blacksmith shop is equipped to turn out all the necessary forgings used on the trucks, car bodies, and special track work, and also make car axles, a provision found in but few street railway shops, and not in many of the large steam railroad shops. These axles are forged out of wrought-iron scrap, which was formerly sold, as the company does not own a foundry. This scrap is put into bins, from which piles, 18 ins. x 10 ins. x 10 ins. in size, are made, as shown in Fig. 13. At night they are worked up into slabs approximately 3 ft. 6 ins. x 6 ins. x 2 ins. in size. These slabs are kept on hand, and are worked into forgings for axles by the day force. Three slabs are required for the smallest sized axle and six for the largest axle, which weighs about 800 lbs. finished. Sixteen axles is regarded as a day's work, and about 30 tons are turned out every month. A double-door reverberatory oil furnace, constructed in the shops, is used for all forgings, both light and heavy. Forgings as large as 21 ins. in

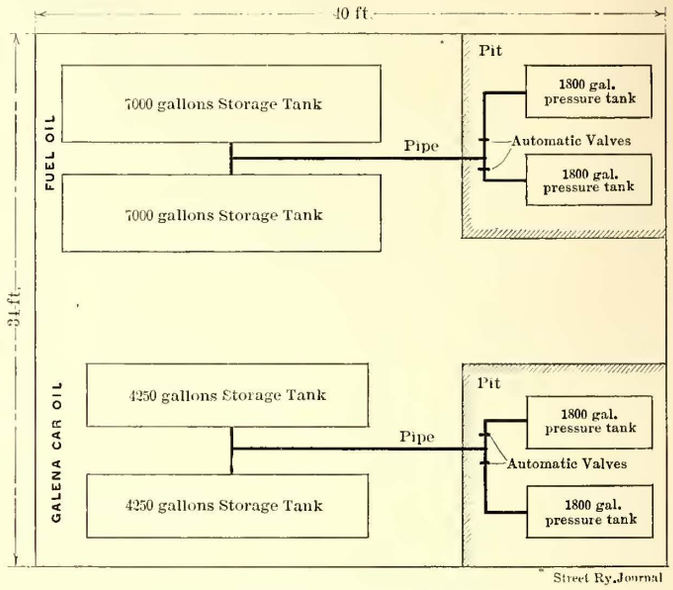


FIG. 24.—DIAGRAM OF ARRANGEMENT OF OIL TANKS IN BASEMENT OF OIL HOUSE

diameter have been handled in this furnace. In the background of Fig. 14 is shown this furnace, and the same view also shows the 3000-lb. steam hammer used in connection with the furnace.

The truck springs are also made in this shop, they being heated in a special oil furnace. All bolts and nuts used in the shop are roughed out by special machines here. The remainder of the equipment includes eleven fires, punch, shear, bulldozer and two small steam hammers.

SPECIAL TRACK-WORK YARD

The yard for special track work adjoins the machine shop, as shown in Fig. 15. The work is usually laid out on heavy wooden horses, so it may be drilled and fitted more conveniently. A hydraulic rail bender is used and two saws. These saws are of the ordinary type usually operated by hand, but they have been fitted with pneumatic motors, as may be seen in Fig. 16, thus greatly adding to the convenience and ease of their operation. One of the saws was built complete in the shops, and is mounted on a heavy iron bed-plate. Forgings made out of wrought-iron scrap are used for all tongues, fillers and angle-bars of special work.

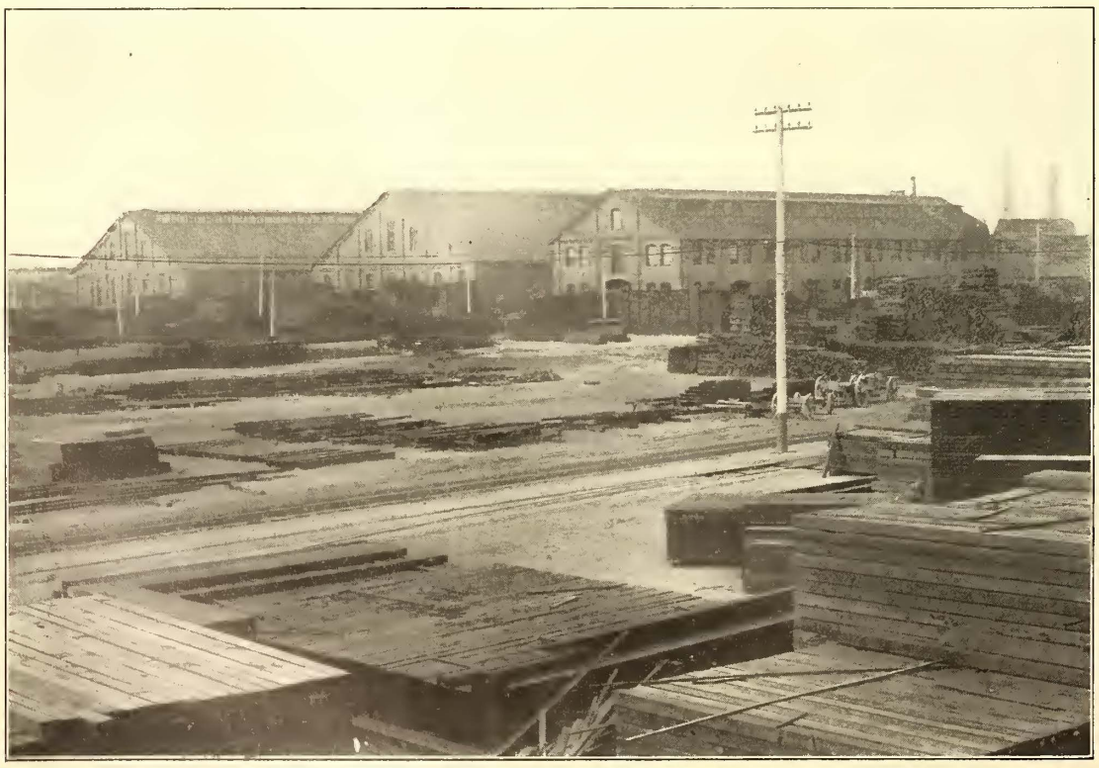
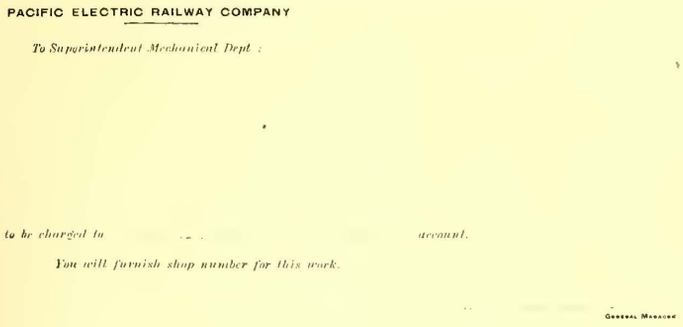


FIG. 23.—REAR VIEW OF SHOP BUILDINGS, SHOWING CAR LUMBER STORAGE

PATTERN AND CABINET MAKING SHOPS

A general view of the pattern and cabinetmak-

ing shops is given in Fig. 17. Here are made all the patterns used for the regular shop castings as well as those used in the power house and on other parts of the system. As mentioned above the company has no foundry of its own, but contracts for


PACIFIC ELECTRIC RAILWAY COMPANY

To Superintendent Mechanical Dept.:

to be charged to account.

You will furnish shop number for this work.

General Manager

FIG. 25.—GENERAL ORDER, OR AUTHORITY BLANK

all of this work, keeping five foundries in the city busy most of the time. In the cabinet shop desks and office furniture are constructed as well as the finer woodwork required on the cars.

WOOD MILL AND CARPENTER SHOP

The heavy woodwork required for the repairing of the car bodies is fashioned in the mill which is located in the south end of the carpenter shop, as shown in Fig. 18. All shavings are carried by means of a blower system through galvanized-iron pipes to the 80-hp boiler located in the end of the lumber storage room. This boiler is arranged for burning shavings at the front, and at the rear end an oil burner is introduced. Either shavings or oil can be used for fuel, and if desired both can be fed to the furnace at the same time. This boiler supplies steam for the hammers in the blacksmith shop, for driving an air compressor with a capacity of 250 cu. ft. a minute, and for other purposes as desired.

At the north end of the carpenter shop are three tracks, with 2-ft. cement pits. Under the mill end of the building is a deeper pit, in which all the motors used in driving the machines are located.

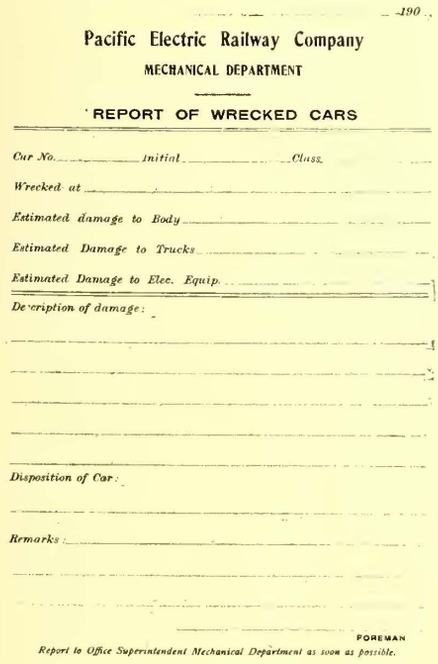
PAINT SHOP

The paint shop, a portion of which is shown in Fig. 19, is the largest single room in the shops, and with its present force of forty men ten cars can be turned out in a week. As a rule, a car is not sent to the paint shop until all the carpentery work has been completed, since it is not desirable to have such work done there. Where priming coats are necessary the painters go to the carpenter shop. The plan is generally followed of completing the repairs on damaged trucks and motors in time for a damaged car to leave the carpenter shop on its own trucks, so when it leaves the paint shop it is about ready for service.

In the southwest corner of the paint shop is the finishing department, and in the northwest corner the upholstering room. At the center of the west side of the building is the paint stock room, where the paints, varnishes, etc., are mixed and dealt out to the workmen. Fig. 20 shows this room, and the order and system of handling materials, as evidenced by the appearance of the room, is carried out throughout all the different shops. Record is kept of all stock issued to the workmen, and for what shop order and what car, so that the items of car repair expense falling to the paint shop may be accurately determined.

ELECTROPLATING DEPARTMENT

A department not commonly found connected with a street railway shop is that devoted to electroplating and burnishing, shown in Fig. 21. Here are lacquered all car trimmings, while all hand-rails, headlight fittings, trainmen's buttons and other parts are nickeled. It is surprising to see how much material passes through this shop, and the cost of operation is slight compared with the former expense entailed by sending the work out. The plating equipment consists of a cyanide of copper tank, one for sulphate of nickel, two containing potash for cleaning, and one cold water for washing. Oxidized copper and silver plating can also be done here if desired. An electric


_____ 190__

Pacific Electric Railway Company

MECHANICAL DEPARTMENT

REPORT OF WRECKED CARS

Car No. _____ *Initial* _____ *Class* _____

Wrecked at _____

Estimated damage to Body _____

Estimated Damage to Trucks _____

Estimated Damage to Elec. Equip. _____

Description of damage:

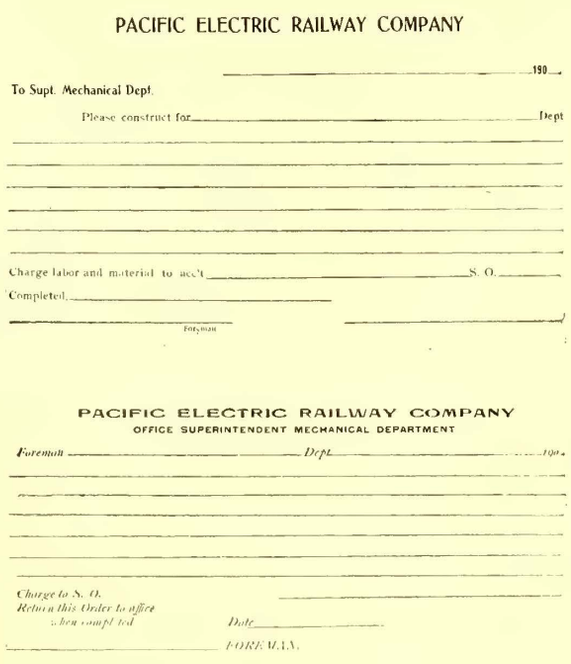
Disposition of Car:

Remarks:

FOREMAN

Report to Office Superintendent Mechanical Department as soon as possible.

FIG. 26.—ESTIMATE BLANK FOR WRECKED CARS


PACIFIC ELECTRIC RAILWAY COMPANY

_____ 190__

To Supt. Mechanical Dept.

Please construct for _____ Dept

Charge labor and material to acct _____ S. O. _____

Completed _____

Foreman

PACIFIC ELECTRIC RAILWAY COMPANY

OFFICE SUPERINTENDENT MECHANICAL DEPARTMENT

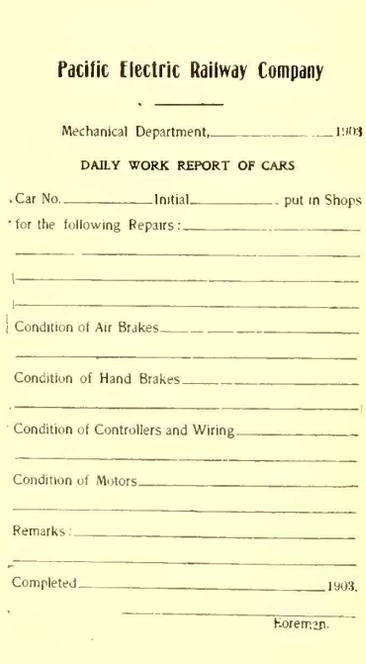
Foreman _____ *Dept* _____ *190*__

Charge to S. O.
Return this Order to office when completed

Date _____

FOREMAN

FIGS. 27 AND 28.—ORDERS ON FOREMAN FOR REPAIR WORK AND CONSTRUCTION WORK


Pacific Electric Railway Company

Mechanical Department, _____ 1903

DAILY WORK REPORT OF CARS

Car No. _____ Initial _____ put in Shops for the following Repairs: _____

Condition of Air Brakes _____

Condition of Hand Brakes _____

Condition of Controllers and Wiring _____

Condition of Motors _____

Remarks: _____

Completed _____ 1903.

Foreman.

FIG. 29.—DAILY REPORT FOR FOREMAN OF CAR REPAIRS

buffing machine, whose wheels are made in the shop, is located in a room by itself.

STORE-ROOM AND OIL HOUSE

The store room of the shops, a portion of which is shown in Fig. 22, resembles the stock room of a large Eastern supply house, a great variety of supplies being kept on hand in good-sized quantities. The stock in the oil house also comes under the supervision of the storekeeper as well as the lumber, of which about 1,500,000 ft. is carried. Part of the lumber stored is shown in Fig. 23. The combined stores under the supervision of the storekeeper have an aggregate value of between $600,000 and $700,000. All track supplies for both construction and maintenance, such as rails, ties, bridge

material, etc., which at present have a value of about $750,000, are disbursed by order of the chief engineer.

As the construction of the oil house is somewhat unusual a description of its arrangement will interest shop men. The building has an iron grating floor, and on one side are 100-gal. steel tanks for the storage of turpentine, benzine, grain alcohol, Atlantic red oil, dynamo oil, lard oil and signal oil. In 244½-gal. tanks are stored coal oil and gasoline distillate. A block and tackle, running on an I-beam supported near the ceiling, is used to raise the carboys for filling the tanks. In smaller

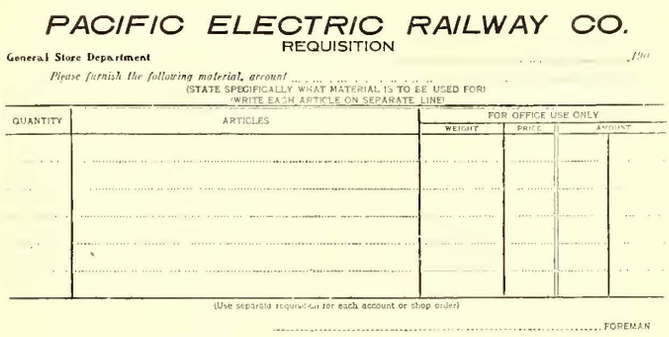

PACIFIC ELECTRIC RAILWAY CO.
REQUISITION
General Store Department
Please furnish the following material, account
(STATE SPECIFICALLY WHAT MATERIAL IS TO BE USED FOR)
(WRITE EACH ARTICLE ON SEPARATE LINE)
QUANTITY | ARTICLES | FOR OFFICE USE ONLY: WEIGHT | PRICE | AMOUNT
(Use separate requisition for each account or shop order)
FOREMAN

FIG. 30.—REQUISITION BLANK ON STOREKEEPER

tanks, barrels and casks, are stored motor grease, Albany grease, drilling oil, graphite and other lubricants and oils.

In the basement of the building are two 7000-gal cylindrical tanks for the storage of fuel oil, and two 4250-gal. tanks for Galena car oil. These tanks are below the level of the street outside, and are filled by gravity from tanks on wagons or cars. The special tank cars are run through the store room from the transfer table, and can thus be checked up by the storekeeper. Both oils are pumped under pressure from the basement, the arrangement being as shown diagrammatically in Fig. 14. The two tanks of each set are connected together by a short pipe at the bottom, from which a pipe leads to a "T" connecting with two 1800-gal. pressure tanks. In each branch of the "T" is a valve, which opens with the flow of oil, and automatically closes one tank while the other is filling. The oil flows by gravity from the storage tanks to these pressure tanks, from which it is forced by 30 lbs. air pressure to the floor above, where it is drawn off in any desired quantity. The fuel oil is also piped to the blacksmith shop for use in the furnaces, and to the boiler room for the boiler fuel.

GENERAL FEATURES OF SHOPS

The shops are well lighted from the roof by side windows, and artificial illumination is supplied by enclosed arcs for general lighting, and incandescents for individual machine lighting. In Los Angeles the days are so generally bright throughout the year that electric lighting is seldom needed except at night. The motors used are of the induction 210-volt type, or 500-volt direct-current motors. Compressed air is piped to the repair shop with a connection at the wall between every other track, and is used for hoists and other purposes in the machine and blacksmith shops and for operating the rail saws in the special work yard, as already mentioned. All pits in the shops, as well as the transfer pit, drain into the sewer. In one corner of each shop are lavatories for the men. The wash basins are of heavy tin, and are pivoted so that when thrown back in the position shown at the right in Fig. 12, they drain off.

SHOP METHODS AND RECORDS

The shops are under the immediate direction of the superintendent of the mechanical department, and all orders for shop work are issued by him. When a car is sent to the shops for repairs the general order form, Fig. 25, is made, giving the authority, the mechanical superintendent furnishing a shop number for the work. This shop number, together with the car number, follows the car and its parts throughout all the shops, and in most of the shops cards are posted on the cars giving the shop and car numbers as shown in Fig. 19.

Separate accounts are kept of wrecked cars and of cars undergoing ordinary repairs, they being given separate shop orders. Often when a car has been slightly damaged general repairing is done to other parts while the car is in the shop, and in this case two shop orders apply to the same car. When a wrecked car comes in a report is immediately made by the foreman of car repairs on a blank, Fig. 16, showing the estimated damage to the car body, the trucks and the electrical equipment, with a description of the damage and the disposition of the car. This report is sent to the mechanical superintendent, who reports the main facts of the estimate to the general manager in letter form.

All cars are received at and sent out from the car repair shop. There the car is dismantled and light repairs are completed. For general repairs the parts are sent to the different shops with orders to the foreman made out on blanks, such as shown in Fig. 27. This order follows the work through its different stages, and when completed it is returned to the superintendent's office, signed by the foreman. For new work for the track department, power department, etc., the blank, Fig. 18, is used, and when the job is finished is signed by the foreman in the same way. A daily report is made by the foreman of car repairs on the blank, Fig. 29, showing the work done on each car in his shop for that day. If a car remains in his shop more than one day a daily report is made on it just the same, showing the state of the work at the close of each day, and when finally completed and sent out the last report shows that fact.

Requisitions on the storekeeper for material are made out by the foremen on the blank shown in Fig. 30, which shows what

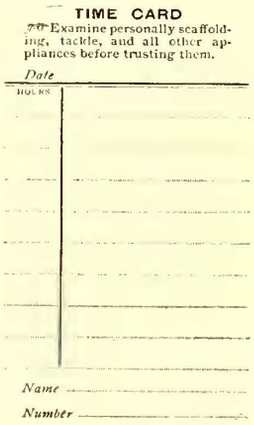

TIME CARD
Examine personally scaffolding, tackle, and all other appliances before trusting them.
Date
HOURS
Name
Number

FIG. 31.—TIME CARD FOR EACH EMPLOYEE, SHOWING HOURS SPENT ON EACH SHOP ORDER DURING THE DAY.

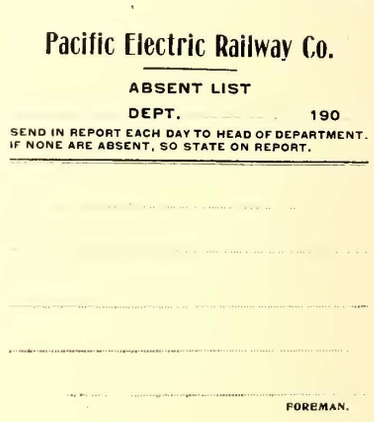

Pacific Electric Railway Co.
ABSENT LIST
DEPT. 190
SEND IN REPORT EACH DAY TO HEAD OF DEPARTMENT.
IF NONE ARE ABSENT, SO STATE ON REPORT.
FOREMAN.

FIG. 32.—DAILY LIST OF ABSENT AND LATE EMPLOYEES, MADE OUT BY EACH FOREMAN.

the material is to be used for and the account or shop order. In the store room the prices are made on the blank, and the goods are then charged to the proper account. General requisitions are made by the storekeeper on the purchasing agent once a month, and emergency requisitions are issued daily when stock is required at once. Standard methods are employed by the purchasing agent in buying materials, in receiving them at the store room, checking against requisitions and approving invoices.

By means of time cards, Fig. 31, made out daily by the workmen, showing the number of hours spent on each piece of work or shop order, accurate data is obtained on the cost of labor for each account. These cards are filed in a large case by the timekeeper, and the proper charges made on the ledger, By the rule of the shops, if a man is late he loses the entire first hour, and is required to report to the timekeeper at the main office as well as the foreman. The latter makes out a daily

absent list (Fig. 32), giving the names of the men who are late or absent in his department. The apprentice system is employed in the shops, and all work is done by day labor, piece-work not being popular with the management, and hardly being practical in most of the shops on account of the great variety of work handled.

NEW POWER PLANT AT CRANFORD

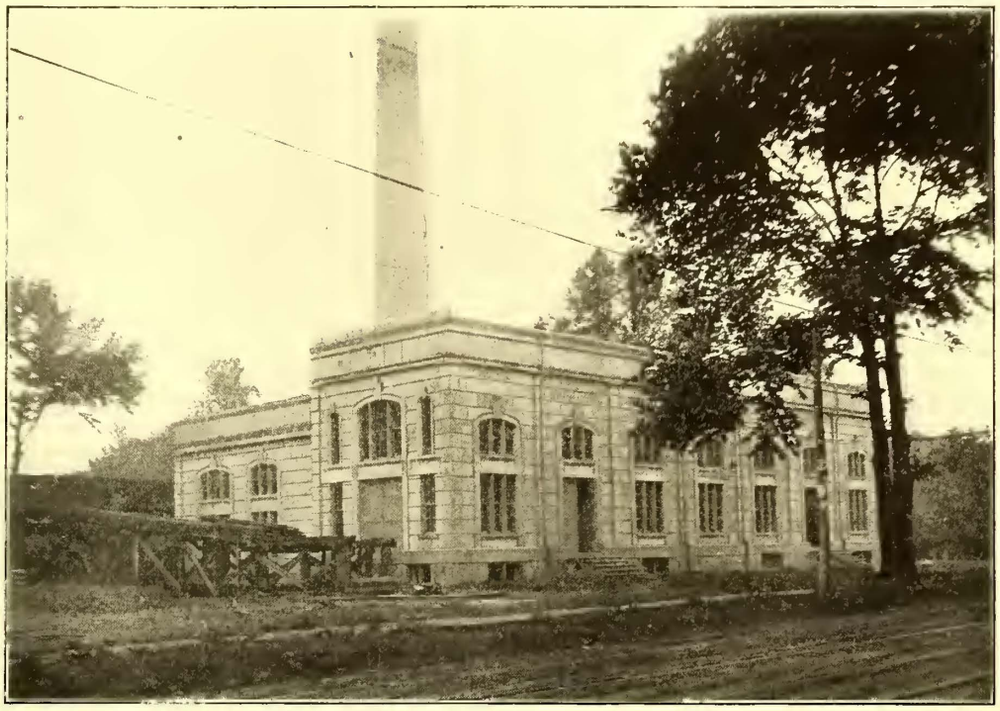
Among the electric railway systems forming part of the consolidated system in Northern New Jersey, represented by the Public Service Corporation, is that of the Elizabeth, Plainfield & Central Jersey Railway Company, one of the sub-companies of the North Jersey Street Railway Company. Before the organization of the Public Service Corporation the North Jersey Railway Company had commenced the erection of a power station at Cranford for the operation of its Elizabeth-Plainfield branch. This station has been completed under the new management, and is particularly interesting owing to a number of novel features which have been introduced into its construction. They include among other departures from standard practice a station built entirely of concrete blocks, and a steam header 81 ft. long without a single valve in it.

The station is designed for a capacity of 3200 kw. The present equipment consists of two 800-kw units, which, with a load averaging 240,000 kw-hours per month, are operating at 3.1 lbs. of coal per kilowatt-hour. Direct-connected vertical compound steam engines, equipped with an interesting system of steam circulation for jacketing and reheating, are employed, operated condensing, and horizontal tubular boilers are installed in the boiler room. Jet condensers are used, with water from the Cranford River, and the feed for the boilers is taken from the condenser discharge. The auxiliary steam machinery exhausts in the usual way to a feed-water heater. The plant was designed by Warner W. McKee, who is chief engineer of the Elizabeth division of the Public Service Corporation.

The plant occupies a site alongside the Central Railroad of New Jersey, so that facilities are afforded for coal delivery, and it is practically on the bank of the Cranford River, which ensures an adequate supply of condensing water throughout the year. The building, which is 127 ft. x 73 ft. in plan, stands some 69 ft. back from South Avenue, in Cranford, and with a lawn in front, cut by cement walks leading to the building, obtains a setting which enhances greatly the general effect of its architecture.

The site was formerly more or less of a wooded marsh, apparently undesirable for its present occupation, but in boring for the foundations hard pan was found underlying the muck at a depth of comparatively few feet, so that concrete footings for the walls and machinery foundations were found possible without the use of piling. For the walls concrete blocks were determined on, planned originally to be hollow, largely to secure a reduction in the first cost of the building. The design of the block or the methods employed in its manufacture did not succeed, however, in producing a hollow block that was proof against cracks, and the pattern finally used was the solid. They were made generally with cinders, in the proportion of 1:3:5, with Vulcanite Portland cement, but whenever cinders were not immediately available crushed stone, 1½ ins. and less in size, was substituted, and the resultant cost of the structure, it is estimated, is about what good brick work would have cost.

The blocks, which are largely of a 2-ft. x 4-ft. face and 6 ins. thick, were placed in the walls as soon as the initial set had occurred, and allowed to harden in position. The blocks on their horizontal mating faces were dovetailed together, one block having a tongue parallel with the outside surfaces and the other a groove into which the tongue is fitted. On their vertical jointing faces each block had a groove, and the two grooves formed a vertical hole, which was filled with cement grout. The joints on all sides was ¼ in. thick, made with cement mortar. The partition wall between engine and boiler rooms is likewise of concrete blocks, and the wall thickness throughout is but 6 ins., except where there are ornamental pilasters or extra thickness blocks around doors and windows.



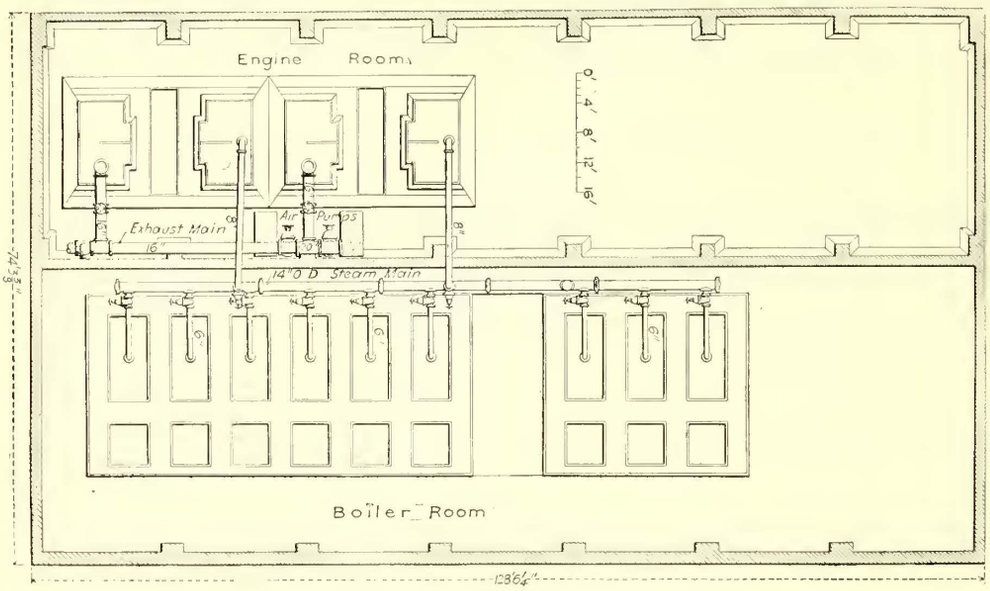
EXTERIOR OF CRANFORD POWER STATION

The walls are continued above the roof level, in a cornice or parapet, so that the roof itself is not visible from the street.

The engine room floor is about 4 ft. above the boiler room floor, and under the former the space around the machinery foundations has been excavated, forming a basement about 7 ft. in clear height, which is lighted by windows and utilized for storage and for electrical apparatus. The engine room floor is of expanded-metal concrete construction, suspended between transverse I-beams, and it has a cement surface marked off in large squares. The roof trusses, which are of light steel construction, are carried by three rows of light, steel columns, two of the rows on opposite sides of the engine room supporting also the girders for a traveling crane. The roof is of gravel, as furnished by the Commonwealth Roofing Company, laid on planks. The walls and under side of the roofs are painted white, except the bottom 5 ft. of the walls, which are black, and the roof trusses and crane are a dark red. The columns in their rise through the building are enclosed in concrete, as a sort of pilaster. There is a clear height of 25 ft. to the under side of the crane, which is a 15-ton hand-power traveling hoist, built by the Reading Crane & Hoist Works. There are practically two rows of windows in the outside walls and also a row of clere-story windows in the partition wall above the

boiler room, so that the engine room presents a lofty, well-lighted and pleasing interior.

Between the boiler room and the railroad coal siding, which is run on a trestle, there is space for some 3000 tons of coal; and in the outside wall there are six pairs of large double doors through which coal is carried by a short haul from coal pile to firing space. At each end of the boiler room there is also a large opening, closed by a Kinnear rolling door. The floor, which is paved with brick, is at grade level, and to the under side of the roof trusses there is a clear height of 22 ft. In the roof there are seven 24-in. ventilators. Fire hose is provided in both rooms, attached to piping extending from the city water supply.

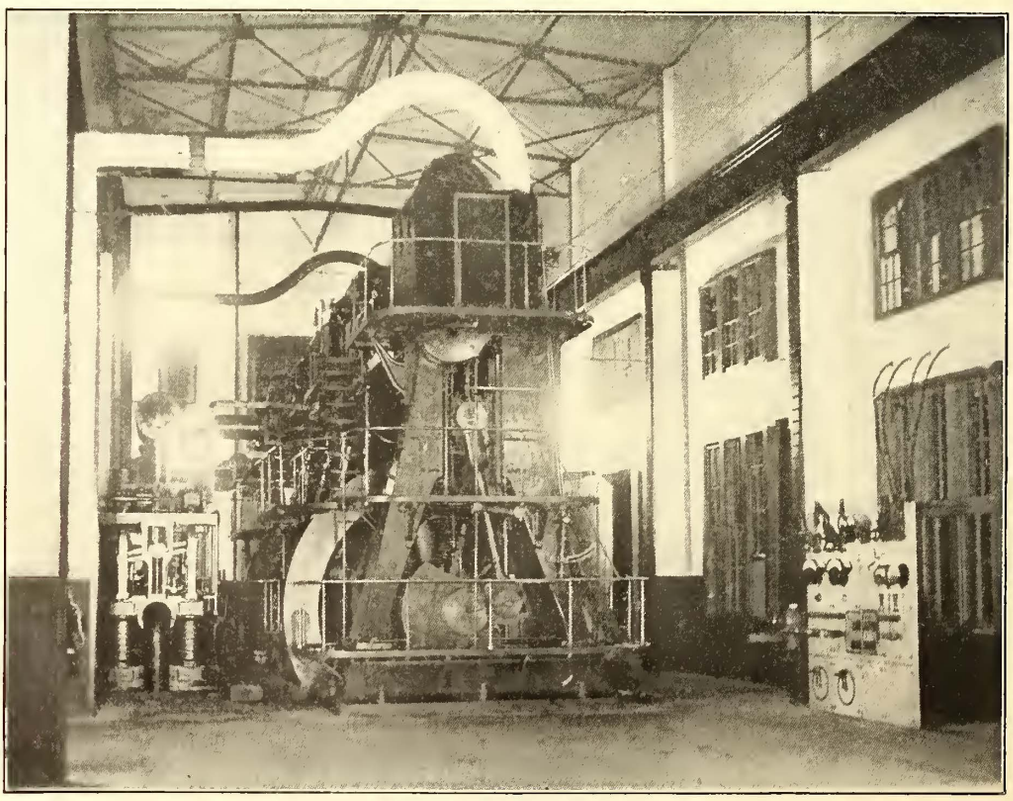


PLAN OF POWER STATION AT CRANFORD

The boiler plant consists, as stated, of horizontal tubular boilers, each of 72-in. shells, with 3½-in. tubes. The room is planned for twelve all told, arranged in two groups on opposite sides of a central cross gangway, where the feed pumps and feed-water heater are located and where communication is had with the engine room. Three of the boilers are yet to be installed. Those now in place were built by the Stewart Boiler Works, of Worcester, Mass., and have a shell 20 ft. long, with 86 tubes, so that the heating surface is 1800 sq. ft. per boiler. Allowing 12 sq. ft. per boiler horse-power, each boiler has a capacity of 150 hp, or 1800 for the whole plant. The floor space taken up by each group of six is 1 2-3 sq. ft. per horse-power, and in the whole room there are about 2.8 sq. ft. per horse-power, with 12 ft. firing space and 5 ft. between the boilers and the partition wall.

The boilers have 9-16-in. shell and ⅝-in. heads, and were designed for 175 lbs. pressure. They are enclosed in a setting built along the lines advocated by the Hartford Steam Boiler Inspection & Insurance Company. The grate area is 33.4 sq. ft., showing a ratio of heating to grate surface of 53.8 to 1, and a ratio of tube area to grate surface of 1 to 5.7, as bituminous coal is burned. The boilers are hand fired, and a record of the coal consumption is kept by means of a street railway fare register, which is rung up every time a barrowful of coal is weighed and brought into the boiler room, the barrow being carefully balanced on platform scales with 300 lbs. net each time. The reading of the register is noted at every change of shift. The boilers have the usual overhanging fronts, and each smoke up-take has an area of 5.4 sq. ft. The breeching is circular, in cross-section, and at its largest point 6 ft. in diameter, or 80 per cent of the total tube area of the six boilers served by it. The smokestack rises outside the building in the position indicated, and is of the Custodis radial perforated brick construction, with square base and ornamental top, 8 ft. in inside diameter at the top and 150 ft. high. A damper in the connection between breeching and stack is arranged for automatic control by means of a Spencer draft regulator.

The steam piping is quite unusual, particularly in the use of a steam header without valves. The arrangement of the piping is shown in the accompanying illustrations. The boiler connections into the header, and the engine supply pipes from it are formed on long radius bends, in accordance with modern practice of allowing in that way for expansion and contraction changes, with an elimination of sharp angles and bends, and with a reduction in the number of joints and fittings. The height of the engines with respect to the roof of the boiler room necessitated an unusual amount of bending in the pipe



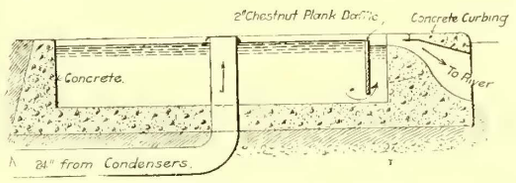
GENERAL VIEW OF INTERIOR OF STATION

in the engine room. One valve only is fitted in the pipes to and from the header and these near to it, and accessible from an elevated platform behind the boilers. The boiler leads enter the side of the header, so that condensation within them can flow back into the boilers, while the other connections rise from the top and drainage of the header is effected by a system of drip pipes. These are 2 ins. in diameter, and one is taken from the header below the inlet from each boiler, with a valve near the header. These pipes drop along the rear of each boiler, and hence into the water space of the boiler, but each connects en route into a 4-in. header, which is carried across the rear of the boilers as an auxiliary steam main and drip line. It will thus be seen that the main steam pipe drainage system provides for returning the water of condensation to the boilers by gravity, while at the same time furnishes a supply of steam for the auxiliary steam apparatus.

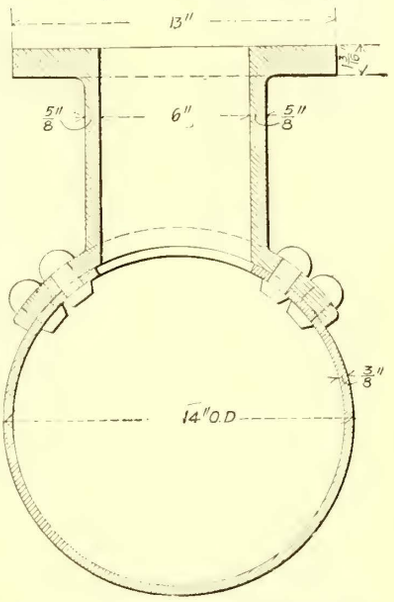
The present steam header is formed of five lengths of 14-in. outside-diameter steel piping, ½ in thick, the lengths ranging from 14½ ft. to 19 ft. 4 ins. The steam pipes are connected to it by flanged necks of cast-steel, ⅞ in. thick, riveted to the header by ⅞-in. rivets. The sections of the header are joined by the recessed lap joint, made by W. K. Mitchell & Company, of Philadelphia. The rest of the piping is of extra strong steel piping, with the Mitchell joint. In all joints a copper-wire gasket, devised by Mr. McKee, is employed. The main valves are of the Chapman gate type, and the piping is wrapped in R. A. Keasbey 85 per cent magnesia pipe covering, 2 ins. thick.

The engine room contains at present two 800-kw, direct-connected direct-current railway units, with space for two more of the same capacity, which, however, may be alternating-current units in case it is desired to provide for long-distance transmission. In that event it is proposed to install rotary converters as a means of connecting the direct and the alternating-current ends of the plant, so that an excessive demand on the one system can be met by the other through the use of the converter. The space occupied in the engine room is 1.18 sq. ft. of floor space per kilowatt of rated output, or 0.88 sq. ft. per horse-power. Taking the whole building into consideration there are, not including the chimney, 2.17 sq. ft. of ground space per horse-power of rated output and 71 cu. ft. of building per horse-power.

The generating sets now in operation consist of Williams vertical compound engines, with 21½-in. and 43-in. cylinders and 36-in. stroke, built by the Quincy Engine Works, and Westinghouse 600-volt railway generators, operated at 120 r. p. m. The engines were furnished under a guaranteed steam consumption of 13½ lbs. of steam per indicated horse-power per hour, with steam at 150 lbs. pressure, a vacuum of 27 ins. and the speed above given. They are equipped with an interesting system of reheating, including a jacket for the high-pressure cylinder and a reheater between cylinders. The live steam in the jacket passes from it through a coil in the reheater, and the outlet of the reheating coil is then connected, after the condensation has been trapped off, to operate the steam cylinders of the condenser air pumps, the pipe thus serving as a convenient method of supplying the condenser units but principally as a means of creating a steady flow of steam through the reheating coils. Such water of condensation as forms later reaches the feed-water heater through the exhaust from the steam pump.



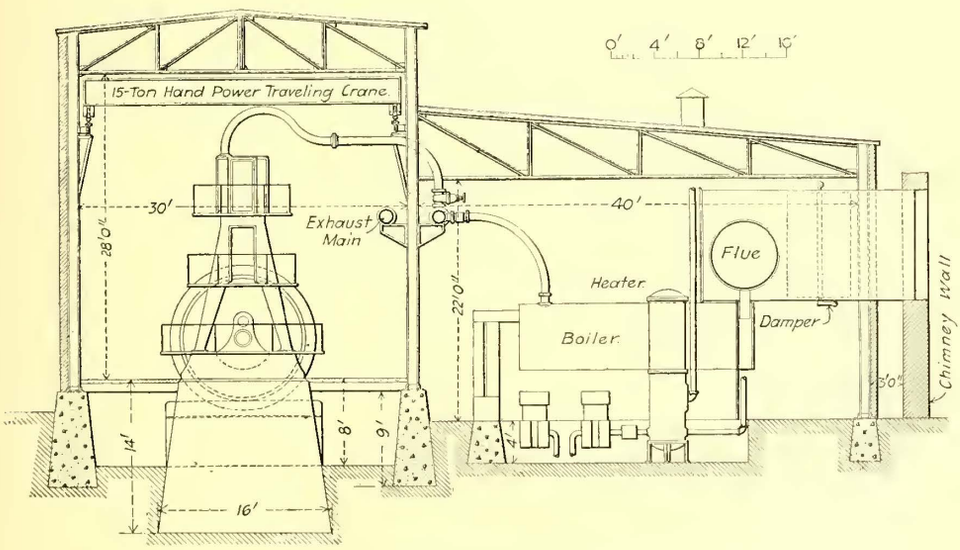
SECTION OF RESERVOIR FOR RECOVERING OIL



SECTION OF BOILER CONNECTION TO MAIN STEAM LEADER

The engines are operated with a fixed cut-off for the low-pressure cylinder, so that with varying load the receiver pressure is variable, and the latter is accordingly equipped with a safety valve of the Crane type, set to blow off at about 60 lbs. The receiver is 36 ins. in diameter and about 4 ft. 9 ins. high inside, and contains sixty 2-in. brass pipes, 3 ft. 8 ins. long, connected at top and bottom by return bends to form a continuous coil. The bearings and guides of the engine are water cooled and lubricated from an oil circulating system, which employs a storage tank on the upper engine gallery. The head under which the oil is circulated is thus not more than a few pounds at the oil spouts, the purpose being to furnish the oil through these outlets in comparatively large globules or streams to avoid the clogging of smaller outlets, which might otherwise have been necessary. The oil from the bearings is caught and drained by a system of piping to a Burt "Cross" oil filter in the engine room basement. Filtered oil from the reservoir is pumped to the elevated tanks by means of a small steam pump, operated a few minutes, as the tanks above become empty.

The condensing system is noteworthy for the directness of the piping system and the location of the air pumps on the engine roof floor, behind the engines readily accessible to the room attendants. The exhaust pipe from each engine, 16 ins. in diameter and of wrought-iron, is 11 ft. long to the 20-in. main exhaust, and each of the two pumps takes from the main



SECTION OF POWER STATION AT CRANFORD

through a pipe 8 ft. long. As indicated in an accompanying drawing, the usual relief connection is provided, with a Blake relief valve discharging through a short horizontal pipe extending through the end wall of the building. The pumps are of the vertical twin pattern, made by the Warren Steam Pump Company, and are 10 ins. x 25 ins. x 18 ins. in size. Each is calculated large enough to serve both engines, and the connections are made so that either one or both may be operated. They deliver into a concrete reservoir outside the building, the chief purpose of which is to afford means for the oil or grease to separate from the water before its final discharge into the river. As shown in a sketch on page 441 the water flows out of the reservoir over a weir in one side, reaching the weir under a baffle, so as not to disturb the surface water where the grease may rise and collect. As little cylinder oil as possible is used in the engines, and thus far no systematic skimming has been necessary.

Water for the boilers is taken from a pocket in the condenser discharge main within the power house, the pocket being located in the bottom of the pipe to minimize the chances of getting oil in the water; and this water, without treatment, except in the feed heater, is pumped into the boilers. The boilers are cleaned in turn after being in use four weeks, and the sediment is a soft mud, easily washed out. There are two 10-in. x 6-in. x 12-in. Warren feed pumps, installed in duplicate and placed on one end, taking a vertical position with minimum floor space. They deliver first through a Union meter, by means of which the record of the boiler evaporation is kept, and then through the feed heater, which is a Wainwright water-tube heater with corrugated tubes. Under normal conditions the feed to and from the heater is 100 degs. F. to 110 degs. F. and 200 degs. F. to 210 degs. F., measured by standard thermometers with dial faces. The heater is rated at 3000 hp, and contains 144 1½-in. tubes, 124 ins. long. The exhaust from the various pumps is led to it, and the condensation is drained to an open barrel near the feed pumps, this barrel serving the same purpose as the concrete reservoir. Considerable oil is recovered in this case, and is skimmed off for utilization over again in the pump cylinders.

The station is entirely a street railway one, subject to the variations of demand peculiar to this class of service. It is at present an adjunct of a 1300-kw street railway plant at Elizabeth, and while located centrally for the suburban lines to Plainfield, to Elizabeth and to Boynton Beach, is frequently called on to send current to the Elizabeth system, a distance of 5½ miles, over a 1,000,000-circ. mil feeder. The station is 9½ miles from the center of Plainfield and 10 miles from Boynton Beach, and furnishes the current necessary to operate all the cars along the line, and at Plainfield as well as Elizabeth.

For the control of the electric system there is a standard switchboard with two panels for the generators, a totalizing panel and the remainder, feeder panels, two feeders per panel, each feeder protected, as usual, with a circuit braker. The totalizing panel carries a recording wattmeter, which is one of the instruments read with changes of shift in the power house, in connection with the records kept of the plant performance.

The plant is run daily except between 2 o'clock and 5 o'clock in the morning. The average load throughout the day is 800 amps., but at the peak, between 5:30 p. m. and 6:30 p. m., the current demand averages 1200 amps., fluctuating between 800 and 1600. Steam, however, is kept up at all times, and the steam pressure is varied proportionately to the load, the idea being that more economical steam distribution is secured in the steam engines at the light loads with reduced steam pressure. The pressure ranges from 60 lbs. during the early hours of the morning to 150 lbs. at heavy-load times, or 160 lbs. in the case of an unusual demand. In the accompanying table is given the record of the coal consumption in seven months' running. The evaporation of the boiler plant, on the basis of the water meter and for the actual continuous performance, day after day, is 9½ lbs. of steam per pound of coal.

RECORD OF SEVEN MONTHS' OPERATION

Month	Kw-hours	Coal Per Kw-hour Pounds
June	.....	3.97
July	.....	3.4
August	.....	3.37
September	.....	3.4
October	.....	3.44
November	210,000	3.4
December	240,000	3.1

On the basis of the December output, it will be found that 29½ lbs. of steam were consumed per kilowatt-hour, including the engines, condensers and feed pumps.

STREET CAR LUBRICATION

BY GEORGE L. FOWLER

To the layman who is not bearing the burden of the responsibility of street railway management but who happens to be somewhat familiar with the practices of the steam roads, and who has seen the great economies resulting from the adoption of the various standards promulgated by the Master Car Builders' Association, it seems passing strange that with all of the excellent work done by the American Street Railway Association, there should be such variations of practice among the roads represented.

Probably in no one detail is this variation of practice greater than in that of methods in use for the lubrication of axle journals. In the days of the horse car the almost universal practice was to use a felt wicking and oil. The speed was slow and the weight light, so that little or no trouble was experienced. But, with the introduction of electricity and the construction of heavy cars intended to be run at comparatively high speeds, the wicking and oil did not seem to be quite satisfactory, and it was dropped here and there, until very few instance of its persistence in electric work can be found.

As the wicking was found wanting, each master mechanic set about, in his own way, to find something that would do the work. And to do the work meant to find a lubricant that would make it possible to avoid hot boxes and cut journals, and thus avoid the resulting delay to traffic. This end once attained all investigations came to an end, and inquiry almost leads one to believe that there is hardly a road in the country whose officials know whether they are using an economical system of lubrication or not.

It is all very well to declare a freedom from hot boxes and an absence of all delay to traffic, but there are other things to be taken into consideration in the matter of lubrication than hot boxes and blockades.

It does not seem to have occurred to most managers that there is such a thing as a coefficient of friction, and, if it has, it has been discarded as of no moment. It is taken to matter little whether that coefficient is .07 or .15. But it is.

This statement may be best illustrated by the experience of a certain railroad that is now almost ancient history. A contract was made with an individual to keep a line of coal cars supplied with oil, waste and brass for a term of years. The individual proceeded upon the plan that the best way to make money out of the job was to use the best materials that he could buy. At the time of the signing of the contract the trainload for the standard engines was fourteen cars. In six months time the improved lubrication made it possible to increase the train to eighteen cars, and this held throughout that whole life of the contract. Owing to the fact that the contractor made money out of the work, the contract was not renewed, and the purchasing agent started in to save what the contractor had made, and a little more. Accordingly, he commenced to buy on

price and not on quality, with the result that in six months time the trainload was once more fourteen cars.

Practically the same thing is being done in street railway service. It may not be that poor materials are bought, but I am well within bounds in saying that improper materials are used.

In some recent tests two cars were used. With the first a speed of 25 m. p. h. was attained and maintained with ease. When work was started with the second it was found to be impossible to reach this speed. Attributing the failure to the motors, those on the first car were put upon the second, and still the speed lagged at 20 m. p. h. The first car was lubricated with oil and felt, the second with grease. This grease was then removed, and the boxes packed with a dope of oil and waste. At first no difference could be detected, then at the end of a day's work, when the oil had been well drawn in between the brass and journal, a speed of 25 m. p. h. was readily attained.

Again, the records of one of the great roads of the country show that there is a wide variation in the amount of power required to propel cars in January and July. In cold winter weather it takes about 28 per cent more power than in the heat of July. Yet what do we find to be the practice of a great majority of the urban electric railroads?

No attention whatever is paid to this important element of coefficient of friction, though the results must be patent to all. Something is put into the journal boxes that keeps them cool, and no note is made as to whether car resistances are 1.25-kw or 2.00-kw hours per car mile. And, worse than all, is the continued use of the same lubricant for both summer and winter service. This is so diametrically opposed to the almost universal practice of the steam railroads that it is inconceivable that the importance of the subject should be so grossly neglected. On one important trunk line it is claimed that if the summer oil is allowed to remain in the boxes too late in the fall, there is a difference of 30 per cent in train resistance.

Yet what do we find in the practice of street railroads? There is little or no knowledge of the real value of the lubricants used when referred back to that court of final appeal, the coal pile; despite the fact of the realization of the variations in power used under varying conditions of temperature.

Returning now to actual methods of practice we find, first, that the old felt and oil method of the horse car is not entirely unsuited to the requirements of urban electric service, provided suitable materials are used. On at least one important line this method is still in use, but the greatest care is taken in the selection of the wicking. The finest quality of piano felt is used, and it is so cut that it lubricates not only the journal proper but the check-plate groove as well. The purchasing agent buys on specifications and not on price. The result is that the journals on that particular road maintain a phenomenal smoothness and evenness of wear. A cut journal or a hot box is an unknown quantity, and a recent inspection of several hundred old axles showed each to be in first-class condition. The same care that is exercised in the choice of material obtains in the maintenance, and when the felt drops away, as the result of wear and saturation, it is blocked up with felt of the same quality and not with wood. The conclusion naturally reached from this is that felt and oil can be used on urban service, because it is; and the suspicion arises that the reason for discarding it lies in the attempt to use poor and cheap materials that would not do the work under heavy cars at moderately high speeds. There really can be no other reason, since the foreign roads have been using felt and oil as a means of lubrication for years, and with great success.

I am not prepared to say that the felt and oil is the best means of lubrication, either from the standpoint of efficiency or economy; but merely that it will work.

Again, grease is used, and "grease" covers a multiude of compounds. It may be as stiff and hard as a plank in winter, and as soft as melted butter in July. It may be mixed with waste to serve as a binder or have the delicate odor of a perfume. It may masquerade under any one of a score of names, but it is still grease.

Sometimes a road has no accepted method of lubrication, but leaves the matter open to the judgment of the car house foremen, who are held responsible for the cool running of the axles. Such a state of affairs may seem improbable, but it does exist.

Then, of course, comes the more common practice of the use of oil and waste. Rarely is there a difference made in the quality of oil used in summer and winter, though in places this is done.

The variation of practice is almost as great, however, as the number of roads. Every variety of waste and oil is in use. I have seen cotton waste that was lumpy, and would mat like corn husks, put into boxes dry, with a heavy oil poured over it that ran like molasses in January; and I have seen a light elastic waste used that had been soaked in oil until it formed a springy dope that would lubricate anything. Mineral wool, Japanese fibre, jute and other fibrous materials come into play with a wide difference in effect on resistances.

Now, there is really no sense in such a multiude of practices. The services of the ordinary street railroads are near enough alike to make it probable that some one general system will be found to be best for all. What this is, a careful and painstaking investigation alone can tell. That it will be found to be identical with the approved practice of steam roads is hardly probable, but that it will develop that it is a matter of no importance as to what is used provided only that the journals run cool, is an absurdity beyond the realm of consideration.

In order to drive the importance of this subject home let us do a little calculating:

Suppose it requires 1.25-kw hours per car mile, at the car, to move it. If this amounts to 60 per cent of the power developed at the engine, that of the latter will be about 2.8-hp hours. If the engine has an efficiency of 1-hp hour on 14 lbs. of water, and the boilers can evaporate 10 lbs. of water per pound of coal, the coal consumption per car mile will be about 3.9 lbs.

If the road has 500 cars in service that are making 100 miles a day each, the coal consumption directly chargeable to car mileage will be 975 tons. Suppose, now, that owing to defective lubrication the power consumption is increased 20 per cent, and this may easily occur. With coal worth $2 per ton, we have the neat little item of extra expense of $390 per day added for "didn't know," or "don't care." Capitalize this at 4 per cent and you have a paying dividend on pretty close to a million dollars. If there is a disagreement as to the basis of the calculation, though it is not far out, let the reader cut it down to suit himself, and he will still find that lubrication is an item of such magnitude that he cannot afford to ignore it.

And yet, despite the data, small as it is that is available, the wonder to the outsider is that the subject of lubrication is so coolly ignored by men who are bending every nerve to cut down operating expenses and pay dividends. It seems to be the old story of saving at the spigot and wasting at the bung.

While sufficient data is not at hand to lay down a definite law as to what is best, it is respectfully suggested that, owing to the high resistance usually developed with grease, this material is unsuited to the lubrication of car journals, and that investigations had best be made with felt and oil and waste and oil. In the case of the former a fine quality of piano felt will be found to be the best, and the oil must be adapted to the season, at least two, and possibly three grades being used, during the year.

With oil and waste, again, use only the best of material. Generally speaking, wool will be found to be superior to cotton, and the wool itself may possibly be improved by the addition of a small quantity of Japanese fibre. In the matter of oil it is of importance that at least two grades be used during the year; and, finally, no waste should be put into a box until it

has been soaked submerged in oil for at least twenty-four hours, and forty-eight is better still. It should then be allowed to drain for twenty-four hours, before being used to pack the boxes. With this no oil should be used, and when repacking is required the old waste should be removed and new put in its place. It is not stated that this will give the best results attainable, but merely that it is probable that the best results will be attained by pursuing the investigation along these two lines.

RECONSTRUCTION OF THE ZANESVILLE (OHIO) RAILWAY, LIGHT & POWER COMPANY'S PROPERTY

The property of the Zanesville Railway, Light & Power Company has been undergoing an almost complete reconstruction during the past eighteen months. As many other properties are in a position where such reconstruction is being considered, the present article, telling how this work was accomplished in Zanesville and the results will, no doubt, be of interest. The old power plant of this company consisted mainly of high-speed simple non-condensing engines and a conglomeration of belts and line shafting for transmitting the power to generators, such as is familiar to most of our readers. This plant is to be entirely abandoned. The new plant consists entirely of steam and water turbines. There are no reciprocating engines driving generating machinery in the plant.

LOCATION

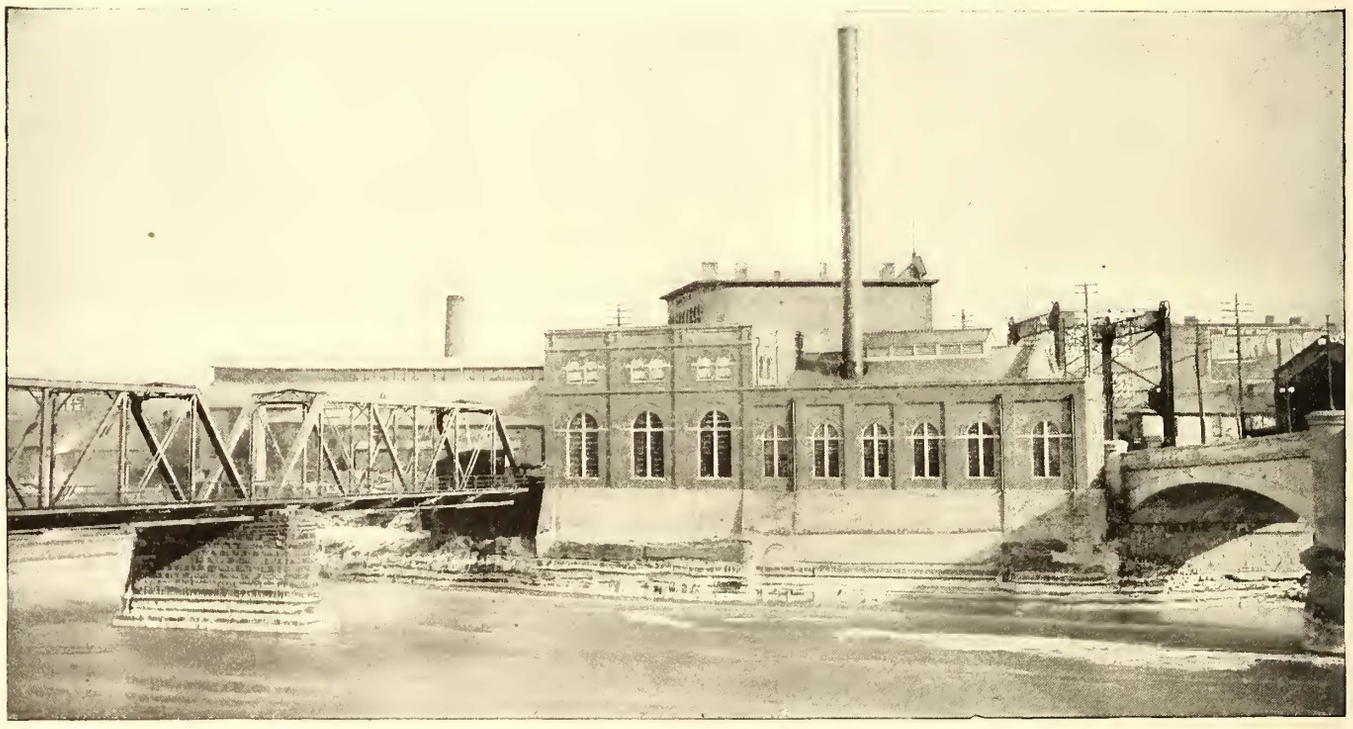
A remarkably fortunate location was selected for the new plant, as shown in Figs. 1 and 8. It is on the bank of the Muskingum River, between the river and a canal maintained by the Government. In order to supply water to this canal the Government maintains a wooden crib dam in the Muskingum River, just above the power plant, as shown in Fig. 8. The water power obtained by this company is therefore secured at no expense for the maintenance or construction of a dam or canal. The only expense connected with the development of the water power has been the building of the water power station itself. In this plant, water power is not depended upon entirely, as there are times when, owing to the great amount of flood water going over the dam, the head water at the power house practically disappears. A steam power plant sufficient to carry the full capacity is therefore placed in the same building, but it is expected that water power will be sufficient during a large portion of the time to operate the plant. Since, in this case, the expense of the hydraulic development was comparatively small, the engineers considered that they could well afford to install a hydraulic plant for the sake of power that could be obtained, even though this power could not be relied on every day in the year.

Just below the power house is a bridge, and from the street railway tracks on this bridge a spur is run to the power house for the purpose of carrying coal and other supplies. A side track of the Baltimore & Ohio Railroad also reaches the plant at one end. A further idea of the location of the plant can be obtained from Fig. 3, which is a photograph taken from across the river, showing the Government dam and railroad bridge at the right with the city bridge at the left. The power house is located on a solid ledge of rock, as can be seen from Fig. 3, which was taken during construction. This shows the ledge of rock on which the power house and the excavation made for the tail race and also the concrete arch construction over the tail race.

CONSTRUCTION AND ARRANGEMENT OF BUILDING

The arrangement of the machinery is interesting, owing to the dual character of the apparatus employed. Thus the water passes under the down stream end of the building, and the boiler house is located over the head race. Vertical shaft turbines are used and are geared by means of wooden beveled gears to a long horizontal shaft, which is direct connected at its ends to the generators. The ordinary level of the tail water is 13 ft. below that of the head water, giving a 13-ft. head on the wheels. This head disappears in times of freshets, as maximum high water comes very nearly to the top of the concrete foundation wall, which is carried up to the level of the engine and boiler room floors.

The up-stream end of the station contains the steam turbine units. The basement floor is 13 ft. below the engine room floor; the basement containing the turbines and condensers, while the generators on the vertical turbine shaft are above the level of the main floor. All the foundations of the building are concrete, laid on solid rock. The roof is slate with copper gutters.



NEW ELECTRIC POWER STATION AT ZANESVILLE, OHIO

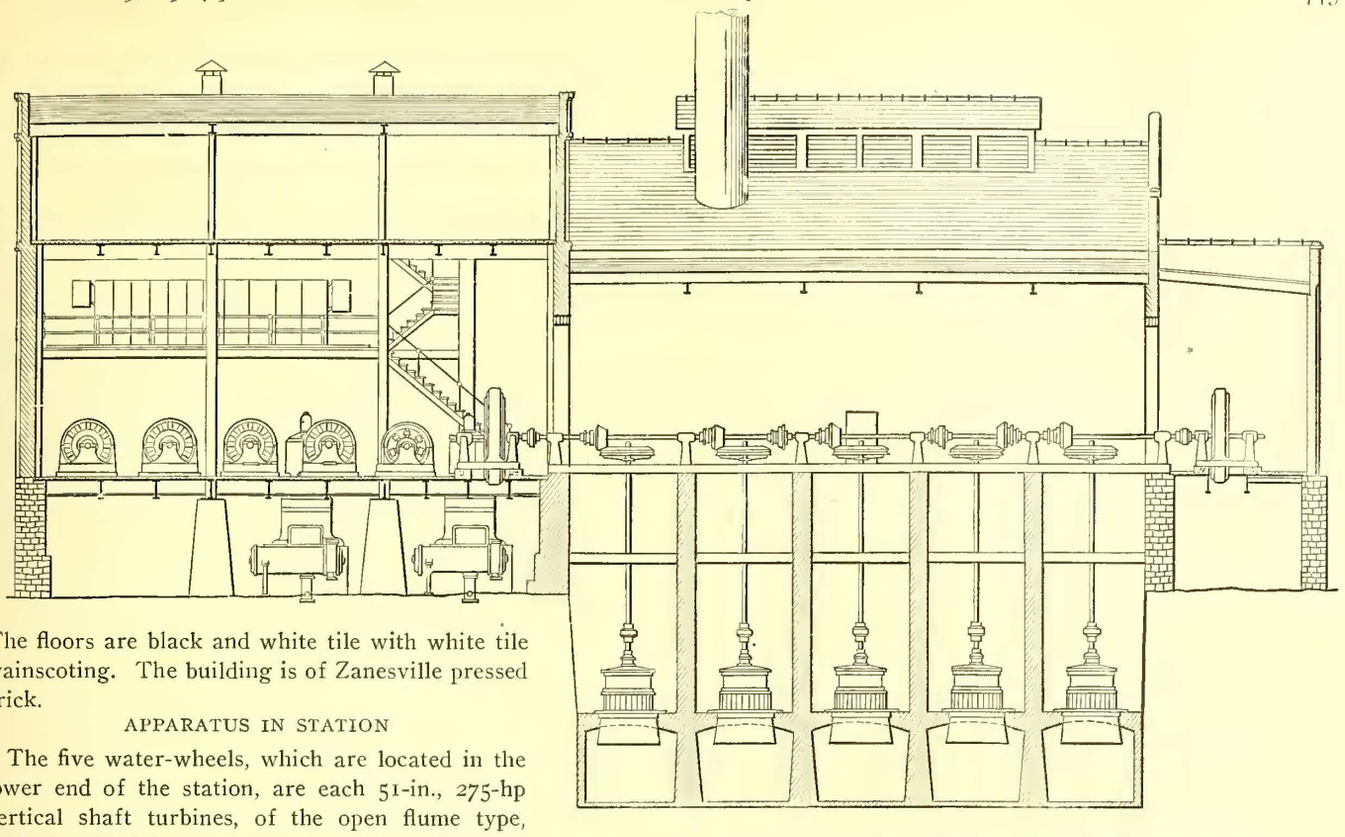


FIG. 2.—LONGITUDINAL SECTION OF POWER STATION

The floors are black and white tile with white tile wainscoting. The building is of Zanesville pressed brick.

APPARATUS IN STATION

The five water-wheels, which are located in the lower end of the station, are each 51-in., 275-hp vertical shaft turbines, of the open flume type, made by the Stilwell-Bierce & Smith-Vaile Company. These turbines run 80 r. p. m., and are geared through bevel gears to a line shaft running 200 r. p. m. On each end of this line shaft is a 375-kw General Electric, 60-cycle, 2300-volt generator. Fig. 5 is a view in the shaft house, showing the shaft, bevel gears and Lombard water-wheel governors. The shaft house is partitioned off from the generators at either end.

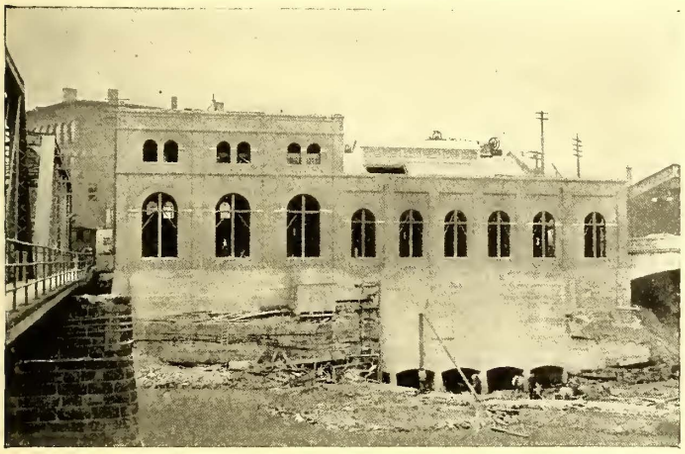


FIG. 3.—VIEW OF STATION DURING CONSTRUCTION

In the steam turbine room, Fig. 6, are two 500-kw Curtis steam turbines, designed to operate at 180 lbs. steam pressure, in connection with Stilwell-Bierce surface condensers. Fig. 7 shows one of these turbine units with its condenser piping. The centrifugal circulating pump is motor driven. Provision has been made in the generator room for two more steam turbine units of this size. The rotary converters mentioned later are also in this room.

In the boiler room resting on a concrete floor over the head race are two 380-hp Heine water-tube boilers, with two Stilwell-Bierce feed pumps. The boilers are hand fired. Coal is shoveled directly from the cars on the siding into the space in front of the boilers. Provision has been made for doubling this boiler capacity.

About 25 per cent of the load of the station is supplied to alternating-current lighting circuits. The remainder is used in rotary converters to give 550-volt current for railway use and 110 volts for the three-wire direct-current network.

For railway purposes one three-phase transformer takes the 2300-volt current and reduces the voltage for use in a six-phase, 60-cycle rotary converter for supplying the street railway.

To supply the direct-current lighting network to three-phase transformers step down the 2300-volt three-phase current for use in two 240-volt rotary converters. The balancing is done by a connection of the neutral of the star connected rotary converters.

Both the railway and lighting rotary converters are supplied from the same generators. This has been made possible by connecting in multiple with the railway bus-bars 256 cells of chloride accumulator. This storage battery is connected in series with a differential booster, which causes the battery to take the fluctuations of railway load and leave a practically steady load on the generators. The cells of this battery are type G, with seventeen plates per cell. The tanks are large enough to allow 50 per cent increase in plate surface. The differential booster is large enough for the ultimate capacity of the cells. This battery is rated at 640 amps. at the 1-hour

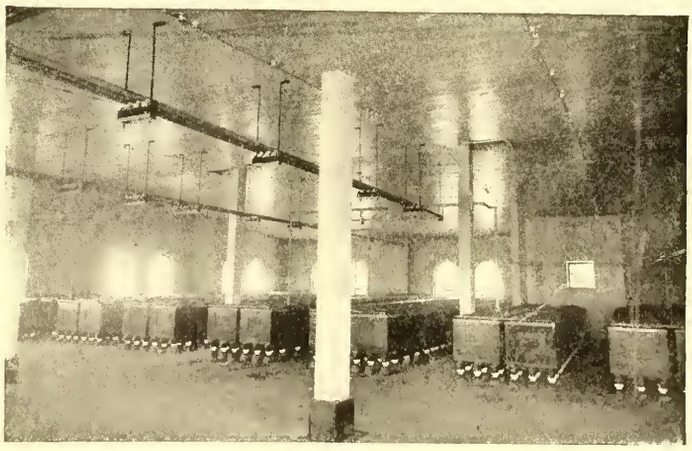


FIG. 4.—STORAGE-BATTERY ROOM

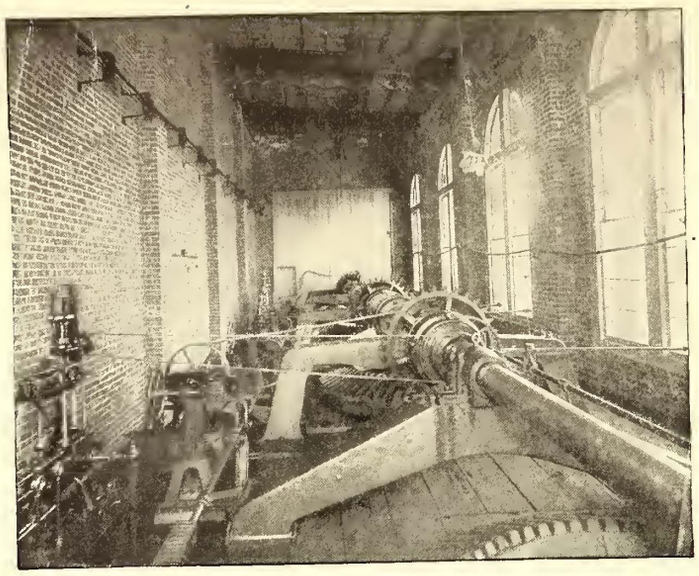


FIG. 5.—SHAFT HOUSE OF WATER-TURBINE EQUIPMENT, SHOWING SHAFT AND GOVERNORS

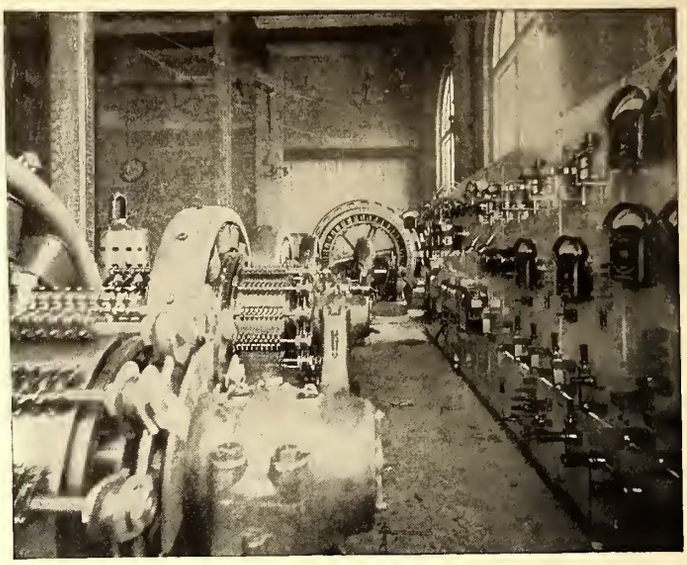


FIG. 6.—VIEW OF STEAM TURBINE ROOM, SHOWING STEAM TURBINES, ROTARIES, ETC.

rate of discharge. Provision has also been made in the battery room for a battery to operate in connection with the three-wire direct-current lighting system. The battery room is shown in Fig. 4.

The value of a battery was forcibly demonstrated last winter during the holidays. The maximum railway load amounted to 660 kw. If there had been no battery this would have been beyond the capacity of the water supply which was then available for use. The average load was only 220 kw. The battery took the fluctuations so that the plant was operated with one wheel at full gate and one wheel at sixteenths full gate. No exciters have been provided for this station for the present, as the engineers considered that in case all the direct-current machinery should be shut down, current for excitation can be obtained from the battery.

The battery room is on a floor above the generator room. It has the regular floor now commonly employed in storage battery rooms, consisting of tile laid in asphaltum, and is drained with lead-lined iron pipes.

The high-tension switchboard in the gallery was furnished

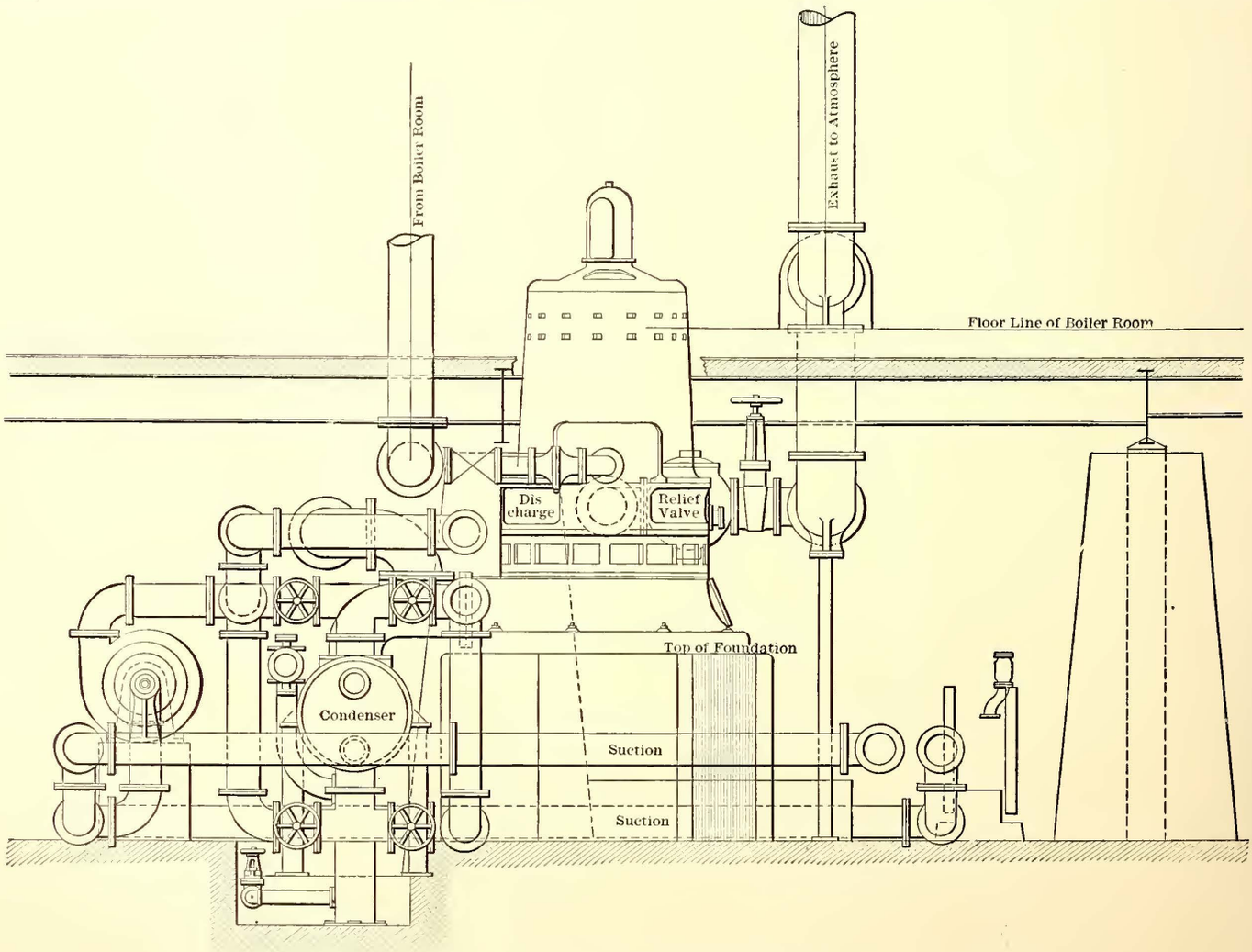


FIG. 7.—ELEVATION OF ONE OF THE STEAM TURBINE UNITS, SHOWING CONDENSER PIPING

by the General Incandescent Arc Light Company, and has "G. I." hand-operated oil switches. Two General Electric potential regulators will be employed on the alternating-current lighting feeders. These regulators will be operated to raise and lower the voltage by means of small alternate-current motors. All the transformers are ail cooled.

As stated before, the water-wheels are governed by Lombard governors. The speed of the wheels can be varied from the switchboard by means of a direct-current motor at the governor for shifting the governor weight.

Street lighting for the city, which has been done formerly by direct-current arcs will be done hereafter with 6.6-amp. "G. I." differential enclosed arcs, 250 in number, twenty-five on a circuit.

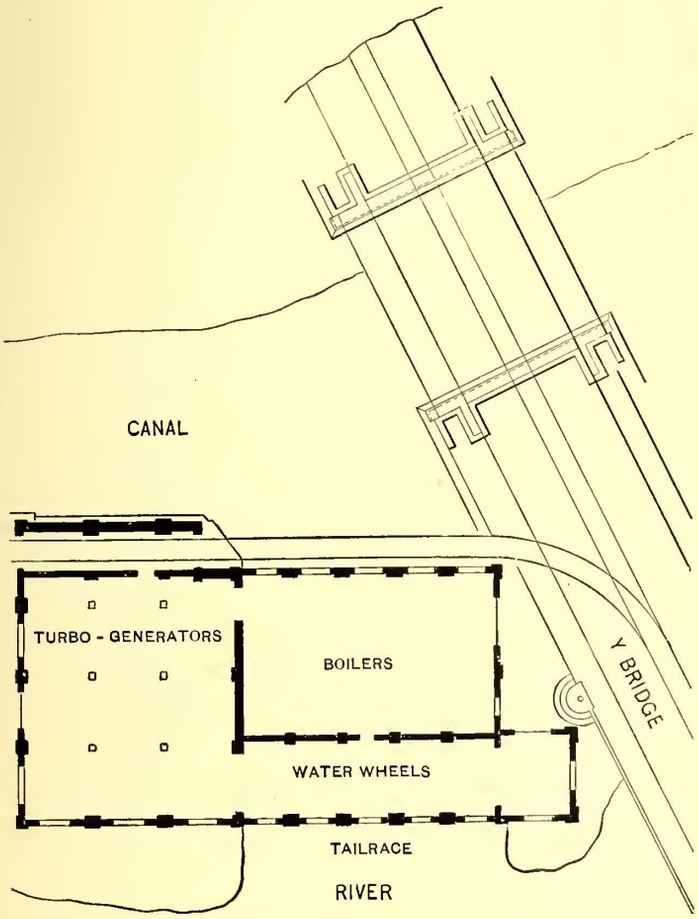


FIG. 8.—GENERAL PLAN OF STATION

ECONOMIES BY THE RECONSTRUCTION

Of course, a great economy in operation is anticipated as a result of the abandonment of the old power station. As said before, much of the total output in a year will be generated by water-power, and, therefore, at no fuel expense. That portion of the power supplied by steam should certainly be generated with much greater economy than in the old plant. The old plant used 12 lbs. of coal per kilowatt-hour. The new 500-kw Curtis turbine units are guaranteed to operate with 20 lbs. of steam per kilowatt-hour. If 8 lbs. of water can be evaporated per pound of coal in the boiler plant (which the engineers assume is a reasonable figure), the turbines would give a kilowatt-hour for 2½ lbs. of coal. The repairs in the old plant were enormous. In the new plant it is believed that they will be very low, as there are so few moving parts, as compared with the old, and the electrical apparatus is confined to large units of modern construction. In the old plant seventeen men were required for its operation. In the new plant six men are required.

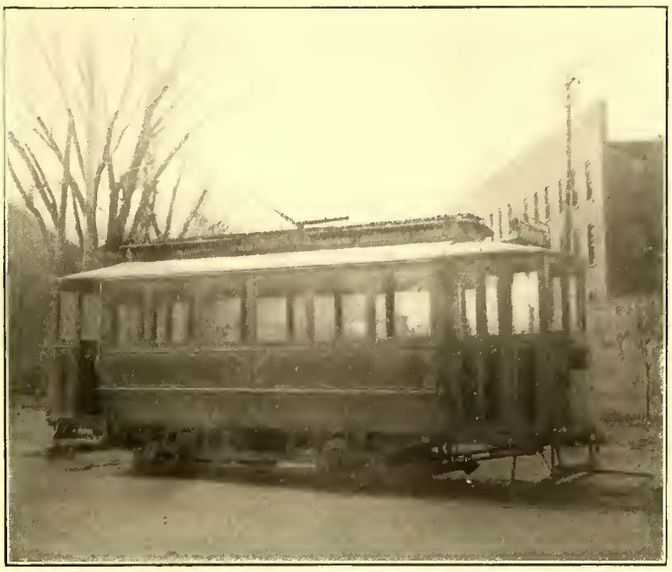


FIG. 9.—OLD SINGLE-TRUCK CAR

Making allowance for interest and depreciation, the engineers estimate that there will be a yearly saving of $18,000, as compared with the operation of the old plant. The cost of reconstruction, which includes also rebuilding of much of the street railway track and the purchase of entirely new rolling stock, so as to bring the street railway system to a standard gage, was $400,000. The present connected load is the equivalent of about 14,000 16-cp lamps. Excluding the small sized motors, there is a motor load of 300 kw distributed among thirty-five motors.

Since the present management took charge the earnings have increased about 20 per cent. Last year railway earnings were about $110,000, and light $65,000. The operating expenses are about 55 per cent of the gross earnings. The base rate for power and light is 10 cents per kilowatt-hour. About 350 kw additional power load is soon to be taken on, and it is further anticipated to transmit power to nearby pottery towns, which, as is well known, are good power consumers. Coal costs the company $1.40, delivered. The company now has outstanding $1,000,000 in bonds and $1,000,000 in stock.

Rudolph Kleybolte & Company, bankers of Cincinnati, New

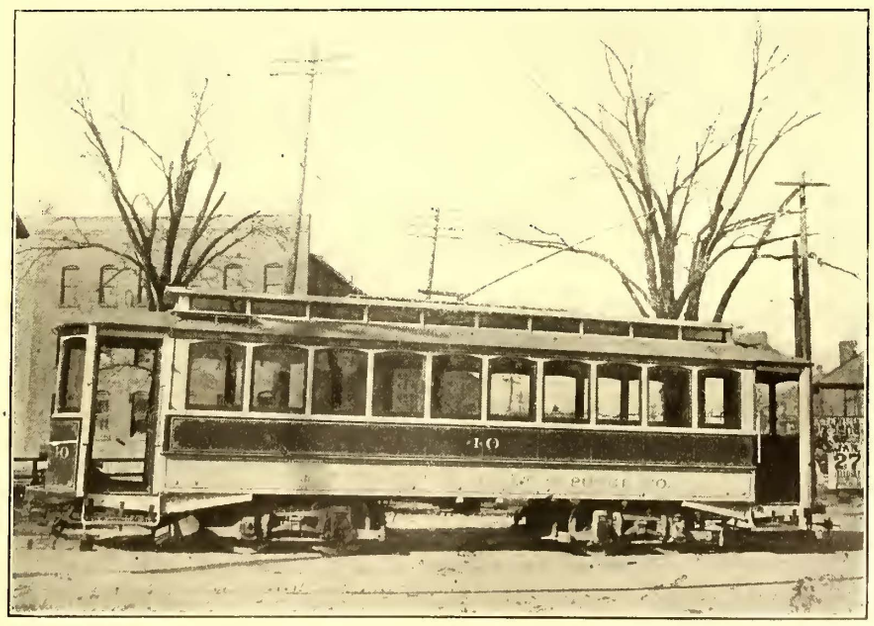


FIG. 10.—STANDARD DOUBLE-TRUCK CAR

York and Chicago, undertook the reorganization of the properties now merged in the Zanesville Railway, Light & Power Company, in September, 1902, their contract providing for, not only the reorganization of the securities of these properties, but also for their complete physical and operati ig reconstruction. Kleybolte & Company, in turn, contracted with H. M. Byllesby & Company, of Chicago, for all the engineering work connected with the rebuilding of the property, the designing of the new power house and its contents, and H. M. Byllesby & Company, in connection with Messrs. Kleybolte & Company, also had charge of the reorganization of the operation of the porperties.

Under the reorganization all the former operating officials were retained, Hon. F. A. Durban, of Zanesville, being elected president; H. M. Byllesby, vice-president and engineer; W. A. Gibbs, general manager and assistant treasurer; W. D. Breed, of Messrs. Rudolph Kleybolte & Company, secretary and treasurer. Mr. Gibbs had been in charge of the properties under the former management for several years, and under the reorganization his powers and duties were largely increased, and he had a prominent part in the reorganization of the operating conditions and in the reconstruction of the properties in connection with H. M. Byllesby & Company. Mr. Gibbs, together with E. C. Braun, one of the engineers of H. M. Byllesby & Company, had charge on the spot of the reconstruction of the property.

The street railway system, comprising some 14½ miles of track, was of 5-ft. 2-in. gage, laid with rails ranging from 36 lbs. to 70 lbs. per yard. Along with the reconstruction of the power house, the street railway system was reconstructed to bring it to standard gage. This also called for a new rolling stock. The track, as reconstructed, now consists of 70-lb. standard A. S. C. E. T-rail in dirt streets and 70-lb. Shanghai T in paved streets. Eight of the 14½ miles of track is in paved street. Ties are 6 ins. x 8 ft., laid 2 ft. between centers. Atlas rail-joints are used. The trolley is No. 0000 wire. The bonds and overhead material were furnished by the Ohio Brass Company. The cars are equipped with four 25-hp G. E. motors. One of the old and one of the new cars are illustrated in Figs. 9 and 10. Eighteen cars are operated during rush hours and ten upon ordinary schedule.

THE CLEVELAND PASSENGER STATION

The plans of the Cleveland interurban lines for a passenger station on the Public Square, Cleveland, have again been taken up, and the City Council committee on street railways has agreed with the companies on a modification of the plan outlined in the Street Railway Journal some weeks ago. The interurban roads objected to the clause in the agreement which required them to maintain the public toilet rooms in the station. Under the new proposition the city will maintain the toilet rooms. A clause was also inserted providing that in case the Council shall at any time decide to exclude the interurbans from the use of the station, the city shall purchase the station at the cost price, less 5 per cent per year for the time it has been occupied by the interurbans.

The clause permitting the interurbans to have package checking facilities has been cut out. The whole matter will now be thrashed out before the Council.

United States Consul Holoday, at Santiago de Cuba, writes that he thinks an opportunity exists there for the profitable investment of capital in a street railway. The city has a population of 50,000, and the only means of conveyance is by coach, the minimum fare of which is 20 cents for a single trip. "Unquestionably," writes Mr. Holoday, "a company that could secure a franchise for the construction of a light and railway plant combined, would have a very valuable privilege."

CORRESPONDENCE

AIR BLAST FOR CONTROLLERS

New York City, March 11, 1904.

Editors Street Railway Journal:

Referring to the description in your issue of Feb. 27 of the use in the controller of an air blast from the brake system, and the statement that such an application has been patented by H. P. Wellman, I beg to call attention to the fact that there is nothing novel in the method employed. As long ago as in 1898, the same plan was proposed by me for the enclosed reversers used in the multiple-unit installation on the South Side Elevated Railway in Chicago. The object in that case was not only to keep out dirt and copper dust from the controller, but also to accentuate the action of the magnetic blow-out and to keep the contacts cool.

Frank J. Sprague.

OMNIBUSES VS. STREET CARS

New York, March 8, 1904.

Editors Street Railway Journal:

I notice with interest the editorial in your last issue on omnibuses and street cars. It is somewhat of an anomaly that the English laws encourage the establishment of omnibus lines while they act as a deterrent to the construction of tramway lines. Theoretically, anyone can establish an omnibus line on any public thoroughfare in London by posting in the 'bus a schedules of fares to be charged and by paying a small license fee. It is not even necessary to maintain the fares constant, but a change in the posted rates can be made at any time, as is done occasionally at the time of some large public festival, as, for instance, at the time of the coronation. Compare this with the difficulties of getting tramway rights, which are well-nigh insuperable, although the tramcar, as shown in the testimony before the Traffic Commission, improves instead of cumbers the traffic of the street, and subjects the pavement to no wear as does its rival.

While, theoretically, any person may establish an omnibus line in London, practically the business is in the hands of a few large companies, owing to a practice popularly called "nursing." If a small owner attempts to run a 'bus on a line which is considered a monopoly of one of the older companies, it is pursued by two 'buses of one of the older corporations. One of these vehicles of the established line drives directly in front of the newcomer and the other attends him on one side or follows close behind him. Between the two the new 'bus has practically no chance to collect any fares. It is said that the 'bus drivers for the older companies, as a rule, relish the duty of "nursing," not on account of any cruel instincts which they may possess, but from the innate love of sport which exists in most men.

Various attempts have been made to introduce automobile 'buses in London and Paris. Storage batteries have been the favorite motive power, but so far they have been no more successful than similar experiments in New York. The competition in both London and Paris is practically confined to that between the electric car and the horse 'bus, and in both cities the former would easily win if given an opportunity.

R. P. Gorman.

SALE OF THE KUHLMAN CAR CO.

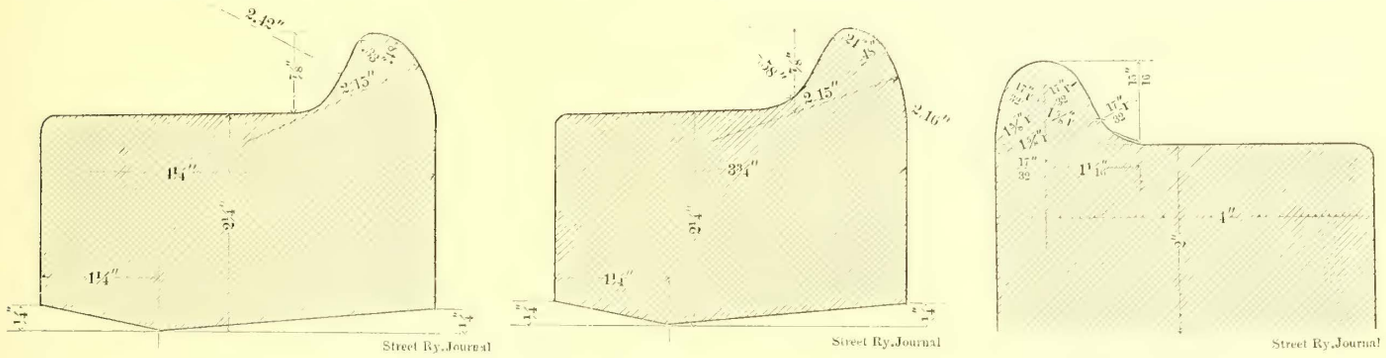
Announcement has been made in Cleveland of the sale of the works of the G. C. Kuhlman Car Company. The purchasers are gentlemen affiliated with the J. G. Brill Company, of Philadelphia, who will undoubtedly reorganize the Kuhlman Company and conduct the works in connection with those owned by them in Philadelphia and St. Louis.

FUSED STEEL-TIRED WHEELS

The growing use of the fused steel-tired wheel for electric railway service makes the publication of additional sections of this wheel used by prominent electric railway companies of interest. For this reason the accompanying engravings, Figs. 1, 2 and 3 are presented, to show some of the various dimensions employed in motor-wheel service to meet the requirements of tracks in cities where the grooved rail is used.

As will be seen, the shape of the flange differs radically in each case, although the maximum height is only 15-16 in. The wheels illustrated were supplied by the Railway Steel Spring Company, of New York.

The flanges shown in the accompanying engravings are somewhat smaller than usually employed on purely interurban work, but were made necessary by the special service in the terminal cities, as in each case the cars equipped with these wheels enter cities over the tracks of the local system. The average size flange for interurban work is about 1⅛ ins. wide by 1 in. deep.



FIGS. 1, 2 AND 3.—SECTIONS OF TIRES OF FUSED WHEELS USED ON ELECTRIC INTERURBAN RAILWAYS

As described in a recent issue the steel-tired wheel, whether provided with a fused tire or a removable tire, is of larger diameter when new than if a chilled-iron wheel were to be used. Thus, in cases where a 30-in. chilled-iron wheel has been employed it is the practice to adopt a 32-in. steel wheel, and where a 33-in. chilled-iron wheel has been the standard a 34-in. steel wheel is employed. The reason of this is that the steel-tired wheel has a greater depth of wear, and if the tire or the flange becomes worn down the wheel can be turned down until it is of the proper section. This is illustrated in Fig. 4, which represents a wheel with removable steel tires, as manufactured by the Railway Steel Spring Company. The same principle, however, applies to the fused wheel, although in that case the tire can be worn down very much thinner than with the steel-tired wheel, say, to ¼ in. at the edge, or ½ in. in the center on the tread instead of ¾ in., as shown with the wheel with removable tires.

In turning down a wheel, such as shown in Fig. 4, the wheel can be put in the lathe six times, taking off ¼ in. from the previous section, as shown in the diagram at the left, or can be put in the lathe four times, and taking off ⅜ in. each time, as shown in the diagram at the right. The center of the wheel is usually made of the best charcoal cast-iron and the tire of open-hearth hammered steel, so as to be homogeneous throughout. It is then hot-rolled. In all cases where steel-tired wheels are used for electric interurban service, the manufacturers should know the service the wheels will be called upon to perform, as they can then furnish special grades of steel tires that will meet the requirements of the railroad; this information, in many instances, would enable them to furnish a tire that would considerably increase the mileage of steel-tired wheels.

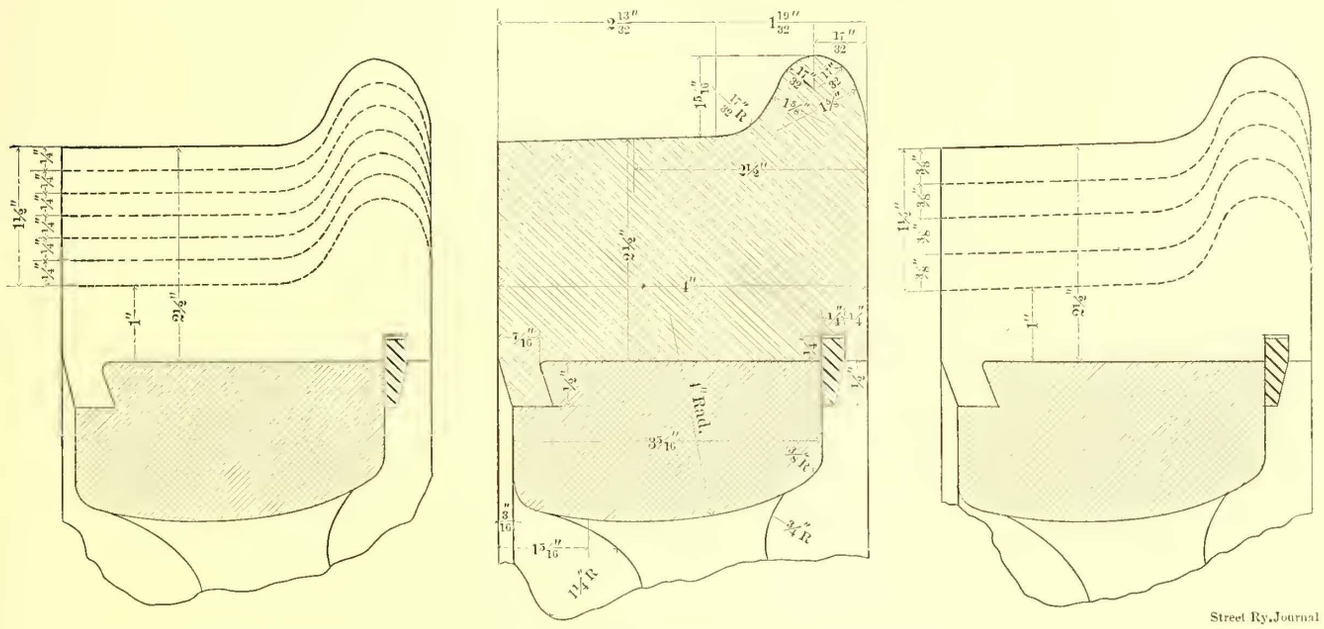
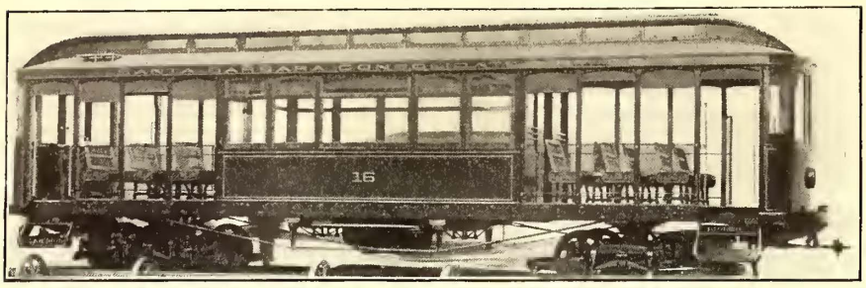


FIG. 4.—DIAGRAM SHOWING SECTION OF TYPICAL NEW TIRE AND SECTIONS AFTER TURNING DOWN

In pressing these wheels on to axles manufacturers recommend a difference in diameter between the bore of the hub and the seat of the axle of .01 in. Practice varies as to the amount of pressure used, but experience has shown that about 10 tons to the inch is a desirable one, that is, if the axle is 6 ins. in diameter, 60 tons should be employed. This pressure, of course, could be somewhat lower, provided a key was used on the wheel seats of the axles.

"CALIFORNIA" TYPE OF CARS FOR SANTA BARBARA, CAL.

A week or two ago the J. G. Brill Company shipped two handsome cars of the "California" type to the Santa Barbara Consolidated Railway Company, of Santa Barbara, Cal. Santa



CAR USED ON THE LINES OF THE SANTA BARBARA CONSOLIDATED RAILWAY COMPANY, OF SANTA BARBARA, CAL.

Barbara is one of the most popular towns on the southern coast, and has a large transient population at all seasons of the year. The road is 7 miles long, with many points of interest, including an amusement park. It is noted for extensive views of the San Rafael range, and of the sea with the mountains of the Santa Cruz and Santa Rosa Islands on the southern horizon.

This type of car is very popular on the Pacific Coast, because of its comfort and large carrying capacity. The vestibules protect passengers from the rush of air at the front, and those who desire more protection may take seats in the closed compartment. The total seating capacity is forty-four. The lower sashes are arranged to drop into pockets, as are also the sashes in the vestibules. The interiors are finished in cherry of natural color, and the ceilings are decorated in three-ply veneer birch.

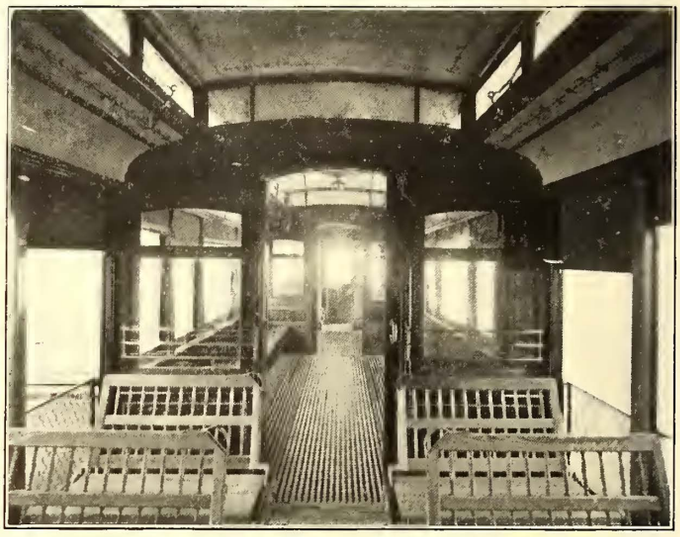
The length of the closed compartment is 14 ft. 6 ins., and over crown pieces and vestibules, 38 ft.; from the end panels over vestibules, 11 ft. 9 ins.; from center of corner posts over vestibules, 3 ft. 8⅝ ins.; width over sheathing, 8 ft. 2 ins. The side and end sills are 4¾ ins. x 7 ins.; sill plates, 8 ins. x ⅝ in.; thickness of corner posts, 3⅝ ins.; side posts, 2¼ ins. x 2¾ ins. The cars are furnished with sand-boxes, platform and conductor gongs, angle-iron bumpers, and draw-bars of the builder's manufacture. The trucks are No. 27-G-1, with 30-in. wheels and 4-in. axles, and are equipped with two 42-ft. motors per car. The track gage is 3 ft. 6 ins., but will soon be changed to 4 ft. 8½ ins., and the body bolsters and other parts are arranged so that the change to the wider gage can be made at comparatively small expense.

THREE KINDS OF SAND BOXES

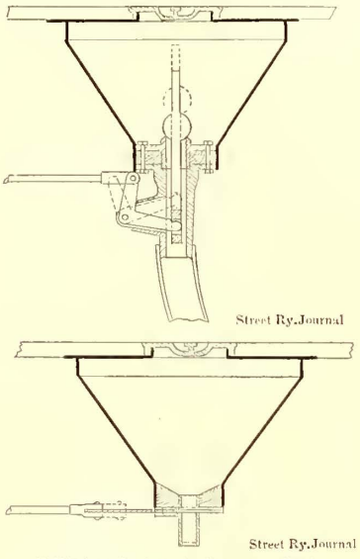
The St. Louis Car Company is now making three different types of sand-boxes. Fig. 1 shows the type known as the No. 1 box. This box has a galvanized iron hopper. The feed valve is of the ball and socket type, and is operated by a set of bell-crank levers from an upright staff on the front platform, although a foot lever can be used in the place of the staff. The action of the ball is to crush the sand lumps before they reach the feed pipe.

The No. 2 sand-box has a hopper similar to No. 1, but instead of a ball and socket valve and agitator, the plain slide valve at the bottom of the hopper is used. This is intended for use where dry, fine sand is always available.

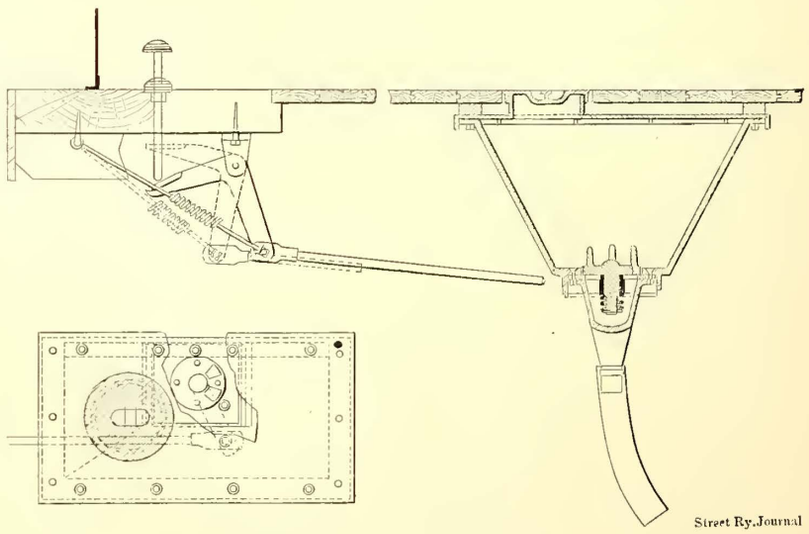
The No. 3 box is of an entirely different type. The hopper is made of cast-iron, so that it has no seams to become leaky. For feeding sand there is a rotary agitator with a disc slide valve on the same piece. This box is operated either by hand or foot lever. The tube attachment of this box is such that the tube can be set in practically any position desired.



INTERIOR OF SANTA BARBARA CAR, SHOWING OPEN COMPARTMENT IN THE FOREGROUND



DETAILS OF SAND BOXES NOS. 1 AND 2



DETAILS OF SAND BOX NO. 3

The Boston Elevated Railway has had to expend an unusually large amount of money for clearing the tracks of snow. The total cost, $250,000, is $100,000 more than last winter.

FINANCIAL INTELLIGENCE

The Money Market

Wall Street, March 17, 1904.

There were no important developments in the money market this week, and conditions and rates remain practically unchanged. Further accumulation of funds is reported at this center, and, although the local banks continue to lose cash on operations with the Sub-Treasury, their losses are more than offset by the receipts of currency from nearby interior points and by the constant receipts of gold from Japan and other sources. The continued inactivity in the local stock and bond markets is reflected in a further sharp falling off in the demand for funds for all maturities, and the banks and other lenders experience considerable difficulty in placing their funds at current rates. A fair demand exists for call money, which is generally satisfied at 1¾ to 2 per cent but for time contracts the inquiry is practically at a standstill. Short time funds, which a short while ago commanded 3½ and 3¾, are practically unlendable at materially lower figures, while six months' money appears to be a drug upon the market at 4 per cent. Some loans extending for five months are made at 3¾ per cent, but the character of the collateral, and the standing of the borrower is considered. Lenders as a rule are not disposed to press their funds upon the market or to make concessions in rates in view of the preparations making for the call upon the banks for the initial instalment of Government deposits, due shortly in connection with the Panama Canal payments. Foreign exchange is extremely dull but strong. The supply of commercial bills coming upon the market continues small, while the demand from remitters and from investors, in view of the decided ease in money, is sufficient to maintain prices at about the highest points of the year. There are no important changes in discount rates at the principal European centers. Money on a call at London rules at 2¾, while the open market rate for both short and long time bills is unchanged at 3 per cent. At Paris the rate continues at 2¾ per cent while at Berlin the tendency is easier, with a decline in the rate of 2⅛ per cent to 3½ per cent.

The Stock Market

The record of this week's stock market is little more than a history of the Northern Securities decision and its effects. Previous Monday the Stock Exchange was very much unsettled, with more or less liquidation in evidence and with prices inclined to move downward; in fact, on Saturday many of the leading stocks reached the low figures of the year. From this point there has been a very sharp recovery which, although it started before Monday's announcement from Washington, has made its greatest progress during the last day and a half. This movement is to be explained partly on the ground of bad news thoroughly discounted, and partly on the ground that the decision, while against the railroad companies, has some things about it which are very reassuring for the future. Attention has been directed principally to the closeness of the vote among the Supreme Court judges, not that it in any way impairs the finality of the verdict, but because it seems to afford hope that in any future cases brought under the law, the issue would be extremely doubtful. As to the practical effects of the decision, the community has had nearly a year to prepare for them, prices are very low, stocks have passed into strong hands; the market is in every way situated to consider the situation calmly from the standpoint of the consequences to real security values, and not to be governed by mere sentimental considerations. It is pointed out that the opinion in the present case affirms nothing new or revolutionary, that precisely the same rulings were made in the joint traffic associations' cases seven years ago, and hence, that the business interests of the country are threatened with no danger to which they have not already long been exposed. It seems to be, therefore, the market's sober view that the episode has been closed for the time being at least, and that one of the several causes of uncertainty surrounding the financial situation has been eliminated. Very genuine relief is what the rapid upturn of the last day or two has really indicated. The movement has been brought about chiefly at the expense of the large short interest which had been created on the idea that the bottom would drop out of things when the hostile court opinion was handed down. When these excited covering purchases are over it will doubtless be recognized that there are other incentives more powerful than the Northern Securities matter to induce caution on the part of investment capital.

The feature in the local traction group during the week was the severe break in the Metropolitan Street Railway issues. The real causes of this decline have not been revealed. Undoubtedly there was a good deal of liquidation, much of it of an immediate character. One idea was that the estate of a prominent capitalist who died a short while ago was being settled, the operation involving the sale of a large quantity of Metropolitan stock. It plainly is more reasonable to account for the drop on some such ground as this rather than on any development, real or prospective, affecting the company's earning power. Some rather good buying has recently been observed in Brooklyn Rapid Transit, but no very vigorous efforts have been made to force up the price. Manhattan, selling ex the 2½ per cent dividend, has taken its course from the general market changes, but on the whole has behaved very well.

Philadelphia

In Philadelphia the week has developed no special feature. News concerning the traction properties has been scarce, and the speculative movement has accomplished little. About the only incident of interest was the sudden development of activity in Indianapolis Street Railway shares, 600 of which sold between 85 and 87½. This is an advance of five points over the last previous sales some time ago. The company pays 3 per cent dividends this year, the rate to be increased next year to 4 and the year after to 5. Presumably the execution of an investment order is what caused the present advance. Philadelphia Traction, selling ex-dividend of 2 per cent, gained a half-point to 95½. Philadelphia Electric has been very dull around 5⅞; so has Philadelphia Company common between 38 and 39. The preferred sold as low as 43⅜ and as high as 44. Union Traction was shaded at one time to 47¼ but rallied later to 47½. Two hundred Rapid Transit sold at 14. Pittsburg preferred was dealt in at 49.

Chicago

There are rumors afloat that the Union Traction stockholders will be assessed, possibly 10 per cent, by the reorganization committee, in the event of a favorable ruling in the ninety-nine-year franchise case. These stories checked the efforts of the Eastern speculative clique to put up the stocks. There was a good deal doing in both common and preferred during the week on the New York Exchange, the common going to 6 and the preferred to 31½. In Chicago transactions were confined to 200 of the preferred at 30⅞, and later at 30. It is rather difficult to find a suitable explanation for the decline in Metropoitan Elevated issues which has carried them again to new low records this week. The company has certainly been earning at the rate of 4 per cent on its preferred during the past five months, and the annual statement due in April is expected to show a surplus of $225,000 against only $10,000 last year. Nevertheless the preferred shares have slid down on heavy selling to 41, and the common to 15, the former completing a loss of 10 points from a month ago. A good deal of the recent liquidation has come from New York. No sales of North Chicago have occurred during the week but one hundred West Chicago went at 45. Lake Street sold at 2, Northwestern common at 17, and South Side from 91½ to 92.

Other Traction Securities

In Boston the active issues have been, as usual, the Massachusetts Electric stocks. The common, after selling as high as 18¾ fell to 17¾. The preferred dropped from 73 to 71½ but rallied to 72½. Boston Elevated was steady between 138 and 138¼. An odd lot of West End common sold as high as 92 but the real market did not rise above 91½. The preferred changed hands at 109½. On the Baltimore Exchange the two features of the week were the recovery in the United Railways issues and a sharp advance in the bonds of the Charleston Consolidated Street Railway Company from 79½ to 85. United incomes recovered from 51⅝ to 53¼, or four points above the low level to which they sank after the fire. The general 4 per cents advanced a point to 90¾, and the stock rose from 7 to 7½. Other sales for the week included Atlanta Street Railway 5s at 105 and 104¾, City and Suburban of Washington 5s at 90¼, City & Suburban of Baltimore 5s at 112½ and Baltimore City Passenger 5s at 108. An odd lot at 103 and another at 104¼ were all that were done in Interborough Rapid Transit stock on the New York curb. St. Louis Transit was stronger, 500 shares selling

at 9. Three hundred Washington Traction preferred sold at 45 and ten of the bonds at 74½.

Tractions were comparatively strong in Cincinnati last week, and practically every issue showed an advance. Cincinnati Newport & Covington opened at 28¼, and advanced to 30 on sales of 1253 shares. The preferred sold to the extent of 335 shares advancing from 82½ to 85. Cincinnati Street Railway made a gain of four points from 135½ to 139½, the latter being the highest mark in many months; sales, 702 shares. Detroit United was practically stationary at 63, with two small sales at 63¼; total, 302 shares. Cincinnati, Newport & Covington first 5s sold at 109 on several lots aggregating $8,000. Miami & Erie Canal sold at 8¾ for several lots.

Demands from Cincinnati for Cincinnati, Dayton & Toledo stock made that the most active issues in Cleveland last week. Sales aggregated about 500 shares, all at 20¾. Cleveland Electric was steady at 73⅛, sales, 180 shares. Northern Texas Traction developed strength at the close and several sales were made at 31⅛ to 31¼. The bonds of this company were also in demand, and $15,000 worth sold at 8½. Monday 100 shares of Cincinnati, Dayton & Toledo sold at the price above mentioned. Cleveland Electric sold at 73⅝. A small lot of Northern Ohio Traction & Light sold at 15, a fractional decline.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid	
	March 8	March 15
American Railways	43	43
Aurora, Elgin & Chicago (preferred)	a54	a55
Boston Elevated	138	138¼
Brooklyn Rapid Transit	40¼	41⅜
Chicago City	156	157
Chicago Union Traction (common)	5	5
Chicago Union Traction (preferred)	30½	30
Cleveland Electric	73	72
Consolidated Traction of New Jersey	62	62
Consolidated Traction of New Jersey 5s	105½	105¼
Detroit United	61¾	61
Interborough Rapid Transit	102½	105
Lake Shore Electric (preferred)	—	—
Lake Street Elevated	1¾	1¾
Manhattan Railway	143¾	*141¼
Massachusetts Electric Cos. (common)	18½	18
Massachusetts Electric Cos. (preferred)	73	71½
Metropolitan Elevated, Chicago (common)	15¼	14
Metropolitan Elevated, Chicago (prefered)	44	43¼
Metropolitan Street	113½	107½
Metropolitan Securities	82	77¾
New Orleans Railways (common)	8	8
New Orleans Railways (preferred)	29	29
New Orleans Railways 4½s	79	78
North American	80	83¾
Northern Ohio Traction & Light	15	14¾
Philadelphia Company (common)	38	38
Philadelphia Rapid Transit	14	13½
Philadelphia Traction	97	*95¼
St. Louis Transit (common)	9	12¼
South Side Elevated (Chicago)	91	90
Third Avenue	120	114
Twin City, Minneapolis (common)	87½	88½
Union Traction (Philadelphia)	47⅛	47½
United Railways, St. Louis (preferred)	51	51
West End (common)	91	91½
West End (preferred)	109	109½

a Asked. * Ex-dividend.

Iron and Steel

The fact is now confirmed that a most surprising change for the better has come over the iron trade during the last six weeks. Authority for this statement is found chiefly in the statistics furnished by the "Iron Age" for the month of February. They showed that while the weekly pig iron production had increased from 185,636 tons on Jan. 1, to 309,926 tons on March 1, stocks on hand during February actually decreased 47,078 tons. In other words, despite a very rapid expansion in output, consumption has increased more rapidly still. What this means, of course, is greatly accelerated activity in the higher branches of the industry. That this should have occurred in face of the very moderate purchases by the railroads, is the most surprising part of recent developments. Quotations are as follows: Bessemer pig iron $15.80, Bessemer steel $23; steel rails $28.

Quotations for the leading metals are as follows: Copper 12⅝ cents, tin 28 cents, lead 4⅝ cents, and spelter 5 cents.

BROOKLYN RAPID TRANSIT SUBMITS STATEMENT FOR YEAR

The Brooklyn Rapid Transit Company, in an application to the New York Stock Exchange, to list $5,000,000 bonds, which has been favorably acted upon, submits a statement of earnings as follows for the year ended December 31. Comparative figures from the company's annual report are added, but it should be noted that the years overlap each other, which somewhat impairs the value of the comparisons:

	1903	
	Year ended Dec. 31	Year ended June 30
Gross receipts	$14,025,825	$13,280,321
Operating expenses	8,392,607	7,931,079
Net earnings	$5,633,218	$5,349,242
Other income	207,522	277,493
Total income	$5,840,740	$5,626,735
Interest and taxes	4,702,514	4,661,857
Balance	$1,138,226	$964,878
Improvements	338,611	*208.481
Surplus	$799,615	$756.397

* Including $40,386 charged off.

The $5,000,000 bonds now listed are a part of the issue of $150,000,000 authorized in 1902. These bonds were sold some time ago. The proceeds already issued have been used to acquire the following stocks and certificates of indebtedness, which have been deposited with the Central Trust Company of New York pursuant to the terms of the mortgage: Brooklyn Union Elevated Railroad Company's 13,103 shares common stock, $37.50 scrip; 1,208 shares preferred stock, $87.30 scrip, $455.963; Nassau Electric Railroad Company's 2,852 shares preferred stock, $25 scrip, $286,588.70; Transit Development Company's 250 shares, $25,222.64; South Brooklyn Railway Company's 1,491 shares, $550,177.43; Brooklyn, Queens County & Suburban Railroad Company's certificates of indebtedness, $625,649; Transit Development Company's certificates of indebtedness (chiefly towards cost of new power house), $1,988,505.64; total, $3,932,106.41; for subsequent expenditures, $67,893.59; total proceeds, $4,000,000. This indicates that the bonds were sold at 80. Additional bonds to the amount of $6,294,000 have been certified by the trustee and delivered to the company, but have not been sold. Of these $3,467,000 were certified prior to Dec. 31, 1903, and appear in the consolidated balance sheet as of that date. Subsequent issues of bonds shall bear such rate of interest as the Transit Company may determine, not exceeding, however, 4 per cent per annum.

Following is a consolidated general balance sheet as of Dec. 31, 1903, of the Brooklyn Rapid Transit Company and constituent companies:

ASSETS.	
Cost of road	$92,817,101
Advances account consolidation for leased companies	11,898,411
Certificates of indebtedness of constituent companies	2,162,450
Guaranty fund for performance of Brooklyn City Railroad Company lease	4,005,755
Treasury bonds, B. R. T. 1st preferred	3,467,000
Other issues	110,000
Treasury stock	146,228
Current assets	5,176,388
Accounts to be adjusted	12,039
Total	$119,795,373
LIABILITIES	
Capital stock B. R. T. Company	$45,000,000
Outstanding capital stock underlying companies	994,955
B. R. T. Company first mortgage	7,000,000
First refunding mortgage	8,467,000
Bonded debt constituent companies	61,328,180
Current liabilities	4,827,690
Long Island Traction trust fund	9,650
Certificates of indebtedness of constituent companies	4,977,171
Surplus	2,657,726
Total	$119,795,373

The Blue Island Avenue car houses of the Chicago Union Traction Company were destroyed by fire Monday morning, March 14. Six hundred cars and the building are said to have been totally destroyed.

THE ANNUAL MEETING AT ST. LOUIS—REPORT OF THE PRESIDENT

At the annual meeting of the St. Louis Transit Company, held March 8, the old directors were re-elected, with the exception of Mr. Wade, who is succeeded by Capt. Robert McCulloch, who is general manager of the Chicago City Railway Company. The directors of the company now are A. D. Brown, Paul Brown, James Campbell, Murray Carleton, Louis A. Cella, Eugene Delano, George L. Edwards, F. E. Marshall, Robert McCulloch, H. S. Priest, C. H. Spencer.

At the organization of the directors on March 11, the projected change in the management of the company was made in the election of Capt. Robert McCulloch as vice-president to succeed A. B. du Pont. Technically, Capt. McCulloch is elected to the place of Corwin H. Spencer, while the office of second vice-president and general manager, the position held by Mr. du Pont, is abolished.

At the meeting of the United Railways Company, the officers were re-elected without change. They are identical with those of the Transit Company with the exception that Corwin H. Spencer's name appears instead of the name of Capt. McCulloch.

It is understood that Capt. McCulloch will go to St. Louis to assume his new duties as soon as he can get away from Chicago, and that he will take with him his son, Richard McCulloch, who is assistant general manager of the Chicago Street Railway Company under his father. Mr. du Pont will acquaint his successor with the details of the management, after which it is stated he will leave the city.

At the meeting of the directors, announcement was made by President Carleton that $8,000,000 of the $20,000,000 improvement and refunding bonds had been placed. The sale of these bonds secured sufficient funds to retire the collateral trust notes of the company and pay for the improvements needed to handle the constantly increasing traffic. It is understood that the $8,000,000 of bonds were sold at 80, and that $4,000,000 was taken by Brown Brothers, of New York, and that the rest was subscribed for by local St. Louis parties. The remaining $12,000,000 of the entire issue will be held for future contingencies.

The report of the company for the year ending Dec. 31, 1903, submitted to the stockholders by President Carleton, follows:

The lease between the St. Louis Transit Company and the United Railways Company, of St. Louis, requires the former (or lessee) to pay as rental interest on the outstanding bonds of the United Railways Company and of its constituent companies, an amount equal to 5 per cent per annum on the outstanding preferred stock of the United Railways Company, of St. Louis, and to provide $1,000 for contingent expenses. The aggregate rental charge was $2,759,781.25, but, deducting $399,935 accruing on the securities of the United Railways Company, of St. Louis, owned by the St. Louis Transit Company, the net rental charge was $2,359,846.25 for the year. The lease also requires the St. Louis Transit Company to make all necessary extensions and improvements to the properties of the United Railways Company, receiving in payment therefor securities of the United Railways Company reserved in the treasury of that company for the purpose. These expenditures have amounted in the aggregate during the year to $1,868,931.45. The principal items embraced in these expenditures are: Seventeenth and Locust Streets sub-station building and equipment, $273,552.66; cars, $362,205.27; motors, $233,108.52; track construction, $561,597.80, of which amount $165,640.12 was for paving between the rails, between the tracks and 1 foot outside of tracks.

By provision of the city ordinance, and pursuant to the approval of the Board of Public Improvements, the company has equipped all of its cars with the approved type of fenders, and they are also being equipped with air brakes.

During the year contracts were let for 450 new cars and the motor equipment for same. Seventy-one of the cars have been received and the balance are to be delivered and will be in operation in time to take cars of the World's Fair traffic.

During the year the new repair shop at Park and Vanedventer Avenues has been completed and is practically in full working order. It is equipped according to the most modern methods for handling the general repair work, and will undoubtedly prove very economical in the maintenance of the equipment, being arranged so that both steam and electric cars can be brought to the proper places for moving all material with the minimum amount of labor. In the machine shop many new tools have been installed, which materially increases the output at a reduced cost. As for instance, there are multiple spindle drills on which a man handles from four to eight drills at a time, instead of a single one, as by the old method. By thus doing the majority of the work in a single shop a higher grade of direct supervision is provided at less cost, and is conducive to maintaining the apparatus in a much better condition.

The armature department has been equipped according to the most approved practice, both for doing the work and testing the conditions of the parts, and allows only apparatus in first-class condition to go on the road. Such testing apparatus, being, of course, quite expensive, could not be introduced while a large number of shops were being maintained.

The new power stations and equipment have been completed, with the exception of the auxiliary station at Seventeenth and Locust Streets, which will be completed by April 15, 1904.

The number of miles of track owned Dec. 31, 1903, is 358.65; in operation, 345.06; leased, 2.54; not used, 11.05. No additional trackage has been built during the year: 1.44 miles of track no longer needed in the operation of the property have been taken up.

Attention is especially called to the fact that plans have been formulated and material ordered for the construction of proper terminals at the World's Fair grounds. This work is to be completed by April 1 next. The first terminal is located just east of DeBalividere Avenue, at the Lindell or main entrance to the World's Fair grounds. The Olive Street cars will use this terminal. The second terminal is located immediately west of DeBalividere Avenue at the Lindell or main entrance to the World's Fair grounds. The Delmar Avenue cars will use this terminal. The third or "Pike" terminal is located at the Pike entrance to the World's Fair grounds. The Easton Avenue cars will use this terminal. The fourth or "Administration" terminal is located at the Administration or Skinker entrance to the World's Fair grounds. The Page Avenue cars will use this terminal.

All of the above-mentioned terminals will be connected by a double track, thereby enabling the company to concentrate as many cars as necessary from any of the above-named routes at any of the above-named terminals to fully meet the demands of any of these entrances.

On the south side of the World's Fair grounds terminals will be located at the southeast entrance of the Fair grounds and at the Skinker Road entrance. To these terminals will be run the Laclede, Market and Taylor Avenue lines, the cars of which can be concentrated at any one of the terminals, thus meeting the requirements of the south side of the Fair. The company has provided for sufficient car equipment to handle 60,000 passengers per hour to the World's Fair grounds, and an equal number per hour from the same.

Since the Transit Company took charge of the property of the United Railways Company, of St. Louis, under the lease of the latter company to it dated Sept. 30, 1899, it has made additions, acquisitions, improvements and betterments during each year as follows:

1899	$662,989
1900	3,836,803
1901	2,593,428
1902	1,378,839
1903	1,868,931
Making the aggregate amount of	$10,340,990

For the improvements thus made, by the terms of the lease, the Transit Company was paid in United Railways 4 per cent bonds and in preferred stock of the United Railways Company, both at par. It was unable to realize upon the securities which it thus received for improvements without suffering a very heavy loss, because the market prices of the bonds and stock which it received were far below par. Anticipating that the earnings of the property would ultimately bring these securities to a higher value upon the market, it has been borrowing from time to time upon them as collateral money with which to make the further improvements required of it by the lease. The improvements necessary to the successful management and operation of the property and to meet the public demands have been nearly accomplished, except such as are yet necessary to be made to equip it to take care of the increased business incident to the World's Fair.

In order to fund the indebtedness thus accumulated and to provide for all future improvements required of it under the lease, the board of directors thought it wise to ask the shareholders to authorize an issue of $20,000,000 5 per cent twenty-year gold bonds secured by a mortgage upon the leasehold of the Transit Company under the lease of the United Railways Company, and the securities which it had received and would receive from the United Railways Company for improvements made and to be made. On May 23, 1903, the shareholders authorized the issue of these bonds upon the security aforementioned. The Transit Company also secured, in order to make them a better and more substantial investment security, the guaranty of the United Railways Company as to the payment of both principal and interest.

Accordingly, the officers of the company, by the direction of the board of directors, made the mortgage and executed the bonds.

Of the amount authorized, the mortgage provides that $6,056,000 be reserved to refund the outstanding 5 per cent collateral trust notes dated Nov. 1, 1901, and due Nov. 1, 1904, amounting to $5,776,000 ($224,000 of the collateral trust notes unissued were canceled during the year), $8,000,000 to be certified and delivered by the trustee immediately for refunding the floating debt and provide for the construction and equipment expenditures for the years 1903, 1904 and 1905, and the balance to be reserved for future acquisitions, construction and equipment expenditures, provided, however, that the amount to be issued for construction and equipment expenditures during any one year after 1905 shall not exceed $500,000 per annum.

The large expenditures made for construction and equipment, betterments and improvements during the year, and the additional outlay necessary for the year 1904 to provide for the World's Fair traffic, are in excess of what would have been required to care for the normal growth of the business, and should relieve the company from any further material expenditures of a capital nature for years to come.

The growth of St. Louis during the last year has been very marked, and it has been due not altogether, nor even primarily, to the World's Fair. The prosperous condition of the State, and, indeed, of the entire Southwest, warrants the belief that there will be a long-continued increase in the population and business of the city, and with this must come a corresponding increase in the business of the company.

For the purpose of showing the growth of the property, a statement is hereto appended showing the gross earnings from operation and other income, operating expenses and taxes, net fixed charges and the resultant surplus or deficit for the last three years.

An examination of the income account will show that during the fiscal year ended Dec. 31, 1903, the earnings from operation and other sources increased $843,628.48 over the preceding year, a gain of 13.07 per cent; operating expenses and taxes, $545,793.25, a gain of 13.75 per cent. The large increase in operating expenses was caused by the increase in the price of coal, rate of wages and a general advance in the cost of supplies. The increase in cost of coal was $99,574.50, and the increase in pay-roll, $251,457.53.

To clean up the accumulation of previous years, accruing from contingent liabilities, and to balance that account, the charges to "damage account" were increased above the actual by the payment of $97,000 out of this year's earnings. The same ratio of charges to this account will be continued during the year 1904 and thereafter until a sufficient surplus has been created to amply provide payment for like contingent liabilities arising in the future.

The increase in taxes of $33,747.38 was caused by an increase in the rate of taxation from $1.95 to $2.15 per hundred.

The sum of $2,423,091.77 was paid in wages to employees in the operating department, and $424,644.43 was paid in wages in the construction department.

On Nov. 1, 1902, a bonus of 1 cent per hour was offered to conductors and motormen who operated their cars for a period of twelve months without an accident. During the year this bonus has amounted to $14,216.45. On May 1, 1903, the rate of pay for conductors and motormen was raised 1 cent per hour. This increase amounted to about $45,000 for the year.

A summary of the business for the years 1903, 1902 and 1901 is as follows:

	1903	1902	1901
Earnings from operation and other income	$7,295,847	$6,452,219	$5,783,912
Operating expenses and taxes	4,513,514	3,967,721	3,692,400
Income	$2,782,333	$2,484,498	$2,091,512
Interest and rental	2,845,119	2,752,581	2,617,142
Deficit in operation	$62,786	$268,083	$525,630
VOLUME OF BUSINESS			
Revenue passengers	147,141,429	130,830,722	117,546,811
Transfers and passes	63,096,679	54,247,218	46,449,131
Total passengers	210,238,108	185,077,940	163,995,942
Mileage	32,535,626	31,074,581	29,340,361
Percentage of passengers using transfers	40.25	38.68	36.76

The above summary would indicate that the percentage of increase is as follows:

	1903 over 1902	1902 over 1901
Earnings from all sources	13.07	11.55
Operating expenses and taxes	13.75	7.45
Interest and rental	3.36	5.17
Revenue passengers	12.46	11.30
Mileage	4.70	5.91

NEW DEVELOPMENTS IN NEW YORK SUBWAY EXTENSION —TUNNEL TO CONNECT BRIDGES

General plans for the extension of the New York Rapid Transit Subway were considered by the Rapid Transit Commission at a public hearing, held Friday, March 11. The rival applications of the Metropolitan and Belmont interests for subway franchises occupied the bulk of the time. On the main proposition for a new subway line in Manhattan, the only opposition came from the Bronx, the residents there objecting to the Manhattan plan because it contemplates a terminal at 138th Street, while the Bronx residents desire to have any new extension continue right through the Bronx Borough. The hearing did not result in anything definite, and was closed after the several factions had their say.

On the same day a hearing was given by the plan and scope committee of the Rapid Transit Commission on the question of connecting the Manhattan terminals of the Brooklyn, Williamsburg and Manhattan Bridges. The Parsons plan for a four-track subway for the connection was favored, principally because of its comparatively low cost. The Best plan, which provided for an elevated connection, was practically rejected.

A letter of Chief Engineer O. F. Nichols, of the Bridge Department, presented the arguments of the plan outlined by Commissioner Best, and also gave the cost of the enterprise, figured at $12,500,000 for the entire proposition, including the connection through Delancey Street. Mr. Parsons presented his estimate of the subway connection, which he declared could be built for $4,500,000, and be completed in two and a half years. August Belmont, in behalf of the Interborough Rapid Transit Company, then presented an offer in writing to carry out a large proportion of the Best plan to good advantage to the city. In short, this offer was to carry out the Best plan slightly modified, provision being made for a fare of 5 cents, with free transfers at all elevated and subway connections. Further, Mr. Belmont offered to operate a special service for bridge travel alone for the same fare as now charged on the Brooklyn Bridge, viz., 3 cents for one ticket and 5 cents for two.

Soon after the meeting of the plan and scope committee on Friday, March 11, President Winter, of the Brooklyn Rapid Transit Company, announced that his company would not operate cars through the tunnel. He also expressed himself as not being very enthusiastic over the proposed elevated connection between the bridges. His objection to the subway was based on the fact that the present equipment of the company would have to be remodeled to insure passengers against fire risks.

At the solicitation of Mayor McClellan, President Winter, President Vreeland, of the New York Railway Company, and the Mayor held a conference on the bridge situation in the Mayor's office on Tuesday, March 15. At this meeting both Mr. Winter and Mr. Vreeland submitted plans under which their companies could operate cars on the new bridge structure. The plan is for the Brooklyn Company to operate cars over to the Manhattan side, turning there and returning to Brooklyn, while the New York City Company's cars are to run to the Brooklyn side and make their loop at the plaza there. No extra fare is to be charged. In addition, both companies are to operate shuttle cars over the bridge, with 3-cent fares, or two tickets for 5 cents, for the bridge trip. All these plans, however, relate solely to the operation of surface cars over the structure. President Winter and President Vreeland say that the new service can be put in operation by July 1, provided the work in charge of the Commissioner of Bridges is completed in time. At the meeting Mr. Vreeland said that his company would have its Fourteenth Street line, from Second Avenue to Avenue B and down Avenue A to the Williamsburg Bridge, equipped with electricity by July 1. He also said that the Eighth Street and East Broadway lines would be equipped with electricity by that time, and that the conversion of the Grand Street line from horse power to electricity will be completed by fall.

The conference was adjourned without any decision being reached as to bridge connections.

The Lake Shore Electric Railway will erect two steel towers at the Black River at Lorain with which to carry its high-tension lines over the river, which is a navigable stream. One of the towers will be 125 feet high, the other will be 140 feet high. Both will be similar in construction to wind-mill towers, and on top of each will be a vertical arm 10 ins. x 10 ins. x 20 ft. high, upon which the high-tension insulators will be placed, one above the other. Contract for the towers has been placed with the Aermotor Company, of Chicago.

AN IMPORTANT DECISION AS TO THE HOLDING OF FRANCHISE RIGHTS TO THE EXCLUSION OF OTHERS

In the decision of Ceylon H. Lewis, of Syracuse, N. Y., as referee, in the case of the Oneida Lake Electric Railway Company against the Syracuse Rapid Transit Railway Company, a blow is struck at electric railway promoters who secure franchises and rights of way merely for speculative purposes.

For a number of years the Oneida Lake Company has professed the intention of building an electric railway between Syracuse and Lower South Bay, on the shore of Oneida Lake, but has done nothing beyond securing property owners' consents and franchises. In the meantime the Syracuse Rapid Transit Company has covered a portion of the route by construction of an extension of its Syracuse system, over the Liverpool plank road to Liverpool. In the litigation just decided, the Oneida Lake corporation sought to oust its rival, claiming its territory had been invaded by the latter and its franchise rights violated. In an exhaustive report Referee Lewis holds that the Rapid Transit Company can not be excluded from the Liverpool route, and that, by failing to build, the Oneida Lake Company has forfeited all its rights under several franchises.

"The plaintiff has acquired no vested rights of property in the highway," declares the referee. "Having acquired no possession or the use of the highway, giving it the right to exclude another and rival company, and having never commenced construction, its right in the highway never became vested. It received from the local authorities and from the abutting property owners a right to build, which was simply inchoate and contingent; such grant or right does not become a contract or a vested right until the grantee has begun to construct its line in the highway. The franchises and consents of the plaintiff were contingent upon construction. They have never become a contract or a vested right, so far as to be protected by the constitutional provisions against impairing the obligation of contracts until the company has begun to do the thing required by such franchises and consents; and the plaintiff has acquired no vested rights of property in the Liverpool plank road which are protected by the constitutional provisions against the impairing of the obligation of contracts."

CHICAGO CITY RAILWAY GETS ANOTHER EXTENSION OF FRANCHISE

The City Council, of Chicago, on March 14 again temporized with the question of extending the franchises of the Chicago City Railway Company by granting an extension until Jan. 1, 1905. The company is to be allowed to install the overhead trolley on Wabash Avenue, north of Eighteenth Street, so as to make it possible to bring more electric cars downtown over Indiana and Wabash Avenues. This will be a material help in handling the traffic. An annual car license fee of $100 per car is to be paid, instead of $50 as heretofore.

It is understood that the company will begin the construction of its contemplated $4,000,000 power station at Thirty-Ninth and Halsted Streets.

ATTEMPTS TO WRECK PACIFIC COAST CARS

Officials of the Pacific Electric Railway and Los Angeles Railway Company have been aroused to vigorous action by attempts within the last six weeks to wreck street cars. A reward of $500 is offered for the apprehension of whoever is responsible for placing obstructions on the rails of the suburban roads. General Manager Randolph thinks the attempts have been made from wantonness. As to the theory that robbery is the motive, he scouts that utterly.

Here is the schedule of dastardly attempts at wrecking cars:

Jan. 26.—First attempt to wreck street cars on Long Beach line; obstructions.

Jan. 29.—Second attempt on same line; same method.

Feb. 1.—Third attempt to wreck Long Beach cars; same method.

Feb. 9.—Attempt to derail car carrying sight-seeing Oaklanders; railroad spike driven into a switch.

Feb. 21.—Attempt to wreck Whittier car; huge stumps on track.

March 3.—Fourth attempt to wreck Long Beach car; heavy obstructions at three different places along the track.

Detectives and secret service men are at work trying to catch the fiend, while the company's tracks are being patrolled to prevent serious accidents

ELECTRIC TRACTION FOR INVERGARGILL, N. Z.

The prosperous seaport town of Invercargill, situated in the most southerly part of New Zealand, about 120 miles distant from Dunedin, is to have an up-to-date American electric traction system. The Australasian engineering and contracting firm of Noyes' Brothers has secured the contract. The generating equipment will be of Westinghouse manufacture. The trucks will be of Brill build.

SOME PAPERS TO BE READ AT THE INTERNATIONAL ENGINEERING CONGRESS

Among the American papers promised for the International Engineering Congress, to be held at St. Louis, Mo., Oct. 3, 1904, to Oct. 8, 1904, under the auspices of the American Society of Civil Engineers, are the following: "Turbines and Water-Wheels," by Professor Gardner S. Williams; "Railroad Terminals," by Elmer L. Corthell; "Underground Railways," by William Barclay Parsons; "Locomotives and Other Rolling Stock," by George Gibbs; "The Substitution of Electricity for Steam as a Motive Power," by James G. White; "Ventilation of Tunnels," by Charles S. Churchill; "Electrical Power Generating Stations and Transmission," by L. B. Stillwell.

In addition to the foregoing, several other important papers are expected from foreign countries.

UNION ENGINEERING BUILDING IN NEW YORK

Some time ago Andrew Carnegie offered to give about $1,000,000 for the erection of a union engineering building in New York, suitable to house the American Society of Mechanical Engineers, American Society of Civil Engineers, American Institute of Electrical Engineers, American Institute of Mining Engineers and the Engineers' Club. It was feared that the refusal of the Civil Engineers to join in accepting Mr. Carnegie's offer would result in its withdrawal. The following letter shows, however, that Mr. Carnegie has increased his donation by half a million dollars.

Andrew Carnegie, 2 East Ninety-First Street, New York.

March 14, 1904.

Gentlemen of the Mechanical Engineers, Institute of Mining Engineers, Institute of Electrical Engineers, Engineers' Club of New York:

It will give me great pleasure to devote, say, one and a half million of dollars for the erection of a suitable Union Home for you all in New York City. With best wishes, truly yours,

(Signed) ANDREW CARNEGIE.

The three national engineering organizations named and the Engineers' Club, have, with the unanimous approval of all the memberships, already taken active steps to put into being the splendid trust for engineering thus created by a man whose own career has illustrated the upgrowth of the engineering and industrial arts in America. The total amount involved is not less than $2,500,000, for, in addition to the amount given by Mr. Carnegie, a sum of over $500,000, represents the investment in land for the three societies on West Thirty-Ninth Street, between Fifth and Sixth Avenues; while the Engineers' Club has also acquired valuable land for its own purposes on West Fortieth Street, immediately facing the New York Public Library. The Union Engineering Building will probably be twelve stories in height, and will be laid out expressly with an eye to the services required of it. The three national engineering societies made trustees by Mr. Carnegie will have large headquarters there; and already several kindred bodies have made urgent requests for accommodation. There will be four or five auditoriums of different size, notably one to seat 1200 to 1500 persons; and all will be appropriately equipped for scientific meetings, lectures and demonstrations. Above all, there will be an engineering museum and a noble library hall, where all the libraries concerned will be grouped and consolidated, yet each section administered by its respective Society librarian and each adding to its own specific literature, so as to avoid duplication of outlay for books or periodicals. It is propsed, moreover, to co-operate intimately with the New York Public Library, nearby.

The three societies have a total membership to-day of over 9000, and are growing at a rate of between 10 and 15 per cent annually. The sister technical societies asking for quarters and facilities represent also another great body of over 5000 members. Large, therefore, as the Union Engineering Building, with its frontage of 125 ft. on five lots may seem, it bids fair from the start to find every inch put to fructifying use. The Engineers' Club Building, a separate entity, will immediately flank the Union Building. The club, with a long waiting list, has just increased its membership to 1,200

The land is provided by the three societies, but in the meantime

Mr. Carnegie has promptly acquired it for them. The leases run out about July 1, and work will then begin and be pushed to completion.

PENNSYLVANIA AWARDS TUNNEL CONTRACTS

On Friday, March 11, the announcement was made in Philadelphia that the Pennsylvania Railroad Company had awarded the contracts for the tunnels to connect Long Island, New York and New Jersey. The tunnel to connect New York and Long Island will extend under the East River, and the contract was given to S. Pearson & Son, Ltd., of London, England. The tunnel to connect New York and New Jersey will extend under the Hudson River, and the contract was given to the O'Rourke Engineering & Construction Company, of New York. Both of these companies are well known in the engineering field, this being particularly true of the Pearson concern, which now has under way some of the largest construction contracts ever awarded. On this side of the Atlantic the Pearson people have work in progress, principally in Mexico, where they are building the National Teuhantepec Railway, which will permit of transit between Coalzocolas, on the Mexican Gulf, and Salina Cruz, on the Pacific Coast. Sir Weetman D. Pearson, Bart., M. P., chairman of S. Pearson & Son, Ltd., left New York for London Tuesday, March 15.

COMPLETION OF NORTH BORE OF HUDSON RIVER TUNNEL

The north tube of the trolley tunnel under the Hudson River, connecting New York and New Jersey, has been completed, so that it is possible to walk through it. To be exact, the tunnel extends from Fourteenth Street, Jersey City, to Morton Street, New York, and the first persons to pass through it from end to end were President McAdoo, of the company which owns the tunnel, and a party of friends, who made the trip Friday, March 11.

From the nearest New Jersey station to the West Street Station in New York the distance is 1 7-10 miles, and the bore under the river, though often mentioned as the entire enterprise, is not the whole of the New York & Jersey Company's underground road. On the Jersey side there is a spur northward to the Lackawanna station in Hoboken. On the New York side there is a stretch of tunnel much greater than all the river section and the Jersey spur combined, and the company has recently applied for an extension to Herald Square.

The history of the first North River tunnel goes back to 1874. In that year a company sought and obtained a franchise, and work was begun. The scheme was to use compressed air, but no shield. The air pressure was to support the silt soil and keep out the water. The result was a cave-in. Fourteen men were killed, and the project was abandoned.

In 1890 a syndicate of English capitalists was formed. There was more boring. But when they struck a ledge of rock they gave up in despair, although they had completed 1500 linear ft. in the north tube and 570 ft. in the south one.

Then came William G. McAdoo, the president of the New York & New Jersey Railroad Company. He organized his company with a directorate of men, prominent in the finanical world. The old franchise, rights and property were bought in for a little more than $4,000,000 from the old Hudson River Tunnel Company, which the Englishmen had launched.

The "sister tunnel" of this one is to be built by the Manhattan & Hudson Tunnel Company between Cortlandt Street, New York, and the Pennsylvania Railroad terminal in Jersey City. Mr. McAdoo is also the head of that enterprise, which is designed to benefit those of the Pennsylvania's passengers who prefer to reach down-town New York through a trolley tunnel rather than up-town New York through the railroad's own tunnel.

Among those who made the trip with Mr. McAdoo were: Vice-President W. G. Oakman, Chief Engineer C. M. Jacobs, Directors John Skelton Williams and G. Tracy Rogers, William Barclay Parsons, chief engineer of the Rapid Transit Commission; President Thomas N. McCarter, of the Public Service Corporation of New Jersey; W. H. Moir, of S. Pearson & Sons of London, the contracting firm awarded the contract for the Pennsylvania East River tunnel.

After the trip Mr. McAdoo announced that the south bore is not now far from completion, and that he felt confident trolley cars would be in regular operation through the tunnels by July, 1905.

NEW CLEVELAND ENGINEERING FIRM

E. P. Roberts and W. H. Abbott have formed the Roberts & Abbott Company to succeed E. P. Roberts & Company. Both of these gentlemen are well known in the engineering field and a list of the installations with which they have been connected would include ninety-eight railways, seventy-one central stations for light, heat, power and water; thirty-six isolated plants, public buildings, manufacturing plants, etc.

E. P. Roberts, M. E., graduated from the Stevens Institute of Technology in 1877. In 1880 he became assistant engineer to Hiram S. Maxim, of the United States Electric Company, and afterward occupied the same position under Edward Weston. Later he was shop superintendent of the American Electric Company, assistant engineer to William Stanley, of the Swan Lamp Company, and erecting engineer for the Rocky Mountain Brush-Swan Company. After leaving that company he aeted as manager and consulting engineer for several Western corporations. He left this work to become associate professor of electrical engineering in Cornell University. Later he returned to commercial work, and became manager of the Swan Lamp Manufacturing Company, Cleveland, Ohio. In 1893 he formed the engineering firm of E. P. Roberts & Company, which has had a long and sueeessful career. Some of the work of this firm includes the installation of the Northern Texas Traction Company, the Dayton & Northern Traction Company, the Dayton & Western Traction Company, the Indianapolis & Greenfield Rapid Transit Company, and the Findlay & Fostoria Electric Railway Company.

W. H. Abbott, E. E., began his career in the works of the Fort Wayne Electric Company. After spending two years there as an apprentice he entered the University of Chicago, from which he graduated with the degree of Bachelor of Science. He then took a post graduate course in the Ecole Internationale des Electriciens, Paris, France. Returning to America he was appointed superintendent of the Ocean City Street Railway & Electric Light Company, Ocean City, N. J. Later he entered the service of the Ft. Wayne Electric Company as construction engineer. When the Siemens & Halske Electric Company, of America, passed into the hands of the former Ft. Wayne people, he was given charge of all outside construction and erection work. Later he became sales agent for the Stanley Electric Manufacturing Company of Pittsfield, Mass. He was then employed by the Pomeroy syndicate to construct the Cleveland & Southwestern Railway, an extension of the Cleveland, Elyria & Western Railway. Following this he became consulting engineer for the Pomeroy-Mandelbaum syndicate. Mr. Abbott is also known as the pioneer in the United States in the introduction of the steam turbine in electric railway power stations.

IMPORTANT MEXICAN PROJECTS

It has been decided to construct an electric railway between Morelia, capital of the State of Michoacan, and Guadalajara, the principal city of the State of Palisco, Mexico. The distance between these two places is about 120 miles. Archbishop Silva, of Morelia, is primarily interested in the project. Carlos F. de Candero, a Morelia engineer, has been commissioned to obtain the usual government concessions.

An electric traction system is to be installed in Pachuca, a mining city of some 50,000 inhabitants, located in the State of Hidalgo, Mexico. The Hidalgo Railroad, which connects Mexico City with Pachuca, is completing the purchase of the mule tramways, about 12 miles long, and they are to be converted into electric motive power.

ACTION IN THE BRONX FRANCHISE CASE

The railroad committee of the Board of Aldermen of New York, through its chairman, has reported favorably on the application of the New York, Westchester & Boston Company for the right to cross certain streets in Bronx Borough, for which the New York & Port Chester Company also has applied. The New York, Westchester & Boston Company's application will now go to the Board of Estimate and Apportionment, where it will encounter an investigation by the Law Department. Under the terms of the charter it will require a three-fourths vote of the Aldermen to pass the permit.

PUBLIC SERVICE COMPANY BUYS THE MIDDLESEX & SOMERSET COMPANY

On Wednesday, March 16, announcement was made that the Public Service Corporation of New Jersey had just completed the deal for the purchase of the Middlesex & Somerset Traction Company, which has 50 miles of line in Middlesex and Somerset Counties. The purchase price was $2,250,000. The purchase is of special significance because it gives the Public Service Corporation control of a through electric railway route between New York and Philadelphia about 90 miles long. The line is composed of the Camden & Trenton Company, operating between Camden and Trenton, a distance of 35 miles; the Trenton & New Brunswick Railroad Company, a distance of 25 miles, and the Public Service Corporation, between New Brunswick and Jersey City, about 24 miles.

ENGINEERING SOCIETIES

AMERICAN INSTITUTE OF ELECRICAL ENGINEERING.—The 185th meeting of the Institute will be held at the Chemists' Club, 108 West Fifty-Fifth Street, New York, Friday, March 25, at 8.15 p. m. The following papers will be presented for discussion: "The Relative Fire Risk of Oil and Air-blast Transformers," by E. W. Rice, Jr., technical director of the General Electric Company, Schenectady, N. Y.; "Use of Group Switches in Large Power Plants," by L. B. Stillwell, electrical director of the Interborough Rapid Transit Railway Company; "Oil Switches for High Pressures," by E. M. Hewlett, engineer of the General Electric Company, Schencctady, N. Y.; "Terminals and Bushings for High-pressure Transformers," by Walter S. Moody, electrical engineer with General Electric Company, Schenectady, N. Y.

THE ENGINEERS' CLUB, OF PHILADELPHIA.—A business meeting of the club will be held Saturday evening, March 19, at 8 o'clock. W. L. R. Emmet will read a paper on "Recent Steam Turbine Developments," which will describe some of the most recent apparatus of the General Electric Company, and give data concerning results obtained in tests. The economic significance of these results will be touched upon and the paper will review briefly the history of the company's turbine work and practical experiences with machines in operation.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED MARCH 8, 1904

753,839. Trolley Wire Finder; William Barnhurst, Dallas, Tex. App. filed June 1, 1903. A pulley mounted beneath the trolley wheel carries a guiding fork which is thrown to operative position by rotating the pulley by means of a cord.

753,937. Railway Switch; Frederick Uhtbrock, New York, N. Y. App. filed April 18, 1903. Means mounted upon a car adapted to engage either side of an angularly formed plate, which is pivoted at its apex and has a slotted arm connected with a switch point, whereby the latter is actuated.

754,169. Device for the Opening or Shifting of Track Switches; William D. Simpson, Columbia, S. C. App. filed July 23, 1903. Details of construction of a switch-operating shoe adapted to be suspended from a car.

754,181. Emergency Car Brake; Michael Woltz, Wilkins Township, Allegheny County, Pa. App. filed Dec. 3, 1903. The flanges of the car wheels are provided with notches or teeth and adapted to be engaged by toothed shoes, to thereby lock the wheels against revolution.

754,193. Car Brake; Henry T. Brown, Wilkinsburg, Pa. App. filed July 22, 1903. A brake shaft, rail brake-shoes, rods connecting the rail brake-shoes with the shaft with compression and adjustment means between the shaft and the shoes, wheel-engaging shoes, and means connected to the wheel-engaging shoes for operating the latter simultaneously with the rail-engaging shoes.

754,331. Wheel Fender; Manuel E. De Los Monteros, Mexico, Mex. App. filed Dec. 4, 1903. Comprises a frame provided with closed sides, a tilting collector within the frame formed of two sections pivoted together and means in the sides for movable supporting each of the collector sections.

CAPTAIN McCULLOCH GOES TO ST. LOUIS

Captain Robert McCulloch has resigned as general manager of the Chicago City Railway Company to become vice-president and general manager of the St. Louis Transit Company. He will assume his new duties as soon as he can conveniently leave the affairs of the Chicago City Railway Company. Captain McCulloch has had the management of the Chicago City Railway since the death of M. K. Bowen in 1899, and is one of the well-known managers of the country, having been general manager of the National Railway Company's lines in St. Louis previous to the consolidation of the St. Louis lines.

ROBERT McCULLOCH

Captain McCulloch has managed the affairs of the Chicago City Railway through an especially trying period of its existence, as, during his administration, franchise matters with the city have been hanging fire, so that many permanent improvements have been delayed. Nevertheless, he has made a large number of important improvements in the property. He introduced, for instance, the long double-truck car in Chicago city railway practice, and demonstrated its practicability on the heaviest traffic lines of the company, where before it had been thought that the advisability of such cars was questionable, because of delay in unloading. These cars of his design proved so successful that they have practically set the standard for Chicago street railway rolling stock of the immediate future. Captain McCulloch is known as a manager who has the conservatism born of age and experience, together with the progressiveness which is ready to adopt anything new of sound merit. He was the first street railway manager to adopt the cast-welding of rail-joints, and among the first to perceive the value of the double-truck car in city service. He goes to the St. Louis Transit Company at an important juncture in the life of that company, from an operating standpoint, as the World's Fair traffic this summer will be a heavy tax on both the operating force and the equipment. That at this juncture the directors should have selected Captain McCulloch as the operating chief of the company is the highest testimonial to their appreciation of his ability and judgment.

SALE OF THE FONDA, JOHNSTOWN & GLOVERSVILLE DENIED

It is officially denied that the Fonda, Johnstown & Gloversville Railway has been purchased by the Andrews-Stanley syndicate, of Cleveland. A statement in regard to some of the purchases of this syndicate was published in the last issue of this paper, but as yet the Fonda, Johnstown & Gloversville Railway, which has been mentioned in connection with these negotiations, remains an independent property.

PERSONAL MENTION

MR. FRANK S. DRAKE, now general sales agent for the Philadelphia Air Brake Company, of Philadelphia, was for years general manager of the railroad properties controlled by the late Albert L. Johnson.

MR. A. M. MATTICE has resigned as chief engineer of the Westinghouse Machine Company to accept the position of chief engineer and technical director of the Allis-Chalmers Company. Mr. Mattice will have his headquarters at Milwaukee, Wis.

MR. WILLIAM ROBERTS, master mechanic of the Northern Ohio Light & Traction Company, of Akron, Ohio, has been promoted to the position of superintendent of motive power, vice Mr. T. W. Shelton, resigned. Mr. R. Turnbull has been promoted to the position of chief engineer and assistant to Mr. Roberts.

MR. GEORGE THOMAS, superintendent of the Columbus, London & Springfield Railway Company, has been appointed to an important operating position with the Scioto Valley Traction Company, the new third-rail line which is to be placed in operation early in the spring. Mr. Thomas assumed his new position March 1.

MR. ALFRED GREEN has resigned as chief electrician and master mechanic of the Rochester Railway Company after thirteen years' service with that company. He will also resign at the end of the current month as master mechanic of the Rochester & Sodus Bay Railway Company. In 1890 Mr. Green went to Rochester for the Brush Electric Company, of Cleveland, to install the Short electric railway system. It was upon completing this work that he entered the employ of the Rochester Railway Company. He was superintendent of the testing department of the Brush Electric Company for twelve years, and previous to that superintendent of the Memphis Light & Power Company. Mr. Green is well known in electric railway circles through his many valuable papers on shop practice, and his active interest in the affairs of the American Railway, Mechanical and Electrical Association, of which he is first vice-president. Mr. Green does not contemplate taking up new work immediately, as he desires to take a much-needed vacation.

ALFRED GREEN

MESSRS. C. B. VOYNOW AND H. B. NICHOLS, engineers of the track construction department of the Philadelphia Rapid Transit Company, were awarded this month the John Scott legacy medal and premium for their zinc joint for rail bonding. This prize is held in trust by the city of Philadelphia, and is awarded by a committee of the Franklin Institute of that city for especially meritorious inventions.

CHIEF ENGINEER ENDO, of the Nanki Railway, Japan, was in Brooklyn recently, and went over a part of the Brooklyn Rapid Transit system in company with Assistant Manager George R. Folds. The visitor is a steam railway man, and has been away from his native country since last May, traveling in various parts of the world, and getting ideas on the operation of both steam and electric roads. The company with which Mr. Endo is connected operates by steam, but it is proposed to adopt electricity over a part of the line at least. Mr. Endo came to this country from England, and will visit all of the larger cities here. He has already been over the street railway system in New York. Mr. Endo will return to Japan next May.

MR. CARL SCHWARTS has resigned from the engineering force of the Commonwealth Electric Company, of Chicago, to enter the electrical department of the New York Central & Hudson River Railroad Company as assistant engineer in charge of the department for the electrical equipment of the power stations for the traction system. Mr. Schwarts, while in Chicago, had charge of the design of the electrical part of the new Fisk Street station, with its fourteen 5000-kw Curtis steam turbines. He is a graduate of the Royal Technical College in Hanover, and was conected with the Allgemeine Elektricitäts Gesellschaft in Germany as designing engineer. He was afterward connected with the Siemens & Halske Company as chief engineer of the company's light and power department in St. Petersburg, and later as its general representative in the South of Russia.

MR. E. P. SHAW, JR., has been appointed general superintendent of the Boston & Worcester Street Railway, of Worcester, Mass., to succeed Mr. Arthur C. Ralph, who recently resigned. Mr. Shaw is a member of the Shaw family, so prominently identified with street railway interests in New England, his father having long been known as a builder of street cars, and his brother, James F. Shaw, being a well-known street railway builder. Mr. E. P. Shaw, Jr., was superintendent of the Worcester & Marboro Street Railway when it was first built, and since then has occupied similar positions with the Norwich & New London Street Railway, of Norwich, Conn.; the Manchester Street Railway, of Manchester, N. H., and lately has been superintendent of the Citizens' Street Railway Company, of Newburyport, Mass., and of the Haverhill & Amesbury Street Railway.

PRESIDENT H. J. PIERCE, of the Netherlands Traction Company, which is a Connecticut corporation and is the holding company of the Haärlem Street Railway Company, and which also owns the new electric railway extension between Amsterdam and the North Sea seaside resort, Zandt-voord, together with Mr. Thomas E. Mitten, general manager of the International Traction Company's lines, Buffalo, who is also a director in the Netherlands Traction Company, returned from Europe last week. Both gentlemen had visited Holland on a tour of inspection of the new work, which has been undertaken by the company, and which is being rapidly brought to completion by the contractors, the J. G. White Company (Limited), of London. It is thought the line will be ready for operation July 1. While abroad at the meeting of the directors of the two corporations, Mr. Chas. Julius, lately of the Westinghouse Electric Works at Havre, was selected as general manager of the new line. Between Haärlem and Amsterdam thirty-five large, double-truck passenger coaches will be run on five-minute headway. Express and freight will later be made a feature. The coaches are divided into first and second-class compartments, the round trip being first class, 35 cents, United States money, 16 cents one way; second class, 12 cents one way, 22 cents round trip. It is expected in time that the new line will secure the government mail contract. A large tract of land along the tracks of the new line from Amsterdam City limits to the government road will be improved with boulevards and parkways, and the property put on the market for suburban residences, as an added enterprise of the present owners and projectors of the new trolley line. This promises not only to be profitable as an investment in improved property for speculative purposes, but also to furnish a large and thickly-settled constituency of daily patrons to the line.

MR. JOHN B. O'HARA, associate editor of the Street Railway Journal, died at the residence of his brother-in-law, J. G. Hickey, in Rochester, March 13.

Mr. O'Hara joined the editorial department of the Street Railway Journal just two years ago, and brought with him to the editorial force of this paper an accumulated experience in newspaper work and technical journalism which was of the greatest value. He was born in Rochester on Dec. 10, 1865. After graduating from the public schools in that city he became connected with the Rochester "Herald," and was afterwards appointed associate city editor of the "Post-Express." Fifteen years ago he went to Chicago to join the editorial staff of the "Western Electrician," and was later appointed editor-in-chief of that paper. This position he occupied for a number of years with marked success. Later he was offered a proprietary interest and business management, with editorial control, of "Modern Machinery," a monthly paper published in Chicago and devoted to the machine tool business. He was soon obliged to resign this position on account of failing health and take a long vacation, part of which he spent in Rochester and part in the South. Partially recovering, and being of a disposition which would never permit unnecessary idleness, Mr. O'Hara joined the publication department of the Westinghouse Companies, with headquarters in New York, but after a few months' connection with this company was offered and accepted the position on the editorial staff of the Street Railway Journal, which he occupied at the time of his death.

J. B. O'HARA

Ten years ago Mr. O'Hara was married to Miss Margaret Hickey, of Rochester. After her death he attended the body to Rochester, where the interment took place, but serious illness followed so soon in his own case that he was unable to attend the funeral in that city. His death occurred just four weeks after that of his wife, to whom he was devotedly attached, and was caused by valvular heart trouble. He is survived by an only son, aged eight years, his father, mother and two sisters.

John B. O'Hara possessed the high respect and esteem of all with whom he was acquainted, and especially of his immediate associates, who had an exceptional opportunity of learning and appreciating his high character and exceptional qualities of mind and heart. To know him was to love him. He had many friends in the city in which he was born, and in those in which he had lived, who will regard his death in the light of a personal bereavement, and as removing one of their most intimate and highly respected friends.

As a writer, Mr. O'Hara had a very clear style of expression, with an excellent quality of going to the foundation of the topic under discussion, and a keen perception of the news feature of every item which he was considering.

FINANCIAL REPORTS OF THE OPERATING STREET RAILWAYS OF THE STATE OF MASSACHUSETTS FOR THE YEAR ENDING SEPT. 30, 1903

NAME	ON SEPTEMBER 30, 1903		YEAR ENDING SEPTEMBER 30, 1903					
	Capital Stock	Funded Debt	Total Receipts All Sources	Operating Expenses	Charges on Earnings	Dividends Paid Amount	Dividends Paid PerCent	Surplus for Year
	$	$	$	$	$	$		$
Boston Elevated Ry. Co	13,300,000	.....	12,019,371	8,259,860	2,932,556	798,000	6	28,955
Boston & Northern St. Ry. Co	10,060,000	8,443,500	3,662,377	2,324,840	849,204	483,000	5	5,334
Old Colony St. Ry. Co	6,812,600	4,667,000	2,483,156	1,606,846	531,011	339,983	5	5,316
Worcester Consolidated St. Ry. Co	3,550,000	1,060,000	1,324,495	797,832	313,576	213,000	6	86
Springfield St. Ry. Co	1,958,400	600,000	915,876	674,426	130,643	156,672	8	def. 45,865
Holyoke St. Ry. Co	700,000	600,000	369,337	252,707	68,112	56,000	8	def. 7,482
Union St. Ry. Co. (New Bedford)	900,000	400,000	366,158	258,758	55,237	48,000	8	4,163
Fitchburg & Leominster St. Ry. Co	350,000	300,000	218,968	130,135	66,988	21,000	6	846
Berkshire St. Ry. Co	800,000	800,000	183,091	104,873	43,130	.....	..	35,087
Lexington & Boston St. Ry. Co	525,000	350,000	164,690	125,153	31,633	19,688	3.56	def. 11,783
Interstate Consolidated St. Ry. Co	275,000	.....	152,611	117,791	7,246	.....	..	27,573
Northampton St. Ry. Co	300,000	225,000	151,031	100,413	29,964	24,000	8	def. 3,346
Milford & Uxbridge St. Ry. Co	440,000	384,000	149,966	111,979	34,458	.....	..	3,529
Hoosac Valley St. Ry. Co	400,000	100,000	148,828	101,977	18,503	24,000	6	4,348
Dartmouth & Westport St. Ry. Co	150,000	90,000	145,656	102,945	14,880	12,000	8	15,831
Newton St. Ry. Co	315,000	280,000	135,623	98,450	31,955	18,900	6	def. 13,683
Pittsfield Electric St. Ry. Co	200,000	200,000	134,952	99,194	23,172	12,000	6	586
Haverhill & Amesbury St. Ry. Co	150,000	490,000	109,389	73,490	38,225	.....	..	def. 2,326
Springfield & Eastern St. Ry. Co	370,000	330,000	107,509	73,130	24,305	.....	..	10,074
Boston & Worcester St. Ry. Co	1,250,000	1,250,000	103,726	41,657	19,490	.....	..	42,580
Worcester & Southbridge St. Ry. Co	500,000	500,000	102,388	53,102	19,923	15,000	3	14,362
Brockton & Plymouth St. Ry. Co	295,000	270,000	99,600	67,363	35,394	.....	..	def. 3,156
Citizens Electric St. Ry. Co. (Newburyport)	240,000	210,000	97,586	61,309	19,253	.....	..	17,025
Commonwealth Avenue St. Ry. Co	292,000	.....	91,930	68,442	11,949	13,140	4½	def. 1,601
New Bedford & Onset St. Ry. Co	500,000	280,000	91,721	58,904	24,635	.....	..	8,183
Natick & Cochituate St. Ry. Co	100,000	.....	88,923	71,958	8,858	.....	..	8,108
Woronoco St. Ry. Co	250,000	75,000	77,220	51,588	6,706	12,000	6	6,926
Milford, Attleboro & Woonsocket Ry. Co	315,000	250,000	76,849	62,083	16,362	.....	..	def. 1,596
South Middlesex St. Ry. Co	100,000	100,000	72,217	58,110	14,936	.....	..	def. 828
Worcester & Blackstone Valley St. Ry. Co	60,000	.....	67,910	41,710	19,225	.....	..	6,975
Newton & Boston St. Ry. Co	200,000	200,000	67,151	98,608	25,434	.....	..	def. 56,891
Warren Brookfield & Spencer St. Ry. Co	150,000	125,000	66,415	45,481	17,791	.....	..	3,144
Greenfield & Turner's Falls St. Ry. Co	130,000	86,000	62,785	35,336	8,227	6,138	5	13,085
Gardner, Westminster & Fitchburg St. Ry. Co	185,000	150,000	59,237	37,742	15,118	.....	..	6,377
Concord, Maynard & Hudson St. Ry. Co	175,000	165,000	58,877	39,506	14,172	.....	..	5,199
Bristol County St. Ry. Co	200,000	200,000	57,639	36,026	20,310	.....	..	1,303
Middleborough, Wareham & Buzzard Bay St. Ry. Co.	150,000	150,000	56,881	44,851	9,747	.....	..	2,282
Northampton & Amherst St. Ry. Co	180,000	180,000	56,746	44,042	12,561	.....	..	143
Norfolk & Bristol St. Ry. Co	200,000	.....	54,703	51,747	12,186	.....	..	def. 9,230
Wellesley & Boston St. Ry. Co	115,000	.....	53,812	43,861	4,213	6,900	6	def. 1,163
Lawrence & Methuen St. Ry. Co	125,000	.....	52,268	53,255	2,605	.....	..	def. 3,592
Norton & Taunton St. Ry. Co	297,000	296,000	48,180	41,664	17,719	.....	..	def. 11,204
Templeton St. Ry. Co	75,000	.....	47,532	36,268	21,370	.....	..	def. 10,106
Providence & Fall River St. Ry	165,000	165,000	44,460	31,486	12,581	.....	..	392
Southbridge & Sturbridge St. Ry. Co	60,000	60,000	43,675	27,377	7,475	1,800	3	7,024
Georgetown, Rowley & Ipswich St. Ry. Co	180,000	180,000	41,221	34,923	12,629	.....	..	def. 6,331
Athol & Orange St. Ry. Co	74,500	60,000	40,385	27,123	5,285	5,960	8	2,016
Framingham Union St. Ry. Co	30,000	47,000	38,274	27,363	6,406	1,500	3	3,005
Marlborough & Framingham St. Ry. Co	105,000	.....	38,272	36,203	5,842	.....	..	3,773
Blue Hill St. Ry. Co	300,000	.....	37,232	31,379	5,768	.....	..	85
Marlborough & Westborough St. Ry. Co	160,000	160,000	36,239	23,803	15,306	.....	..	def. 2,870
Haverhill & Southern New Hampshire St. Ry. Co.	80,000	.....	35,652	43,366	1,788	.....	..	def. 9,502
East Taunton St. Ry. Co	110,000	45,000	35,257	20,229	4,441	5,500	5	5,087
Haverhill, Georgetown & Danvers St. Ry. Co	60,000	35,000	31,581	20,634	6,531	3,600	6	816
Amherst & Sunderland St. Ry. Co	97,100	51,500	29,413	25,917	5,796	1,860	2	def. 4,160
Hampshire & Worcester St. Ry. Co	155,000	135,000	28,654	18,891	9,426	.....	..	337
Framingham, Southbridge & Marlborough St. Ry. Co.	80,000	60,000	24,730	14,319	5,599	.....	..	4,811
Uxbridge & Blackstone St. Ry. Co	80,000	80,000	24,275	12,977	4,136	.....	..	7,162
Norfolk & Western St. Ry. Co	100,000	100,000	24,078	30,249	9,361	.....	..	def. 15,532
Medfield & Medway St. Ry. Co	100,000	100,000	23,233	15,810	7,330	.....	..	92
Lowell & Pelham St. Ry. Co	40,000	.....	21,813	22,765	716	.....	..	def. 1,668
Shelburne Falls & Colrain St. Ry. Co	50,000	50,000	15,160	10,015	3,606	.....	..	1,539
Westborough & Hopkinton St. Ry. Co	40,000	40,000	14,138	12,098	2,215	.....	..	def. 177
Lowell & Boston St. Ry. Co	90,000	90,000	13,659	15,320	15,013	.....	..	def. 16,674
Linwood St. Ry. Co	12,000	.....	12,553	9,552	484	720	6	1,797
Hampshire St. Ry. Co	67,300	.....	10,131	6,080	3,665	.....	..	385
Conway Electric St. Ry. Co	35,950	.....	9,001	5,373	3,498	.....	..	129
Norwood, Canton & Sharon St. Ry. Co	62,500	.....	8,549	11,647	9,799	.....	..	def. 12,896
Plymouth & Sandwich St. Ry. Co	36,800	.....	7,077	5,235	1,116	.....	..	726
College City & Edgartown Traction Co	60,000	.....	4,500	4,039	236	.....	..	225

NEWS OF THE WEEK

CONSTRUCTION NOTES

BIRMINGHAM, ALA.—The City Council of Wylam has granted the Birmingham Railway, Light & Power Company the right to extend its line down Bank Street.

BIRMINGHAM, ALA.—The new line of the Birmingham Railway, Light & Power Company, between Powderly and Bessemer, 7 miles, has been opened. This gives the company two direct lines to Bessemer, which is 12 miles from Birmingham.

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company has bought a piece of property 41½ ft. by 150 ft., near its power house, so as to enlarge the plant. Several new boilers, a large 60-cycle, three-phase, 2300-volt alternator and a new direct-current, 1600-kw, 575-volt generator will be installed.

IVANPAH, CAL.—The unique electric motor carriage roadway from Ivanpah to the Lila C. mine of the Pacific Coast Borax Company, just across the Nevada line, has been completely graded the entire 100 miles, and it is expected motor trains designed especially for ore hauling will soon be in operation. While designed primarily to haul the product of the borax company, a large quantity of freight will be handled for the mines of the various districts in San Bernardino and Inyr counties, in California, and the southeastern part of Nevada. The electric road will connect at Ivanpah with the Salt Lake and Santa Fe lines and form an outlet for a vast mining territory without railway transportation.

LOS ANGELES, CAL.—The City Council has voted to advertise for sale a franchise on East Twelfth Street. The proposed line will serve a considerable portion of the district left without car facilities by changing the East Ninth Street line from a street railway into a trunk line railroad.

LOS ANGELES, CAL.—Major H. M. Russell has returned from New York, whither he went to finance the Ventura & Bakersfield Electric Railway project. He believes the bonds have been placed as a result of his trip, and promises that work shall be rushed at once.

LOS ANGELES, CAL.—July 1 is given as the date for opening the Huntington interurban depot for business. About half the mammoth building has been rented, and, as soon as it can be done, the several Huntington railway headquarters will be removed to the new structure.

LOS ANGELES, CAL.—The City Council has expressed its willingness to offer for sale two more franchises from the Southern Pacific shops, beginning at Main and Lamar Streets and running southward on Lamar Street to Alhambra Avenue; also beginning at Main Street and Avenue Twenty and proceeding north on Avenue Twenty to Pasadena Avenue.

LOS ANGELES, CAL.—The Pacific Electric Railway Company is getting 16,000 tons of steel rails from Belgium. There are now 10,000 tons on the water, and three cargoes have been unloaded at San Pedro within the past month. Officials of the company will not admit that there is any significance in the fact that some of the rails are unloaded at San Diego, but the amount unloading there is more than enough to build a single-track system with sidings between this city and San Diego. It is thought the rails will not be brought to Los Angeles "just yet."

LOS ANGELES, CAL.—The Los Angeles-Pacific Railroad Company is enlarging its power plant at Vineyard Station, and is dismantling the main station at Ocean Park. Preparations are being made for handling an unusually large traffic during the coming summer. Other improvements contemplated by the road are the renewing of track on Bellevue Avenue and the reconstruction of the Sixteenth Street line from Hill Street and Pico Street to Georgia Street. Several new cars have been ordered by President Clark.

LOS ANGELES, CAL.—The Pacific Electric Railway's new line to Lamanda Park has been opened, and, like all the roads of the system, is standard gage, double tracked, constructed according to the most approved railway standards. From Los Angeles to San Diego the line uses the tracks of the Monrovia branch, and in Pasadena connection is made with the local street railway system of that city. The new line traverses a section of the Southland rich in scenic attractions.

SAN FRANCISCO, CAL.—The North Shore Railroad Company is building eight electric cars at its shops in Sausalito, Cal., under the superintendence of Chief Electrician Vanatta. The new cars will be similar to the large vestibule cars built in St. Louis for this company last year, which are in successful operation on the third-rail system between Sausalito, Mill Valley and San Rafael.

SAN FRANCISCO, CAL.—The United Railroads of San Francisco has filed a petition with the Board of Public Works for permission to reconstruct the steam road which extends to the Cliff House from California Street via Lake Street and the Bay Shore as an electric road. A standard-gage electric road of substantial construction will be built along this scenic route as soon as possible, after permission is granted. This will give the company an opportunity to relieve the pressure on the present roundabout route to the cliff south of Golden Gate Park. If proper connections are made with the downtown districts several transfers may be done away with, and the time from city to ocean reduced.

DENVER, COL.—General Manager C. W. Sells, of the Manitou & Pike's Peak Cog Road, announces that after this year the road will be operated by electricity. The work of changing the motive power from steam to electricity will cost approximately $200,000. Mr. Sells recently made a visit to the East for the purpose of securing bids from large electrical companies on the various machinery and apparatus needed in the new method of operation.

DENVER, COL.—The electric railway between Denver and Greeley will be in operation by next fall if the plans of the company, as now agreed upon, are perfected. D. F. Carmichael and J. J. Cahill are the active spirits of the enterprise, while a number of Eastern people are heavy backers of the road. This road will be built under the name of the company incorporated in 1893—the Platte Valley Railway Company, but a new franchise has been secured. The line follows the Brighton Road. A large power house will be erected at Brighton. The road will do a general freight and passenger business. While it will parallel the Union Pacific road for a large part of the way, it will be several miles shorter. Its length will be 54 miles.

GLENWOOD SPRINGS, COL.—Albert C. Johnson, who says he represents considerable Southern capital, has been here looking into the feasibility of running an electric railway from Glenwood Springs to Mt. Sopris, 12 miles south, and has incidentally looked into the practicability of building a similar line over the mountains to Trapper's Lake, about 25 miles north.

LEADVILLE, COL.—The Leadville-Denver Mining, Tunnel & Tramway Company has voted to issue $500,000 worth of bonds for the purpose of building an electric railway from Leadville 6 miles to a point where a tunnel will pierce the mountains for half a mile. This new electric road will cost, with its equipments, $260,000, and will be a connecting link for the steam railroads between Denver and Leadville. It will cut down the distance between the two points mentioned 175 miles by the Denver & Rio Grande Railroad and 40 miles by the Colorado & Southern Railroad. The new line will be equipped for carrying both freight and passengers. The officers of the company are: James A. Shinn, president; Alfred C. Phelps, vice-president; Byron Tifft, secretary. The company is incorporated for $2,000,000.

HARTFORD, CONN.—The board of directors of the Danbury & Harlem Traction Company has changed its personnel by electing Joseph A. Serre, of Danbury, and W. H. I. Howe, of North Salem, N. Y., to succeed William D. Marks and W. J. Patterson, of New York, resigned. The following officers were also elected by the board: D. E. Loewe, of Danbury, president; Stephen B. Quick, of North Salem, vice-president; J. N. Cronley, of New York, secretary; Philip Simon, of Danbury, treasurer. Technical difficulties arising from a transfer of control of the corporation resulted in a cessation of construction work, but it is expected that operations will be resumed this spring. The roadbed has deteriorated considerably through disuse and lack of care. The proposed line is about 17 miles long.

ATLANTA, GA.—The franchise which was recently granted to the Atlanta & Roswell Electric Railway Company by the County Commissioners has been forfeited by the corporation. The time limit allowed the company by the Commissioners in which to file a $15,000 bond to indemnify the county and to guarantee the construction of the line has expired.

ATLANTA, GA.—The Atlanta Water & Electric Power Company is projecting an electctric railway from Atlanta to Bull Sluice. This has already been decided upon by the owners of the property. Application for a franchise will be made to the Board of County Commissioners during the next session of that body, and it is believed that the franchise will be granted to the corporation. The electric road will travel over the former proposed route of the Atlanta & Roswell Railway Company. As stated above, the franchise granted that concern has not been used, and it is now valueless to those who secured it, because they failed to give the required bond of $15,000. It is the intention of the owners of the Atlanta Water & Electric Power Company to commence work on the street railway as soon as the franchise has been granted by the Board of County Commissioners. It is believed that the new road will be completed during the early part of 1905.

BOISE, IDAHO.—Equipment for a 5-mile extension of its system has recently been ordered by the Boise Rapid Transit Company, the City Council having granted a franchise which permitted this extension.

EAST ST. LOUIS, ILL.—Articles of incorporation have been filed by the St. Louis, Vandalia & Eastern Electric Railway, with a capital stock of $50,000. The incorporators are: William M. Fogler, Charles G. Sonnerman, George D. Steinhauer, H. C. Doyle, T. N. Lakin, of Vandalia.

EAST ST. LOUIS, ILL.—The surveyors of the Southern Illinois Electric Railway Company have begun a new survey preparatory to commencing actual work. With Okaville as the starting point, the survey passes through New Memphis station, thence along the right of way of the Louisville & Nashville Railway, through Mascoutah, on South Street, to Rentchler, where it passes north to the Mascoutah Road to the Belleville public square, where it will connect with the East St. Louis & Suburban Railroad.

EAST ST. LOUIS, ILL.—Articles of incorporation were filed March 4, by the Eastern Illinois Traction Company, having a capital stock of $5,000 and principal office at Mattoon, Ill. The object of the corporation is to construct a railroad from Mattoon, in Coles County, in a northerly direction through Coles and other counties to Champaign in Champaign County. The incorporators, who also constitute the first board of directors, are: Emery Andrews and James Vause, of Mattoon; Thomas Lyons, of Arcola; Charles G. Eckert, of Tuscola; E. A. Potter, of Chicago.

EAST ST. LOUIS, ILL.—The East Side Railway & Transfer Company, with principal offices in this city, filed articles of incorporation recently. The new concern has a capital stock of $2,500. Its object is to construct a belt railroad around East St. Louis. The incorporators are: Thomas H. Koch, of Mt. Olive; H. C. Begole, of Belleville; W. E. Trautman and John J. McLean, of East St. Louis; F. A. Methan, of St. Louis. The incorporators constitute the first board of directors.