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The Referendum in Rapid Transit Franchises

Although the responsibility for reaching a final decision among the several rapid transit plans now proposed for the city of New York rests primarily upon the Board of Estimate and Apportionment of that city, the average visitor to New York would have good ground for assuming that the question was to be settled by popular vote. During the past two or three weeks each of the two companies whose proposals are being carefully considered by the board has gone to considerable expense in advertising through the newspapers and otherwise the advantages of its particular plan and of explaining the deficiencies, so far as the public is concerned, of the proposal of its competitor. Presumably the same arguments have been presented in detail and at length before the city officials by whom, under the charter of the city, the selection must be made. But each company has recognized as well the power of public opinion, and by maps, cartoons and arguments has been conducting a series of lessons for the education of the community on rapid transit subjects, but especially to demonstrate the merits of its particular proposal. It is refreshing to find in at least one city in this country a rapid transit proposition which appears intrinsically desirable. The expectations of Mayor Gaynor, quoted in this paper a month ago, that a decision would be reached within a week, have not been fulfilled, but the verdict cannot now be long postponed. Undoubtedly, in reaching its conclusions, the board will pay considerable regard to the public sentiment which has been awakened and enlightened by these announcements.

Reinforced Concrete Poles

Like the concrete tie, reinforced concrete poles of many types have been designed and a few have been installed in different parts of the country, but in spite of the claims of low cost, great strength and long life made for them they are not coming into use very rapidly. Where it is possible to mold concrete poles in yards and transport them over good roads to the place where they are to be installed, the first cost can be kept down to a moderate figure, but the smaller sizes cost proportionately more than the larger sizes, while the opposite is true in the case of wooden poles. Their life is problematical as yet, although the life of other reinforced concrete structures has usually been taken as the basis for estimates which vary from thirty years to an indefinite period. In some localities where the soil is permeated with alkali and other salts concrete structures buried in the ground have shown signs of disintegration, and if such action should take place at the base of a concrete pole it would be as destructive as rot in the case of wooden poles. Experience has shown that a very rich mixture of concrete is neces-

sary to prevent disintegration due to the deflection of the top under wind loads. One disadvantage which does not seem to have been overcome in any of the types of concrete poles yet developed is the difficulty of securely attaching extra cross-arms, telephone and postal boxes, fire alarms and similar devices to the poles. This is an important detail in poles intended for use in city streets. At present prices of wooden poles, unsightly and short-lived as they are, the use of concrete poles will be limited to experiments in a few localities. Those that have been put in during the past two or three years are standing up satisfactorily under all sorts of weather conditions, and in a few years more they should demonstrate their probable life and cost of maintenance with reasonable certainty. Improvements in design will no doubt reduce the first cost somewhat in the future, and if the life proves to be what is expected the present low cost of wooden poles will not prevent the extended use of a more economical substitute.

Chicago Elevated Consolidation

The long-discussed possibilities for economies and the improvement of service through a consolidation of the Chicago elevated systems are in a fair way to be realized. Final announcement has been made that capital for the purchase of the stocks of the various roads has been provided and that the directorates of three of the companies have agreed upon the terms. The consolidated road will have 1200 cars and about 175 miles of track covering the downtown district of Chicago and radiating to all the important sections of the city. There has been no competition between the elevated systems because they serve different districts. There is severe competition, however, between the elevated and surface roads, and the situation has been considered by many to forecast the final unification of all lines of urban transportation in the city. The consolidated resources of the combined companies represented by the new Chicago Elevated Railways Company will make it possible to effect needed improvements and desired extensions that should result in increased revenue and operating economy. Since the completion of the rehabilitation of the surface systems and the establishment of through routes and the exchange of transfers, the people of Chicago have increased their agitation for the "one city, one fare" plan of operation. While a combination of the elevated roads admittedly will improve operation, it is another question to introduce universal through routes of elevated trains and 20-mile rapid transit trips for a single fare of five cents. It will not be unreasonable for the consolidated elevated property to refrain from further extension of the present long rides for a single fare. The solution of the problem of extension of the service with adequate revenue for the longer hauls will be interesting.

The Ventilation of Turbo-Generators

The adequate ventilation of compact high-speed turbo-generators presents many difficulties which never had to be taken into account in the design or operation of engine-driven units of much larger bulk but smaller capacity. A slow-speed multipolar generator has a large area for radiating heat and its fan action induces a free flow of air through the large openings which are allowed in the design. With a turbo-generator, however, running at from 1500 r.p.m. to 2000 r.p.m. the cooling air must be forced through restricted passages at very high velocities, which in itself generates heat due to skin friction. The internal losses in a large generator may amount to several hundred kilowatts, all of which is converted into heat and must be absorbed and carried off by the ventilating air. As air has a low specific heat, this process of radiation and absorption is inefficient at best. Some idea of the difficulty of the problem is gained from the statement made in a paper by R. B. Williamson, presented this week at the convention of the National Electric Light Association and abstracted elsewhere in this issue, that at times the weight of the air which must be passed through the generator is greater than the weight of the steam passing through the turbine. A 5000-kva generator requires approximately 28,000 cu. ft., or 2270 lb., of air per minute for proper ventilation. In view of the enormous volume of air which must be passed through a generator of this or larger size, thorough filtration is most important. One large generating station is now being equipped with an air-washing apparatus similar to that installed in hospitals and public buildings, and all the foreign matter in the air used for ventilating the turbines will be removed before the air is allowed to pass through the turbines. For small units the cloth filters described by Mr. Williamson have been found satisfactory where they have been used.

Central Power Stations for Railroads

In one of the papers read at the National Electric Light Convention this week Mr. Darlington refers to a probable development in power transmission which is attracting a great deal of attention now from power transmission engineers. This is the economy which would result from the establishment at different strategic points of power stations so large as to be able to supply all of the energy needed within a radius of 100 miles or so, not only for industrial purposes, but also for electric railroad service. Up to the present a power station designed exclusively for railroad work has seemed the indispensable adjunct to every steam railroad electrification, and this fact has undoubtedly had its weight as a deterring influence in decisions relating to the adoption of electricity as a motive power. But, as Mr. Darlington states, there is no more reason why a railroad company should generate its own power than why it should mine its own coal, or than why each large consumer of electricity in a city should have an isolated plant. Improvements in the art of electric power transmission have been so notable during the past few years that the plan of establishing three or four power stations to supply all of the energy needed in large amounts in Illinois, or the electrical connection of New York and Philadelphia with the anthracite coal fields, seems no longer so chimerical as it would have been called a few years ago. It has come nearer reality not only through the development of electric transmission practice but also through that of power generation, because those power stations which are equipped with the large units of to-day are developing energy at a surprisingly low cost for labor and fuel. According to Mr. Darlington, the possibilities in the central generation of power are so great that an argument for electrification of many steam lines can now be based purely on economy of operation. Such a condition should exercise enormous influence on the extent of railroad electrification to be undertaken in the future. A common power station for the steam railroads entering Chicago would seem particularly desirable.

THE TRAINING OF ELECTRIC RAILWAY ENGINEERS.

This is the season at which electric railway companies are arranging to take on technical graduates to work into their business and those about to become technical graduates are looking earnestly around for available situations. To tell the truth, the railways are a little uncertain as to just what they need in the way of technical training for their employees, and the neophytes are wondering in how far their training will serve them in good stead when it comes to the grim rub of every-day work. Now, a young man wrenched out of his academic environment and dropped into the middle of electric railway work finds things passing strange to his somewhat untrained vision. There are not lessons to be learned but things to be done, and instead of examinations he finds decisions which must be made quickly and accurately and followed up assiduously in order to obtain results. What kind of training will stand him in the best stead and be of the most service to those who are employing him?

Electric railway engineering is not very closely allied in its requirements to the ordinary electrical engineering courses of the schools. It requires far more mechanical engineering as a basis for future success than does any other branch allied to electrical engineering, and of electrical engineering itself railway engineering requires only a certain portion for its practical uses, namely, that portion which has to do with the generation and transmission of power under comparatively limiting conditions. On the other hand, the mechanical engineering requirements are somewhat strenuous and a knowledge of civil engineering does not come amiss. In a general way, therefore, the electric railway engineer needs a somewhat different course from the man who is planning to engage in either electrical or mechanical engineering in a more generalized way. This difference in requirements is not often taken into account in the schools, nor is there generally adequate opportunity for electives in sufficient amount to enable the student to specialize in this particular way. Perhaps it is not desirable that he should so specialize, yet the field of electric transportation is a growing one and unless all the signs of the times are fallacious the next generation will see some tremendous work done in the application of electric railroading.

If the time for preparation at his disposal is ample, it would probably be best for the young electric railway engineer to take the full course in either electrical engineering or mechanical engineering, and then a post-graduate course designed to supplement what was lacking of electric railway engineering in each. Such a plan would have the additional advantage that it would give the student wider opportunities for useful work after graduation. But, assuming that the time which the electric railway engineer can spend at the university is limited, he would naturally prefer to take up those special studies which pertain directly to his chosen field rather than those which belong to other special branches of engineering. Under these circumstances it is safe to say that thorough instruction in the general principles of mechanical engineering is a necessity and the generation and transmission of electricity needs a somewhat disproportionately large amount of his time. The railway engineer ought, too, to have a firm grip on the principles of civil engineering as applied to railway work and the theory of railway locations. This he cannot generally get in the engineering courses as now arranged, since his time is taken up with somewhat intricate and irrelevant work in both mechanical and electrical engineering. If the schools are to do their best for their graduates who are to enter the great field of electric transportation they should make room for studies leading toward the technical railway work of civil engineering. This is perhaps the greatest single need in the training of the young man for this particular field of activity. He should also possess a knowledge of at least the principles of accounting and for his own sake should have such knowledge of rhetoric and English composition as will enable him to express himself orally and in writing so as to make his thoughts intelligible to others. These two subjects are often neglected and are extremely necessary if the electric railway engineer aspires to any administrative work. As it is, the railways, which are always looking for clever and capable beginners, have to take their chances on the preliminary training and select men from the various engineering courses and even from the academic courses and break them in to the particular requirements of the railway work. As a matter of fact, the men who "make good" come in uncertain proportions from all these sources.

Of course no amount of engineering or other training will make a first-class executive. Like poets, efficient executives are born, not made. They either have that mental grasp that enables them to take hold and do things or they lack it. A thoroughly first-class man without more technical training than he gets in the academic courses of instruction may in a few years find himself superintendent of a big railway company and his classmates who followed the engineering courses working under him, or the exact reverse may be the case.

Sometimes we are tempted to think that a too exclusive technical training narrows one's vision or at least leads one to look in particular directions instead of attaining a generalized viewpoint. Until there is deliberate and somewhat practical training directed particularly toward electric transportation the railway company on the lookout for good men will have to take its chances as it does to-day, and in these circumstances it cannot afford to exclude any promising material even if the applicant's purely technical training seems at first inadequate. The young man who has learned to use his mind with facility on new problems is quite as likely to make his mark as one who has acquired deftness in particular problems, unless he is to work in a very contracted field of effort. Initiative and resourcefulness are the two most valuable mental assets in the field of railway engineering and management. If one looks over the field of successful and brilliant railway men he will find that some of them have risen from the ranks, others have received training in particular specialties, and still others have had only the general mental training which the well-educated young man of this generation has at his command. Perhaps the best thing at present is for the railways to take in for their particular training the best natural material that they can find, irrespective of particular educational lines. This material will sort itself soon enough, and the capable men will drop into the important positions. But we believe that there is still much important work that can be done in the schools toward picking out as it were the capable men before graduation and giving them an opportunity to acquire training which will be particularly useful in the electric railway field. If the schools and the electric

railway companies which happen naturally to be in touch with them would get together with the view of sorting out the men with a bent for railway work and would give to them a practical grip on current railway problems, the situation would be much simpler than it generally is, and this we think is the line of co-operation which will eventually do the greatest good.

THE STORAGE BATTERY CAR IN NEW YORK

The news that the Third Avenue Railroad, New York, has ordered thirty-five storage battery cars in addition to the thirty which have been in service for the past year must be gratifying to all who have deplored the survival of horse car lines in the chief city of the nation. This result does not mean that the crosstown line problem in New York necessarily has been solved. Under the present conditions of slow speed, light traffic and high labor cost, the crosstown transportation situation is far from a cheerful one at present, nor does the future hold forth any very great amount of encouragement for financial success. Nevertheless a beginning has been made of the retirement of the horse car, with which no improvement was possible. A short account of the situation may be of interest.

On the 110 miles of track not equipped with the underground conduit in the borough of Manhattan, 9.6 miles on the Third Avenue Railroad are now operated with storage battery cars and there will be about 12 miles after the delivery of the new cars. It is needless to detail here the reasons why it has been financially impracticable to equip these routes with the conduit system. It suffices to say that many of these lines which were essential to the public in the days of ferry traffic have lost their importance and can rely now only upon a limited short-haul business and on such additional traffic as comes to them through transfers with the longitudinal lines. The disintegration of the surface railway system in the borough of Manhattan has deprived most of these lines of the latter traffic to a large extent and has left their prospects more hopeless than ever. The only way out of the difficulty was to find a self-contained car whose operating and maintenance costs would be less and whose traffic possibilities would be greater than those of the horse cars. The Third Avenue Railroad, which was operating some of these properties, therefore determined to conduct experiments with both gasoline-electric and storage battery cars. The gasoline-electric car was placed in service November, 1909, and the first storage battery car in March, 1910. It was soon apparent that under the conditions which prevailed in New York the storage battery car had many advantages in its favor. Current was obtainable at very low rates because the batteries were charged during periods of low load, there was no expense for charging station labor, and the current consumption of the cars was very small. The one great obstacle which made the company hesitate to install the self-contained electric cars on a large scale was lack of knowledge of the maintenance costs and life of a traction battery. However, an enterprising manufacturer of storage batteries made a satisfactory mileage maintenance guarantee on his batteries and the railway company built and placed in operation thirty storage battery cars. The maintenance costs of these equipments have proved so low that still lower figures were submitted for the thirty-five additional car equipments which have just been ordered. The railroad company stands on pretty safe ground inasmuch as the manufacturer guarantees that during five years he will replace any batteries that fail to give at least 75 per cent of their original rating. Under these circumstances the Third Avenue Railroad management have not found it necessary to make any allowance for battery depreciation.

Some idea of the comparative status of the gasoline-electric car and the storage battery car under the operating conditions on the horse car routes in New York may be obtained from the fact that the guaranteed maintenance charge of the batteries plus the cost of electrical energy was actually less per car mile, even in the first contract, than the cost of gasoline alone. In addition to this it was plain that the maintenance of the gasoline-electric car would be greater, owing to the fact that it carried a gasoline-electric set in addition to a motor and control equipment which was similar to that on the storage battery cars.

The storage batteries have given none of the operating troubles which were anticipated by some. They have proved just as efficient in the coldest winter days as in summer, and their radius of action has not been diminished materially after a year's regular service. In one case an equipment was run for more than 114 miles on a single charge, after it had previously been operated for more than 12,000 car miles. The most striking feature about the experiences with these cars is that the troubles which did arise came from an entirely unexpected quarter, namely the transmission chain. The old adage that a chain is no stronger than its weakest link proved to be literally true, because the wear of the sprockets caused an unbalanced riding of the chains and eventually the links wore out. It seems rather strange that chains which had proved so satisfactory in automobile work should fail to meet the demands of the lightest street railway service, but it is evident that they were not suited for running conditions which require eight to ten stops per mile. To eliminate future transmission troubles the new and old cars will have miniature railway gearing which will be arranged to give practically the same speed reduction as the chain. It is anticipated that the efficiency of the gearing will not be materially different from that of a new chain.

Not only has the storage battery car proved an engineering success, but it is fulfilling in a large measure the hope that it would result in increased business. On the One Hundred and Tenth Street line for instance, only one horse car was operated in April, 1910, it making 1470 car miles. In April, 1911, three to five storage battery cars were operated for 15,716 car miles. It is hardly necessary to point out that this increase in mileage shows that the public has appreciated the improvement in transportation facilities.

To summarize the situation, the results with self-contained electric cars on the Third Avenue Railroad system indicate that there is a field for storage batteries on city lines and short suburban extensions, where the travel is too light to justify the installation of overhead lines and trolley feeders but where it is possible to buy electrical energy at very low prices. It has also been suggested that storage battery cars could be used on standard lines to help out in rush hour service, provided the cars were charged before the peak loads came on the power station. On the other hand, the gasoline-electric car appears to be much better suited for operation over suburban and interurban lines where appreciable grades must be surmounted and where reasonably high speeds are desirable.

ELECTRICAL FEATURES OF THE PENNSYLVANIA TUNNELS.

Aside from the fair statement of the reasons for adopting direct current for the Pennsylvania tunnels in New York City, perhaps the most interesting part of the paper by George Gibbs, which is printed in abstract elsewhere in this issue, is the discussion of the power-generating equipment. From one standpoint the combined Pennsylvania and Long Island Railroad electric zones seemed to warrant two power stations, each located approximately in the load center of its own system. The load center of the Long Island Railroad electric lines is close to Jamaica, L. I., while the load center of the Pennsylvania Railroad service is near the North River. Two stations, each of 23,000 kw capacity, would have provided sufficient power for both roads, and in an emergency one station could have handled the entire load, which now reaches a maximum of 26,000 kw. It is worthy of note that instead of dividing the generating equipment into two stations of moderate size and widely separated from each other all of the current is being generated in one station in Long Island City, admirably located as regards water and coal-handling facilities and close to the load center of the combined systems. Reliance is being placed on this one station to furnish all the current for operating 254 miles of track. Economy of regular operation, in the opinion of the engineers who are responsible for this plan, more than offset the remote liability of complete shut-down of the station.

That this plan is fully justified is shown by the operating records of two of the other heavy electric traction systems entering New York City. The New York Central built two power stations for its electric zone, one at Port Morris near the load center of the Harlem division and one at Yonkers near the load center of the Hudson River division. As the electrical equipment of the main line north of Yonkers has been delayed because of local conditions, the Yonkers station has had little to do, but the Port Morris station has never had to be shut down on account of an accident or failure of the machinery. The New Haven power station at Cos Cob is now being more than doubled in size to supply the Harlem River division, the New York, Westchester & Boston and to provide for future extensions of the electric zone east of Stamford. In six months of 1909 the total train delays due to failure in the Cos Cob power house were only 54 minutes, a record which would hardly justify duplication for emergency service only.

The precautions which have been taken against accidents, fires and electrical disturbances in the river tunnels are very elaborate. The bench wall construction insures only small damage to cars from derailments and provides a safe and convenient exit for passengers on a train which might be wrecked or stalled. No wooden cars of any kind are allowed in the tunnels; even the private cars of railroad officials are side-tracked at Harrison. The third-rail is sectionalized every 1500 ft. and switches are installed at intervals of about 800 ft. and by means of these switches the circuit breakers controlling the adjoining sections of third-rail may be opened instantly and all current cut off except in the lighting and signal circuits. These switches can be used by repair gangs as well as in emergencies, thereby insuring the safety of trackmen.

THE STANDARDIZATION OF CITY RULES

It is sincerely to be hoped that the membership of the American Electric Railway Association will co-operate seriously during the next two or three weeks with the committee appointed by the Transportation & Traffic Association to revise the existing code of city rules. It is almost needless at this time and in this place to emphasize the desirability of having such a standard code.

The preliminary draft of the changes recommended by the committee on city rules is being sent out by the secretary of the association this week and is accompanied by a request that the member companies express their agreement with or dissent from each proposed change. If this request receives a prompt response, either favorable or unfavorable, the committee will be able to be guided by these suggestions and can compile a report which should be acceptable to the membership at large. If not, the committee will be in the dark as to the wishes of the members and the chances will be very strong that no definite action will be taken in October.

A revision of the operating rules is a subject which is far better adapted to consideration by letter ballot and letter criticism than it is to discussion in an open meeting. In the first place, it is very difficult for anyone in the hurry and bustle of an open meeting to draft or even carefully to consider the best wording for a rule. In the second place, the number of companies which are likely to be represented in such a meeting by transportation officials who are fully conversant with the requirements of the rules is apt to be a comparatively small proportion of the total membership of the association. But there is no reason why the manager of each member company, the smallest as well as the largest, cannot examine the proposed code critically at his home and then express his opinion about it in writing, clearly and definitely. If the experience of last year with the plan of letter criticism of the rules is repeated this year, the result will be unfortunate. Although some 355 circulars requesting criticisms were sent out by the 1910 committee on city rules, the number of replies received by letter amounted to only a few over sixty; the maximum number of those voting at the meeting at which these rules were considered was fifty, and the verdicts of the majority at the meeting in most of the cases were just the opposite of those expressed in the letter ballot. It is easy to understand that under such circumstances a committee appointed to carry out such an important work as the revision of the code of city rules might very easily become discouraged.

The point which we wish to make is that the most important work of the member companies, so far as the city rules are concerned, is not so much to be in attendance at the convention next October in Atlantic City, at which action will be taken on the code, as it is now promptly to reply to the request of the committee. If a large and representative expression of opinion is received by the committee during the next two or three weeks favorable to the rules, it is safe to say that their acceptance will be reaffirmed at Atlantic City and a standard code of city rules will become a reality. If the opinion expressed by letter ballot during the next two or three weeks is decidedly opposed to the proposed amendments, the committee has ample time to revise the code and still have a fair assurance that such changes will receive indorsement at the convention in October.

SHOPS, ROLLING STOCK AND OPERATING PRACTICE OF THE HAVANA ELECTRIC RAILWAY COMPANY

BY F. W. HILD, FORMERLY ASSISTANT GENERAL MANAGER AND CHIEF ENGINEER OF THE COMPANY AND NOW GENERAL MANAGER OF THE PORTLAND RAILWAY, LIGHT & POWER COMPANY, PORTLAND, ORE.

In the issue of the Electric Railway Journal for June 3 the writer described the reorganization, track and power generating system of the Havana Electric Railway and gave some particulars of the practice of the company in operating single truck cars. An account of the other principal features of the system follows:

SHOPS AND ROLLING STOCK

The shops, the largest carhouse and the offices of the company are located on the block bounded by Eighteenth, Twentieth, Ninth and Eleventh Streets, Vedado. In the early days of the electrification of the system a large brick and steel building of the standard factory type of ten years ago was erected to become the shops and storeroom. Later in 1906 all the remaining area of the block was utilized by a one-story reinforced concrete extension for carhouse purposes, and in 1908 a second story was added to a part of this extension and became the company's offices.

The shops are well equipped with machine tools and include also a Devine-Passburg vacuum drying and impregnating machine. The shop annex, which is just across the street from the main shop and is devoted to woodworking, contains a quite complete set of woodworking machinery. The company builds its own car bodies and manufactures many of the supply repair parts for the cars, including field coils, some armature coils, etc. A card system wherein is recorded the mileage of the cars and the constituent parts has proved a valuable help in selecting supply materials and suggesting improvements in details of the construction. As the policy of the management is to keep the cars in fresh, clean, presentable condition, all the cars are brought into the shops according to a schedule and are repainted and revarnished or overhauled as the case may be. Under the conditions of sun and rains in Havana it is found necessary to revarnish the cars every eight months and to repaint them every three years. The Northern woods of which the first consignment of 110 cars were built succumbed very rapidly to the ravages of an insect called the "comejen," so that most of these have been rebuilt of native hard woods.

The following is the list of the company's rolling stock:

266 passenger cars.	1 tower car.
1 parlor car.	1 electric crane car.
1 observation car.	5 tower repair wagons
2 express cars.	2 machinery floats.
70 freight cars.	11 carts and wagons.
9 electric locomotives.	

Instead of a multitude of types of cars, the Havana Electric Railway Company, unlike most tramway systems, has but one type of passenger car for regular service, and except for a few minor details all the cars and their equipments are alike. All the track rolling stock have identical single trucks, McGuire-Cummings A-6, and all the powered cars, except two freight motors, have identical electrical equipment (GE-52 motors). All of which makes for simplicity and convenience.

The passenger cars are the semi-convertible single-truck type, 22 ft. between the corner posts and 30 ft. over the platforms. Each car seats 32 people, has 16 rattan reversible double cross seats, arranged for center aisle. In the newer cars the last two seats at each end are placed lengthwise so as to afford freer space at the doors. The body is made of native hard woods, including mahogany, majagua, sabicú, ocuje, ácana and cedar, all splendid woods. The trucks are McGuire A-6. The original cast-iron wheels which came with them are being rapidly replaced by Schoen pressed-steel wheels. Two GE-52 (25-hp) motors with K-9 controllers form the electrical equipment. International registers, Parmenter fenders, Wood gates, Ackley brakes, American Brake Shoe & Foundry brake-shoes and Electric Service Supplies Company's automotoneers are parts of the standard equipment. The shops build the bodies and assemble, paint and finish the cars. As all of the routes are loop lines all the later cars are built with single-end control. Each passenger car finished weighs about 8 tons.

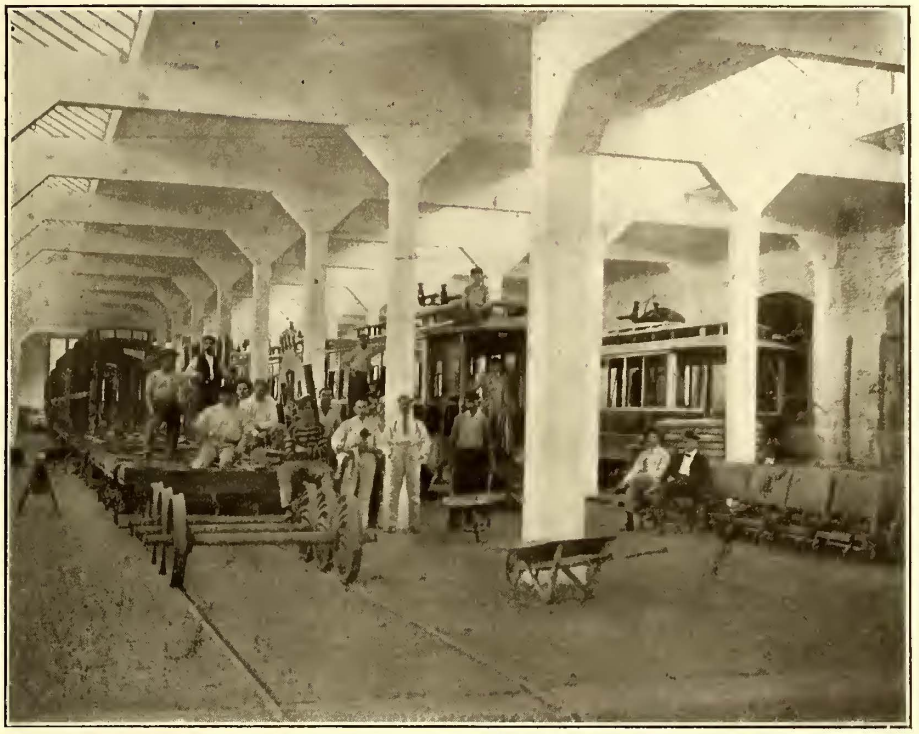
Havana Electric Railway—Exterior of Main Car House

The observation car is of open construction. The ribs, posts and roof beams are made of ordinary pipe, the hardwood seats and ornamental ironwork forming the sides. The floor is inclined so that the polished seats rise toward the rear just as in the gasoline sightseeing "rubberneck" automobiles so common in the large cities of the States. The car has proved to be very profitable.

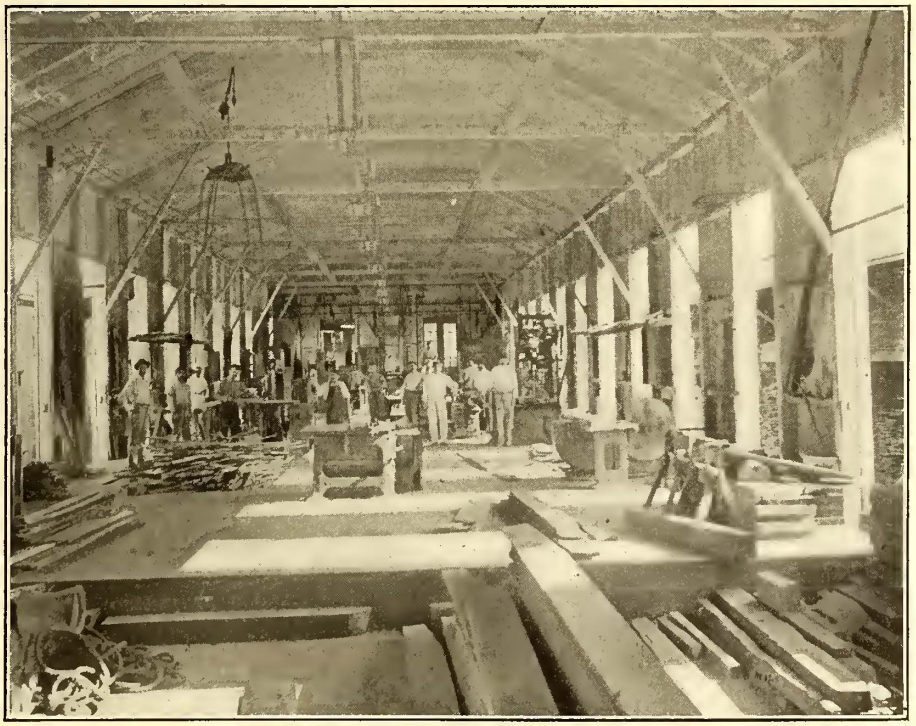
Five of the electric locomotives are of box construction with truck and motor equipment identical with the passenger car equipment. Two have two GE-73 (75-hp) motors with K-6 controllers each, but are otherwise the same as the other five locomotives. The two remaining locomotives, which were built in 1910, are double-truck four-motor (GE-52) outfits, with open flat bodies except for a small canopy at each end

for the protection of the crew against sun and rain. The double trucks are made up of McGuire A-6 single trucks and embody ample flexibility and strength. Tomlinson automatic couplers with radial drawbar, safety chains to supplement the couplers and Ackley adjustable brakes form part of the equipment.

The freight cars are all single truck, and include box cars, flat cars, gondolas, bottom-dumping cars for coal and ashes, and steel side-dumping cars. The last named is perhaps worthy of more than mere mention. The subframe is made of I-beams, angles and channels, and upon the ends and center are placed the ways upon which the bodies rock. The ways are of plate girder construction. Each car has two V-shaped steel bodies which can be tilted to one side or the other by rolling or rocking them on the ways or guides. The bodies are made up of steel plates reinforced by angles, and to the ends of the bodies are riveted the rockers, which are malleable iron. The rockers have round protuberances, regularly spaced on the perimeter of each rocker. These as the bodies tilt or rock fit into holes punched in the ways just as the teeth of a pinion fit into a rack. Each body has 6 cu. yd. capacity, making 12 cu. yd. per car. This is equivalent to 8½ tons of coal or cinders; but when heavier materials, such as granite paving block or sand or broken stone, are to be transported a removable false bottom made of wood is provided which limits the weight of the load to the desired amount and also keeps the center of gravity high enough to permit ready tilting.



Havana Electric Railway—Truck Shop



Havana Electric Railway—Woodworking Shop

The loaded bodies can be dumped and emptied by one man, the bodies returning automatically to the loading position. Rocking brackets and safety chains keep the bodies in position while in transit. Each car has Tomlinson automatic radial couplers, Ackley hand brakes and safety chains to supplement the couplers.

A new lot of 24 steel gondolas and flat cars is under construction in the shops. These will have structural steel underframes and hardwood floors, all carried on McGuire A-6 trucks and with accessories the same as the steel side-dumping cars.

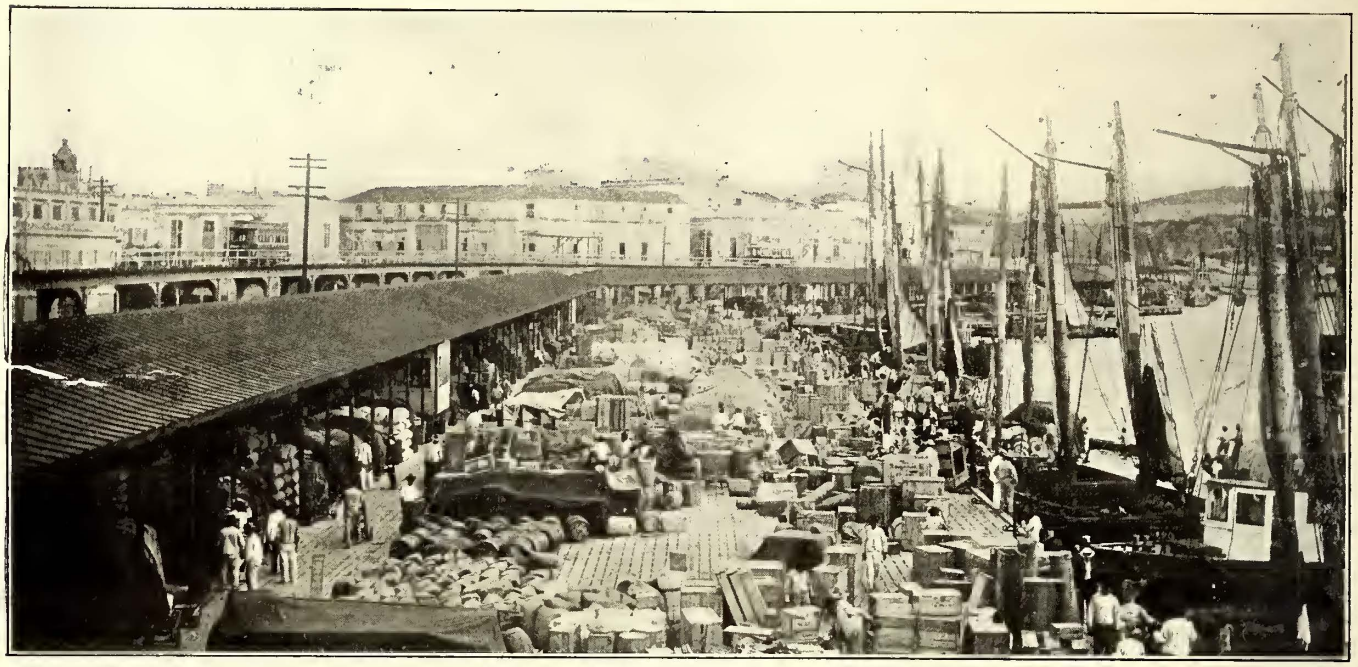
The extremely shallow and narrow grooves of the track rail and the numerous sharp curves have proved so hard on the chilled cast-iron wheels which originally came with the trucks as to make necessary their replacement by pressed-steel wheels, which have proved to be very satisfactory.

Four Trenton tower wagons, mule-drawn, and one electric automobile tower truck are the rolling stock needed for the overhead wire repairs. The tower truck consists of 2-ton chassis with Exide battery and G. E. motor furnished by the General Vehicle Company. The tower, which is in three sections, and the body for this were built in the company's shops. The three-section tower when telescoped is sufficiently low to permit the automobile truck to enter and maneuver in any of the streets of the city. The two-section tower wagons, while they can pass wherever the company's tracks are laid, are often hindered by projecting iron curtain rods, which are common in the retail shopping streets of Havana.

CARHOUSES

Dispatching stations are located at the termini of the lines in Vedado, Jesús del Monte, Cerro, Principe and Universidad; and the first four together with La Puntilla are also storage houses, making five in all. Universidad is a dispatching station, but has space for six cars. Except Universidad, all the stations have transfer tables and inspection pits, and at all

of them minor repairs are made, the cars cleaned nightly and lubricated. Two "mecánicos" at each station, one on the day shift, the other on the night shift, are in charge of the repair men and the cleaners. Each cleaner is required to wash and clean thoroughly five cars on his turn of duty. A fixed number of extra supply parts, such as registers, fenders, field coils, armatures, etc., are kept at each station, but the great majority of the repairs are made at the shops. Each station is provided with several testing thermometers, which are used to ascertain the temperature rise of the field coils and armatures of the motors. A schedule is worked out so that every car is thus tested about every third or fourth day, and when the thermometer reads 75 deg. C. the car and its service undergo special examination and investigation. When the thermometer readings attain 85 deg. C. or more and the examination at the carhouse does not reveal the apparent cause the car is sent to the shops, where the trouble is usually located and remedied.



Havana Electric Railway—Wharf and Elevated Railway Used by Electric Cars

CAR OPERATION

All the routes are loop lines. Beginning at the five outlying districts, Vedado, Universidad and the cemetery, Principe, Cerro and Jesús del Monte, all but five of the twenty lines lead to the city into two main downtown loops, one known as the Aduana or elevated route, the other as Muelle de Luz or ferry route. Four of the other routes are crosstown, and join Vedado, the cemetery and Malecón with Cerro and Jesús del Monte. These crosstown routes go south on Galiano Street and north on Belascoain Street, intersecting all the other lines, the intersections being all the transfer points required by the concessions. The remaining route extends from Vedado at the boundary limits of Havana to the town of Marianao, a fine suburb of about 10,000 population, distant some 6½ km (about 4 miles) from Vedado. This line is essentially a suburban line, and serves Camp Columbia, the headquarters of the Cuban army, and several other very rapidly growing communities.

Havana Electric Railway—One of the Large Plazas in Havana

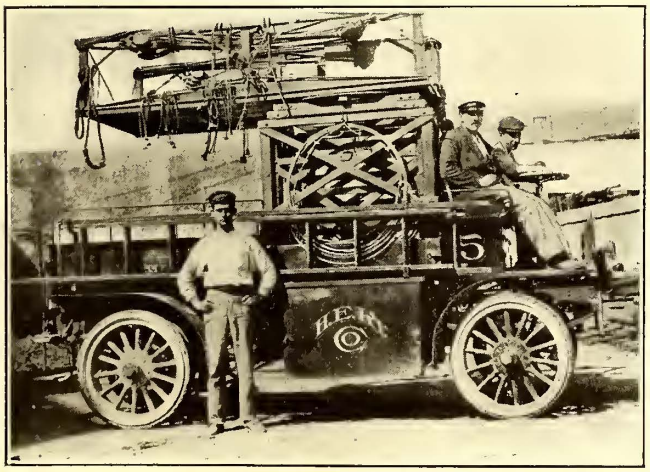
The frequent car service calls for a rather large force of inspectors, whose duties also include register checking. They are to be found everywhere. When a tie-up occurs an inspector appears promptly on the scene, and with the aid of the tower wagon crews quickly straightens out the tangle.

The average schedule speed is about 7½ m.p.h., and ranges from a limit of 6 m.p.h. in the narrow streets to a permissible 24 m.p.h. along the two private right-of-way stretches in Vedado and Principe.

The street car travel in Havana is affected by a number of conditions. The great frequency of the service has promoted a considerable pleasure travel and also what for want of a better term may be called "convenience travel." This last is that due largely to the shoppers who put off until to-morrow the trip which to-day threatens to become inconvenient. In Havana this class of travel is quite large and is not confined to the shoppers, but includes also many who have rather more pressing business to justify the travel; but the customs of the people, the "mâñana" habit, readily permit of postponements which would drive a "hustler" in the North frantic. For these reasons, when it rains or when the weather becomes disagreeable to the Cuban the receipts at once fall markedly; on the other hand, the receipts always reflect by the increased travel the influence of pay days.

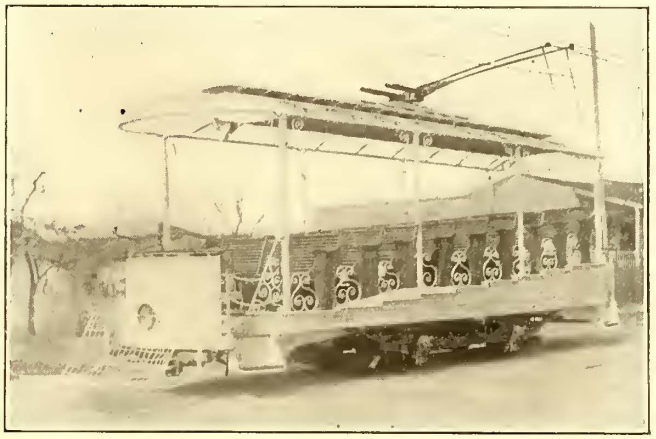
The peak service requirements are not so pronounced as in the cities of similar size in the States. Still, additional service is given during the midday to facilitate the considerable number who go home to lunch, or "breakfast," as it is called in Havana, while in the late afternoon and early evening a much larger peak is felt. The average weekly traffic curve shows the highest point on Sunday, descending daily until Friday, which is usually the lowest point on the curve, and then rising abruptly on Saturday. The average monthly curve, which, of course, reproduces the weekly curves, finds the highest points on the Sunday nearest the first of the month, and then the succeeding weekly curves descend quite regularly to the end of the month. The yearly curve, taking into account the different number of days in the various months, shows a small peak in December with another lesser peak in July and August. The deepest depression is usually in September and October, the hurricane months. Neither the peaks nor the valleys, however, are very marked, the curve being quite flat with a constantly rising tendency toward the end of the year due primarily to the natural increase in travel.

The traffic movement in Havana is the subject of constant



Havana Electric Railway—Electric Automobile Tower Wagon

study, in which the data gathered by the inspectors are very helpful. A great number of schedules have been worked out to fit almost every condition. The superintendent of traffic notifies the dispatchers daily of the schedule which is to go into effect. Special events have special schedules. Thus, long in advance of carnival, which usually lasts throughout Lent, a complete set of schedules is figured out with reference to the style and duration of the daily carnival entertainments. On All Souls' Day and All Saints' Day, Nov. 1 and 2, when all Havana visits its only cemetery, the service receives a good test. The ordinary service past the cemetery averages 30 cars per hour, but on the two days mentioned the service increases to a maximum of 120 cars per hour for a number of hours. Baseball is a very popular game in Havana and crowds of 12,000 are not unusual. The grounds are on the Principe line, near the terminus, and on such occasions the crowds freely



Havana Electric Railway—Observation Car

violate the municipal regulation limiting the total number of passengers to 40 (32 seated and 8 on the rear platform). In checking up the conductors when handling such crowds, the register inspector counts the number of passengers on the car before it gets away from the grounds and the conductor certifies to the count by his punch on the inspector's report.

Rates of fare are 5 cents in United States currency or 7 cents in Spanish silver. On the cars which leave the termini after midnight and until 4:30 a. m. the fare is doubled. The rates of exchange of Spanish silver to American gold fluctuate nowadays from 1.10 to 1.15, but during the first intervention, when the concession was granted, it was 1.40. Many passenfers to-day pay in Spanish silver and the difference is kept by the conductors, who make all returns in United States coin.

Havana people are so accustomed to traffic conditions engendered by the narrow streets that accidents because of the cars are relatively very few. The laws hold the drivers of the vehicles responsible, so that when a car and a wagon come into collision the motorman and the driver dismount and after a wordy argument the cart driver usually, in the minor cases, pays the motorman an amount to cover the damages to the car. This the motorman turns into the company. Of course the majority of the cases go to the courts.

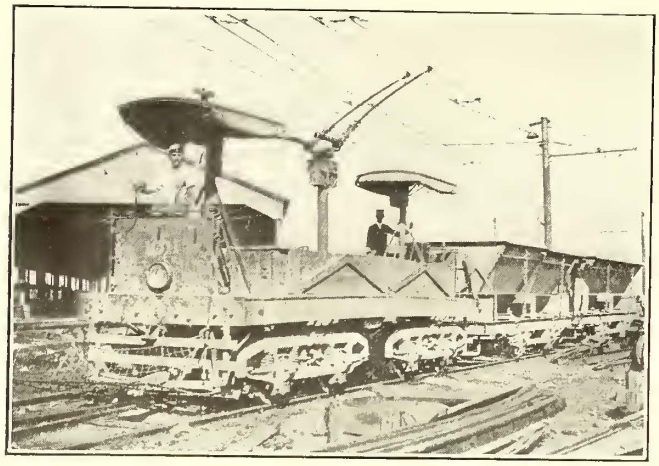
The freight traffic of the company until lately was handled mostly by the Insular Railway. Standard freight cars of the other roads are taken and returned by the Insular motors at the junction of the Insular tracks and the Havana Central Railroad tracks in Marianao. The commodities handled are mostly cement from a large cement factory on the Insular Railway and broken stone from a quarry on the Havana Central Railroad. Recently, however, the Havana Electric Railway Company entered into contract with the contractors for the paving of Havana to haul some 400,000 tons of paving materials. For this purpose the steel side-dumping cars are proving very useful.

STAGE LINES

The company owns some 1500 mules and 180 stages with which it operates a stage service in the city and into the surrounding country. Some of the routes supplement to some extent the car lines, but for the most part they serve districts not reached by the cars. Dispatching depots are used similar to the street-car method. The stage lines well serve the purpose of determining the traffic possibilities of new territory and of helping to keep a good hold on the transportation situation of the city and suburbs.

The stages are of two sizes and seat from 10 to 14 passengers. Two, three and four-mule teams, depending on the distance and route, are used to haul the stages. The mules are mostly the small, tough, sturdy Mexican burro.

Fares range from 3 cents up in Spanish silver, which is worth from 10 per cent to 15 per cent less than United States currency. The method of insuring proper returns is unique. Each route has a certain fixed earning value per trip, and

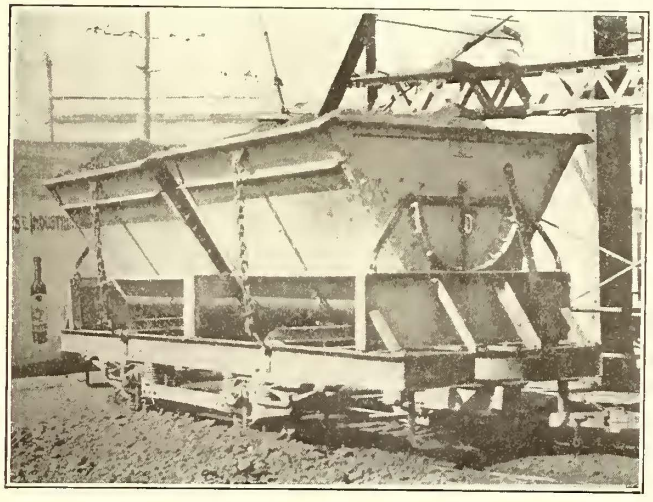


Havana Electric Railway—Locomotive and Dump Cars

this varies with the weather, the day of the month and the period of the year. The driver is required to turn in to his dispatcher at the end of each day as a minimum an amount of money which corresponds to the number of trips he has made and is based on the above. Needless to say more than the minimum is not often turned in. Nevertheless the arrangement has worked out satisfactorily to the men and the company. The drivers are paid regularly at the rate of $35 United States currency per month.

GENERAL

The offices of the company are in the upper floor of the Vedado carhouse and shops structure. They are commodious, well ventilated, well lighted and well equipped. They include the administrative offices, the traffic offices, the accounting department, the legal and the engineering departments. Except for the recent selection of the turbine and electrical machinery,



Havana Electric Railway—Steel Side Dumping Car

which was made in the Cleveland office of the president of the company, all the engineering and the purchases have been conducted from Havana.

In the same structure is the stores department. Owing to the time required in making and receiving foreign purchases a very large stock of material is necessarily carried. A card system of records with continuous inventory and a schedule of minimum stock to be carried makes this department a rather smooth-working institution. Owing to the competition of the European manufacturers, materials and supplies can be purchased at prices much lower than those usually quoted in the States. Nevertheless, the Cuban protective duties bring up the ultimate costs to figures much higher than those enjoyed by the companies in the States.

Havana, besides being the cleanest, is one of the most orderly cities in the world, the police records showing a remarkably low percentage of crime. Perhaps the fear or respect that the strong arm of the old Spanish monarchical authority instilled in the Cuban mind is partly responsible, but it is more likely due to the natural courtesy and orderliness of the people. Intoxication among the Latins is almost unknown; and it must be regretfully admitted that the only drunken persons seen are Americans or other Anglo-Saxons.

The 1750 employees of the Havana Electric Railway Company are recruited almost all from the ranks of the Cubans and the Spaniards, the latter in small minority. They well exemplify the attractive traits in their countrymen. To quote from one of the published guides to Havana:

"Conductors in Havana street cars are invariably courteous. 'Step lively!' and 'Forward, please!' are expressions omitted from their vocabulary. Formerly every one of them on receiving a fare made the little gesture of thanks usual in Cuba—a quick movement of the hand toward the passenger, sometimes accompanied by the spoken word 'gracias.' Unfortunately Havana is growing too Americanized to retain all her Latin politeness, but there are still some conductors who observe the pleasing formality. If all seats are occupied it is customary to inform ladies who desire to board the car of that fact. If one nevertheless persists in doing so, some gentleman will invariably give her his place. Most conductors speak at least a little English. All of them will do their utmost to understand a passenger's Spanish."

Motormen and conductors are uniformed in very light-colored neat linen suits and linen caps; the inspectors wear white drill suits and caps. All make a very attractive appearance and it is seldom necessary to discipline them for lack of neatness.

An interesting feature in the disciplining of the employees is the jury system which has been in effect since October, 1907. Two of the oldest and most reliable employees are selected by the management to act on this jury for four months each. Usually they are a conductor and a motorman. They hear the majority of the minor cases and pass judgment upon the offenders. A schedule establishes the discipline to be visited upon the latter. This system has worked out very well, the judgments of the jury having proved to be scarcely without exception very fair-minded and equitable.

An employees' benefit society fostered and encouraged by the company claims over 1000 employees in its membership. This has done valuable work, not only in the usual relief in cases of illness or death, but also to rescue the men from the hands of the usurers who formerly exploited them.

OFFICERS

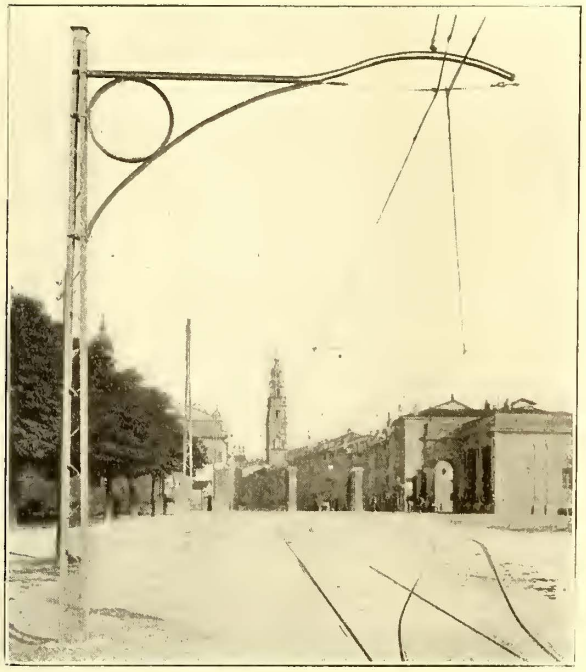
The officers of the company are: Warren Bicknell, of Cleveland, Ohio, president; D. T. Davis, of New York, first vice-president; Frank Steinhart, of Havana, second vice-president and general manager; Antonio San Miguel, of Havana, third vice-president; C. W. Ricker, of Havana, chief engineer; H. Kraemer, of New York, treasurer.

ALPHABETICAL LIST OF EXPENSE ITEMS

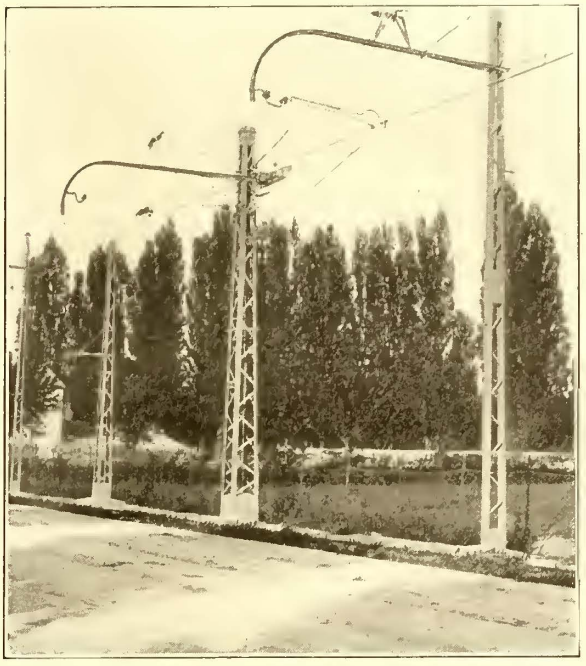
Walter Shroyer, secretary and treasurer Central Electric Accounting Conference, has sent circular letters to electric railways calling attention to the fact that the second edition of the alphabetical list of items of expense in the operation of electric railways, published by the conference, will be exhausted soon and that in all probability another edition will not be printed. Orders for copies should be placed at once with Mr. Shroyer, who is the auditor of the Indiana Union Traction Company, Anderson, Ind. The cost is $1 for three copies.

PARMA SINGLE-PHASE RAILWAY

The provincial government of Parma, Italy, has been operating since May, 1910, a single-phase railway system, consisting of 14.5 km (9 miles) of city track and 39 km (24.2 miles) of suburban track. A preliminary article on the equipment of this line was published in the ELECTRIC RAILWAY JOURNAL for Nov. 20, 1909, on page 1061. The following additional particulars



Parma Single-Phase Railway—Lattice Pole and Curved Bracket Construction in the City



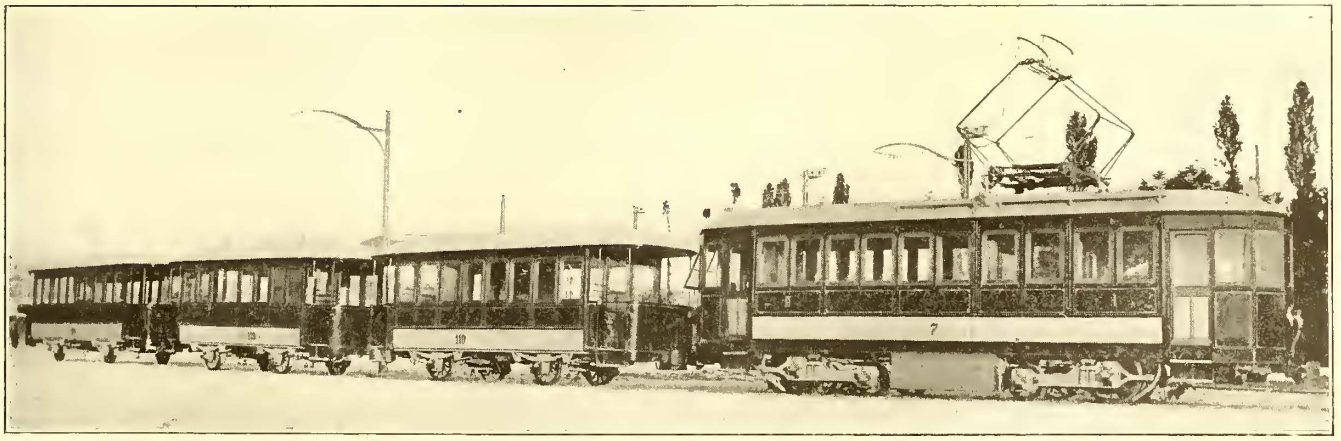
Parma Single-Phase Railway—Bracket on Second Pole from Left to Trip Collector, from 400-Volts to 4000-Volts

are based on an article by Arnold Derrer in a recent number of the *Elektrische Kraftbetriebe und Bahnen.*

The track construction consists of grooved rails weighing 42 kg per meter (84 lb. per yard) in the city and of T-rails weighing 21 kg per meter (42 lb. per yard) in the suburbs. The average clearance between the trolley line and the head of the rails on the suburban section was specified at 6 m (19 ft. 8 in.) but in one case it is as low as 4.1 m (13 ft. 5 in.). The most severe grade on the suburban section is 3½ per cent and on the city section 4.6 per cent. The sharpest curve is of 40 m (131 ft. 4 in.) radius. The maximum operating speed is 40 km an hour (24.8 m.p.h.).

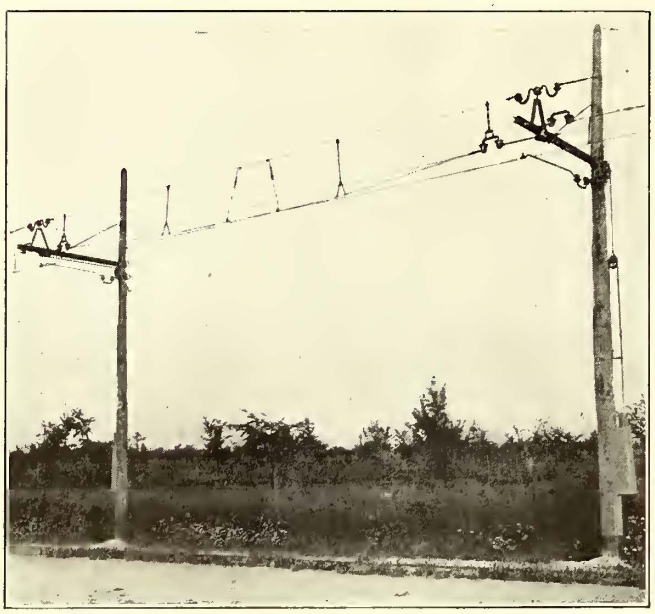
The suburban line construction consists of the Siemens-Schuckert double catenary design with automatic tension take-up devices. The poles on this section are set 64 m (210 ft.) apart with the main or upper catenary having a sag of 1.5 m (4 ft. 11 in.). The auxiliary catenary is suspended from the main catenary at intervals of 16 m (52 ft. 6 in.) and the contact wire in turn is carried at intervals of 8 m (26 ft. 3 in.) from the auxiliary catenary. The copper contact wire is kept at a tension of 300 kg (660 lb.) by automatic counterweights placed every 1500 m (4925 ft.).

The poles on the suburban sections are of chestnut. In the city limits lattice-steel and tubular poles are used in addition to rosettes on houses. All metal in the line is connected to the running rails by a galvanized iron wire. These running rails are grounded every 1500 m (4925 ft.) to buried plates which are immersed in water. Double porcelain insulators are used throughout to insulate the line from the ground. In back of every station there is set a line-breaker which is bridged by a shunt circuit and horn-type switch. The horn switches are operated from the ground with insulated rods. Lightning protection devices are installed on the line at all stopping places. Some arresters are of the ordinary horn type and are placed in circuit between the trolley and ground; others are narrow-gap horn arresters which are connected to the trolley circuit, through a resistance. Each station is illuminated with 110-volt current from a 1-kva transformer.



Parma Single-Phase Railway—A Standard Train of One Motor Car and Three Trailers Operated Within the City of Parma, Italy

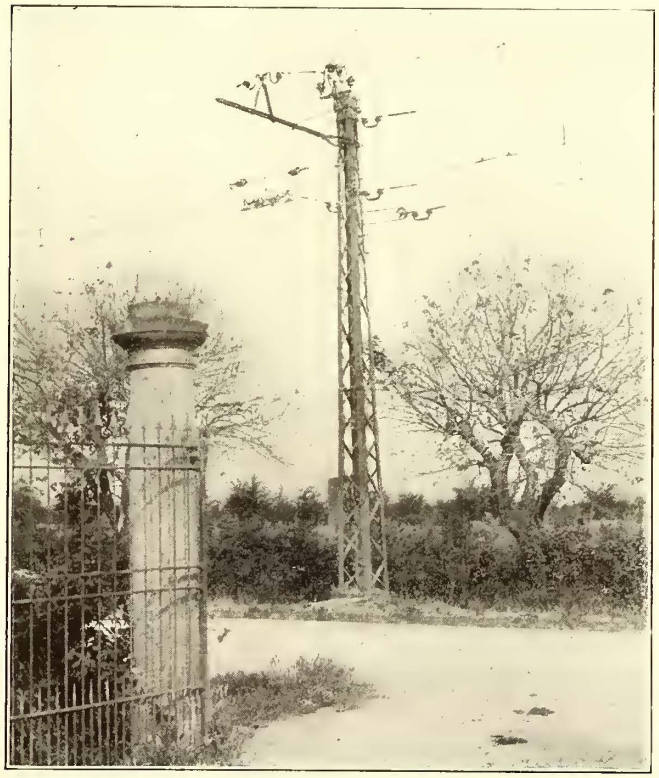
The transition from the 4000-volt single-phase suburban potential to the 400-volt, single-phase city potential is effected through the medium of a dead running piece 16 m (52 ft. 8 in.) long which is placed between two 4000-volt circuit breakers. The middle of the dead section has a tripping piece which



Parma Single-Phase Railway—Automatic Tension Take-Up Weights on the Poles

effects the change-over of the car circuits. It is at this place also that the catenary construction is replaced by the ordinary form of line suspension.

The rolling stock for the suburban lines consists of ten



Parma Single-Phase Railway—Line Circuit Breaker at Gajano

motor cars, each car having a total of twenty-eight seats in two compartments and one freight compartment. Each platform has standing room for ten passengers. There are also eleven trailers, one having twenty-four seats, four with twenty-eight seats and six with thirty-six seats. There are also eighteen freight trailers. A standard train consists of one motor car and three trailers. The trucks are of the Boeker maximum traction type with 900-mm (35.4-in.) driving wheels and 600-mm (23.6-in.) ponies. The motor cars are 11.42 m (37 ft. 5 in.) long over the buffers.

Each motor car carries two 70-hp motors, a transformer motor compressor, reverser, oil and hand switches, safety devices, electric heaters, etc. All high-tension devices are placed in a separate chamber which cannot be opened until the pantograph collector has been lowered. The pantograph collectors are furnished with two contact pieces; the collector is maintained under tension against the trolley in such wise that it will sink as soon as the air is cut off. All cars are equipped with hand and air brakes.

Means are provided whereby the motorman himself carries out the necessary switching operations in passing from the high-tension to the low-tension setion, but, in any event, damage will be prevented by safety devices which will prevent high-tension current from getting into the low-tension circuits. Human operation is desirable because otherwise the brushing of a passing vehicle as high as the roof of a car could operate the lever which changes the pantograph collector from the high-tension to the low-tension circuit connections. The automatic operation of this roof lever serves for the change from low tension to high tension.

The controller differs from the ordinary d.c. type in that each one has two separate groups of contactors and magnetic blow-outs for the step control and the accompanying interruptions of the circuit. The transformers have taps for the following potentials: 183 volts, 217 volts, 250 volts, 284 volts, 317 volts and 350 volts.

The motors are of the six-pole type with compensated armature winding and auxiliary excitation. A separate exciter winding is installed for each direction of running. The latter feature does not involve extra copper because the exciter circuits also help in equalizing the armature reaction. The compensating winding tends to suppress brush sparking.

All of the electrical and mechanical equipment was furnished by the Italian Siemens-Schuckert Company.

ELECTRIFICATION OF SWISS RAILWAYS

The Swiss Federal Railways, which some time ago decided to introduce electric traction on all their lines, are gradually obtaining concessions for the necessary water-power. They have already acquired several in the region of the Simplon, in the cantons of Uri and Ticino, and elsewhere, and now have concluded an agreement with the authorities of the canton of Valais. By this agreement they obtain the right to utilize the power of the waters of the Rhône between Fiesch and Mörel. On the Gotthard line about 10 miles of water conduits have been built between Arolla and Bellinzona, preparatory to the electrification of this line from Lucerne to Chiasso. It is calculated that between 25,000 hp and 30,000 hp will be obtainable from these works alone. The concessions for utilizing the water-power on both sides of the Gotthard Pass, in the cantons of Uri and Ticino, have also been secured. It is estimated that when the Valais works are ready the minimum yield of power will be 15,500 hp.

CAR WIRING METHODS IN DENVER

The Denver City Tramway is revising its car wiring methods. The main cable is now being carried above the car floor at the side of the car in wood boxing, compounded on the inside, and cars being cleaned by compressed air to avoid the penetration of moisture. All cables in the future will be of individual flame-proofed wires and the covering on the entire cable will also be flame-proofed. Where the leads to motor and resistances pass under the car framing they are supported on porcelain or composition insulators and the bottom of the car framing is protected by sheet iron.

The connection board under the car is provided with as-

bestos wood facing and barriers and is backed by sheet metal. The rheostats have sheet metal protection. Light and heater circuit wiring is of "slow-burning" wire except that in the light wiring overhead ordinary rubber-covered wire is used with a special grooved hard-wood molding with grooves spaced so as to take strap hangers, receptacles and molding supporting screws, the molding being run down the center of cars and backed by the maple ceiling board. There are no wire joints in this molding.

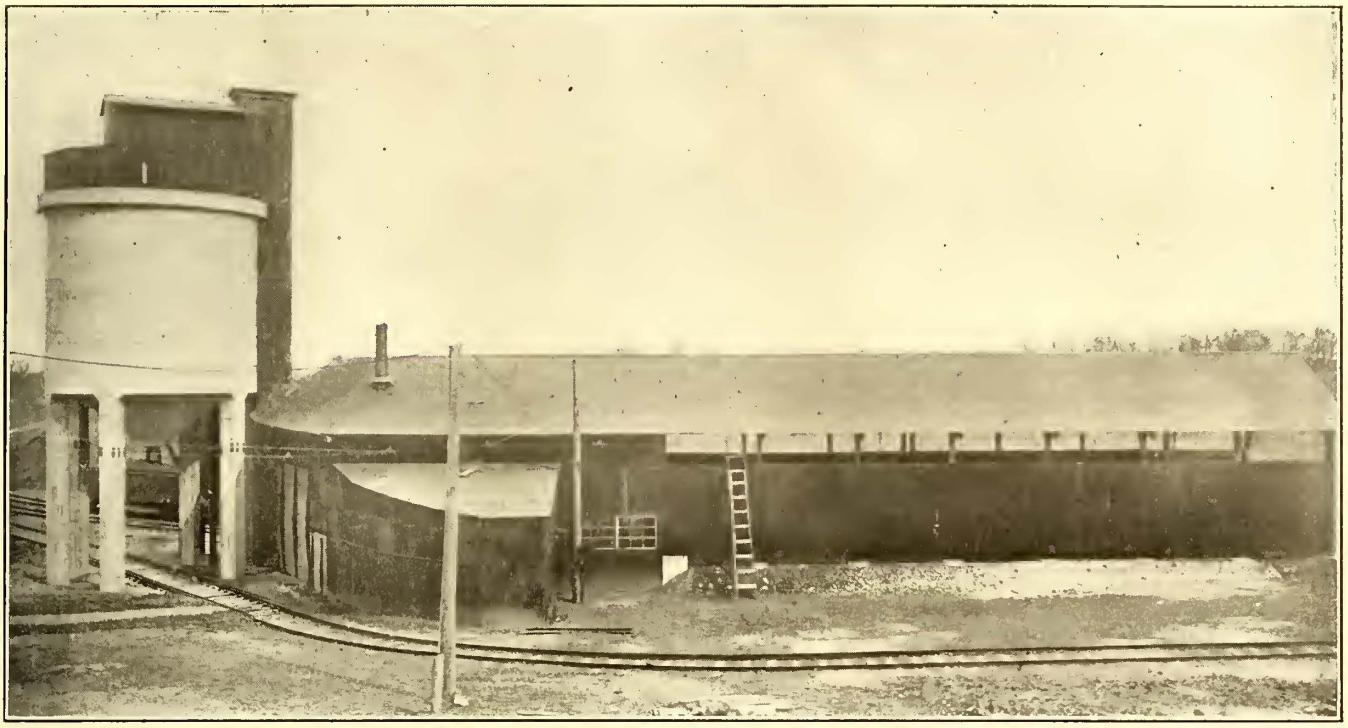
The light and heater circuit fuses are mounted on asbestos wood panels on the front platforms, where, owing to design of cars, they are inaccessible to the general public. In other portions of car wiring, where necessary, flexible tubing protection is used.

This improvement in car wiring was largely brought about by the desire to eliminate all possible fire hazards from the new sprinklered storage car house just constructed at Thirteenth and Arapahoe Streets.

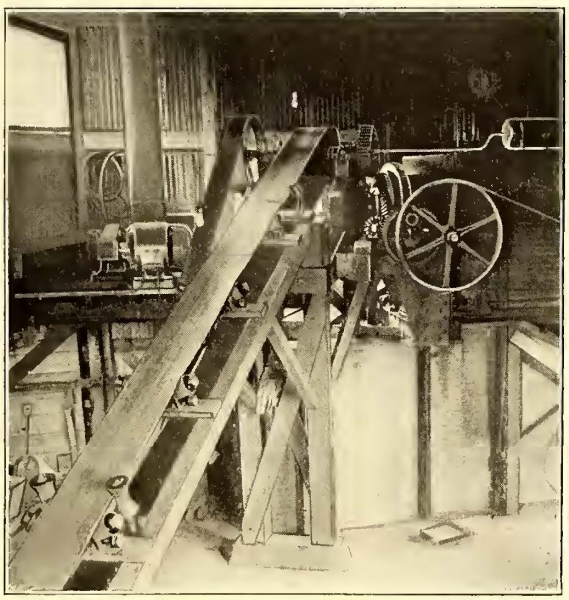
NEW SAND-DRYING PLANT AT ST. LOUIS

The United Railways Company of St. Louis has just completed the construction of the sand-drying plant which is shown in the accompanying engravings. The company uses about 6000 cu. yd. of sand, corresponding to about 162,000 cu. ft., per year. During the winter, at the period of maximum demand, about 1200 cu. ft. per day is required. The sand is Mississippi River bar sand and contains, when it arrives at the plant, about 5 per cent of moisture and quite a large proportion of gravel.

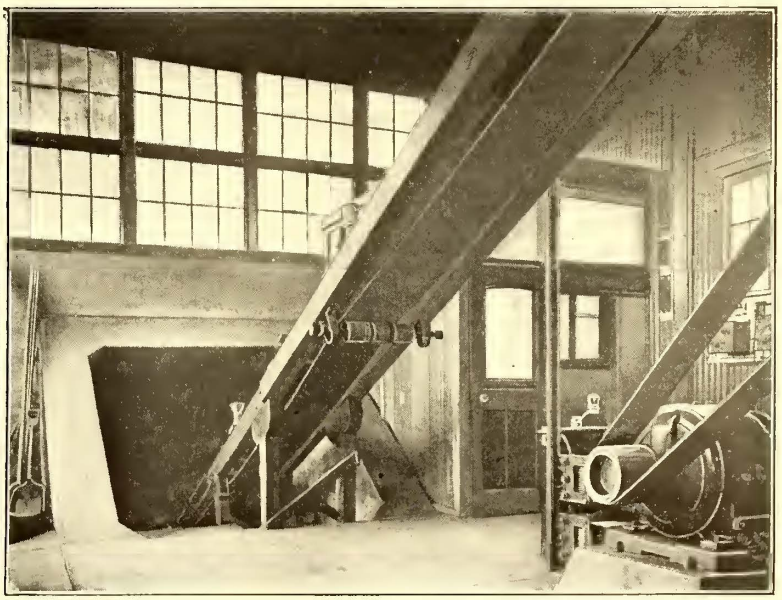
The course of the sand at the dryer can be followed from the cross-section of the sand-drying plant published on the next page. It will be seen that the wet sand is dumped by gravity from the steam railroad cars directly into a concrete wet sand pit. An apron conveyor takes this wet sand from the bottom of the storage pit and dumps it onto a belt conveyor which travels at a speed of 300 ft. per minute and discharges the sand into a rotary dryer. The dryer turns at a speed of 10 r.p.m. and



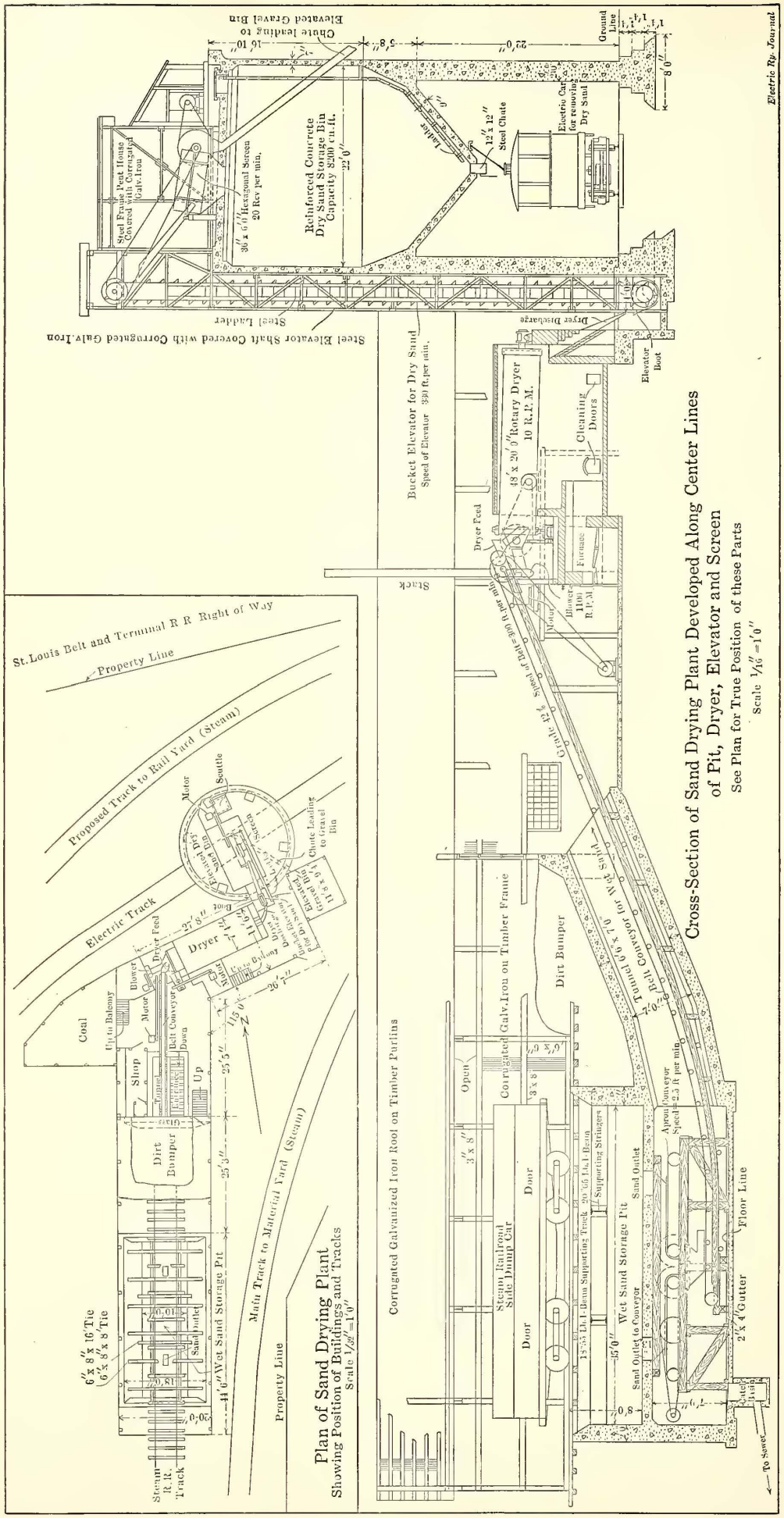
St. Louis Sand-Drying Plant—Exterior View



Feeding End of Rotary Dryer



Belt Conveyor Leading to Wet Sand Pit



is heated by the gases from a furnace. These gases travel, first, underneath the steel dryer, and then through openings in the dryer to its front end, where they are exhausted into the air through a stack by means of an exhaust fan. The hot dry sand after passing through the rotary dryer falls into a bucket elevator which conveys it to a rotating screen in the top of a circular reinforced concrete dry sand storage bin. From this rotating screen the dry sand falls directly into the storage bin, while the gravel passes into a chute leading to a gravel bin. The capacity of the dry sand storage bin in 8200 cu. ft., or almost seven days' supply. The dry sand is taken directly from the hopper of the storage bin into cars which distribute it to dry sand bins in the various carhouses.

The plant is automatic as far as possible and is operated by two men, who unload the steam cars, fire the furnace, watch the various moving parts to see that they are properly oiled and also keep the place clean and in good order. The entire cost of this plant was about $15,000.

A recent test of this plant demonstrated that when using sand with 5 per cent moisture the capacity of the dryer was 1420 cu. ft. of sand per ten-hour day. This corresponded to a capacity of 142 cu. ft., or 7.1 tons, per hour. A still later test proved that the capacity of the plant with sand containing 3½ per cent moisture was 11 tons per hour. The cost of labor and coal for drying sand in this plant has been found to be 0.6 of a cent per cubic foot. The cost of labor and coal by the former method of drying sand in stoves was 2.11 cents per cubic foot. The cost of sand itself delivered at the plant is 1.72 cents per cubic foot. The cost of the dry sand ready for use, including the cost of sand, cost of labor and coal, and 12 per cent on the investment, for interest, depreciation and taxes, is 3.36 cents per cubic foot.

The Somerset Traction Company, Skowhegan, Maine, is improving Lakewood Park between Skowhegan and Madison, Maine. The park will open on June 19.

ELECTRICAL FEATURES OF THE NEW YORK TUNNEL EXTENSION OF THE PENNSYLVANIA RAILROAD *

BY GEORGE GIBBS, CHIEF ENGINEER ELECTRIC TRACTION PENNSYLVANIA RAILROAD

The writer in his capacity as chief engineer of electric traction and terminal construction for the Pennsylvania Railroad had charge of the design and construction of the terminal station building on Manhattan Island and all of the details of electrical equipment in the tunnel and approaches and in the station proper. The total length of the New York tunnel extension from the Manhattan transfer, east of Newark, N. J., to the east end of Sunnyside yard, on Long Island, is 13.31 miles. The total length of the main and yard tracks is 94.52 miles, all of which have been equipped for electric operation.

Regular train service of the Long Island Railroad in and out of the new terminal station was begun on Sept. 8, 1910, and the Pennsylvania Railroad train service was begun on Nov. 27, 1910. The initial service of the Long Island Railroad consisted of 200 trains in and out each day, and the Pennsylvania Railroad started with 150 trains in and out each day. The summer schedules for 1911 will require 200 trains on the Pennsylvania Railroad and 250 trains on the Long Island Railroad. All of the Pennsylvania Railroad trains are handled in and out of the station by electric locomotives, of which thirty-three are in service. The Long Island trains are made up of multiple-unit cars. The maximum capacity of all the approach tunnels under the rivers is estimated at 156 trains per hour, and sufficient track room has been provided in the station to accommodate this number of trains with an allowance for standing and switching of from five to twenty minutes.

TUNNELS

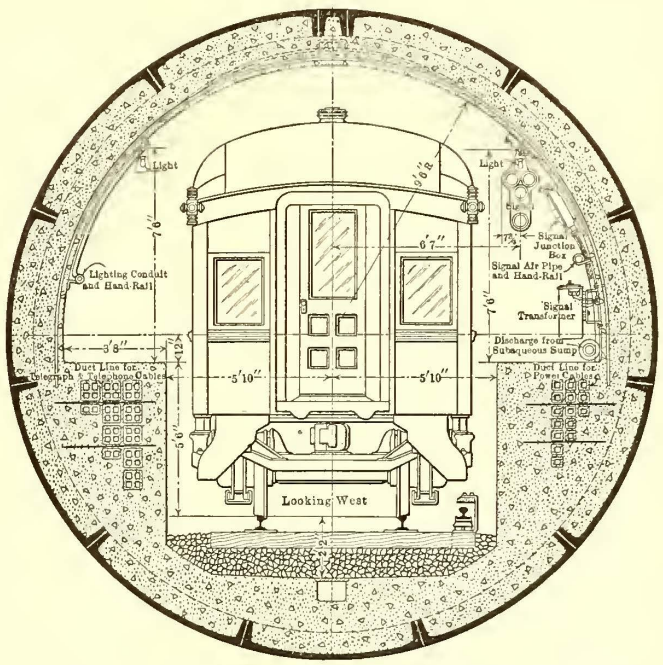
The total length of the single-track tunnels is 15.54 miles. The tubes under the rivers have a total length of 12.02 miles. They are 19 ft. inside diameter, which provides a minimum clearance from the car roof to the crown of 1 ft. 9 in. This provides for the possible use of an overhead electric conductor for traction should developments in the art require it at a later date. A cross-section of one of the river tunnels showing the car clearance and the location of signals, ducts, etc., is reproduced.

Satisfactory ventilation for the tunnels was considered to be of great importance. Two general conditions were provided for: first, purity of the air in normal operation, and, second, requisite ventilation for an indefinite period in case of stoppage of trains in the tunnel from accident or other cause. It was thought, and afterward verified by trial, that the piston action of the trains when in motion would be an effective means of changing the air, as each tube contains only one track, and is isolated from the adjoining tube and open at each end to the free air. A special ventilating system, therefore, is needed only to provide air to a stalled train in an emergency, or to dissipate smoke and fumes from an electric arc, the possibility of which conditions was thought of sufficient importance to warrant the installation of a very extensive forced-draft ventilating plant. It was determined that the air in the cars should not be allowed to contain more than eight parts of carbon dioxide per 10,000, requiring 30 cu. ft. of fresh air per minute to each passenger. To insure this quantity of fresh air in the cars it was thought advisable to furnish more, namely, 50 cu. ft. per passenger per minute in the tunnels, and the fan equipment was designed to meet this requirement, having due regard to emergency conditions and the occasional irregular spacing of trains. The quantity of air required per section of tunnel on this basis is about 60,000 cu. ft. per minute, which will completely change the contents of the tubes three times per hour.

For producing the requisite ventilation by pressure a forced-draft system was adopted in which a constant and uniform current of air is induced in the tunnel by forcing, in the direction of the traffic, the required volume of air into the portal. A divided nozzle, in the form of a tapering flue, is placed on each benchwall for this purpose. The arrangement of tunnels and shaft openings required in all fourteen sets of ventilating apparatus at different points, with a total capacity of 1,119,000 cu. ft. per minute. In two cases exhausting instead of pressure blowers were used; these are for the purpose of causing a return current of air at the west ends of the crosstown tunnels, where they merge into three-track tunnels approaching the passenger station, the object being to prevent blowing air from the tunnels under and into the station building.

The blowers are of the multi-vane "Sirocco" type, belt-driven from induction-type electric motors, and the speed of the fan can be adjusted by cone pulleys from normal to 70 per cent or 40 per cent of normal, as required.

From tests made in the tunnels, with and without the fans running, it is apparent that, under normal conditions, the piston action of the trains can be relied on to give satisfactory ventilation. Records show that in the East River tunnels the air is changed every forty minutes by the passage of trains



Pennsylvania Tunnel—Cross-Section Showing the Location of Signals

during non-rush hours, and every fifteen minutes during rush hours.

The average velocity of the air in the East River tunnels due to the action of the fans alone is about 8 m.p.h. This is increased by the passage of trains to more than 30 m.p.h., the latter figure, of course, depending on the number of cars in the train and the speed. It is evident, therefore, that in regular operation the fans need not be run, and provision has been made to start and stop them, as required, from two central points, the power house for the East River tunnels and the service plant for the North River tunnels.

TUNNEL-ALARM SYSTEM

The tunnels are equipped with a special safety device which has two functions, one to cut off the current in a given section of the third-rail and the other to send a fire-alarm call. The system consists of a series of alarm boxes, set about 800 ft. apart. Each box is numbered and contains two levers, colored blue and red respectively. The blue lever is marked "Power," and when pulled trips the circuit breakers controlling the third-rail section adjacent to the box, thus cutting off the power and at the same time sending a call of two rounds of the alarm-box number. The red lever is marked "Fire," and when pulled performs the same function as the power lever, but sends in two additional rounds of the box number.

*Abstracted from a paper entitled "The New York Tunnel Extension of the Pennsylvania Railroad. Station Construction, Road, Track, Yard Equipment, Electric Traction and Locomotives," to be presented before the American Society of Civil Engineers, Oct. 18, 1911, and printed in the *Proceedings* for May, 1911, page 636.

In case of a partial short-circuit on a car or at the third-rail, which may maintain an arc, or in case it is desired to work around defective apparatus under a standing train, the current may be cut off from the third-rail of the section by pulling the "Power" lever. In case of a serious fire or other emergency the "Fire" lever may be pulled, and then the railroad fire department at the station and the emergency crews will respond.

TRACK

The track standards adopted were in general those of the Pennsylvania Railroad. In the tunnel it was desired to adapt the track to high-speed running, with a minimum of vibration of the track or tunnel structure, and to reduce noise as far as practicable; also to permit of ease of renewal without disturbance of the tunnel concrete lining. For these reasons it was decided to adopt ballasted track rather than any special form built into the tunnel structure.

The rail is 100 lb. per yard and is of the new "Pennsylvania" section and of open-hearth steel. The joint angle-bars are of the six-hole type, with an extended flange below the rail base. The base has also a special cross-section providing space for copper bonds between rail and splice. The ties are of black gum and yellow pine, creosoted, the minimum dimensions being 8 in. face, 7 in. thick and 18 ties to the rail length of 33 ft. All track is tie-plated with special rolled-steel plates 7 in. x 13 in. and ⅝ in. thick. Under each plate is placed a pad of compressed hair-felt ½ in. thick, the tie being tapped out to receive the pad. The rail is secured to the tie through the plate by two 1-in. lag-screws, each bearing on the rail flange and shoulder of the plate. The ballast is of trap rock screened through 1½-in. mesh and laid for a depth of 12 in. under the ties.

CONCRETE-BASE TRACK

For the track under the station building and adjacent to the passenger platforms it was desired to provide a form of construction which would present a smooth surface and could readily be kept clean. This was especially desirable where cars stand and drip oil and water on the track structure, and at places where rubbish may be thrown on the tracks by passengers. In general, the concrete surface was laid on the rock of the sub-grade, but in places where the sub-grade consisted of loose rock back-filling, crossed by drains and subways, it was necessary to secure uniformity for the concrete base by specially ramming the filling and using rod reinforcement or bridging in the concrete.

The track was first laid complete with its fastenings to the tie-blocks, and then raised and leveled with great care to the proper grade and alignment by hanging the structure from a timber bridging carried on the station platforms; the concrete mixture was then poured, tamped and allowed to set; then the bridging was removed. The cost of this track complete under the special conditions obtaining in this place was $6.27 per linear foot for the base and $2.67 per linear foot for the tie-blocks and fastenings, making a total cost of $8.94 per linear foot.

Each fifth tie in the ballasted track is used at one end as a seat for the third-rail insulator and for the bracket to support its covering; therefore, they were longer than the standard ties, or 9 ft. 3 in. All frogs and switches are according to the Pennsylvania Railroad standards. In the station yard all frogs and crossings have hardened manganese steel points.

ELECTRIC POWER SYSTEM

The electric power requirements include power for traction and for auxiliary purposes, including signals, lighting the station, tunnels and yards, the operation of motors for various purposes about the station and for the ventilation and drainage of the tunnels and yard; also, for secondary purposes, in charging car batteries as well as batteries for the telephone and telegraph system and baggage trucks.

Pennsylvania Tunnel—View in Terminal Station Yard

As the use of a tunnel entrance into New York City was predicated upon the use of electric traction, a statement of the conditions to be met and of the investigations leading up to the determination of a proper system and a description of its general characteristics will be of interest. In 1902, when the terminal work was commenced, there were few practical examples of heavy electric traction in existence, and none of the magnitude and complexity of the proposed terminal operation. As it was realized that much experimental work would be necessary to perfect the details, a complete program to this end was laid out some years in advance of the time when the actual installation of apparatus would be required.

Electrification of a portion of the Long Island Railroad was begun as a separate matter at about the same time, the system adopted being the so-called "third-rail" or "direct-current." This system was practically the only one in a sufficiently ad-

vanced state of development to warrant its adoption for heavy work at the date in question. The single-phase, alternating-current system was offered later as a possible advance in the art and was adopted on important work, notably the New York, New Haven & Hartford Railroad from its New York connection to Stamford, Conn. This development, therefore, demanded an investigation of the relative merits of the two systems for the New York terminal, and to this end a systematic plan was formulated for investigating the practical behavior of the two systems, and, in order to try out certain features of the single-phase system in its application to the tunnel conditions, an experimental line 5 miles in length was constructed on a branch of the Long Island Railroad. On this line an equivalent of a tunnel section was installed and equipped with a high-tension overhead conductor, various contact devices designed for sparkless collection of current were tried, and a multiple-unit motor-car equipment and a special type of a.c. locomotive were tested. The test car and locomotive, as well as much other apparatus, were kindly supplied by the Westinghouse Electric & Manufacturing Company.

The results of the tests cannot be given here in detail, but they were reassuring in some respects and disappointing in others. In the main they demonstrated the need of considerable further experimental work to adapt the system to the tunnel and yard conditions. The final recommendation was for the adoption of the direct-current system, interchangeable with that used on the Long Island Railroad, for the following main and important reasons:

First, reliability, from the start; second, freedom from complication in interchange with the Long Island traction system and the Newark rapid transit line through the Hudson & Manhattan tubes into Church Street, New York, and third, less expenditure involved at present and for some time to come. The above reasons, it should be remembered, apply only to this special installation. No broad generalization is intended for other traction projects, where local conditions must govern.

LOAD CONDITIONS

The load conditions include both traction and auxiliary power, and, in case of traction power, the requirements for the Long Island Railroad. Considering all these requirements, the load center was at a point adjoining the railway lines in Long Island City and not far from the water front of the East River. It was first proposed to establish two power houses, each to relay the other, under which plan the location of one house would fall on the New York side of the Hudson River and the other at a point not far from Jamaica. Neither of these locations was altogether suitable on account of difficulty in procuring the site in the first mentioned place and the absence of water for condensing purposes in the other. Furthermore, it was found that in dividing the load between two plants the call on neither one would be sufficient to give reasonable economy in operation; the relaying feature, therefore, of the two power houses, in the case of the disablement of one of them, was the only important point in favor of such a plan. Experience has shown that a properly designed plant, provided with suitable safeguards against a general breakdown from an accident to a part of the machinery, and with duplicate cable connections to the outside, can be depended on to furnish an uninterrupted supply of power, except for very infrequent and short interruptions, in which cases power supply can be restored in less time than it would take to obtain full relief from a second plant, especially where both are only of moderate size. Furthermore, in a great electric traction center such as the city of New York it is possible to establish emergency connections with other power plants. In view of these considerations, therefore, it was determined to establish only one power house for present operation and to equip it to supply power for both traction and auxiliary purposes.

EMERGENCY SUPPLY OF POWER

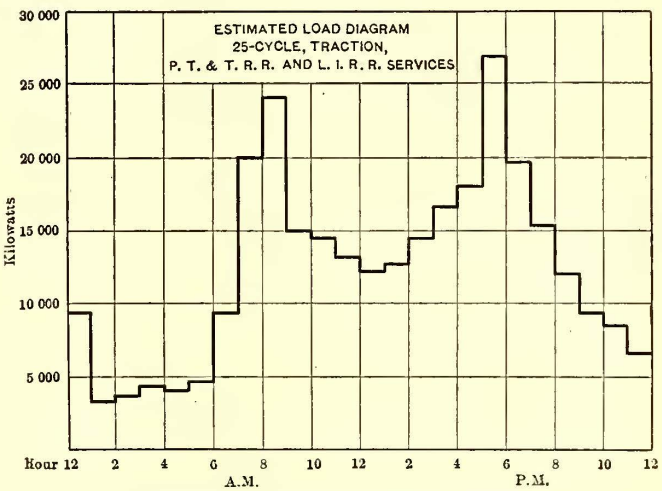
For an emergency supply of power for traction it has been arranged to connect the general traction system at three different points with the power plants of three companies, namely, the Public Service Corporation in New Jersey, the Hudson & Manhattan Railroad Company in New York and the New York & Queens County Railway in Long Island City.

As an emergency supply for auxiliary power purposes the service plant adjoining the terminal station is equipped with generating apparatus capable of supplying all the auxiliary power required for the entire system. The combined traction load conditions are shown in the accompanying curve, and the central power plant has been designed to care for these loads with sufficient reserve for ordinary emergencies and a limited amount of spare capacity in the building for growth of traffic; but it has not been designed to take care of a general extension of the electric traction system to other Pennsylvania lines. When such extensions are made additions can be made to the present power house building, or, preferably, a new power house can be erected on the New Jersey side.

LONG ISLAND CITY POWER HOUSE

The Long Island City power house is on the East River, in Long Island City, a location nearly central to the present load conditions, close to the tunnel lines, and requiring only short cable connections to the tunnels and thence over the terminal division.

The building of this plant was undertaken some years prior to the completion of the tunnel system in order to care for the electrified lines of the Long Island Railroad into Brooklyn, following the completion of the Atlantic Avenue improvement of that road, and power from it for this operation has been furnished since 1905. Recently additional equipment has been added for the tunnel operation.



Pennsylvania Tunnel—Load Diagram

The present equipment consists of thirty-two boilers, each of 564 hp, sixteen on each floor, of Babcock & Wilcox water-tube type, built for a working pressure of 200 lb. per square inch and fitted with superheaters for 150 deg. of superheat and mechanical stokers. At the rear of the boilers are placed the economizers, one for each two batteries of boilers. Westinghouse-Parsons steam turbines drive directly the three-phase, a.c., 11,000-volt, 25-cycle, revolving-field generators. The equipment initially installed to operate the Long Island Railroad traction system consisted of three units of 5500 kw each at 750 r.p.m. To care for the increase of load from the terminal operation, two units were recently added. These are double-flow turbines, direct-coupled to 11,000-volt, three-phase generators of 8000-kw capacity at 750 r.p.m. Two 3000-kw turbo-generators of the same type, generating three-phase current at 11,000 volts and 60 cycles, have been provided for auxiliary power purposes. These units relay similar units in the Thirty-first Street service plant and are used either for emergency or in summer when exhaust steam from the latter plant is not needed for heating the station building. There is space in the present building for an additional unit of 8000 kw, with the necessary boilers and accessories.

TRANSMISSION

The transmission of electrical energy from the power house is entirely 11,000-volt, three-phase, alternating current, the trac-

tion power being 25-cycle and the auxiliary power 60-cycle. The distribution of all power is by three-conductor, paper-insulated, lead-covered cables, drawn into the conduits between the switchboards and the shafts communicating to the tunnels.

Four power cables run from the power-house direct to service plant substation No. 2; three additional power cables run direct from the power house to substation No. 3 at the Hackensack portals, New Jersey, and two extension cables connect substations Nos. 2 and 3. At substation No. 3 these feeders leave the house in three three-phase open-wire circuits on the steel pole line, crossing the Meadows and terminating at substation No. 4 at Harrison. All these 25-cycle feeders are of 250,000 circ. mils section per conductor.

Power for the Long Island Railroad is supplied in a similar manner through seven high-tension cables laid in the conduit system to an arrester-house at the west end of Sunnyside yard, from which open circuits are continued, through suitable lightning arresters, overhead on a steel pole line through the yard and thence to various substations on the Long Island electric traction system.

To provide for the contingency of an extension of the traction system on the New Jersey side beyond Newark, or for tie lines to a future power house, space has been provided on the pole line for additional circuits suitably spaced for 33,000-volt transmission. In the event of such requirement it is intended to provide step-up transformers in the Hackensack portal substation and a 33-000-volt line westward therefrom.

Auxiliary power (60 cycles) is transmitted from the power house through the tunnels to the service plant in a similar way by four cables, two of these going to the service plant direct and two to the tunnel shafthouses for tunnel lighting and miscellaneous power. The two cables to the service plant have conductors of No. 00 B. & S. section and those to the tunnel shafthouses have conductors of No. 4 B. & S. section.

As there are four tunnels under the East River, the 25-cycle and 60-cycle cables are subdivided into groups and distributed through the tunnels so that there is a duplication of routes, as well as cables, for all service Between the power house and the shafts the conduit lines are divided into two groups with separate manholes, in each of which approximately half of the cables of each type are run. Similarly, the cables for the Long Island transmission are kept entirely distinct from those of the tunnel operation.

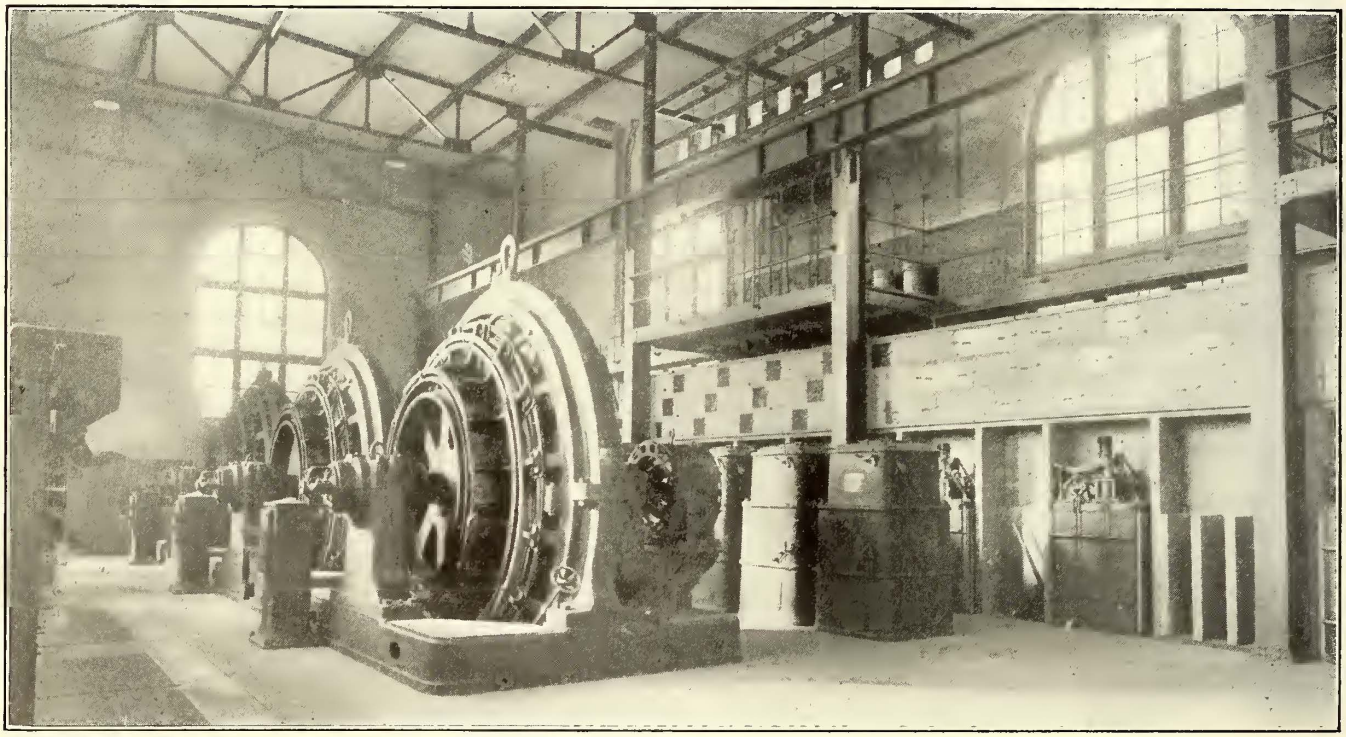
Furthermore, in providing cables for various purposes, by the above arrangement each substation has three or more traction power cables, two of which are ample to carry the load, and the auxiliary power cables are in duplicate; thus there is a margin of from 30 per cent to 50 per cent in the capacity of the cables to provide against breakdown.

At splicing chambers in the duct system, and where the cables are exposed in the substations, the lead sheathings of the cables are connected and grounded at intervals for protection against electrolysis.

TRACTION SUBSTATIONS

There are four traction substations for the terminal division and their locations have been fixed with reference to the loading requirements and by certain physical conditions along the line.

No. 1 has been placed in the power house and supplies the East River tunnel lines, Sunnyside yard and the Long Island tracks through the yard to a point where the load is taken by the first substation of the latter road. This location secures economy in first cost and operation of the direct-current supply for this section. No. 2, in the service plant, adjoins the main yard and is centrally located for movements in the yard, the East River and North River tunnels. No. 3 is at the Hackensack portals, because of the desirability of having the power supply near the tunnel grades, and in order to permit of changing from underground cables to overhead line construction at the first point where such a change was permissible; it obviates separate provisions for housing switching apparatus and for lightning protection at a point between substations. No. 4 is at the junction of the Terminal and the New York divisions, making it available for supplying power not only to the Terminal division, but for the rapid transit line between Newark and Jersey City, in connection with the Hudson & Manhattan Railroad tunnels to Church Street, Manhattan.



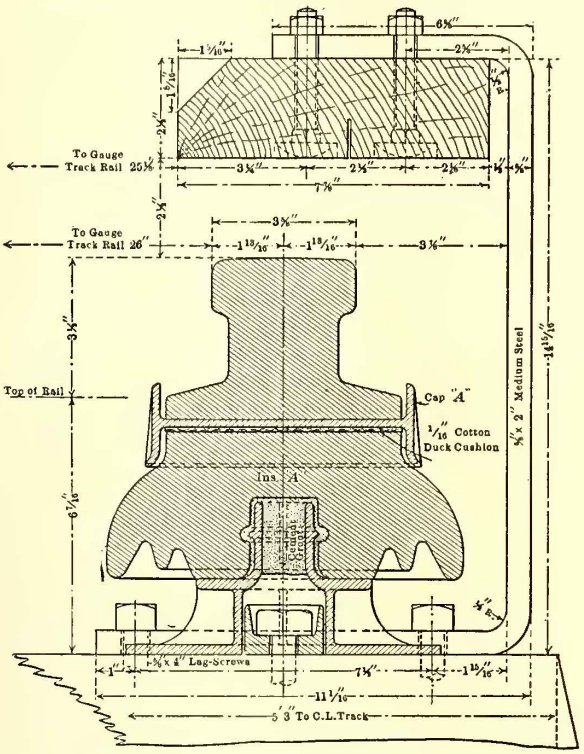
Pennsylvania Tunnel—Harrison Substation

In each of the substations there are installed high-tension switching apparatus, step-down transformers of the air-blast type and three 2000-kw rotary converters for converting the alternating current into direct current for traction purposes; also the necessary low-tension switching apparatus for controlling the out-going direct current to the various third-rail feeders. The normal direct-current voltage is 650, and the machines are designed with special reference to the fluctuating nature of the traction load and will operate up to 200 per cent

overload. Two of the rotaries in each substation will carry the load on that substation, the third being in reserve, and space is provided in the buildings for an additional machine when required.

SWITCHING STATIONS

Intermediate between the traction substations are located switching stations, in chambers built in the tunnel system, and in small buildings adjacent to the line in the open. These stations are not provided with attendants; they contain switches



Pennsylvania Tunnel—Section of Third-Rail and Protection for Tunnel Sections

for sectionalizing and cross-connecting the direct-current third-rail system. With two exceptions the stations are equipped for the remote control of switches and circuit-breakers, and are operated from the nearest traction substation by special control circuits. The two which are provided with hand-controlled switches are at or near signal cabins and are operated by the signalmen.

DISTRIBUTION AND CONTROL

In general the direct-current traction feeder circuits consist only of the third-rail and track return, with short cable connections between the substations and the third-rails and tracks, these being sufficient to carry the currents without excessive losses. The only exception is between substations Nos. 3 and 4, where the distance is such that it is necessary to supplement the third-rail and track return by a positive and negative feeder; these are each of 2,000,000 circ. mil section and are carried on the high-tension pole line. The return feeder is continuous between substations, with a connection to each track at each automatic signal. The positive feeder is omitted between switching stations.

It is necessary, in order to avoid undue current loss or excessive first cost, to connect all substations in parallel through the third-rail, and to interconnect the third-rails of the two tracks at intermediate points between substations. An accident, such as the grounding of the third-rail, under these conditions, however, would ordinarily affect the entire section of line; in order, therefore, to secure the advantages of the interconnected system and at the same time to permit of ready isolation of any section of track without interfering with operation on the adjacent tracks, a system of sectionalizing was installed. To do this the switching stations above referred to have been provided, in addition to the normal switching apparatus in the substations, and the connections at the switching stations are such that by remote control the operator in any substation has complete control of each section of track between that substation and the nearest switching station. The circuit-breakers are also automatic at both points, so that on overload or short-circuit the section affected is cut out only between the substation and the nearest switching station and on one track only.

To restore the section after the overload, the operator closes a switch in the substation, and this, through the remote-control circuit, actuates the switch in the switching station. At the hand-operated switching stations the switches are closed by the signalmen on receiving instructions from the substations.

At the yards a complete system of sectionalizing is also provided. This is necessary because of the multiplicity of tracks and the necessity for isolating a limited section only, which may be affected by the accident. In the station yard the tracks are divided into twenty-one sections and these are planned so that an accident on any section will not interfere with through movements on the main tracks, and will not isolate an undue portion of the station tracks. The station yard sectionalizing is effected by switches in the service plant substation and under the control of the operator there. Similarly, the third-rails of the Sunnyside yard tracks are divided into seven sections, controlled in the yard switching station.

In addition to the provisions for sectionalizing and cross-connecting the third-rails, as above described, this rail in each tunnel is subdivided into sections, each about 1500 ft. in length, by quick-break knife switches. These are located approximately at each of the signals, and where the signals are far apart they are placed half way between. They are normally closed, but may be opened in emergencies, such as wreck or derailment, or the grounding of the third-rail, so as to localize the trouble and allow trains not immediately within this section to be operated out of the tunnel and also to allow electric wrecking trains to be operated close to the point of derailment to assist in clearing up the wreck, or to haul stalled equipment from the tunnels.

In connection with the subdivision of the third-rail into sections controlled from substations and switching stations, provisions have been made to prevent a train from running on a dead section of third-rail. To do this the rail is sectioned at certain of the automatic signals and a relay is provided, with connections to the third-rail and to the signal, to which the circuits are arranged so that when the rail is dead the signal indication will be "Stop," and at the same time a gong will ring at the signal to notify the motorman, when he brings his train to a stop, that he is not to proceed. Where the sections occur at interlockings the indication is given to the operator in the signal cabin.

THIRD-RAIL AND TRACK RETURN

The terminal operation, as elsewhere explained, required through service with the existing traction system of the Long Island Railroad, comprising more than 100 miles of electrified track. The top-contact type of third-rail is in use on the Long Island Railroad and has been found satisfactory, the cost of maintenance being very low, and it has the important advantage of simplicity of parts, flexibility, ease of maintenance and installation, and is easily repaired in cases of derailment. Third-rail location and clearances have been standardized by the American Railway Association, and, as a matter of course, the Long Island and the Terminal Railroad installations have been made to conform therewith.

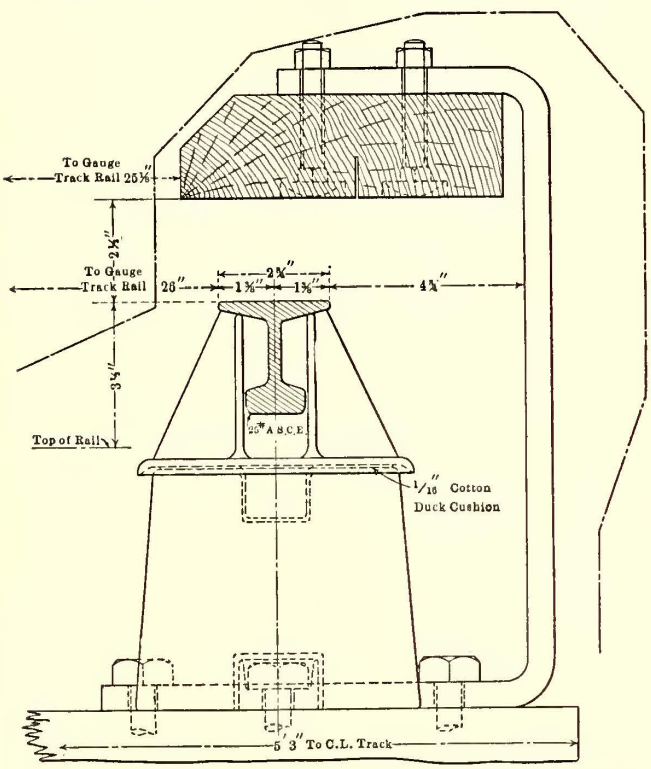
On account of the very heavy currents used for individual trains and the density of traffic it is necessary to have large current-carrying capacity and conductivity in the collector system. The capacity is in part fixed by the distance between the feeding points, and the required conductivity may be provided either by a light third-rail supplemented by copper feeders or a rail of large cross-section and special composition, which in most cases would require no supplemental feeders. The latter arrangement was adopted as being more economical in first cost and of greater simplicity. The rail section used on the main-line tracks is the heaviest yet adopted for traction pur-

poses, being 150 lb. per yard and of special chemical composition, low in carbon and other hardeners, giving a resistance of about eight times that of copper, instead of about twelve times, as in the ordinary track rail.

The rail is a tee section having a vertical height of 4 in. and a lower flange width of 6 in., making a section which allows for ample insulation from the track ties and is stable against overturning; it also provides for a simple form of splice and convenient bonding at the joints. In the yards, where the large section is not needed for conductivity, and where it is desirable to have the maximum of clearance for signal and other apparatus along the track, the section consists of 25-lb. standard Bessemer tee-rail mounted in an inverted position, the foot of the rail constituting the contact surface.

Experience on the Long Island Railroad and elsewhere with various type of insulators has resulted in the adoption by the Terminal Railroad of a simple and substantial form of insulating block for supporting the third-rail. These blocks are of porcelain, made by the "dry" process, which gives a very tough and mechanically strong insulator, with ample and permanent insulating qualities. For the open sections of the road a simple rectangular block with rounded corners is used; in the tunnels, where in places there is dampness due to condensation or salt seepage water, a petticoat-type insulator is used which furnishes a more extended surface to provide against leakage of current.

The heavy-section rail is bonded with ribbon type, compressed-terminal foot bonds, four to a joint, having a conductivity equivalent to 80 per cent of that of the third-rail. The light-section rails for the yards are bonded with the pro-



Pennsylvania Tunnel—Section of Third-Rail and Protection for Yard Tracks

tected-type, pin-terminal cable bonds. The third-rails throughout are protected by a continuous plank carried on wrought-iron brackets secured to the third-rail ties. On the open line this plank is of yellow pine, but in the tunnel Jarrah wood, imported from Australia, has been used because of its slow-burning qualities.

The connections to the third-rail from substations and switching stations are made by insulated cables of 2,000,000 circ. mil section for the heavy rail and 1,000,000 circ. mil for the light rail. The cables terminate in special porcelain "pot-heads" from which flexible cables are connected to the third-rail by bond terminals.

Throughout the main tracks both rails of each track are bonded; in the yards, however, only one rail is bonded. In the open, where there is danger of theft of copper, the bonds are of the protected type, placed under the joint angle-bars; in the tunnels and terminal yard, from which the public is excluded, long cable bonds are run around the angle-bars. All bonds are of wire cable, provided with forged copper terminals, and are secured in drilled holes in the rails by steel pins driven through the center of the heads. As a matter of interest, it will be noted that there was great difficulty in drilling the open-hearth steel rails for these connections. It was found that tools suitable for Bessemer rails would drill only from two to four holes in the open-hearth rails; therefore special steels had to be used for the drill bits.

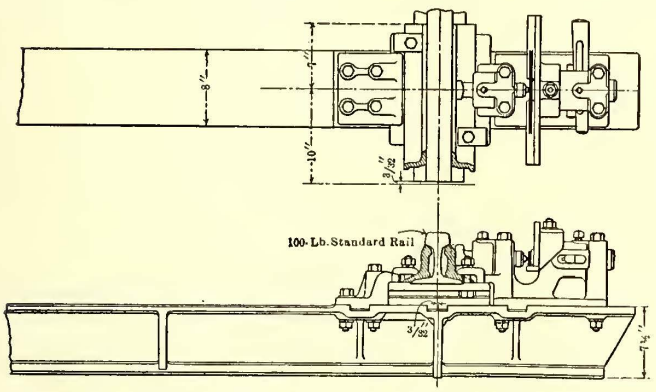
ELECTRIC LOCOMOTIVES

Quite independently of the general character of the traction system, it was felt that considerable experimental investigation was needed to decide on the type of electric locomotive suitable for handling heavy main-line trains. Therefore a special locomotive committee was appointed to investigate existing designs and develop, by experiment or otherwise, a suitable locomotive for the exacting conditions of the proposed service. As a result of the work of this committee two locomotives were designed and built at Altoona in 1905. These locomotives were designed for a maximum speed of about 45 m.p.h. on a level, with a normal train, as at that time it was intended to confine the terminal electric operation to the haul through the tunnels from the west portal at Bergen Hill, N. J., to the yard at Long Island City. Practically all this portion of the line is on heavy grades and over a short distance only, and a slow speed would conduce to economy and would not be prohibitive as to time consumed. Subsequently it was determined to extend the terminal run to Harrison, N. J., on the west, and possibly to Jamaica on the east, involving level stretches of about 10 miles at each end. Hence it became necessary to adapt the locomotives to the higher speed conditions normally obtaining in main-line operation. Accordingly, the two locomotives under test were modified electrically to permit of a maximum speed of about 65 m.p.h. Tests with these machines had demonstrated their hauling power and successful operation at the slow speed for which they were originally designed, but when speeded up it was found that they became quite destructive to track. At speeds greater than 45 m.p.h. they developed a tendency to rhythmic side swaying and the production of excessive lateral pressures at the rail heads. Such peculiarities in steam locomotives with low-hung boilers, of course, were not altogether unknown to railway engineers, but they are intensified in an electric locomotive, where the power is applied with extreme compactness and where a convenient method of motor attachment concentrates great weight around the axles; also where it is not only possible but generally most convenient to utilize all weight for adhesion.

TESTS ON WEST JERSEY & SEASHORE RAILROAD.

In order to bring out more fully the elements of design as affecting tracking, it was determined to institute a series of road tests, recording as far as practicable the comparative lateral rail pressures at various speeds with various types of steam and electric locomotives. A special recording apparatus for the purpose was devised and placed in a stretch of tangent track on the electrified portion of the West Jersey & Seashore Railroad. A complete series of tests was made, and from the information obtained the mechanical characteristics of the design of the locomotive to be built for tunnel operation were determined. During 1910 this test apparatus was again installed, this time in a section of the Terminal division track, and the new locomotives were tested thereon to check their actual with their expected performance. The test was made over a length of 165 ft. of special track carried on cast-steel ties having chairs near their ends for holding the rails. The chairs rest on rollers on seats in the ties and allow for free lateral motion outward of the rails, except as restrained by the pressure-registering device on each tie. This device is in the form of a plug carried in a guide on the chair-seat casting;

other it carries a hardened steel ball which is placed in contact with a strip of plate steel. Proper adjustment for gage is made before each run by wedges between the plugs and rails. Any side pressure at the rail from the wheel flanges of a locomotive moving over the track causes the steel balls to press into and indent the steel-plate strips. The diameter of the impression, when measured by a micrometer microscope, indicates the magnitude of the side pressure, the location of the maxima and the tendency of the locomotive to "nose" or oscillate. Typical samples of the records obtained along this track section are reproduced, one showing a normal record from a steam locomotive of the Atlantic type, another from the original design of electric locomotive and a third from the adopted type of electric locomotive. The tests were conducted



Pennsylvania Tunnel—Special Track Tie and Registering Device for Locomotive Tests

to show the free-running characteristics of the locomotives at speeds as high as 94.6 m.p.h. with a steam locomotive and 86 m.p.h. with an electric locomotive.

To test the pressure of individual wheels on curves, especially as affecting behavior in taking switches and turn-outs in yards, a hydraulic apparatus devised by George L. Fowler was used. With this device the side pressure of each wheel flange is measured by connecting a short section of one rail through a system of levers to a hydraulic cylinder and its pressure-recording device. From experience obtained in the service tests of three different types of electric locomotives and the results of the special track instrument tests it was decided to make quite a radical departure from general practice in the final design of the high-speed locomotives for the terminal equipment. An attempt has been made to pattern the locomotive mechanically on the fundamental characteristics of modern steam locomotive design in the following particulars:

(*a*) High center of gravity of the machine as a whole, and especially of the heavy electric motor portion.

(*b*) The large proportion of the total weight spring-borne and equalized by a system having considerable amplitude of motion.

(*c*) An unsymmetrical distribution of wheel-base of the locomotive.

(*d*) A combination of driving and carrying wheels.

To accomplish these results required an important modification in the customary method of mounting and connecting the electric motors; instead of being placed concentric with or in the plane of the axles, and direct-mounted or geared to them, they are placed on the main frames above the wheels and driving connections are made with rods. The locomotive is double, or articulated, each half being similar to an "American" type or eight-wheeled steam locomotive in the wheel arrangement, frames and running gear. These halves are permanently coupled back to back by a drawbar and equalizing buffer connection.

The maximum weight of train to be hauled by one locomotive under the given conditions was specified as 550 tons trailing load; the actual capacity, however, in intermittent service has approximated 700 tons trailing. The tractive effort per locomotive equals 60,000 lb. for one-half minute and 50,000 lb. for two minutes, or 12,000 lb. at 800 amp, all with full field. One of the conditions was that the locomotive was to start and accelerate a 550-ton train, in addition to the locomotive, on the 1.93 per cent maximum tunnel grade, and with a 550-ton train on level tangent track was to attain a speed of 60 m.p.h.

SIGNALING

The switch and signal system was made unusually complete. The physical conditions surrounding the station yard are exceptional in the following respects:

(*a*) The yard is practically underground, and the view from trains and of the tower operators is obscured by numerous yard structures and building columns.

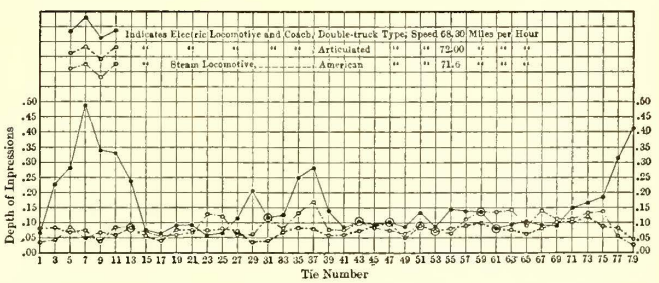
(*b*) Clearances, both overhead and side, between the trains and structures are very limited, and the space available for the installation of signals and apparatus is restricted.

(*c*) The character and extent of the train movements required the realization of the fullest capacity of all track facilities, necessitating the greatest freedom for simultaneous parallel movements.

(*d*) The complexity of the track plans and the presence of yard service facilities, such as the piping system for steam, air and water, drainage and traction conductors and conduits, required that the signal appliances should be mounted on special foundations and that control wiring should be run in permanent and accessible shape in a conduit system.

On account of these conditions it was found necessary to divide the control of the yard movements between four different power-operated switching cabins. These cabins, each controlling only a part of the yard, required a certain amount of interconnection to insure rapid and complete movements in the yard, a result accomplished partly by electric locking between cabins, partly by light indicators on the track models in the cabins, to show how the tracks between them are occupied and when trains are approaching, and partly by central communication by telephone, etc., with the train director.

The tunnels involve train movements over heavy grades, at high speed and at the minimum safe interval, a condition which led to the adoption of automatic block signaling with overlaps of the same length as the block sections; in other words, a two-indication block in which a "proceed" indication requires that two sections shall be unoccupied. "Caution" indication must show that at least as much track is unoccupied as the foregoing. The length of the sections is variable, depending on the



Pennsylvania Tunnel—Diagram of Relative Riding Qualities of Steam and Electric Locomotives

grade and maximum train speed at the point in question, being made 150 per cent of the length in which a stop can be made by the application of the brakes.

At each block in the tunnels a "track stop" is installed to apply the train brakes automatically should a danger signal be overrun. The closest headway at which trains can be run at normal speed, therefore, is the time required to pass over two block sections, corresponding to about two minutes, and at restricted speed under caution signals, one block, or about one and one-half minutes.

"Lock and block" control has been provided between the station and the Long Island approach of the East River tunnels, so that if necessary any one of the four tunnel tracks can be operated in the reverse direction. The North River tunnels have the same provision, with the addition of automatic signals

for following movements. The grades are such that the spacing of signals for reverse movements could not be the same as for movements in the normal direction of traffic, and on account of this there was considerable complication in putting the signals for a certain direction out of commission and those for the opposite direction in, and changing the control of the automatic stops so as to make them effective at the right time.

The Meadows section has been equipped with automatic semaphore block signals without track stops. Complete reverse-movement signaling has been provided for at each block. At the Hackensack River, midway of the section, the drawbridge has been provided with the usual interlocking bridge and signal appliances and the cross-overs between tracks at the east approach to the bridge, so that reverse movements may originate either east or west from this point.

Because of the absence of daylight conditions in the tunnels and in the covered portion of the terminal area the indications are given entirely by lights. This signal contains no mechanism other than that required for changing the colors of stationary lights in such a manner as to reproduce the same colors and combinations as called for by changes in position of a semaphore signal under like conditions in the controlling currents. The signals are cast-iron receptacles carrying colored lenses, behind which are located standard 4-cp incandescent lamps (two in multiple for each lens), and the mechanism consists of relays housed in separate shelters near the signals, the contacts of which are adapted to shift the current from lamp to lamp and thus change the colors displayed as the relays are energized or de-energized by manipulation of the machine levers, or by the action of trains on track circuit, or by both.

Because of the difficulty of obtaining ample clearances and suitable supports for semaphore signals in the yard, and in order to maintain a uniform type of signal within the station area, special hooded lenses and lamps of high candle-power are used in the "lamp" type of signal in these exposed places and are found to give effective indication for the possible range of observance. Elsewhere on the line, outside of the terminal and tunnels, this form of signal would not prove satisfactory because of the higher speeds and longer range of observation required, therefore the semaphore type is used on the open line.

SINGLE-PHASE ELECTRIFICATION IN SOUTHERN FRANCE

In 1908 the Compagnie des Chemins de fer du Midi, the great railroad system of southern France, equipped experimentally a 10-mile section of the branch line between Villefranche, Vernet les Bains and Perpignan with a 4000-volt, 16 2/3-cycle, single-phase line. This installation has proved so satisfactory that an order has now been placed with the French Westinghouse Company for the electrical equipment, except for locomotives, of the 70-mile main line section between Pau and Montrejean, together with intermediate branch lines, comprising in all about 175 miles. The 70 miles between Pau and Montrejean are double track. The trolley voltage will be 12,000 volts and the frequency 16 2/3 cycles. Energy will be transmitted from four hydroelectric stations at 60,000 volts to substations at Pau, Lourdes, Tarbes, Launemezan and Montrejean. The plan is to operate express passenger trains at speeds up to 62 m.p.h. and regular passenger trains at speed up to 40 m.p.h. The main line trains are to be hauled by electric locomotives, but multiple-unit motor cars and trailers will be used on single-track branches.

The type of locomotive to be supplied by the Allgemeine Elektricitäts Gesellschaft was illustrated on page 668 of the Electric Railway Journal for April 9, 1910. There is a leading axle at each end, while the three driving axles are coupled together and are driven from two jackshafts which are coupled in turn to two 800-hp Winter-Eichberg repulsion motors. The total weight of the first locomotive furnished is 85 tons, the weight available for adhesion is 54 tons and the weight per driving axle is 18 tons. The maximum drawbar pull is 27,500 lb. and the speed 47 m.p.h. The motors are supplied from a common transformer which is mounted between them. Regenerative control is installed to return energy to the line on down grades at speeds between 18.5 m.p.h. and 34 m.p.h. The order received by the French Westinghouse Company includes 30 double-truck motor cars each equipped with four 125-hp motors. Each motor car will weigh about 56 tons and is to haul four trailers.

MEETING OF NEW ENGLAND STREET RAILWAY CLUB

The regular monthly meeting of the New England Street Railway Club was held at the American House, Boston, on May 25, with President Franklin Woodman in the chair. At the conclusion of the usual dinner a short address was delivered by Charles C. Peirce, Boston, extending the best wishes of friends to Carl A. Sylvester, general manager of the Boston Suburban Electric Company, who is soon to leave New England to assume executive duties in the organization of the Rio Janeiro Tramway, Light & Power Company. On behalf of assembled friends Mr. Peirce presented Mr. Sylvester with a gold watch and a wardrobe trunk. The recipient responded in happy vein, after which the regular business of the meeting was resumed. Papers were read by Walter M. Denman, consulting engineer, Springfield, Mass., on "Reinforced Concrete Bridges" and by A. A. Hale, engineer Griffin Wheel Company, Boston, Mass., on "Chilled-Iron Wheels and Their Relation to Service Conditions."

REINFORCED CONCRETE BRIDGES

Mr. Denman described the type of reinforced concrete bridge construction designed by Daniel B. Luten, of Indianapolis, Ind. The usual practice is to place one rod near the upper surface of the arch ring to cover the region over the haunches which may carry tension stresses. A second rod is placed over the intrados for the full distance between abutments, although the only part in tension is located under the crown. In order to prevent the upper rod from bursting out of the crown when it buckles in compression many stirrups must be used, tying the upper and lower rods together. This applies only to the earth-filled arch. In the Luten method one rod covers all those points of tension and with less concrete at the crown than by the older method. Nearly 4000 of these arches are now in service. The first bridge of this type had a span of but 6 ft. and a rise of 18 in., the crown thickness being 4 in., with ½-in. rods for reinforcement. A large number of slides of bridges were shown, with comments upon special features of interest in each case. Emphasis was laid upon the use in some cases of an inexpensive bridge rail of concrete, which is molded in sections 4 ft. long during construction and then set in place on the coping. A separately molded hand rail is placed on top and the total cost is about $1 per foot. The longest and highest bridge thus far built by this company's method is that over the Maumee River at Waterville, Ohio, for the Toledo & Western Railway. This is 1200 ft. long and has twelve spans. The filling was accomplished by placing timbers from spandrel to spandrel, laying the rails on the former and delivering material from a ballast train. The bridge has a capacity of 10,000 lb. live load per foot of track and cost $100,000.

Short spans which are half-way between a bridge and a culvert often are the cause of accidents on account of the inadequate attention given to their design. The use of wooden stringers and steel I-beams is objectionable because of the subsequent rusting of the beams, and the practice of embedding I-beams in concrete is unduly costly since the I-beams are in no genuine sense reinforcements, as they must be heavy enough to carry not only the live load but all the dead load of the concrete as well. There has been developed in the Luten truss a reinforcement for spans from 5 ft. to 30 ft. to meet these objections. It is made of steel rods of the sizes best suited to the spans, and is supplied in units ready to place. It is cheaper in first cost and handling than are I-beams and cannot readily be installed incorrectly, as plans are supplied with the units. A view was shown of a bridge having five spans from 70 ft. to 84 ft. long, and a carrying capacity of a train of 75-ton cars run at high speed, the total cost being $18,175. In conclusion, Mr. Denman described the methods of overcoming various difficulties in construction for the Portland & Lewiston Electric Railway. A span

of 15 ft. under fill, cost $1,200; span of 25 ft., $1,600; clear span of 100 ft., $7,250; span of 35 ft. on piles, $2,250.

CHILLED-IRON WHEELS

Mr. Hale stated that the Griffin company has a complete record of over 9,000,000 wheels, showing the serial numbers, date cast, railroad, total mileage and cause of removal, and touched upon the value of such data in manufacturing and selecting wheels for specific service. The practice of some operating companies was criticised on the ground that insufficient attention has been paid to increasing weights and speeds of cars when purchasing wheels. The methods of manufacturing wheels were reviewed, including the use of chemical and physical tests in the factory, selection of test pieces, and the measurement of the depth and range of chill. The marking of wheels to show each 1/16 -in. variation in circumference is now standard practice. In the past few years exhaustive tests have been conducted upon various alloys to obtain a wheel which should be superior in strength and wear to the ordinary chilled wheel. As a result of these tests wheels have been placed on the market which have proved superior in both wearing quality and stability against structural failure. Such wheels are referred to by the Griffin company as the "FCS" type. The combined carbon in all parts of the chilled-iron wheel, except at the flange and tread, is about 0.7 per cent, which is about the same as that of all parts including flange and tread of the steel wheel. The chemical action which takes place when the molten metal comes in contact with the chiller when a wheel is poured increases the combined carbon to about 3½ per cent, thus increasing the hardness.

Mr. Hale referred to the brake test made last year at Purdue University for the M. C. B. Association to establish the relation between the brake friction, the amount of metal worn from the brakeshoe and from the wheel. These showed that the relative resistance to wear exhibited by different shoes is somewhat affected by the severity of the application of a series of shoes; that all shoes wear more rapidly on steel wheels than on cast-iron wheels when tested under like pressure; that shoes which wear greatly below the average are those which cause wear in the wheel, and that all shoes show greater wear per unit of work performed under the higher pressure.

The speaker stated that the economy of the chilled-iron wheel has been thoroughly demonstrated, and that if the capacity and weight of the car when light, the amount of brake pressure and the speed of the car are given the manufacturer chilled-iron wheels can be safely used for all classes of service which now exist. On account of the absence of ductile metal in the tread, the chilled-iron wheel is better suited than any other material for highly concentrated loads. By the use of alloys much can be accomplished along lines hitherto undesirable.

Uniform diameters are of great importance, since a difference of ⅛ in. in circumference of two 32-in. wheels mounted on the same axle on a car making 100 miles per day means a slippage of 636 ft. This tends to cause sharp flange and corrugated rail as well as to increase the power needed to run the car. This is less disastrous in a chilled wheel than in others of a softer material. Mr. Hale showed that off-center boring tends to cause locking of brakeshoes at the high point, with sliding and flat wheels. It is wise to check the jaws of the boring mill frequently, as one jaw is likely to wear out faster than the others. Better work can be done on a four-jaw or five-jaw boring mill. The importance of accurate mounting of wheels on axles was also mentioned and the use of the wheel check gage recommended. All axles should be prick-punched designating the center point. The practice of measuring the distance from the ends of the journals to the front hub when pressing on axles is not always accurate owing to the variation in the lengths of the axles and in the distance through the hubs of the wheels. Greater mileage and better wheel performance would result from giving more attention to the proper fitting of wheels on axles. The maintenance of track gage is also of the utmost importance in connection with the wheel wear. The accumulation of bolts, nuts, etc., in track work is highly objectionable as it tends to produce chipped flanges. An average of from 15,000 miles to 20,000 miles has been obtained at slight cost from old wheels condemned to the scrap pile but reclaimed and mated with care.

At present the custom is too prevalent of scrapping wheels of chilled iron which have become flat in spots. The use of an emery truing brakeshoe is very successful on smaller properties where the wheels can be closely watched and the emery shoes taken out as soon as the flat spots have been removed. It is ordinarily only necessary to grind away 1/64 in. to 1/32 in. of the wearing quality of the wheel in order to eliminate the flat spots. This method is not so efficient in larger systems where it is impossible to keep a close watch of the wheels being ground while in service. Emery truing shoes can be purchased for $7.50 per pair, and from ten pairs to fifteen pairs of wheels can be ground with one pair of shoes.

On large systems the pit grinder has proved economical. By its use an increase of 25 per cent to 40 per cent in wheel mileage has been obtained. Pit grinders can be installed at a cost of from $375 to $1,500. Many companies have built their own grinders. The time required to remove flat spots varies from twenty minutes to forty minutes. The cost of grinding wheels by pit machines consists of the items of actual labor expense, cost of emery wheel, and interest and depreciation on the investment. An average cost is from 40 cents to 60 cents per pair. The Public Service Railway Company of New Jersey will shortly have twelve pit grinders in service. The Rhode Island, Connecticut and Worcester Consolidated companies are also using them with success. When it is necessary to remove the wheels and axles from the trucks and grind them in the old type of grinder the cost is much increased, as the expense alone of removing and replacing a pair of wheels would amount to about 70 cents and to this must be added the cost of grinding.

It has been found that from 15,000 to 25,000 additional miles have been secured after grinding wheels which would have been scrapped otherwise. A pit grinder will pay for itself in a short time. If, upon examining the tread, no evidence of mottled gray iron is found to indicate that the chill is worn through, the question as to depth of chill can be determined by taping or calipering the wheels in order to determine how much of the diameter has been worn away. This can be accurately calculated by keeping a record of the circumferences of the new wheels when put in service. It is safe to assume that a minimum of ¾-in. reduction in diameter can be allowed before the wheels are worn through the chill, and from this up to 1½ in. for the heavier weights of wheels. After inspecting wheels for a short time workmen are able to determine readily whether or not it would pay to grind them.

RECOMMENDATIONS OF COMMITTEE ON CITY RULES

The committee on city rules of the American Electric Railway's Transportation & Traffic Association has just issued a data sheet to all members giving the changes tentatively adopted in the existing code of city rules, also certain additional code rules, a set of carhouse rules, a set of prepayment-car rules and titles for local operating rules for each of these three codes. The proposed changes are being mailed thus early to the membership with the earnest plea that the members read them carefully and reply promptly to the committee whether they favor these amendments, and if not why not. The data sheet states in the case of practically every change the reasons which induced the committee to recommend the change, and after each rule on the data sheet a blank is left where members can say whether they favor the amendment, and, if not, give the reasons for their dissent.

The recommended changes follow in general the wording tentatively adopted at the meeting of the committee in New York on April 14-15, but further consideration by the members of the committee indicated that a few changes should be made, and these changes are incorporated in the data sheet just issued.

REPORT OF COMMITTEE ON OVERHEAD LINE CONSTRUCTION, N. E. L. A.

The National Electric Light Association's committee on overhead-line construction, of which Farley Osgood, Public Service Electric Company, is chairman, presented a report which occupied 195 pages of text. The members of the committee comprise representatives of other associations, among them Prof. A. S. Richey, of Worcester, who represented the American Electric Railway Engineering Association. The report is divided into four sections as follows:

Section No. 1: Specifications covering methods of overhead-line construction for 2300-volt distribution and for street-lighting circuits and specifications for material.

Section No. 2: Specifications covering methods of overhead-line construction for secondary voltages, including pole wiring for street-lighting work.

Section No. 3: Inter-company agreement form and specifications for the joint use of poles by lighting and telephone companies.

Section No. 4: Specifications for overhead crossings of electric light and power lines.

Sections 1, 2 and 3 have previously been submitted to the association in other form but have been revised. Sections 1 and 2 are of particular interest to lighting companies. To section 3 a clause (No. XIX) has been added on railway attachments and is of special interest to railway companies. It is printed below and is followed by Section 4.

CLAUSE RELATING TO THE POSITION OF RAILWAY ATTACHMENTS ON JOINT POLES

"(A) Where poles are jointly used for telephone attachments and attachments of railway feeders, supporting or span wires, supporting brackets and line apparatus used in connection with the overhead construction of electric railways, the attachments shall be made in accordance with the foregoing articles, wherever the same are applicable, excepting as modified by the following paragraphs, which refer specifically to poles jointly used by railway and telephone attachments.

"Double-Pole Line Construction:

"(B) Where the railway construction is of a type in which the trolley wire is supported by spans, attached to two separate lines of poles, and these two lines of poles are to be used for the attachments of the lighting, railway and telephone companies, it is always preferable that the lighting, power and railway lines should be carried on one line of poles, and that the telephone lines should be carried on the other line of poles.,

"Single-Pole Line Construction:

"(C) Where the railway attachments and the telephone attachments are carried on one and the same line of poles the railway feeders and attachments shall occupy a position on the pole below that occupied by the telephone cross-arms. If the poles carry also lighting and power attachments these shall occupy the upper position on the pole and above the telephone attachments, subject to the provisions of Article IV.

"Spans and Brackets:

"(D) Where span wires and brackets for supporting or holding trolley and guard wires are attached to poles jointly used the attachments shall be made as follows:

"The span wires and supporting brackets may be attached to the pole at a height convenient for the railway operation.

"The span wires and brackets may be attached to the pole by bolts passing through the pole.

"Every span wire and bracket supporting trolley wires shall be effectually insulated from the railway potential.

"Feeders:

"(E) The railway feeders on poles jointly used shall be carried on cross-arms located on the pole approximately at the point of attachment of the supporting trolley span or bracket.

"Where telephone attachments are located above such feeders a horizontal distance of not less than 24 in. shall be maintained between the pole pins on the cross-arms carrying the railway feeders.

"Distance to Be Maintained Between Telephone and Railway Lines:

"(F) On poles carrying railway attachments the lowest telephone cross-arm shall be at least 2 ft. above any part of the brackets or span wires supporting the trolley wire, and shall also be above the nearest railway cross-arm by a distance not less than 40 in.

"Railway Switches and Line Apparatus:

"(G) Signal boxes, switches, cut-outs and similar railway apparatus may be installed on the pole at the point necessary for convenient operation, provided that they shall not be installed in such a manner as to interfere with the employees of either company in climbing the pole or to prevent the installation of vertical runs, as described in Articles XII and XIII. When located below telephone lines or attachments they shall be of a type in which all live parts are covered and protected from accidental contact.

"Railway signal-line wires run on jointly used poles, and below telephone attachments shall be installed so as to provide a climbing space through them of not less than 24 in.

"Connecting wires to such railway apparatus run down the pole shall be insulated and shall be attached to the street side of the pole and maintained at a distance of not less than 5 in. from the surface of the pole.

"Telephone Attachments on Standard Short Railway Poles:

"(H) Wherever poles used by the railway company are too low to permit, under the terms of this specification, the attachment thereto by the telephone company of cross-arms for carrying their wires the telephone attachments which may be made shall consist only of twisted pairs or a single telephone cable.

"Where only one such twisted pair is used it may be carried on an insulator on the top of the pole or on a side bracket.

"Where more than one twisted pair is carried along the line of poles the pairs shall be bunched together throughout their length and attached at or near the top of the poles. In no case shall the pairs so carried exceed ten in number.

"Where the telephone cable is attached to such poles it shall not exceed 1½ in. diameter and shall be placed at or near the top of the pole.

"The attachment of twisted pairs or of telephone cables, as above, shall be so made as not to restrict the proper use of the pole by the railway company, and the railway company may use its standard methods of construction in installing its feeders, span wires, brackets, switches and any other appliances on such poles."

SPECIFICATIONS FOR OVERHEAD CROSSINGS FOR ELECTRIC LIGHT AND POWER LINES

These specifications are given in full below. They are followed by five appendices as follows: (A) Wind and ice loads. (B) Tables and curves of conductor sags. (C) Specification for galvanizing for iron and steel. (D) Pole formulas. (E) Drawings of typical crossings.

This report was made as a joint report with the following committees of other associations: The high-tension transmission committee of the American Institute of Electrical Engineers; the committee on power distribution of the American Electric Railway Association; the committee on high-tension wire crossings of the Association of Railway Telegraph Superintendents, and the sub-committee of the committee on electricity of the American Railway Engineering and Maintenance of Way Association. The specifications follow:

"General Requirements

"1. *Scope:* These specifications shall apply to overhead electric light and power line crossings (except trolley contact wires), over railroad right-of-way, tracks or lines of wires; and, further, these specifications shall apply to overhead electric light and power wires of over 5000 volts constant potential, crossing over telephone, telegraph or similar lines.

"2. *Location:* The poles, or towers, supporting the crossing span preferably shall be outside the railroad company's right-of-way.

"3. Unusually long crossing spans shall be avoided wherever practicable.

"4 The poles, or towers, shall be located as far as practicable from inflammable material or structures.

"5. The poles, or towers, supporting the crossing span, and the adjoining span on each side, preferably shall be in a straight line.

"6. The wires, or cables, shall cross over telegraph, telephone and similar wires wherever practicable.

"7. Cradles, or overhead bridges, shall not be used.

"8. *Clearance:* The side clearance shall be not less than 12 ft. from the nearest rail of main-line track, nor less than 6 ft. from the nearest rail of sidings. At loading sidings sufficient space shall be left for a driveway.

"9. The clear headroom shall be not less than 30 ft. above the top of rail under the most unfavorable condition of temperature and loading. For constant potential, direct-current circuits, not exceeding 750 volts, when paralleled by trolley contact wires, the clear headroom need not exceed 25 ft.

"10. The clearance of alternating-current circuits above any existing wires, under the most unfavorable condition of temperature and loading, shall be not less than 8 ft. wherever possible. For constant potential, direct-current circuits, not exceeding 750 volts, the minimum clearance above telegraph, telephone and similar wires may be 2 ft. with insulated wires and 4 ft. with bare wires.

"11. The separation of conductors carrying alternating current, supported by pin insulators, for spans not exceeding 150 ft., shall be not less than:

Line Voltage.	Separation.
Not exceeding 6,600 volts	14½ in.
Exceeding 6,600 but not exceeding 14,000	24 in.
Exceeding 14,000 but not exceeding 27,000	30 in.
Exceeding 27,000 but not exceeding 35,000	36 in.
Exceeding 35,000 but not exceeding 47,000	45 in.
Exceeding 47,000 but not exceeding 70,000	60 in.

For spans exceeding 150 ft. the pin spacing should be increased, depending upon the length of the span and the sag of the conductors.

"Note: This requirement does not apply to wires of the same phase or polarity between which there is no difference of potential.

"With constant-potential, direct-current circuits not exceeding 750 volts, the minimum spacing shall be 10 in.

"12. When supported by insulators of the disk or suspension type the crossing span and the next adjoining spans shall be dead-ended at the poles, or towers, supporting the crossing length of the crossing and adjoining spans generally shall be used as strain insulators.

"13. The clearance in any direction between the conductors nearest the pole, or tower, and the pole, or tower, shall be not less than:

Line Voltage.	Clearances.
Not exceeding 14,000 volts	9 in.
Exceeding 14,000 but not exceeding 27,000	15 in.
Exceeding 27,000 but not exceeding 35,000	18 in.
Exceeding 35,000 but not exceeding 47,000	21 in.
Exceeding 47,000 but not exceeding 70,000	24 in.

"14. *Conductors:* The normal mechanical tension in the conductors generally shall be the same in the crossing span and in the adjoining span on each side, and the difference in length of the crossing and adjoining spans generally shall be not more than 50 per cent of the length of the crossing span.

"15. The conductors shall not be spliced in the crossing span nor in the adjoining span on either side.

"16. The method of supporting the conductors at the poles, or towers, shall be such as to hold the wires, under maximum loading, to the supporting structures in case of shattered insulators or wires broken or burned at an insulator without allowing an amount of slip which would materially reduce the clearance specified in paragraphs No. 9 and No. 10.

"17. *Guys:* Wooden poles supporting the crossing span shall be side-guyed in both directions if practicable, and be head-guyed away from the crossing span. The next adjoining poles shall be head-guyed in both directions. Braces may be used instead of guys.

"18. Strain insulators shall be used in guys from wooden poles carrying any power wire of less than 6600 volts. Strain insulators shall not be used in guying steel structures, nor required on wooden poles carrying wires all of which are 6600 volts or more.

"19. *Clearing:* The space around the poles, or towers, shall be kept free from inflammable material, underbrush and grass.

"20. *Signs:* In the case of railroad crossings, if required by the railroad company, warning signs of an approved design shall be placed on all poles and towers located on the railroad company's right-of-way.

"21. *Grounding:* For voltages over 5000 volts wooden cross-arms if used shall be provided with a grounded metallic plate on top of the arm, which shall be not less than ⅛ in. in thickness and which shall have a sectional area and conductivity not less than that of the line conductor. Metal pins shall be electrically connected to this ground. Metal poles and metal arms on wooden poles shall be grounded.

"22. The electrical conductivity of the ground conductor shall be adjusted to the short-circuit current capacity of the system and shall be not less than that of a No. 4 B. & S. gage copper wire.

"23. *Temperature:* In the computation of stresses and clearances, and in erection, provision shall be made for a variation in temperature from —20 deg. Fahr. to +120 deg. Fahr. A suitable modification in the temperature requirements shall be made for regions in which the above limits would not fairly represent the extreme range of temperature.

"24. *Inspection:* If required by contract, all material and workmanship shall be subject to the inspection of the company crossed; provided that reasonable notice of the intention to make shop inspection shall be given by such company. Defective material shall be rejected, and shall be removed and replaced with suitable material.

"25. On the completion of the work, all falsework, plant and rubbish, incident to the construction, shall be removed promptly and the site left unobstructed and clean.

"26. *Drawings:* If required, by contract, ... complete sets of general and detail drawings shall be furnished for approval before any construction is commenced.

"Loads

"27. The conductors shall be considered as uniformly loaded throughout their length, with a load equal to the resultant of the dead load plus the weight of a layer of ice ½ in. in thickness, and a wind pressure of 8 lb. per square foot on the ice-covered diameter, at a temperature of 0 deg. Fahr.

"28. The weight of ice shall be assumed as 57 lb. per cubic foot (0.033 lb. per cubic inch).

"29. Insulators, pins and conductor attachments shall be designed to withstand, with the designated factor of safety, the tension in the conductors under the maximum loading.

"30. The pole, or towers, shall be designed to withstand, with the designated factor of safety, the combined stresses from their own weight, the wind pressure on the pole, or tower, and the above wire loading on the crossing span and the next adjoining span on each side. The wind pressure on the poles, or towers, shall be assumed at 13 lb. per square foot on the projected area of solid or closed structures, and on one and one-half times the projected area of latticed structures.

"31. The poles, or towers, shall also be designed to withstand the loads specified in paragraph No. 30, combined with the unbalanced tension of:

2 broken wires for poles, or towers, carrying five wires or less
3 broken wires for poles, or towers, carrying six to ten wires
4 broken wires for poles, or towers, carrying eleven or more wires

"32. Cross-arms shall be designed to withstand the loading specified in paragraph No. 30, combined with the unbalanced tension of one wire broken at the pin farthest from the pole.

"33. The poles, or towers, may be permitted a reasonable deflection under the specified loading, provided that such de-

flection does not reduce the clearances specified in paragraph No. 10 more than 25 per cent or produce stresses in excess of those specified in paragraphs Nos. 65 to 69.

"Factors of Safety

"34. The ultimate unit stress divided by the allowable unit stress shall be not less than the following:

Wires and cables	2
Pins	2
Insulators, conductor attachments, guys	3
Wooden poles and cross-arms	6
Structural steel	3
Reinforced concrete poles and cross-arms	4
Fountains	2

NOTE.—The use of treated wooden poles and cross-arms is recommended. The treatment of wooden poles and cross-arms should be by thorough impregnation with preservative by either closed or open-tank process. For poles, except in the case of yellow pine, the treatment need not extend higher than a point 2 ft. above the ground line.

"35. *Insulators:* Insulators for line voltages of less than 9000 shall not flash over at four times the normal working voltage, under a precipitation of water of 1/5 in. per minute, at an inclination of 45 deg. to the axis of the insulator.

"36. Each separate part of a built-up insulator, for line voltages over 9000, shall be subjected to the dry flash-over test of that part for five consecutive minutes.

"37. Each assembled and cemented insulator shall be subjected to its dry flash-over test for five consecutive minutes.

"The dry flash-over test shall be not less than:

Line Voltage.	Test Voltage.
Exceeding 9,000 but not exceeding 14,000	65,000
Exceeding 14,000 but not exceeding 27,000	100,000
Exceeding 27,000 but not exceeding 35,000	125,000
Exceeding 35,000 but not exceeding 47,000	150,000
Exceeding 47,000 but not exceeding 60,000	180,000
Exceeding 60,000	3 times line voltage

Each insulator shall further be so designed that, with excess of potential, failure will first occur by flash-over and not by puncture.

"38. Each assembled insulator shall be subjected to a wet flash-over test, under a precipitation of water of 1/5 in. per minute, at an inclination of 45 deg. to the axis of the insulator.

"The wet flash-over test shall be not less than:

Line Voltage.	Test Voltage.
Exceeding 9,000 but not exceeding 14,000	40,000
Exceeding 14,000 but not exceeding 27,000	60,000
Exceeding 27,000 but not exceeding 35,000	80,000
Exceeding 35,000 but not exceeding 47,000	100,000
Exceeding 47,000 but not exceeding 60,000	120,000
Exceeding 60,000	twice the line voltage

"39. Test voltages above 35,000 volts shall be determined by the A. I. E. E. standard spark-gap method.

"40. Test voltages below 35,000 volts shall be determined by transformer ratio.

"Material

"41. *Conductors:* The conductors shall be of copper, aluminum, or other non-corrodible material, except that in exceptionally long spans, where the required mechanical strength cannot be obtained with the above materials, galvanized or copper-covered steel strand may be used.

"42. For voltages not exceeding 750 volts solid or stranded conductors may be used up to and including 4/0 in size; above 4/0 in size stranded conductors shall be used. For voltages exceeding 750 volts, and not exceeding 5000 volts, solid or stranded conductors may be used up to and including 2/0 in size; above 2/0 in size conductors shall be stranded. For voltages exceeding 5000 volts all conductors shall be stranded. Aluminum conductors for all voltages and sizes shall be stranded.

"The minimum size of conductors shall be as follows:

"No. 6 B. & S. gage copper for voltages up to 5000 volts.

"No. 4 B. & S. gage copper for voltages over 5000 volts.

"No. 1 B. & S. gage aluminum for all voltages.

"43. *Insulators:* Insulators shall be of porcelain for voltages exceeding 5000 volts.

"44. Strain insulators for guys shall have an ultimate strength of not less than twice that of the guy in which placed. Strain insulators shall be so constructed that the guy wires holding the insulator in position will interlock in case of the failure of the insulator.

"Strain insulators for guys shall not flash over at four times the maximum line voltage under a precipitation of water of 1/5 in. per minute at an inclination of 45 deg. to the axis of the insulator.

"45. *Pins:* For voltages of 5000 and over insulator pins shall be of steel, wrought iron, malleable iron or other approved metal or alloy, and shall be galvanized, or otherwise protected from corrosion.

"46. *Guys:* Guys shall be galvanized or copper-covered stranded steel cable, not less than 5/16 in. in diameter, or galvanized rolled rods of equivalent tensile strength.

"47. Guys to the ground shall connect to a galvanized anchor rod, extending at least 1 ft. above the ground level.

"48. The detail of the anchorage shall be definitely shown upon the plans.

"49. *Wooden Poles:* Wooden poles shall be of selected timber, peeled, free from defects which would decrease their strength or durability, not less than 7 in. minimum diameter at the top, and meeting the requirements as specified in paragraphs 17 30, 31 and 34.

"50. *Concrete:* All concrete and concrete material shall be in accordance with the requirements of the report of the joint committee on concrete and reinforced concrete.

"Structural Steel

"51. Structural steel shall be in accordance with the Manufacturers' Standard Specifications.

"52. The design and workmanship shall be strictly in accordance with first-class practice.

"53. The form of the frame shall be such that the stresses may be computed with reasonable accuracy or the strength shall be determined by actual test.

"54. The sections used shall permit inspection, cleaning and painting, and shall be free from pockets in which water or dirt can collect.

"55. The length of a main compression member shall not exceed 180 times its least radius of gyration. The length of a secondary compression member shall not exceed 220 times its least radius of gyration.

"56. The minimum thickness of metal in galvanized structures shall be 1/4 in. for main members and 1/8 in. for secondary members. The minimum thickness of painted material shall be 1/4 in.

"Protective Coatings

"57. All structural steel shall be thoroughly cleaned at the shop and be galvanized, or given one coat of approved paint.

"58. *Painted Material:* All contact surfaces shall be given one (1) coat of paint before assembling.

"All painted structural steel shall be given two (2) field coats of an approved paint.

"The surface of the metal shall be thoroughly cleaned of all dirt, grease, scale, etc., before painting, and no painting shall be done in freezing or rainy weather.

"59. *Galvanized Material:* Galvanized material shall be in accordance with the Specifications for Galvanizing Iron and Steel (Appendix).

"Bolt holes in galvanized material shall be made before galvanizing.

"Foundations

"60. The foundations for steel poles and towers shall be designed to prevent overturning.

"The weight of concrete shall be assumed as 140 lb. per cubic foot. In good ground the weight of "earth" (calculated at 30 deg. from the vertical) shall be assumed as 100 lb. per cubic foot. In swampy ground special measures shall be taken to prevent uplift or depression.

"61. The top of the concrete foundation, or casing, shall be not less than 6 in. above the surface of the ground, nor less than 1 ft. above extreme high water.

"62. When located in swampy ground wooden crossing and next adjoining poles shall be set in barrels of broken stone or gravel, or in broken stone or timber footings.

"63. When located in the sides of banks, or when subject to

washouts, foundations shall be given additional depth, or be protected by cribbing or riprap.

"64. All foundations and pole settings shall be tamped in 6-in. layers while back-filling.

"Working Unit Stresses

"Obtained by dividing the ultimate breaking strength by the factors of safety given in paragraph No. 34.

"65. *Structural Steel:*

Tension (net section)	18,000	lbs. per sq. in.
Shear	14,000	lbs. per sq. in.
Compression	$18{,}000-60\frac{l}{r}$	lbs. per sq. in.

"66. *Rivets, Pins:*

Shear	10,000	lbs. per sq. in.
Bearing	20,000	lbs. per sq. in.
Bending	20,000	lbs. per sq. in.

"67. *Bolts:*

Shear	8,500	lbs. per sq. in.
Bearing	17,000	lbs. per sq. in.
Bending	17,000	lbs. per sq. in.

"68. *Wires and Cables:*

Copper, hard-drawn, solid, B.&S. gauge, 4/0, 3/0, 2/0	25,000 lbs. per sq. in.
Copper, hard-drawn, solid, B.&S. gauge, 1/0	27,500 lbs. per sq. in.
Copper, hard-drawn, solid, B.&S. gauge, No. 1	27,500 lbs. per sq. in.
Copper, hard-drawn, solid, B.&S. gauge, No. 2, 4, 6.	30,000 lbs. per sq. in.
Copper soft-drawn solid, B.&S. gauge	17,000 lbs. per sq. in.
Copper, hard-drawn stranded B.&S.	30,000 lbs. per sq. in.
Copper soft-drawn stranded B.&S.	17,000 lbs. per sq. in.
Aluminum, hard-dr'n stranded B.&S. gauge under 4/0	12,000 lbs. per sq. in
Aluminum, hard-dr'n stranded B.&S. gauge 4/0 and over	11,500 lbs per sq. in

"69. *Untreated Timber:*

	Bending	Compression. $\left(\frac{L}{60D}\right)$
Eastern white cedar	600 lbs. per sq. in.	600 "
Chestnut	850 lbs. per sq. in.	850 "
Washington cedar	850 lbs. per sq. in.	850 "
Idaho cedar	850 lbs per sq. in.	850 "
Port Orford cedar	1150 lbs. per sq. in.	1150 "
Long-leaf yellow pine	1100 lbs. per sq. in.	1100 "
Short-leaf yellow pine	950 lbs per sq. in.	950 "
Douglas fir	1000 lbs. per sq. in.	1000 "
White oak	950 lbs. per sq. in.	950 "
Red cedar	700 lbs. per sq. in.	700 "
Bald cypress (heartwood)	800 lbs. per sq. in.	800 "
Redwood	850 lbs. per sq. in.	850 "
Catalpa	500 lbs. per sq. in.	500 "
Juniper	550 lbs per sq. in.	550 "

L = Length in inches.
D = Least side, or diameter, in inches.

This portion of the report concludes with letters from four companies regarding the specifications for overhead crossings. The Postal Telegraph Cable Company, the Western Union Telegraph Company and the American Telephone & Telegraph Company write that these specifications have received their approval. The fourth letter is from E. H. McHenry, vice-president New York, New Haven & Hartford Railroad, who writes that the report has been received by the committee of the American Railway Association appointed to consider the subject, and, while the committee has not finally acted upon it, it has been favorably received by the committee.

PACIFIC CLAIM AGENTS' ASSOCIATION MEETS

The third annual convention of this association was held in Seattle, Wash., on May 19 and 20 and was well attended. The Seattle Electric Company entertained the members of the association in a very hospitable manner.

The following officers were elected for the ensuing year: President, B. F. Boynton, claim adjuster Portland Railway Light & Power Company, Portland, Ore.; first vice-president, A. M. Lee, district claim agent Northern Pacific Railway Company, Seattle, Wash.; second vice-president, T. A. Cole, claim agent Los Angeles Railway Company, Los Angeles, Cal.; third vice-president, J. M. Hone, claim agent Spokane & Inland Empire Railroad, Spokane, Wash.; secretary-treasurer, Ida P. Newel, chief clerk of claim department Portland Railway Light & Power Company, Portland, Ore. The executive committee consists of the following: Chairman, J. H. Handlon, claim agent United Railroads of San Francisco; Geo. Carson, claim agent Seattle Electric Company; S. A. Bishop, claim agent Pacific Electric Railway Company; T. G. Newman, attorney Whatcom County Railway & Light Company, Bellingham, Wash.; A. E. Beck, claim agent British Columbia Electric Railway Company, Vancouver, B. C., and G. N. Smith, assistant claim agent Southern Pacific and Oregon Railway & Navigation Railroads, Portland, Ore.

CENTRAL POWER PLANTS AND ELECTRICITY SUPPLY FOR TRUNK LINE RAILROADS*

BY FRED DARLINGTON, WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

It is the belief of the writer that when central station power supply is established on the larger scale to which it is surely growing the best interests of all concerned, including the public, will be served by railroads buying electric power and keeping its railroad business distinct and separate from the business of generating and distributing power.

There is one essential to railroad work that must be met to the fullest extent befort central stations can hope to succeed in the general supply of electricity for railroad motive power. The railroads must be assured of its continuity of service under all circumstances. This implies a degree of permanency and a simplicity of construction that has not been generally attained by power transmission companies, but it is possible of achievement and will be amply justified by the very large installations which will be needed when railroad power is extensively supplied by central stations.

COMPARATIVE COSTS

For the purpose of argument, let us assume that as the capacity of a central station generating plant increases the various things that enter into the cost of power are reduced by generating current on a large scale in such a proportion that, while for plants of 50 kw the operating labor cost may be about 0.75 cent per kw-hour, for plants of 5000 kw it is about one-half of this amount. For very large plants working at a good load factor we may assume that it is about one-fifth of this amount, or, say, 0.15 per cent per kw-hour; and the very largest plants working at a good load factor have reduced this latter cost approximately one-half, or say to 0.075 cent per kw-hour. We may anticipate that the labor of producing power will eventually be reduced, under favorable conditions, to about 0.05 cent to 0.07 cent per kw-hour. The cost of fuel is likewise rapidly reduced as advantage is taken of the generation of power in large quantities. While it is customary for small generating units to use 6 lb. or 8 lb. of coal per kw-hour, many large central stations have got their coal consumption down to 3 lb. or 4 lb. per kw-hour. A few of the largest stations are reporting coal consumption as low as 2 lb. or 2½ lb., which latter is equivalent to about 10 per cent or 12 per cent thermal efficiency, with a possibility of some further savings in this direction with still larger stations and better load factors. Likewise, in the matter of installation cost of generating plants and of transmission and distribution lines, increased size leads to reduced cost of construction. Many central station plants with relatively small units are to-day costing to construct $100, more or less, per kilowatt, while large plants have reduced their construction cost to the neighborhood of $70 per kilowatt, with good prospects that in the future this cost will be reduced for very large installations to less than $50.

The production of power in very large quantities also almost always results in good load factors.

In the transmission and distribution of power still more striking advantages are gained in large operations. It would ordinarily be unprofitable to transmit 1000 kw 25 miles, for it would not pay to secure 25 miles of right-of-way and put up pole lines, etc.; but if the amount of power to be carried is much larger, say 20,000 kw or 30,000 kw or more, the profitable distance for transmission may easily be 50 or 100 miles.

The economy of electric power from large generating plants as compared with isolated steam engine plants and other small sources of power is based on cheaper operation and maintenance of the large electric plants and not on a smaller first cost.

RAILROAD MOTIVE POWER

Let us next turn to the question of railroad motive power and its bearing on central stations.

*Abstract of paper presented at meeting of the National Electric Light Association, New York, May 29 to June 2, 1911.

The largest and best steam railroad locomotives are nothing more or less than relatively poor portable steam engine plants of 1000 i.h.p. or 1200 i.h.p. By the very nature of their service they are tied down to pretty nearly all of the conditions which are recognized as objectionable in stationary power generating plants. They have to be operated non-condensing, their firebox space is very limited and, worst of all, they have a very poor average load factor. These things, together with many minor factors which often exist, contribute to make steam locomotives relatively poor power machines. These conditions offer opportunity for central stations to furnish railroads with power and thus to widen the scope of their own profit and usefulness.

On the other hand, electric locomotives can do other and better railroad work than can be performed with portable steam engines. It is not the purpose of this paper to touch these points, as they have already been widely discussed. But the fact that railroad motive power requires a sliding contact to deliver central station power to moving trains should not, and does not, constitute any good reason why central station companies should not supply their power for train propulsion as well as for mills and factories and all kinds of stationary work.

Much has been said about the very great cost of electric power on railroads, and the existing instances where electricity is used in heavy traction are referred to, to demonstrate this great cost, which is believed by many to be always greater with electric than with steam locomotives, and to be justified only where other questions than economy make electrification necessary. To install an entirely new motive power system for a few miles of operation must always be disproportionately expensive. But under suitable conditions electrification of trunk line railroads is advisable in many places for purely economical reasons. I do not mean by this that to-day it is economical or would be economical to electrify all railroads. There are many places where the conditions are unfavorable for doing so, where the density of railroad traffic is small, where the distances to be covered by trolleys or third-rails are very great relative to the amount of power to be served, just as there are still many places where it is unprofitable to carry transmission lines to serve stationary powers from central stations, because the distances are great and the quantities of power are small. But you people of the National Electric Light Association should begin by furnishing the railroad power where it is economical and profitable to use electricity. Up to the present time you have not furnished trunk line railroad power excepting in one single instance, namely, in the very recent installation in the Detroit River tunnel of the Michigan Central Railroad. In every other case the railroads are making their own power for trunk line service.

I will point out two examples which seem to me to be the logical solution of the power problem for certain territories. One is in the State of Illinois and the other in eastern Pennsylvania, including part of New Jersey. I do not propose these as exact descriptions of the most advisable developments, but as indications of general plans to be followed.

ILLINOIS POWER SYSTEM

In the State of Illinois, excluding Cook County, there will probably eventually be three or four power centers which will be located in coal mining districts. One district is in the northerly central part of the State, another district is in the southern and western part of the State and another in the eastern part, or perhaps just over the State line of Indiana. When the power business grows to its natural, most economical plan for generation and distribution, it is probable that three large central stations (or possibly more) will supply the State and will be connected together with high-tension transmission lines from which will extend branches and feeders to reach smaller outlying districts, and that this network will include and serve all of the power business for every kind of work in Illinois. The system of transmission lines and feeders will network the State in much the same manner that the State is now covered with railroad lines, excepting that there will probably be less diversity of ownership and less competition than there is among the railroads. The advantage of the central stations for serving power will be so great, as compared with individual corporations and enterprises, that the latter will not be in a position to afford to generate their own power, because it will be cheaper to go to the central stations and buy power than to make it themselves.

This might at first seem in restraint of trade; but, as a matter of fact, provision of available cheap power will result in vastly increased railroad facilities and business. Experience will prove that there will be more incentive to singleness of ownership and management of power transmission business than there is in the railroad business, because the increased economy resultant upon increased service is proportionately greater in the power business than in railroad work. On the other hand, from the railroad point of view, one of the most objectionable features of electrical operation is that this work, if they make their own electric power, requires them to take up a new line of business, for which they are not equipped and with which they are not familiar, requiring a large and uneconomical expenditure for generation and transmission. Electrification would be much more acceptable to railroads if it required on their part only the purchase of electric locomotives and the erection of trolley lines or third-rails along their right-of-way, without necessity of going into the central station business. My belief is that when power lines are established, as suggested for Illinois, many railroads will go to the power companies and buy power just as they now go to the coal companies and buy coal. Furthermore, such business to the power companies will be one of the most assured sources of revenue that they can look forward to. The railroads have got to run regardless of any variable local conditions. Their power bills will have to be paid, and, being a monthly expenditure, these bills can be collected as reliably and surely as are the present coal bills or bills for any other supplies that enter into railroad operation.

Here I want to make one suggestion, namely, that the larger and more comprehensive the power systems of the country become the more the public may be expected to demand governmental supervision of such systems. They will require the right of eminent domain, and this right will properly be granted to them in their capacity as public service companies. That they will be treated by our law makers as our common carriers are treated is reasonable to expect, and probably the same methods of regulation that are found successful to govern railroads in matters of competition, rate making, etc., will be applied to power companies. It may prove advisable that they should be subjected to some of the same restrictions that apply to railroads in the control rates charged, the prohibition of rebates, etc.

EASTERN PENNSYLVANIA POWER SYSTEM

The second center instanced which seems to the writer to constitute a natural power supply center is the district of the anthracite coal mines of eastern Pennsylvania. There is a very large consumption of power in mining, cement manufacturing, lighting, railroad work, etc., that is within short transmission distance or within a radius of 75 miles of these mines. This power can be better made in central stations than in the small units now in use, and if the locomotives on the railroads within the district are added to the central station service the relative advantage of central station supply compared with small steam plants will be further enhanced. Such a center may eventually extend its service with profit to include much power as far away as New York City and Philadelphia. The transmission distances would be about 90 to 120 miles, but if the transmission to the larger cities is done on a large scale, it would be profitable as compared with the central stations now existing in the cities. It does not seem at the present time that the best economy in power service for New York and Philadelphia can be had by serving the power for the cities exclusively from central stations at the coal mines, but rather by installing very large transmission lines to Philadelphia and New York capable of carrying, say, one-third of the total

amount of power now produced in the big steam central station plants in these cities. These transmission lines could be utilized to carry the base load or long-hour service of the central-station plants in the big cities, and the existing city plants could be depended upon to take care of the peak loads and shorter hour service at the times of heavy or so-called peak-load demand. In this way central station plants of approximately one-third the maximum power of the city peak-load could supply something like three-quarters of the total kw-hours used and thereby cut the business of transporting coal for these large power plants to nearly one-quarter of what it would otherwise be. There is also a large amount of distributed power consumed in Newark, Jersey City, Trenton and intermediate points between New York and Philadelphia, and a vast amount of railroad motive power which could be supplied by electricity. Transmission lines installed between New York and Philadelphia could be made a sort of bus-bar connection tying the two city power supplies together and thus utilizing the space capacity in either city for reserve power when demanded in either city. At the same time these lines could be employed for the local distribution of power between the two principal points, making the main arteries a triangular connection with one point at the coal mines, one point in New York City and one point in Philadelphia. Into this great transmission system any economical power supply could be fed, as from the Delaware River.

REPORT ON THE PRIME MOTIVE POWERS *

BY THE COMMITTEE, I. E. MOULTROP, EDISON ELECTRIC ILLUMINATING COMPANY, BOSTON, CHAIRMAN

There were no important new developments in the field of power generation during the past year. The manufacturers of steam turbines have made a few minor improvements in design and construction which will affect the cost of maintenance more than efficiency of operation.

BALANCING OF VERTICAL TURBINES

The problem of securing a satisfactory running balance for Curtis vertical turbines was at one time a very serious one, but with experience in balancing it is now rare that trouble occurs due to serious vibration. The only rules laid down for balancing turbines appear to be, in general, "cut and try," balancing first the steam element and then later putting the field on the shaft and balancing the entire rotor. Balancing is done by attaching weights in different places on the revolving element, running the machine up to speed, noting the effect and if unsatisfactory removing some weights or adding others in different places; but when a satisfactory balance is once secured there appears to be little danger of the machine later becoming unbalanced.

Examination of a large number of carefully kept records of balancing operations indicates that for the first shot the balancing weight should be applied at a point 50 deg. behind the high marks on the shaft; in other words, after the point of maximum eccentricity has been determined on the shaft the weight should be first applied at a point on the turbine 50 deg. away in the direction opposite to the direction of rotation.

CONDENSER TUBE TROUBLES

Troubles with condenser tubes, such as pitting, breaking, etc., are confined almost exclusively to those stations located on the seacoast and using salt water for the circulating medium. One large central station on the seacoast has reduced condenser tube troubles to a very nominal amount by using untinned Admiralty mixture tubes of most careful manufacture. These tubes are given a very rigid inspection before being installed, and any one which shows even a blemish is rejected. Some other stations have tried every kind of tube which is on the market and have been unable to find any combination or mixture which would materially reduce the amount of their tube troubles.

Some companies have reported that they are troubled with the condenser tubes creeping endwise, and in some instances the endwise movement of the tube has been sufficient to wear away the shoulder on the gland and permit the tube to come out of the tube sheet. It would appear that this is caused by the high velocity of the steam entering the condenser, as the tubes which give trouble are those at the top of the condenser and receive the impact of the steam as it enters the condenser at a very high velocity. A suggested cure for this difficulty is to make a special gland for these tubes which will screw tight into the tube sheet, making a vacuum-tight joint without packing, with a groove on the inside of the gland next to the tube. The tube can then be rolled into the gland in a manner similar to the way a boiler tube is expanded in a boiler head. The other end of the tube may be packed in the ordinary manner.

CONTROL OF CIRCULATING WATER PASSES IN SURFACE CONDENSERS

Many central stations are so located that at certain seasons of the year the circulating water is very heavily laden with refuse and foreign matter of various kinds. The continuity of operation of the condenser then becomes a serious matter, as much of this refuse will pass through the usual screens, reach the tube sheets and clog up the tubes. Sometimes this obstructing of the tubes is done in an incredibly short space of time and to such an extent as seriously to cut down the cooling surface of the condenser and thus materially reduce the vacuum of the unit.

One central station reports that it has had serious trouble of this kind and has devised a remedy which is substantially an arrangement so that what was originally a multi-pass condenser is changed over to a single-pass. The condensers were originally constructed for three-pass and it was decided to cut away the first baffle, thus putting all the tubes in multiple with one another and making the condenser one-pass. This change resulted in presenting three times the opening to the flow of water and reducing the path of the flow of water to one-third of the former distance. When this change was made much less trouble was encountered by tubes stopping up. The tubes did become stopped up more or less, but with so many more tube ends exposed it took a much longer time to stop up a sufficient number of tubes seriously to affect the vacuum. No appreciable effect was experienced from reducing the path of the flow of the circulating water by two-thirds of its original amount, except that the discharge temperature of the circulating water was much lower. The same vacuum could be maintained in both cases. It should be noted, however, that with the one-pass condenser a much larger quantity of circulating water was used for the same vacuum and the temperature of the condensed steam was higher with the one-pass arrangement than with the three-pass. This latter was doubtless due to some peculiarity of the condenser, as otherwise the temperature of condensation should be the same for a given amount of vacuum, regardless of the number of passes of the circulating water. With plenty of circulating water available the single-pass condenser affords an increased tube area to the circulating water, thus eliminating to a great extent the trouble of choking of the tubes, and permitting a higher temperature of the condensed steam. Considerably more circulating water is required with the single-pass, which entails additional capacity in the circulating pumps and more power to drive them, but by reason of reducing the troubles incident to plugging up of the tubes, and the gain in temperature of the condensed steam, the cost of pumping the extra amount of water is more than warranted. These condensers are now arranged so that they may be readily converted from the three-pass to the single-pass or vice versa. This has been accomplished by replacing the baffle with a gridiron valve, which is operated from outside of the condenser nozzle.

CYLINDER OIL FOR AUXILIARIES USING SUPERHEATED STEAM

Considerable diversity appears in the practice of different companies in the specifications for cylinder oil for this purpose. The viscosity reported varies from 145 to 240, and the flash from 531 to 660. One company reports oil compounded at 7½ per cent of mineral oil and another company no compounding

*Abstract of report presented at meeting of the National Electric Light Association, New York, May 29 to June 2, 1911.

at all. Prices reported range from 27 cents to 40 cents per gallon. The oils which should be avoided are those having an asphalt base, which tends to carbonize in the cylinders under the high temperatures.

STEP BEARING OIL

Although a few instances are reported where water is being used for step bearings, and with satisfaction, a light pure mineral oil is generally used for this purpose, and here again is found considerable diversity in specifications and price.

The specifications which the General Electric Company recommends for step bearing oil are as follows:

"The oil must be pure mineral, hydrocarbon oil, free from:

"(1) Tarry, slimy and saponifiable matter;

"(2) Acid, soaps or thickeners;

"(3) Water, dirt, grit or other suspended matter;

"The specific gravity should be between 860 and 880 at 60 deg. Fahr.

"The flashing point, open-cut tester, must not be below 334 deg. Fahr.

"The viscosity as determined by the Seybolt 40 deg. C.

"Viscosimeter (Standard Oil Company) should be no greater than 228 seconds."

The purification of the oil is generally accompanied by straining through muslin bags. In some instances it is filtered through excelsior and in others it is merely passed through water and given some time to purify itself by gravity. Whatever separating of entrained water is done is usually by gravity.

One member company reports that the oil sometimes carries as high as 40 per cent of water in cases when the time allowed for settling is brief. Another company reports that when it is unable to free its oil from water by settling the moisture is boiled out in an open tank heated by steam coils. Some oil is inevitably lost with the water which is rejected from the filter, and the amount of this loss varies with the time allowed for quiescent settling and with the characteristics of the oil which enable it to form an emulsion more or less readily with the water.

Oil as it returns to the filter from the step bearing is at a temperature which necessitates cooling. This is usually accomplished by allowing it to flow over copper coils as it comes from the filter.

FEED-WATER HEATING IN STEAM TURBINE STATIONS

For heating feed water in steam turbine stations the general practice is to install principally non-condensing, steam-driven auxiliaries and use the exhaust steam mainly in open heaters for heating the feed water. The companies which reported on this subject use comparatively few electrical auxiliaries. About 75 per cent use the open heater in preference to the closed type. The conditions vary with different stations and a summary of the reports turned in is as follows:

The hot well temperature appears to range between 75 deg. and 125 deg. Fahr., with an average of about 90 deg. Fahr. The temperature of the feed leaving the heater ranges between 170 deg. and 210 deg. Fahr., with an average of about 195 deg. Fahr. It is rather significant that quite a number of plants using open heaters report a feed-water temperature between 200 deg. and 210 deg. Fahr., which is obtained without any other source of heating except that from the exhaust steam rejected by the auxiliaries. As a matter of fact, nearly all of the plants seem to have enough exhaust steam for heating the feed water, and only a few are making use of the expedient of taking a certain amount of steam from one of the intermediate stages of the turbine.

CLEANING OF AIR USED FOR VENTILATING TURBO-GENERATORS

Most of the companies corresponded with have turbines of the inclosed self-ventilating type and about one-half of them are taking fresh air from outside of buildings. None has installed any system of purifying the air, although in many instances the generator windings and ventilating slots rapidly accumulate a heavy coating of dirt, to the detriment of the machine. It would seem that a cheap and easily operated air-cleaning system would be of considerable value for many central stations.

A purification system about to be installed by one large company is located outside of the engine room and will deliver clean, cool air free from all the dirt and oil present in the engine room, as well as free from the dirt and soot usually found around a power station, especially where located in the midst of railroad yards.

The turbine generating equipment for which ventilation is provided consists of four 12,000-kw Curtis vertical turbines of the self-ventilating type, running at a speed of 750 r.p.m. and requiring 40,000 cu. ft. of air per minute each delivered at the inlet opening, or 160,000 cu. ft. of air per minute for the four units.

After a careful study of the local conditions it was decided to place the air-cleaning equipment on the roof of the station, 70 ft. above the hoods of the units. The four units, which are located in a straight line on one side of the engine room on 20-ft. centers, have been connected to a common supply duct 8 ft. x 8 ft., of light sheet metal securely framed and supported on the wall 20 ft. distant from the units. The duct is carried through the north wall of the power station and rises vertically 70 ft. to the roof of the building, where the air cleaners are to be installed. Each unit is connected to the duct by a branch duct provided with self-closing damper. The main duct is provided in the engine room with a closed opening, which may be opened to admit air in severe weather to temper the cold air. The duct has been so designed that the velocity of the air in any part will be less than 2500 ft. per minute, except at the inlet opening on the turbine, where the velocity becomes 2700 ft. per minute.

One of the first propositions considered was a system of screens covered with a loose woven cloth, such as cheese cloth, but the screen area required to handle 160,000 cu. ft. of air per minute and the inefficiency of the cloth, together with the difficulty of keeping the screens clean, either with compressed air blown through the screens from the inside or a vacuum cleaner to remove the dirt from the face of the screen, caused the rejection of this type of cleaner at once. A velocity of 150 ft. to 200 ft. per minute, being the maximum permissible through cheese cloth, required an area of 800 sq. ft. to 1000 sq. ft. of exposed cloth surface. The weave of the cheese cloth is so close that the effective area is reduced to only about 20 per cent of the total, and a very small amount of dirt collecting on the surface decreases this area until the volume of air passing through the screen is practically zero.

A number of successful commercial systems of mechanical cleaning of air for ventilation of buildings by means of water spray for washing and cooling the air were investigated and found to be highly efficient and most satisfactory in removing dirt and soot and delivering clean, cool air. Various makes were carefully examined, and it was decided that the straight spray system and a combination of the spray and sheet-cleaning surface were the two that offered sufficient merit for consideration.

STRAIGHT SPRAY SYSTEM

The straight spray system consists of the following parts: Tempering coils, spray chamber or washer, eliminator consisting of a series of baffles, a system of spray piping, water circulating system and storage tank for cooling water, which are all housed into one unit on either a sheet-iron casing or concrete structure. The tempering coils are placed in front of the washer or spray chamber and consist of a sufficient number of cast-iron heater sections to raise the temperature of the air above 32 deg. to prevent freezing of the spray water. Directly behind the tempering coils is the spray chamber, which may be of any desired shape to suit local conditions. The spray water is brought into the chamber through a vertical or horizontal header, from which branch pipes lead to the spray heads. Below the chamber is the settling basin, consisting of a tank for storing water and a sump for catching the dirt. From this tank the spray water is drawn through a system of strainers by means of a centrifugal pump of suitable size and recipro-

cated through the spray heads. The water for washing the air is used over and over again until it becomes too dirty, or in summer time the temperature is too great for properly cooling the air. The sump is connected to the sewer and can be flushed.

The most important part of the apparatus is the spray head and the arrangement of the same. The spray head consists of a nozzle containing a small or an adjustable opening, similar to a needle valve, together with a disk or spoon deflector, also adjustable, which regulates the size and density of the disk of water thrown off. The disk of water is several inches in diameter and consists of a solid sheet of water around the nozzle, then breaking up into a fine mist or spray composed of drops whose degree of fineness depends on the pressure of water and adjustment of deflectors.

To keep the nozzle clear of dirt the deflectors are automatically shifted at certain intervals, allowing the dirt to be carried away. The distribution of the spray heads over the area of the washer depends on the shape and, to a certain extent, on the size of the apparatus. They must be so located, however, that a curtain of water of uniform density is presented over the entire area. In order to accomplish this one of the methods provides two curtains of water, while the other requires only one with spray heads set nearer together and with the nozzles staggered so that the air will have to pass through an area of equal density. As the disk of water around the spray head rapidly breaks up into fine mist, the sprays are so spaced as to overlap each other and thus present a surface of almost uniform density.

The air after passing the tempering coils enters and passes through the spray chamber, coming into intimate contact with the water, and the heavier particles of dirt are at once deposited. The lighter particles having become thoroughly wet pass through the chamber and enter the eliminator directly behind. When the moist air enters the eliminator its direction is being constantly changed at right angles, the dirt not already deposited strikes a wet surface and the direction of motion being rapidly changed causes it to drop or be deposited on the first baffle. The entrained water in the air is also lost in the same way and the air leaves the eliminator after six or more alternate deflections free from entrained water and 98 per cent clear of dirt. The eliminator consists of vertical baffles set at an angle with the forward edge turned out at right angles, forming a hook arranged so that the current of air striking the baffle is deflected at right angles and strikes the next row of baffles until six or more rows of deflectors are passed. The air, still laden with dirt and a large percentage of spray water, strikes the first row of baffles violently, precipitating the dirt and water, which flows down the baffles into the tank. The amount of water contained in the air assures the thorough washing down of the forward baffle and keeps the plates thoroughly cleaned. The eliminator is approximately 3 ft. deep, and the baffles are so arranged that all of the entrained water is deposited and it is practically impossible to force water through the eliminator with a hose. Special flushing devices for cleaning the plates are unnecessary in the vertical type, as they are entirely self-cleaning.

Another type of washer is provided with six rows of horizontally inclined eliminators. The first row is a smooth plate with the rear edge hooked, which forms a guttter to carry off the water; the second row is corrugated and set below the first, every other row being corrugated. The air entering the eliminator is first deflected downward by the smooth plate, striking the corrugated plate below, which abruptly changes the direction at right angles, throwing the air upward on to the next plate. The upward and downward motion is repeated three times and the entrained water and dirt are removed by the scrubbing action on the surface of the corrugated plates and the abrupt change of direction of the current of air.

Automatic feed valves are provided to control the water supply; flushing of the spray heads is taken care of by a simple device which is operated by a part of the spray water being collected in a pivoted tank which automatically fills and dumps, at the same time tripping the flushing mechanism.

COMBINATION SPRAY AND SHEET CLEANING SYSTEM

The combination of spray and sheet cleaning surface differs radically from the system previously described, in that the air is kept in contact with a large area of wet surface in addition to passing through four sprays and two waterfalls.

Instead of taking the air directly through the narrow spray chamber of the previous type and giving the air only one opportunity to come in contact with the water, a series of curved deflectors in the shape of a letter "S" form the spray chamber, and the air is required to make a complete change of 360 deg. in the direction of motion, and at each turn is sprayed once and passes through the fall of water from the next spray above, in addition to being deflected by large surfaces over which the spray water is flowing.

The air enters at the lower portion of the "S"-shaped casing and immediately passes through a spray, and the water falling from the three sprays above is deflected by the curved lower surface of the casing through two center sprays and again deflected by the upper curved surface through a fourth spray; from these the air enters the eliminator chamber, which is the full height and width of the washer.

The spray heads differ from the mist or atomizing sprays and use a large volume of water, which is sprayed into the air, forming a curtain of water. In addition to the water curtain from the sprays, the water falling from the deflectors forms another curtain, and the large area of wet deflectors also offers a scrubbing surface, which effectually washes the air.

The eliminator is of the vertical type and is of several times the area of cross-section of the washer, so that the velocity of air passing through is reduced and the entrained water thoroughly removed. This type of washer offers several advantages over the "straight through" type, in that the thorough mixing of the air and spray water besides thoroughly removing the dirt results in greater cooling, due to the air being in contact with the water for a longer period of time. The transmission of heat is not an instantaneous process, and the longer the air and water are in contact the greater will be the cooling effect on the air. This transfer of heat controls the humidity as well as the temperature of the air.

The questions that are suggested in connection with the operation of an air washer are the danger of entrained water being carried through the eliminator; the regulation of the humidity in order that saturated air shall not enter the duct; also the degree of cooling of the air that may be reasonably expected in the summer and the protection against freezing of the water in the spray chamber in winter, and amount of steam required for tempering the coils.

Large units have been successfully operated for years without the slightest trouble from entrained water being carried through, even in case of hard driving rains, when the velocity of the air passing through the eliminators has been increased several times. The humidity can be regulated so that there will never be an occasion for trouble from saturated air entering the turbines and depositing moisture.

COST OF INSTALLATION FOR CLEANING AND COOLING AIR

The cost of a complete installation for thoroughly cleaning and cooling the air for large units will vary with local conditions, but the washer, eliminator, motor-driven circulating pump and housing should not exceed $800 for an equipment furnishing 40,000 cu. ft. of air per minute. For a 160,000-cu. ft. washer approximately 1100 gal. of water per minute are required under ordinary weather conditions, which call for a 6-in. centrifugal pump working under 12 lb. to 14 lb. pressure with a 15-hp motor. The amount of make-up water depends on the quantity of dirt and temperature of air, and cannot be estimated, though the total quantity should be small.

LARGE-SIZED BOILER UNITS

None of the larger member companies is seriously considering the matter of installing large-size boiler units, with the sole exception of one company. The Detroit Edison Company has made an installation of some boilers, each having a capacity of 2300 hp. They are the largest single units reported

up to date, and while they have not been in operation for any great length of time they are apparently quite successful.

USE OF ECONOMIZERS

The general tendency in building large plants is to provide for the possible installation of such apparatus at some future time, but so far as learned economizers are not being generally installed at present.

ACCOUNTING FOR DEPRECIATION *

BY H. M. EDWARDS, AUDITOR NEW YORK EDISON COMPANY

It is assumed that every company recognizes that its tangible assets are disappearing with use or with the march of improvement and realizes that some provision must be made in the accounts to provide for the replacement of worn-out or superseded apparatus.

Starting with this premise there yet remain the questions: First, how should the amount to be reserved for depreciation be determined, and second, how should the reserve be treated in the accounts?

The Public Service Commissions of New York do not recognize as a proper subject for capitalization amounts spend for replacement of apparatus worn out by use or superseded by improved or more efficient devices—or, it should rather be stated, they permit the capitalization of the new expenditure but require that the thing replaced shall be credited at its cost to property account and charged against the reserve, or, in the absence of a reserve, to surplus account. It is not proposed to argue the question whether this theory is correct and the fair one to apply in all instances, although there is much to be said against the absolute acceptance of the theory. Let it be agreed, at least for this discussion, that the purpose of the depreciation fund is to maintain the efficiency of the property, as shown by the books, reinvesting the fund as the apparatus is replaced or retaining in the fund the cash equivalent.

Taking up the first of the two questions, two methods of determining the amount to be reserved suggest themselves, one of which may be called the specific method and the other the general method.

A company adopting the specific method would undoubtedly inventory its physical properties, noting in adjoining columns the original cost, scrap recovery value, life, etc.

Assuming that the books have been properly kept, it would not be difficult to inventory the plant and list the costs. The life table would present a real difficulty, for, as the life of the apparatus determines largely the amount of the reserve, it must be reasonably accurate. What is the life of any piece of apparatus? Such life tables as exist give the life of a boiler, for instance, as twenty years, but boilers forty years old are in existence to-day and doing their work acceptably. An Edison tube main would probably be rated as relatively short-lived. The copper is, of course, practically indestructible, but the insulation and those qualities which constitute it a conductor, would cause it to be assigned a life of, say, fifteen years; yet there is Edison tubing in the streets of New York twenty-five years old and, provided it is not disturbed, good for many years more.

The scrap recovery value also presents a difficulty. This value, it must be conceded, is largely conjecture, and at the same time may affect materially the amount of the reserve.

One of the objections to the specific method is that it endeavors to treat with exactness what in the very nature of things is inexact and to the last degree approximate. The second objection, and to the writer an insuperable one, is that the specific method takes no account of supersessionary depreciation. No one can even approximately forecast what the future will bring forth.

GENERAL METHOD

Under this method a reserve may be built up by a stated percentage of the inventory value of the property, by a percentage of the gross earnings, by a rate applied to the electric current generated or sold, or by a definite amount appropriated from surplus earnings. A reserve created by any of these means is frankly approximate and its sufficiency can only be determined with the lapse of years. In this respect the method is in accord with the fact, for any reserve created to provide for the cost of replacement occasioned by use or supersession, and especially the latter, must be the result of approximation, and this approximation should not be in detail, but should be applied to the property as a whole.

The New York Edison Company started its depreciation reserve fund on the date of its incorporation, May 1, 1901. This was just after the time of the appearance of the rotary converter, which brought about so great a revolution in generating and transmission methods. The company was, therefore, fully alive to the necessity for providing for supersessionary depreciation. In the selection of a plan the company had in mind the desirability of having a ready means of computation, one which should be flexible, permitting the raising and lowering of the rate as experience might show to be necessary and would apply equally to its entire product. Generally speaking, depreciation is the result of use or, in our business, of kw-hours produced. A percentage of the book value of the property did not include the element of work done and a percentage of the gross earnings did not bear equally on the product because of the rate schedules. Upon the latter basis, assuming that the reserve was to be 10 per cent of the gross earnings derived from the sale of electric current, the retail customer at 10 cents per kw-hour would contribute 1 cent per kw-hour to the reserve, whereas current sold to large customers would contribute less than ½ cent per kw-hour, although the depreciation effect of both sales might be the same. The plan of creating a reserve by an appropriation from surplus earnings was discarded and the company finally adopted a rate of 1 cent per kw-hour sold to general customers. The selection of kw-hours sold rather than kw-hours generated was the result of local conditions and the fact that because of relations to affiliated companies a considerable portion of the current generated did not circulate through its entire system including transmission and distribution apparatus and devices. At 1 cent per kw-hour sold to general consumers the company has been able to accumulate an adequate reserve which has provided for all its depreciation to date, with ample provision for the future.

TREATMENT OF RESERVE IN THE ACCOUNTS

Should the amount be treated through operating expenses or as an appropriation from surplus earnings? Depreciation, whether from wear and tear or supersession, is a cost and must be recovered in the price of the product sold. The gross earnings, less the expenses of operation, including depreciation, taxes and bad debts, would represent the net earnings from the business which bear a direct relation to the amount of capital invested. It is apparent, therefore, that the theoretical price for the product would be a sum derived from adding together operating expenses, depreciation, taxes, bad debts, cost of money invested and a profit on the money invested, and this sum total divided by the kw-hours sold gives the average rate per kw-hour which the company should charge. If the gross earnings do not equal or exceed this total either some way must be found for reducing the cost of doing business or the price at which the product is sold must be raised.

It is customary to show the net earnings as applicable to the returns on the capital invested. It would not be consistent or logical to claim that depreciation is a part of the cost of the product and then provide for it through an appropriation from the surplus belonging to the owners of the property.

It is clear that the Public Service Commissions of New York recognize that depreciation or amortization is an operating expense and their treatment of it in the pamphlet issued by the commissions entitled "Uniform Systems of Accounts for Electrical Corporations" is consistent and logical, for to permit a company to recover the cost of depreciation as a part of operating expenses necessarily implies that the item of depreciation shall occupy an appropriate position in the schedule of operating expenses.

*Abstract of paper presented at meeting of the National Electric Light Association, New York, May 29 to June 2, 1911.

Reference has been made to the fact that the amount of the reserve should be based upon the property as a whole. If a contrary course is followed and reserves are accumulated separately for the production plant, the transmission plant, the distribution plant and the miscellaneous plant a number of reserves will be established, and, although the sum total may be adequate for the company's purpose, yet individual reserves may be insufficient or excessive and transfers from one to the other would throw the entire system out of gear. The argument for individual reserves is that the cost of production at the company's switchboard should include depreciation as an item of cost, as should also transmission and distribution expense totals, but the amounts of reserves are the result of approximations and the advantage of being able to show total costs at each of the main divisions of the operating expense schedule are overshadowed by the disadvantages and complications resulting from limiting the uses of the individual reserves.

The plan of the Public Service Commissions of New York is much preferable, as it simplifies all the transactions and treats the subject of depreciation in one item, the reserve accumulated being available for all the replacements which may be necessary.

If a company has accumulated a reserve for depreciation it is not necessary to charge off at annual intervals a proportionate amount of the cost of the tangible assets; rather the property should be carried in property account at its original cost until finally retired from service. This simplifies the accounting problem involved and enables an exhibit to be made of the status of the reserve fund showing the unexpended balance remaining therein, and also identifies the cost of the actual apparatus retired and charged to the reserve.

There remains for consideration the status of a company which has not created a depreciation reserve fund, and upon this point it may be well to refer again to the rule of the Public Service Commission of New York. The uniform system of accounts of the commission became effective Dec. 31, 1908, and all companies within the jurisdiction were required to establish a depreciation fund as of that date. The commission also required that all construction and property accounts in existence on Dec. 31, 1908, should be consolidated into one account to be known as "Fixed Capital—Dec. 31, 1908." The amortization rule in relation to such fixed capital on Dec. 31, 1908, means that a company which has not heretofore established a reserve fund will only be allowed to charge against the fund after it is created that part of the depreciation of a thing which occurred after the fund was started, the balance being charged to surplus account. This is a very drastic rule, and it is not unreasonable to expect that a strict adherence to its provisions might require a company having no reserve to make charges to its surplus fund sufficient in amount to prevent the payment of dividends for years to come.

The following recommendations seem to be justified:

First—In view of the fact that depreciation in electric lighting plants is to an extraordinary extent the result of supersession rather than of wear and tear, the reserve should be determined by the general rather than the specific method.

Second—Considering the nature of the business, and because of the fact that the entire product consists of electric energy expressed in kw-hours, the most feasible way of determining the amount of the reserve is by a rate per kw-hour generated or sold, according as local conditions apply.

Third—In view of the fact that depreciation is a definite item in the cost of operation the reserve should be built up through operating expense and not as an appropriation from surplus.

Fourth and Finally—Any member company which has not as yet provided for a depreciation reserve fund should do so at once as otherwise the day of reckoning will soon arrive and delay may seriously affect its financial stability.

At the celebration in Bismarck, Wash., recently, in honor of the extension of the lines of the Tacoma Railway & Power Company, Tacoma, Wash., to that place, L. H. Bean, general manager of the company, was presented with a leather wallet mounted with silver.

OTHER PAPERS AT THE NATIONAL ELECTRIC LIGHT CONVENTION

Four papers read May 29-June 2 at the convention of the National Electric Light Association being held this week in New York are published under separate headings elsewhere in this issue. The following are short abstracts of other papers presented during the first four days of the convention which are of especial interest to electric railway companies.

LIGHTNING PROTECTION

The committee on lightning protection, of which B. E. Morrow, Hudson River Electric Power Company, is chairman, discussed in its report methods of protection of high-tension transmission lines. The principal difficulties from lightning experienced on transmission systems at the present time are those arising from line failures, i.e., insulators breaking down either from direct or indirect discharges, wires burned off by direct strokes, etc. In tracing the failures of apparatus due to lightning the fact is sometimes overlooked that the apparatus might have been seriously weakened or strained at some previous time by heavy overloads, and but for that reason probably could have withstood the unusual stresses not taken care of by the arresters. It is in cases of this kind that some of the new and later types of arresters are credited with the failure to protect the apparatus on which the insulating value had already been seriously impaired. The results obtained from the use of the electrolytic type of arresters are very satisfactory, and in most cases justify the expectations of the purchaser and the guarantees of the manufacturers. In several cases reports have been made to the effect that the installation of these arresters has decreased both the interruptions to service and the cable punctures by large percentages. The principal objection to the electrolytic arresters is high first cost and the necessity of frequent charging and attention. In stations of minor importance it has been considered cheaper to replace an occasional damaged transformer.

Transmission lines having overhead ground wires seem to suffer the least damage; in fact, one company reports that the damage from broken insulators, shattered poles, burned-off wires and cross-arms on lines protected in this manner is less than 20 per cent of that on other lines without this type of protection. In some cases where an unusual amount of trouble was experienced from insulators spilling over, special devices have been developed as an alternative of the overhead ground wire. One of these devices is in the form of a grounded metal ring for each insulator. This is reported as being effective, although the use of them has not eliminated all line disturbances and is no protection against the direct stroke. In some other cases a grounded spark-gap has been provided for each insulator. Still another form is that of installing a grounded wire on each pole and carrying this wire well above the top of same. These experiments are reported as being more or less successful and especially to the end of reducing the interruptions to the service, but it is a question if the expense of installation will be justified in all cases. In some instances attempts have been made to protect the transmission lines by the installation of arresters at points far removed from the stations, but in most cases these experiments have resulted in failure.

A special device known as the arc suppressor is now being experimented with for the relief of transmission-line troubles due to an arc around the insulator. This arcing ground suppressor is designed to be used at the busbars of the principal station to take care of the entire system. It consists essentially of an electrostatic and electromagnetic selective relay. This selective device picks out the faulty phase and closes the release circuit of a single-pole oil switch which is connected between the faulty phase and ground. The oil switch shunts out the accidental arc at the insulator and opens up again immediately. If the insulator is properly designed the arc will invariably take place around the porcelain skirts, and, therefore, the arcing ground suppressor will entirely eliminate the trouble. If the insulator should be punctured the switch of the arcing

ground suppressor is again automatically closed and thus prevents the high-frequency oscillations from playing in the circuit which would otherwise result, due to the make-and-break of the arc at the faulty insulator.

Choke coils are in general use. One large company has discontinued the use of them in one generating station because of the fact that every time a bad short-circuit was experienced on the line the choke coils would be twisted out of shape. This is the first time where results of this kind have been reported, but there is nothing to indicate that the trouble was not limited to the question of mechanical design.

Where all lines leaving a station are operated separately it seems necessary that each of them be provided with an arrester, and this should be installed on the line side of all apparatus. In other cases, where two or more circuits are connected to a common busbar experience justifies the advisability of installing one arrester on the busbar. Of course, under the latter condition complete protection is not secured, as the line oil switches, relays and transformers for operating them are exposed. However, apparatus of this kind with a high factor of safety can now be secured, so that very little, if any, trouble is experienced with same. With some of the older types of apparatus it would probably be more desirable to install arresters on the individual circuits. In either case, provision should be made for quickly cutting the arresters out of service in the event of any trouble being experienced with same. In addition to the lightning arresters themselves choke coils should be installed on every circuit leaving the generating station.

VENTILATION OF TURBO-GENERATORS

R. B. Williamson, Allis-Chalmers Company, presented an interesting paper on this subject. He said that it is now universal practice to make turbo-generators totally inclosed and obtain the cooling by forced air circulation. By inclosing the generator the air currents can be more effectively directed to reach the parts where heat is generated and at the same time the noise is greatly reduced. The inclosed machine also has the advantage that air can be piped to it from outside or from other sources and discharged into the station, basement or outdoors, as may be required.

The quantity of air to be supplied should be from 100 cu. ft. to 150 cu. ft. for each kilowatt of internal loss in the generator. In some cases the air supply may be as low as 80 cu. ft. per kilowatt loss; 125 cu. ft. is a fair value and will give good results if the circulation in the generator is such that the air can get at all parts where heat is generated.

In estimating the internal loss to be carried off by the air, the windage loss must be included, as this is one of the largest losses in a turbo-generator and contributes to the heating just as much as the core loss or copper loss. A turbo-generator run on open circuit with no excitation and no loss in it other than the windage will show quite an appreciable rise in temperature, in extreme cases as much as 12 deg. C. to 15 deg. C. A great deal of windage loss is due to the skin friction of the rotor and is independent of the fans. The passage must be arranged so that the air will be guided through the generator with as small an amount of friction as possible.

In a 60-cycle generator of 5000 kva (normal) output, running at 1800 r.p.m. and operating at unity power-factor, the internal losses might be as much as 220 kw. Allowing 125 cu. ft. per kilowatt loss, this generator should have about 28,000 cu. ft. per minute for satisfactory cooling. This amounts to 2270 lb. of air per minute, or over 60 tons per hour. The total internal loss will usually be from 4 per cent to 6 per cent of the rated kva output, being a larger percentage for the smaller machines. As a rough estimate, therefore, the allowance of cooling air may be taken as 5 cu. ft. to 7½ cu. ft. per minute per kilovolt-ampere rated output. On the above basis the weight of air to be passed through the generator end of a steam turbine unit is in many cases greater than the weight of steam passed through the steam end during a corresponding period of time. In order to handle this large quantity of air, careful attention must be paid to the ducts or pipes through which it is supplied and the air should be as clean and cool as practicable. In some cases it may be drawn directly from the basement, but this should not be done if the space below the generator is occupied by auxiliaries which heat the air.

In case cool air cannot be obtained from the basement a pipe or duct should be run outdoors and the opening protected so that rain or dirt cannot be drawn in. Ducts should be as straight as possible and of such cross-section that the air velocity will not exceed 1000 ft. to 1200 ft. per minute. When air is drawn from outdoors it is advisable to have dampers arranged so that it can, if necessary, be taken from the basement in cold winter weather. The air should be clean. The quantity of air passed through a generator is so large that even a small percentage of dust soon results in a large amount of dirt within the machine. In Europe a great deal of attention has been paid to the cleaning of the air, and numerous forms of air filter have been devised. A filter can be easily made by stretching cheese cloth, cotton or thin flannel between two frames. The cloth is passed around flat strips of galvanized iron and is pulled taut by nuts on threaded studs at each corner. The cloth is threaded back and forth so that the entering air has a large surface of cloth to pass through. The velocity of the air through the cloth is, therefore, very low and a filter unit approximately 3 ft. wide, 3 ft. high and 2 ft. deep can pass 2000 cu. ft. of air per minute with an air velocity through the cloth not exceeding 10 ft. per minute. With this low velocity the filter does not throttle the flow of air to any great extent, and with the large area so obtained the cloth will not clog up rapidly. By constructing the filter in units as many units as may be required for a given machine can be set in a framework to form a wall through which the air must pass before reaching the generator.

Air filters should be mounted so that they can be easily taken out at intervals and cleaned. Unless they are cleaned from time to time they will become worse than useless by cutting off the air supply entirely. Even when they are provided, the interior of a turbo-generator should be cleaned periodically.

The discharged air is usually allowed to flow up into the power house, though frequently it is discharged downward into the basement or piped outdoors. The heat discharged represents from 3 per cent to 6 per cent of the station output, and it has been suggested that it be utilized under the boilers. It would not entail a very great additional expense to discharge the air downward into a duct leading to the boilers and opening under the grates.

WOOD PRESERVATION

The report of the committee on preservative treatment of poles and cross-arms was presented by W. K. Vanderpoel, chairman, C. C. Tutwiler, chairman sub-committee on preservatives, and Martin Schreiber, chairman sub-committee on treatments. This was the second report of this committee. It includes definite working data, such as plans and specifications, so that those desiring to treat timber will find many suggestions of practical use. The committee favors creosote oils partly because it still lacked evidence covering results that could be obtained through domestic application of other processes and partly because it still lacked evidence that such processes could be as successfully applied as creosote for the preservative treatment of poles and cross-arms. The committee presented three specifications for creosoting as follows: Specification "A," to insure the furnishing of high-grade coal-tar creosote; specification "B," covering the admixture of certain tars with coal-tar creosote, and specification "C," covering conditions where water-gas tar creosote is used. Important features of these specifications are the addition of certain tests which would more certainly tend to indicate adulteration and the adoption of the flask instead of the old-fashioned retort for making distillation tests. The mixed tar and water-gas tar creosote specifications were drawn up because considerable quantities of water-gas tar and distillates are available for wood preservation. The committee believes that, if the consumer can purchase the treated material from a reliable creosoting plant at a reasonable price compared with the cost of installing either a pressure or an open-tank system, the former course should be adopted, because the commercial organizations are

usually of sufficient size to justify the most approved apparatus, superintendence and labor. The commercial plant also could be held responsible for losses due to poor work.

As it was now certain that satisfactory results could be obtained with some kinds of wood through the intelligent use of the open tank, the committee did not hesitate to recommend its use in preference to brush treatment by those companies that do not find it feasible to purchase timber which has been treated in pressure cylinders. The committee therefore submitted plans showing the construction details of open-tank plants of various capacities and their cost, and also gave general instructions. The committee regarded the full-cell treatment of timber by the pressure process as the standard method, although it appreciated that conditions did not always make it possible to make it a universal practice to use only pressure-treated timber. Attention was called to the need for caution on the part of those who contemplate undertaking timber preservation.

In addition, this report contains a number of valuable appendices. Appendix "A," by Dr. Hermann von Schrenk, described the treatment of telephone and telegraph poles for preventing decay as practised in Europe during the year 1910; appendix "B," by Howard F. Weiss, described the open-tank treatment of poles with creosote; appendix "C" was a company's experience with a creosoting plant; appendix "D" related to the inflammability of treated timber, from which it appeared that creosoted timber is less damaged by fire than untreated timber identical in every respect; appendix "E" was a report from the Bureau of Entomology, United States Department of Agriculture, on damage to timber by wood-boring insects; appendix "F" was a reprint of the statistical information in Bulletin No. 9 of the Forest Service; appendix "G" was a discussion of timber preservation by Dr. Hermann von Schrenk.

UNDERGROUND CONSTRUCTION

The report of the committee on underground construction of which W. L. Abbott, Commonwealth Edison Company, Chicago, is chairman, included specifications for joints in paper-insulated cables, a discussion on the prevention of electrolysis in cable sheaths and a discussion on methods of protecting cables in manholes. With regard to splicing the committee's conclusions are as follows:

A good splicer can produce a good joint of either of the two types commonly used. The personal equation plays a greater part in the production of a satisfactory joint than does the type of joint. Neither type of splice can be made fool-proof; neither eliminates the human error element—therefore, assuming the method and material used to be nearly equal in all essential respects, other conditions also being equal, a joint of either type will be only as good as the splicer makes it. A well-made joint (either type being considered) is electrically as good as or better than any part of the cable.

With reference to the use of compound, high-melting value is a good point in its favor. Adhesiveness is not such an important point, unless the filling job is a poor one and the compound has to depend upon its adhesiveness to stay where first put. Brittleness is a bad quality, but, unless a joint is subjected to severe mechanical shocks or excessive vibration, brittleness does not become a menace to the electrical security of the joint. Paraffine is indisputably inferior to the compound on account of its excessive contraction coefficient, but, in spite of the points against its use, paper or cambric tape joints filled with paraffine have given satisfaction.

Eight companies from which inquiries were made all reported to have experienced trouble from electrolytic action on cable sheaths. It was impossible to ascertain definitely the influence of the duct material as affecting electrolytic action, but two companies reported their preference for fiber conduits over any other material for ducts. These two companies are using waterproof joints between sections of fiber ducts and claim thereby to secure waterproof duct throughout.

In the case of tile ducts distinct evidence of electrolytic action at the joints of successive sections of ducts was found in at least one instance. In other instances of electrolytic action in ducts the pitting was more distributed throughout the length of the cable, making it difficult to separate the influence of the non-waterproof joints of successive sections of ducts. The committee was unable to put a definite value upon the advantages of fiber conduits in respect to electrolysis. Two companies which have had severe troubles with electrolysis place insulating joints in the lead sheath at intervals of 400 ft. or 800 ft., and at one end of each section they ground the lead to a pipe driven in the bottom of the manhole, or, in one case, to a special bare-ground return conductor paralleling the cable. By this arrangement any portion of the lead sheath is prevented from carrying the cumulative return railway currents of a long length of cable.

Some companies have attempted to keep the whole length of the cable practically insulated from ground, except at the station ends, relying on the vitrified-duct material or fiber conduit for the insulation in the ducts, and placing a rubber cushion under the cable in the hangers in the manholes. All of these methods have proved beneficial.

Wherever several large-size cables are exposed in a manhole there is always a danger that a short-circuit occurring on one cable in the manhole will involve some or all of the remainder, and possibility of such cases of trouble in congested manholes is obviously a matter of very serious concern.

To protect cables in such situations from the arcing flame of an adjacent cable various methods of protection have been adopted, principally as follows:

(a) Concrete shelves.
(b) Cement coating with ¼-in. rope bond.
(c) Asbestos tape saturated with silicate of soda.
(d) Asbestos tape covered with soft-steel tape armor.
(e) Asbestos rope.
(f) Split tile duct.

The first method is applicable only to manholes containing few cables.

Cement coating seems to have given good results in many cases, the principal objection being its liability to crack and fall away from the cable if not well or properly bonded. On the other hand, in case of a breakdown of the cable insulation the location of the rupture will be plainly indicated by the cement covering being blown off the cable at that point.

The objection to split-tile duct is its clumsiness, and that in manholes with numerous cables it cannot be used on account of lack of space.

Of the three remaining types asbestos tape saturated with silicate of soda and protected with soft-steel tape armor seems to be very generally used with satisfactory results. There is very little difference in cost between the types mentioned. The asbestos tape saturated with silicate of soda and with steel armor is perhaps a little higher in cost, but the protection afforded is more than sufficient to warrant this slight increase.

REPORT OF THE COMMITTEE ON PUBLIC POLICY

Questions relating to the environment of working classes constitute the subject of the report of the public policy committee. Modern industry depends upon three factors: Capital, direction, executive and administrative, and labor. The harmony of all is essential. The question of wages is a local one, but in the same locality wages should be fully equal to those paid by other employers engaged in similar work. The term "service annuity" is adopted rather than pension as compensation for continuous service over a period of several years. Wages is inclusive of both wages and salaries. Any contribution for the improvement of an employee's surroundings or of himself should not be construed as affecting his wage or as either charity or philanthropy. It is to secure the added service of enhanced efficiency, increased devotion to the employer and more careful utilization of time, tools and materals that the committee has directed its efforts to find a form of compensation reasonable and mutually satisfac-

tory. The suggested forms of relationship between employer and employee include, in brief, acident insurance, sickness insurance and death benefits, service annuities, profit sharing, employees' savings and investment funds and life insurance.

METROPOLITAN STREET RAILWAY REORGANIZATION PLAN

Additional testimony in the reorganization case of the Metropolitan Street Railway of New York was offered before the New York Public Service Commission, First District, May 24.

Benjamin S. Catchings appeared on behalf of a tort creditors' committee to defend the interests of the accident creditors of the New York City Railway and the Metropolitan Street Railway in the proceedings. He had evidence to introduce with regard to the value and nature of the accident claims and had a proceeding pending before the United States Circuit Court to adjudicate the question as to whether or not the claims for injuries sustained in the operation of the Metropolitan Street Railway system by the New York City Railway between April 1, 1902, and Sept. 24, 1907, amounting to about $1,877,000, should not be classified also in the receivership proceedings as claims against the Metropolitan Street Railway Company.

Mr. Catchings asked that he be permitted to withhold evidence which he might desire to introduce until after the commission had introduced its evidence and the claimants had concluded their proof with regard to the value of the property.

Commissioner Maltbie said that the hearings would not be closed immediately and legal procedure in the presentation of evidence was not followed strictly so that that could be arranged unless the time was too long.

R. Gray, head clerk in the office of the auditor for the receivers of the Metropolitan Street Railway, testified as to the correctness of certain accounts. Edward Krause, assistant to the auditor of the New York City Railway, gave testimony of a similar nature.

METROPOLITAN STREET RAILWAY REORGANIZATION.—SUMMARY OF ASSETS AS OF OCT. 1, 1910.

Reproduction cost of system		$102,206,240
Additions representing sub-contractors' profit, plus additions to general contractor, engineering, interest and taxes, not previously included	1,834,765	
Acquisition value of land above W. H. Wheelock's valuation, making claim valuation at least $15,000,000	1,191,013	
Revised total		$105,232,018
In addition to above assets are the following reorganization assets:		
Bonds of Central Park, North & East River Railroad	$1,200,000	
Amount remaining of $10,000,000 to be raised after discharge of all obligations of the companies and receivers ($10,000,000 less $7,785,000)	2,215,000	
Total realized from various claims, at least	1,600,000	
Total		$110,247,018

Note: The last two items, particularly the latter, are estimates only, although believed conservative, and the commission is not asked to accept them so far, as, if at all, they may be material, until realized.

Also "going concern" value, or whatever term is employed to identify the item, estimated upon percentages or amounts stated by the various witnesses and adopted in other cases, $7,500,000 to $15,000,000 and certainly not less than the amount of any physical deterioration in the plant.

The above are exclusive of "special value of amount for street railway purposes as distinguished from ordinary purposes," of any "promoters' profit," of any "discounts on securities" and of any "special value of existing franchises," and also of the net investment in superseded property, except so far as any part of such sum may be included in "going concern" value. All these items are claimed as capitalizable even where no testimony has been presented of their cost or value.

Schuyler C. Stivers, accountant for Ford, Bacon & Davis, supplemented his testimony in reference to the accounts.

Charles F. Mathewson, counsel for the reorganization committee, presented the accompanying statement of reorganization assets in response to a request from Commissioner Maltbie.

The Grand Rapids (Mich.) Railway is planning to enlarge its resort at Ramona Park, Reed's Lake, by using part of the land on the lake front formerly occupied by a private theatrical enterprise. The private theater was burned about a year ago.

ATTACK ON THE "LOAN SHARK" EVIL IN NEW YORK

A meeting was held in New York on May 18 under the joint auspices of the Russell Sage Foundation and the Merchants' Association of New York to discuss various phases of the salary-loan problem. Addresses were given by various employers and others who have given attention to this subject, among them C. D. Meneely, vice-president and treasurer of the Brooklyn Rapid Transit Company. After the addresses a general discussion followed, and the following four resolutions were unanimously adopted:

"First—That employers rescind rules of discharge in order to assist employees in resisting unreasonable interest charges and deprive money lenders of the power of extortion.

"Second—That all employers disregard claims filed by money lenders against the wages of employees, not in direct compliance with law, the employers to interest themselves in assisting employees involved with loan sharks.

"Third—That, in self-interest as well as for the benefit of their employees, all large employers of labor encourage and assist in the creation of co-operative savings and loan associations in their respective establishments.

"Fourth—That laws be enacted which will allow a reasonable rate of interest on all small loans and provide for the licensing of money lenders and the efficient supervision and control of such licensees, preferably under the supervision of the State Banking Department."

Mr. Meneely said that about ten years ago his corporation, on the recommendation of its legal department, decided on the policy of refusing to recognize assignments of wages. The loan companies brought three or four cases in court, in defending which the corporation placed the borrower on the stand to prove usury. All the cases were won by the corporation. For a short time thereafter the loan companies brought a few more suits, which were abandoned as soon as he, accompanied by the borrower and counsel, appeared in court. In thus defending worthy employees involved with loan sharks the corporation greatly benefited itself because the money lenders quickly realized the futility of filing and the danger in bringing suit to collect. The Company's Mutual Aid Association supplies the aid to employees which might otherwise be sought from the loan shark. The company's rule at the present time simply requests employees not to assign their wages in place of the mandate in effect years ago summarily discharging an employee for such act.

Other testimony presented at the meeting showed that the extent of the usurious loan business in New York City is $20,000,000 annually, and that the net profit of the money-lenders exceeds 100 per cent a year on the capital invested. The fear of discharge, due to the attitude of many employers toward men who assign their wages for loans, serves the loan shark as the most efficient collection agency which could be devised.

A number of employers testified that it was their fixed policy not to discharge employees for assigning wages, but to help them when they need financial assistance. According to one speaker, under a recent decision based on Section 42 of the Personal Property law, the loan company must file notice on an employer in a salary loan within three days after the loan is actually made. This decision was considered all-important as a weapon against the loan shark because it removed secrecy from the transaction. An employee was not likely to make a loan if the employer was to become aware of it within three days after the transaction. The addresses also showed that with a number of the companies employees' co-operative savings and loan associations had been established to counteract the salary loan evil. The usual charge to borrowers is about 1 per cent per month. An official of the Celluloid Company testified that such an organization had been conducted among the employees of that company since 1906. During that time he stated that the company had loaned about $60,000 with a loss of less than $100.

RECENT NEW YORK RAPID TRANSIT ADVERTISEMENTS

During the past week three large advertisements have appeared in the daily papers on the proposed rapid transit franchises in New York. The first was published on May 26 in the interest of the Interborough Rapid Transit Company and occupied six columns. It was headed "The Interborough offer completes the city-owned subway, the Brooklyn Rapid Transit Company asks the city to build subways as terminals for its elevated railroads. The Brooklyn Rapid Transit Company proposes more elevated roads for Brooklyn, the Interborough builds subways there. The Interborough plan gives a 5-cent fare to Coney Island." The advertisement was accompanied by a map, and said in part:

"The Interborough's plan establishes a universal 5-cent subway fare from Fort Hamilton, Coney Island, Sheepshead Bay, East New York, Ridgewood, Woodside, Corona, Astoria and all parts of the Bronx. The Brooklyn Rapid Transit Company's plan establishes a 10-cent fare within the Greater City and for a great many of the people in Queens, Manhattan and the Bronx a 15-cent fare to Coney Island. The Brooklyn company claims that it will make a great saving to Brooklyn people by extending its lines into Manhattan, thus avoiding a double fare.

"The Interborough Company, by going to Brooklyn for the people with its numerous lines with a single fare, saves more than the Brooklyn Company claims to save, because on the Interborough there will be a single fare to reach from every point in Brooklyn to every point in Greater New York.

"If the Brooklyn Rapid Transit Company is so interested in reducing the expenditures of the fare-payer, why do they insist in their proposition that for a short ride from Brooklyn to Coney Island the fare must be 10 cents?

"The Interborough has adopted the principle that a single 5-cent fare paid on the subway system shall carry a person from one end to the other of the Greater City of New York. On the other hand, the Brooklyn Rapid Transit Company's plan proposes to perpetuate a two-fare and three-fare system.

"The Brooklyn Rapid Transit Company's proposal is that it will spend less than $21,000,000 for construction in improving its elevated lines in Brooklyn and placing third-tracks thereon if the Greater City of New York will pay about $168,000,000 of the taxpayers' money for subway construction and connect it with the out-of-date elevated lines in Brooklyn, provided further that all the receipts on the subways built by the taxpayers' money shall be used by the Brooklyn Rapid Transit Company in establishing for all time a dividend on many of the unprofitable elevated lines in Brooklyn.

"The Interborough's plan proposes to extend the present city subway so that all the people in Brooklyn, including the outlying districts, will be given a 5-cent subway fare from one end to the other of the Greater City of New York. If the Interborough's plan is adopted by the city it will save $58,000,000 of the taxpayers' money that the Brooklyn Rapid Transit Company's plan calls for and this $58,000,000 will construct the lines shown on this map to Richmond, to Jamaica and to Flushing, and if these lines are constructed there would still be $30,000,000 of the taxpayers' money saved by accepting the Interborough's plan.

"The Brooklyn Rapid Transit Company advertises that it will take only $73,500,000 of city money to construct the rapid transit lines which it has been showing in heavy black lines on its advertising maps. The misleading character of this talk about cost can be seen readily by looking at its offer of April 25, in which it was stated that the city's requirement of new capital would be $73,500,000 for the lines then proposed.

"Since that date and on May 1 the Brooklyn company added to its so-called original lines: (1) The Jerome Avenue extension to Jerome Park reservoir; (2) the Southern Boulevard extension to the Bronx River; (3) lines to Astoria and Corona; (4) the Nostrand Avenue extension; (5) the Livonia Avenue extension; and (6) the Fourteenth Street tunnel to East New York.

"But not a word has been said about the additional cost of these lines. Every day since they were added the Brooklyn company has stuck to its original figure of $73,500,000. More than this, and still further showing the deceptiveness of their advertisements, the Brooklyn company are placing upon their advertising maps in black lines the following lines which they have not even yet agreed to put in their offer: (a) The Southern Boulevard line extending as far as Pelham Bay Park; (b) the Utica Avenue extension, and (c) the tunnel to Staten Island.

"And still they seek to lead the public to believe that all the black lines will cost the city only $73,500,000.

"Now, the facts are that the cost to the city of the lines first mentioned by them will be $118,000,000. The cost to the city with their additions of May 1 will run up to $168,000,000. The grand total cost to the city of this layout as advertised will run up to $188,500,000."

THE BROOKLYN RAPID TRANSIT COMPANY'S REPLY.

On May 31 the Brooklyn Rapid Transit Company replied with an advertisement headed "Abraham Lincoln and the Interborough," in which it stated in part:

"The first sentence of that familiar saying of Abraham Lincoln about fooling some of the people part of the time still has attractions for the Interborough Rapid Transit Company. It has made one set of propositions to the Board of Estimate Committee and Public Service Commission and by transparently deceptive literature is making another set of propositions to the reading public.

"It has added in its newspaper and pamphlet propositions 24 miles of routes which are never mentioned in its official propositions. These do not include many miles indicated with ciphers, which without figures before them are generally understood to stand for nothing. It seeks to convince the public that these new routes are all to be built if the city accepts the Interborough proposal.

"Not one of them can be built and operated under that proposal without an absolute guarantee by the city indemnifying the company against any loss of any kind—even to the extent of interest on its own investment for equipment required for the operation of these lines.

"The wonder is that with such a saving clause the company did not add 100 miles to its pictured routes. But perhaps in that event none of the people would have been fooled any of the time. The published products of acceleration indicate that some good people have already been fooled.

"But even if the 24 miles of additional routes should yet be embodied in the Interborough's formal proposition, and even if the city might be persuaded to give the company the guarantee of indemnity against loss which it demands, what would the people get under the revised plan?

"One hundred and two miles of rapid transit routes (including existing subways) against

"One hundred and twenty miles of rapid transit routes furnished under the B. R. T. plan.

"And what would the city invest?

"One hundred and ten million dollars under the Interborough plan—taking the company's own figures; and

"One hundred and three million five hundred thousand dollars under the B. R. T. plan—including the extensions to be built and operated as 'original lines.'

"Truly, the thoughtful citizen or taxpayer would not hesitate long in his choice between these two offers if he were not deceived by misleading representations and fallacious figures.

"Certainly the careful merchant will not fail to detect in which proposal his greatest interest lies if he studies this transit controversy with full information of the facts.

"Then, if the city is to go into partnership with transportation companies, there is the question of the character and corporate history of the partner to consider. On the one side consolidation and growth have been accompanied by great scandalous and fictitious increases of capitalization (see Judge Gaynor's article in *Pearson's Magazine*); on the other side, by many millions of decrease in capitalization. On the one

side is a shady record of juggling with corporate accounts and improper diversion of corporate moneys (see records of the Public Service Commission's investigation and of the District Attorney's office); and on the other side is a clear bill of corporate health and living (see records of the Public Service Commission's investigation). On the one side is a year's negotiation with the city accompanied by subterfuge, threat, political influence and intrigue—no yielding in terms except under compulsion; and on the other side is a three months' frank, open, honest and conciliatory conference with the city's representatives for the proper working out of the city's great problem.

"We prefer to trust to the latter part of Abraham Lincoln's famous utterance—that you cannot fool all the people all of the time."

THE ANSWER OF THE INTERBOROUGH RAPID TRANSIT COMPANY

In the same issue of the daily newspapers the Interborough Rapid Transit Company published the following advertisement:

"No out-of-date and inefficient plan of rapid transit. No use of taxpayers' money to bolster up the B. R. T.

"This is what the late John H. Starin, vice-president of the Rapid Transit Board, said about the B. R. T. in 1906:

"'It's the old, old struggle that I have seen over and over again on this very board of the out-of-date and comparatively inefficient system resisting the advance of the modern and efficient.

"'I want, now, to register on the records of this board that I am opposed to this elevated loop plan, among other reasons, because I do not intend to have any part in bolstering up any private corporation at the expense of the city of New York.

"'If the old city of Brooklyn gave away hundreds of millions of dollars worth of street franchises and has nothing to show for it except an overgrown and undeveloped railroad system, I see no reason why this board should be forced to come to the rescue. We have built subways for Manhattan and the Bronx that are the best that money can buy, and we propose doing as much for Brooklyn; our opponents propose that we patch up an ineffectual system with another piece from the same old material.

"'Let us not assist in perpetuating a great error. Let us build a modern system and at least do our part toward remedying the blunders that have been made in the past in Brooklyn.'

"The Interborough offers to extend its modern system which Vice-president Starin described. This will make it possible to go from one part of the city to any other part for one 5-cent fare, which Mayor Low said was necessary for the unification of the city.

"Does Brooklyn want a unified subway system or patched-up elevated lines? Judge what you may hope for by what you have."

FIRE HOSE SPECIFICATIONS

At the annual meeting of the National Fire Protection Association, whose headquarters are in Chicago, there was presented a report which gave a list of the most common defects of the fire hose now sold in the market and which explained how such defects could be detected. In order to enable purchasers to secure high-grade hose the report included a complete set of specifications covering the materials of which the hose should be made for different sizes and the test conditions which the product should satisfy before it should be accepted for service. The report stated that the present general practice of purchasing hose by brand or trade names was chiefly responsible for the present unsatisfactory condition of this material.

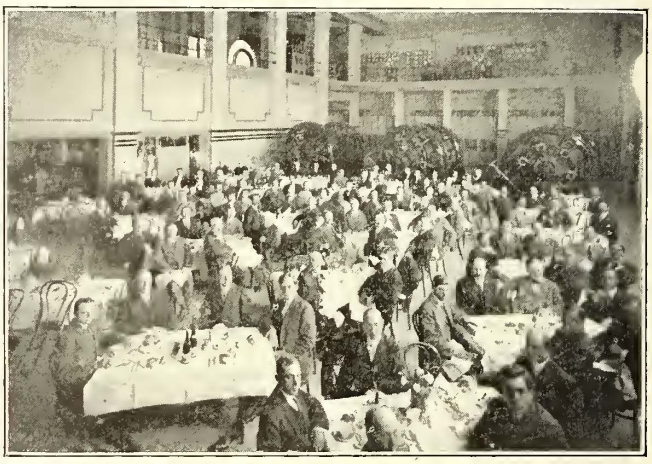
STORAGE-BATTERY CAR FOR LONG ISLAND RAILROAD.

The Long Island Railroad has placed a single-truck Beach storage-battery car in regular operation on its Bushwick branch to replace steam operation. The car runs between Bushwick and Bushwick Junction, a distance of 3½ miles, and makes seven round trips or 49 miles per day.

SOUTHERN PACIFIC COMPANY ENTERTAINS A. I. E. E.

On the evening of May 19 the Southern Pacific Company celebrated the completion of the first part of the work of changing its elaborate suburban steam service in and around Oakland, Berkeley and Alameda to electric operation by inviting to inspect its power station at Fruitvale, the San Francisco Section of the American Institute of Electrical Engineers and the officials of the various power and railway companies in San Francisco, Oakland and vicinity. An elaborate dinner had been prepared on the floor of the power house under the management of the commissary department of the railway company, and the corps of dietetic experts abandoned for a few hours their exciting life on the bounding main, or rather rail, for the more prosaic domesticity of the great building.

One of the company's standard dining cars was placed in the power house on the permanent construction track for a kitchen. By means of a skip attached to the 15-ton hoist of the traveling crane a quick and easy transfer was made between the dining car and the machine shop, which was utilized temporarily as a serving room. The dining tables were placed on the main floor of the generator room between the turbines and the rotaries. The building was as neat as a parlor, and, with its ceiling 50 ft. above the diners and the harmonious decorative effect of its construction, was as impressive as a great church interior. During the evening many compliments were extended



Banquet in Fruitvale Power Station

over the successful completion of the work so far performed to the members of the engineering staff of the Southern Pacific Company, and to A. H. Babcok, its chief electrical engineer.

After the dinner had been discussed the large party of experts left the tables to inspect the details of the plant. The difficulties outlined above were found to have been solved by the adoption of a 1200-volt d.c. catenary trolley system for which current is furnished by 600-volt rotary converters assembled in pairs and operated in series, the rotaries being actuated from 25-cycle, three-phase generators.

The third-rail being entirely out of the question locally, the engineers felt that they had the problem as cornered as well as it could possibly be cornered, so that no matter which way "the cat jumped" they could easily adapt themselves to whatever conditions the future might have in store as the best system, whether 600 volts d.c., 1200 volts d.c., 25-cycle single-phase a.c., or three-phase a.c.

While the guests were engaged in strolling about, studying and admiring the excellent work to be met with everywhere, the tables were removed, and at 9 p. m. the visitors again sat down this time to the regular monthly meeting of the large San Francisco Section of the American Institute of Electrical Engineers. At this meeting papers were read by those various engineers of the railway company who had designed and developed the details of the construction. These papers were followed by discussions, and the occasion was concluded with everyone feeling he had been honored by being present at the

celebration of this great undertaking, which, considering the vast fuel oil and hydroelectric possibilities of California, is destined to be followed in its field by as rapid extensions as was the successful demonstration of electric street railway operation in Richmond, Virginia, twenty-five years ago. An account of the engineering details of this work, with illustrations, appeared in the Feb. 4 number of the JOURNAL.

In connection with this meeting it is of interest to report that in the daily papers of the morning following the event just described the announcement appeared that the Southern Pacific company contemplated at once undertaking the problem of changing from steam to electricity on its vast suburban and interurban system in and about Los Angeles, Pasadena, Riverside, Redlands, etc., and perhaps as far north as Santa Barbara.

SOLID STEEL WHEELS IN BROOKLYN

The Brooklyn Rapid Transit System was one of the first electric railways to adopt the solid rolled-steel wheel for surface cars. The company has operated thousands of these wheels for the past three years with such satisfactory results that it has also designed and ordered them for the pony axles of its maximum traction trucks. The original estimates made by the mechanical department showed that the steel wheel would be cheaper than chilled cast iron on a cost per mile basis if it gave a minimum average life of 120,000 miles. In practice, however, the average mileage obtained has frequently exceeded this figure.

The satisfactory results obtained from solid steel wheels are shown by the following averages made up in October, 1909, for wheels placed in service at various dates between Dec. 19, 1906, and May 6, 1907, inclusive on 100 cars:

Average Mileage per Wheel.	No. of wheels.	No. of Turnings.
83,904	312	None
54,915	308	One
63,346	146	Two
66,613	34	Three

The mechanical department inspects all wheels on arrival as to their conformity to the specified profile, dimensions, thicknesses, etc. The Brooklyn company would like to use the standard wheel of the American Electric Railway Association, but cannot do so because its track conditions demand a flange 1 in. wide at the gage line and 5/8 in. high. The wisdom of selecting this special profile is proved by the entire absence of flange breakage, such as frequently occurs on other railways where the track work is unsuitable for the wheels.

The average life of the solid steel elevated wheels is 10,000 miles per 1/16-in. wear and of the surface wheels 6000 miles to 7000 miles per 1/16-in. wear. The limit of radial wear is 2 in., corresponding to a reduction of 4 in. in diameter. On the elevated division all of the rolling stock except 36 special equipments is furnished with solid steel wheels. The wheels for the elevated motor trucks are 34 in. in diameter, while those for the trailer trucks are 31 in. in diameter. As the larger wheel weighs 850 lb. and the smaller one 690 lb., there is obtained a net saving of 640 lb. of revolving weight per car as compared with the practice of using the same diameter wheel for both trucks.

The surface car wheels of 34 in. diameter weigh 560 lb., those of 33 in. diameter weigh 530 lb. and the pony wheels of 21 in. diameter 250 lb. One point usually brought up in favor of the cast-iron wheel when possible savings in weight are considered is that a 33-in. cast-iron wheel weighs only 420 lb., whereas a solid steel wheel of the same diameter weighs 530 lb. The difference in weight rapidly decreases, however, with service, because the cast-iron wheel is scrapped after it is worn down, say, 3/4 in., corresponding to a loss of 40 lb., whereas the steel wheel will lose over 200 lb. by the time it has reached the limiting radial wear of 2 in. It will therefore be seen that by the time the steel wheel has reached about one-half its useful mileage its weight will become less than that of a cast-iron wheel, so that there is little to choose between the two types in respect to saving weight.

COMMUNICATION

TRUNK LINE ELECTRIFICATION

DEPARTMENT OF WAYS AND COMMUNICATION OF RUSSIA.

St. Petersburg, May 12, 1911.

TO THE EDITORS:

I have read in your issue of April 15 the report of the paper by W. S. Murray on trunk line electrification, and although his evidence goes to show that the electric system of the New York & Hartford Railroad is a complete success, I cannot agree with him in his conclusions as to the universal use of the single-phase system on trunk lines. It is impossible to disregard the question of the relative costs and merits of the various system of electric traction, and no one electric system can yet be considered the best for all conditions unless one is satisfied under some conditions with a very poor average. The adoption of the single-phase system would mean too heavy a sacrifice in numerous instances where we ought really now to see electric traction substituted for existing steam traction.

I am by no means opposed to the single-phase system, nor am I an advocate of other systems, yet the really wonderful performances of many existing direct-current and three-phase lines cannot be ignored. It seems to me that the much-discussed question of one single universal system of electric traction for trunk lines is purely of an abstract character. If all railroads had to be electrified in the same way the single-phase system might at present be the best suited for such a general purpose, or it might not be.

This same policy of reasoning in the abstract was followed by several of those who presented reports on electric traction at the International Railway Congress held at Bern in 1910, and, so far as the purely hypothetical case was concerned, the opinion of these gentlemen in favor of the selection of the single-phase system as a universal system may in a way have been justified. But the same speakers, from their elaborate studies of the question of electrification in Bavaria, Austria and Switzerland, reached the conclusion that electric traction could advantageously be substituted for steam traction on trunk lines only under two conditions, namely: (1) Where the energy required could be generated at less than a certain sum per kw-hour, and (2) when the density of traffic was greater than a certain amount.

If we consider the cases even of these three countries, whose representatives at the congress were those who took the position mentioned above, in favor of the adoption of the single-phase system as a universal system, we find that there are only two classes of trunk lines which are warranted now in adopting electrification, namely: (1) Mountain divisions, sometimes with short, flat adjacent sections, and with a cheap source of energy in the vicinity, and (2) suburban sections of trunk lines which adjoin larger cities and have a high density of traffic. For these two special applications, which represent the real possibilities of electrification, other systems, such as the three-phase system and the direct-current system, would often be more economical and more desirable from purely technical reasons than the single-phase system. This has been shown by the records of performance, time and again.

What then remains of the electrification of entire systems of trunk line railroad, which is advanced as the chief argument for the adoption of the single-phase system as the universal system of electric traction? Nothing. And what would be the real benefit of finding such a universal electrical system, if that was possible? None; that is to say, unless we are prepared to underestimate the capabilities of the modern steam locomotive, which is now and for a long time will remain the cheapest and best motive power for miles of existing railroads, and unless also we disregard the merits of all other electrical systems.

On the other hand, the art is progressing so rapidly that no one can guarantee that ten years from now some other system will not be developed which will compete actively with any now in existence.

The practice of extrapolation has always been condemned by mathematicians, and where the expenditure of millions of dollars is at stake, as in the case of electrification of trunk lines, and where the owners of these great railroad systems are pretty apt to ask specific explanations as to the return each year on the money expended in electrification, it would seem that engineers must be even more careful than mathematicians in their attempts to extrapolate in an unknown field.

It might also be said that since motor-car trains are peculiarly suited only for local traffic, all long-distance service with heavy trains must be handled by locomotives, and it will not take any more time nor trouble for a train to change electric locomotives of different types, say from three-phase and to single-phase or vice versa, than it now takes to change the steam locomotives on a train at the end of an engine run. The very small complications involved in the distribution system for making such a change are not worth consideration.

The conclusions at the Bern congress on the question of systems of electric traction seem fully to confirm these views. Clause No. 2 of these conclusions was accepted by the vast majority of the attendants at that convention, which included railroad men and electrical engineers from all countries, and was as follows: "There are various systems at hand and the selection of one or another system is dependent on its respective suitability in each case."

It is better, then, to let each system develop along natural lines and find its own field rather than arbitrarily to attempt at this time to compel adoption of one to the exclusion of others. The one most fitted for the service will win.

Henry Graftio,
Engineer of Ways and Communication.
Local Hon. Secretary, A. I. E. E.

CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION

The thirty-fourth annual convention of the National Electric Light Association was in session in New York City as this paper went to press and the last session was to be held June 2. The report of the membership committee of the association shows that the number of members has nearly doubled during the past year, the gross gain being 3919. The total membership of all classes on May 30 was 8665 and the registration at the convention was 4154. Most of the meetings were held in the Engineering Societies Building on Thirty-ninth Street and the long program of papers and committee reports was divided into commercial, accounting, technical and power transmission sessions.

Abstracts of several of the papers and reports presented at the technical sessions are printed elsewhere in this issue.

ANNUAL REPORT OF LEEDS AND BRADFORD TRAMWAYS

The report of the Leeds Municipal Tramways for the fiscal year ended March 31, 1911, shows total receipts of £370,402, total expenditures of £195,303. A payment of £51,886 was made toward the reduction of taxes. The number of passengers carried was 80,806,270, and 4,308,439 car miles were operated. The receipts per car mile advanced from 21.04 cents in the preceding year to 21.38 cents.

The annual report of the Bradford Tramways for the same fiscal year shows passenger earnings of £264,075. The earnings per car mile were 23.2 cents, against 22.4 cents for the preceding year. The number of car miles operated was 5,461,562, and the number of passengers carried 52,919,559. The last figure was equivalent to carrying every inhabitant of Bradford 157 times a year.

Blind passengers were given 82,589 free trips, in accordance with custom. The Bradford system comprises 54.8 miles of route.

AEROPLANES AT STREET RAILWAY PARKS

One of the principal show features of large electric railway parks this year promises to be aviation meets. No invention in recent years has attracted such popular interest as the aeroplane, and none attracts such a large attendance. Inquiry at the headquarters of the Curtiss Exhibition Company in New York recently elicited the information that this company is planning to pay special attention to electric railway parks this year. The Winona Interurban Railway, of Warsaw, Ind., as mentioned in the issue of this paper for May 20, is one of those which will provide such an attraction this summer. In many respects the aerial flights are especially adapted for electric railway exhibit purposes, because they can be held at any point on the line where there is an open field or even, by the use of the new hydro-aeroplane devised by Mr. Curtiss this year, where there is a body of water. Thus, at the aviation meet in Los Angeles, Dec. 27, 1910, on the line of the Pacific Electric Railway, no enclosure was used. The right-of-way of this railroad is fenced in and persons holding admission tickets arriving on the railroad were allowed simply to pass through a gateway in

Hydro-Aeroplane

the right-of-way fence and the field was practically inaccessible in any other way.

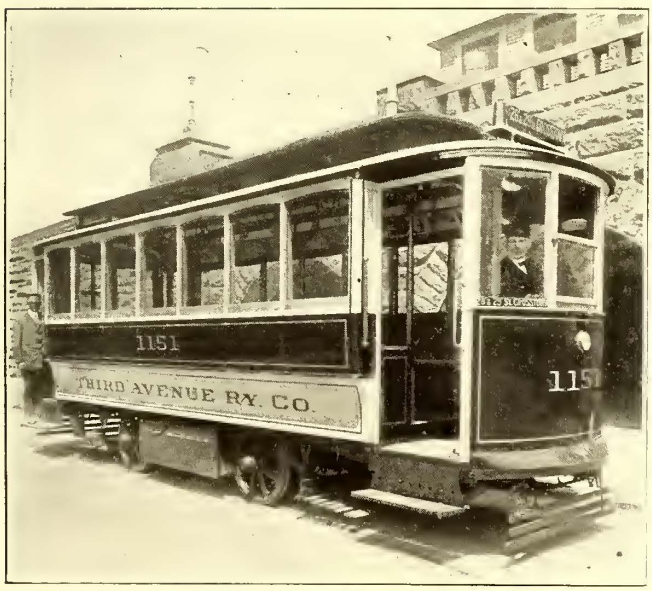
The general type of the Curtiss aeroplane is the biplane, formed by two sets of wings or surfaces, one directly over the other. The woodwork is almost entirely of selected spruce, and the trussing is done with galvanized-steel wire cables. The propeller is of ash and spruce, the heavier and more flexible wood forming the core. The wing panels are made with a light and strong wooden frame covered with linen cloth. Light bamboo rods extending to the front and rear of the main planes support the forward horizontal surface, which acts as a rudder to steer upward and downward, and also the rear vertical rudder and stabilizing plane. At the ends of the main framework there are small movable planes to maintain the lateral balance of the aeroplane. The motive power is supplied by an eight-cylinder, 60-horse-power "V"-shaped, gasoline engine.

The new Curtiss hydro-aeroplane is similar to the standard type of Curtiss aeroplane except that it is fitted with a skimmer-shaped boat on wheels, which enables the machine to be used on land or water, or in the air. This design was developed by Mr. Curtiss last winter at San Diego, although his first demonstration with the machine was at Salt Lake April 10-12, 1911. The hydro-aeroplane can arise from or descend to the water, over which it can skim at the rate of 50 m.p.h., and it is safer than the ordinary aeroplane because its ability to alight on water provides it with a safe place for landing. The accompanying view of the hydro-aeroplane was taken at San Diego.

FOUR-WHEEL DRIVE STORAGE BATTERY CAR

The Third Avenue Railroad has placed in regular service on the Twenty-eighth and Twenty-ninth Street crosstown line in New York City a storage battery car mounted on a Berg four-motor, four-wheel drive truck. This type of driving mechanism is a modification of the four-wheel, four-motor drive which has been successfully applied to a large number of heavy automobile trucks and omnibuses during the past five years by the Commercial Truck Company of Philadelphia. Each of the four motors drives a single wheel through suitable reduction gearing and each wheel therefore acts as an independent unit. The advantages claimed for this method of driving are: (1) Curves and inequalities of the track are compensated for and the wear on the wheels and rails is thereby reduced; (2) higher rates of acceleration are possible with less drain on the battery; (3) in starting, the motors can be connected four in series and thus prevent losses of current in external resistances; (4) the gearing between the motors and the wheels is incased and runs in an oil bath so that the gears have a high efficiency and long life. The motors are of General Electric manufacture and are rated at 22 amp on 100 volts. They are completely inclosed and are mounted between two channel cross-beams. The pinion engages with a triple planetary gear the casing of which is bolted to the end of the motor and forms an oil reservoir in which the gears run. On the outer face of this casing is a hollow axle on which the wheel turns. The spider of the planetary gear has a shaft which passes through the hollow axle and as shown in one of the accompanying illustrations terminates in a square end. In the hub of the wheel is mounted a Timkin roller bearing and the outer face of the hub is notched to engage with the hub cap which fits on the square end of the shaft. The wheel has a rim cast on the side of the spokes into which an internally expanding band brake is fitted. If it should be necessary to remove a wheel or a motor it can be done in a few minutes by the removal of the hub cap.

The compactness of the driving mechanism and the absence

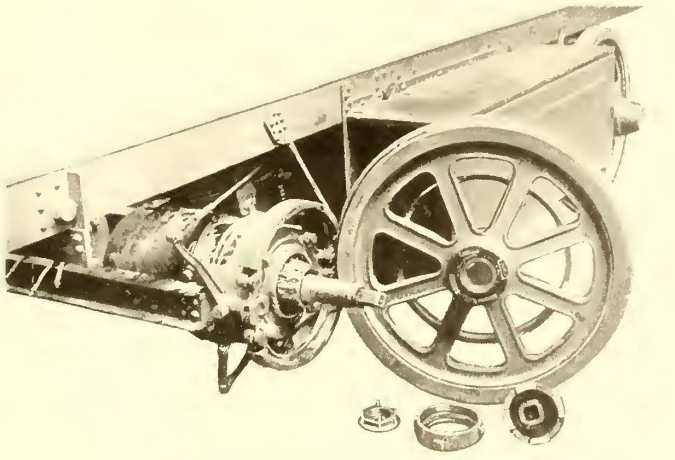


Four-Motor Storage Battery Car

of all chains or gears between the two pairs of wheels makes it possible to mount the storage battery in a box attached to the truck frame under the car body. With this arrangement an exhausted battery can be removed and replaced by a fully charged battery in less than one minute without taking the car out of service. Smaller batteries, therefore, can be used, ample time can be given to charging and inspection under favorable conditions, and by providing a few extra batteries all cars can be kept in service for a full day of sixteen or eighteen hours.

Other advantages obtained by mounting the battery under the car are less side sway and splashing of the electrolyte due to the battery being low down; battery may be handled as a unit by machinery; ample ventilation can be provided and no gases or fumes can enter the car; the electrolyte which is spilled out cannot come in contact with and rot any wood except the inexpensive battery trays.

The body of the car was built by the Third Avenue Railroad. The side panels, dashers and roof are formed of Agosote.



Method of Dismounting Wheel

The car will seat twenty-eight passengers and has the following weights:

Truck, including motors, battery tray and control	5,000 lb.
Body	4,200 lb.
Wheelguards	346 lb.
Battery—50 cells at 75 lb.	3,750 lb.
Total	13,296 lb.

The operation of the car since it was put in service early in May has been very satisfactory. It is equipped with a Gould battery of fifty cells and a rated capacity of 520 amp-hours. The car runs from 50 to 70 miles per day and uses from 330 to 400 amp-hours on one charge of the battery. The following table shows the performance of the car for seven days:

Days.	Car Miles.	Amp-Hours.	Amp-Hrs. per Mile.	Watt-Hrs. per Mile.
April 28	51	330	6.46	646
May 3	51	336	6.60	660
May 4	51	360	7.05	705
May 6	51	336	6.60	660
May 7	61	384	6.30	630
May 11	66	390	5.90	590
May 13	67	378	5.64	564

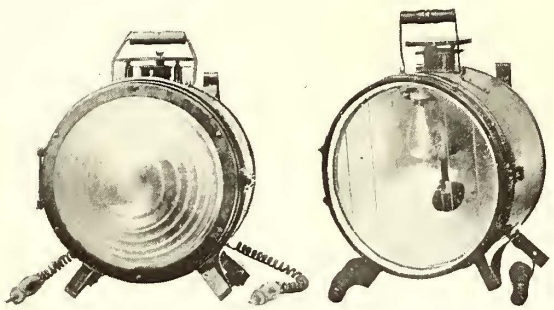
Between May 7 and May 11 the brakes were adjusted with a resulting marked improvement in the current consumption. Assuming an average passenger load of 2000 lb., the power consumption per ton mile based on the average of May 11 and 13 was 75 watt-hours. The car makes an average of nine stops per mile.

The truck was designed by Charles Berg, president of the Imperial Electric Motor Company and general manager of the Berg Storage Battery Car Company, Hudson Terminal Building, New York. It was built by the Commercial Truck Company of Philadelphia, of which Mr. Berg was one of the founders. The Berg Storage Battery Car Company is preparing to design and build four-motor four-wheel drive trucks for all types of storage battery and overhead trolley street cars.

The Public Service Commission of New York, Second District, has required reports of steam-railroad companies for three years of all delayed passenger trains in the State. For the year ended March 31, 1909, an average of 54,216 trains per month were run on the steam railroads of the State. For the year ended March 31, 1910, the number was 58,651½, and for 1911 it was 63,236. For the three years the average per cent of trains on time as reported to the commission of the second district was 83.4.

ARC HEADLIGHTS FOR ELECTRIC CARS

In the new line of arc headlights for electric cars developed by the General Electric Company the well-known characteristics of the luminous magnetite arc have been advantageously employed. The brilliant and large volume of light given, when operated normally, insures units of high efficiency and the low luminosity resulting with reversed polarity affords a most convenient means for dimming the glare of the lights. The last-named feature is distinctly new and tends to eliminate the inconvenience attending the use of screens. Since some electric railways favor auxiliary incandescent lamps for dimming, several of the eight styles available are equipped with one or more standard 16-cp, 110-volt incandescent lamps connected in series with a suitable resistance for operation across the nominal voltage of the railway circuit. All the styles are usually adjusted to operate on 550-volt direct current, with an 80-volt arc and a 4-amp current. Four of the styles are suitable for suburban, two for interurban and two for mine service.



Two Types of Magnetite Arc Headlights

The headlights for cars operating on suburban tracks with many curves and interscecting roadways are equipped with parabolic reflectors of highly polished metal. They furnish a broad fan beam which illuminates the track directly from the head of the car and 50 ft. on each side to a distance of 1200 ft. or 1500 ft., thus enabling the motorman to see to some extent around curves and also to detect the presence of persons or vehicles approaching the track. Special chimneys or shields are provided for cutting off the objectionable side rays, and suitable arrangements are made for dimming by reversed polarity or by incandescent lamps. In either case the motorman merely throws a switch to obtain full or subdued illumination at will.

The interurban styles are equipped with mirror reflectors or with semaphore lenses and spherical mirrors. The semaphore lens is of the molded plano-convex type. It consists of a series of circular sections arranged for giving the best optical effect with great structural strength and minimum weight. Its depth of focus enables it to be placed sufficiently far from the electrodes to prevent its being materially affected by the heat of the arc. This headlight furnishes a brilliant beam which illuminates the track to a distance of about 2000 ft. Since an interurban limited traveling at 60 m.p.h. can be brought to a stop within 1700 ft. or 1800 ft. the illumination obtained from this headlight affords an ample factor of safety. The illumination is confined practically to the width of the track, and, therefore, the motormen of cars running in opposite directions are not blinded by the glare of other headlights, nor is the traffic on paralleling roadways interfered with in any way. Dimming is accomplished by reversing the polarity or by means of auxiliary incandescent lamps.

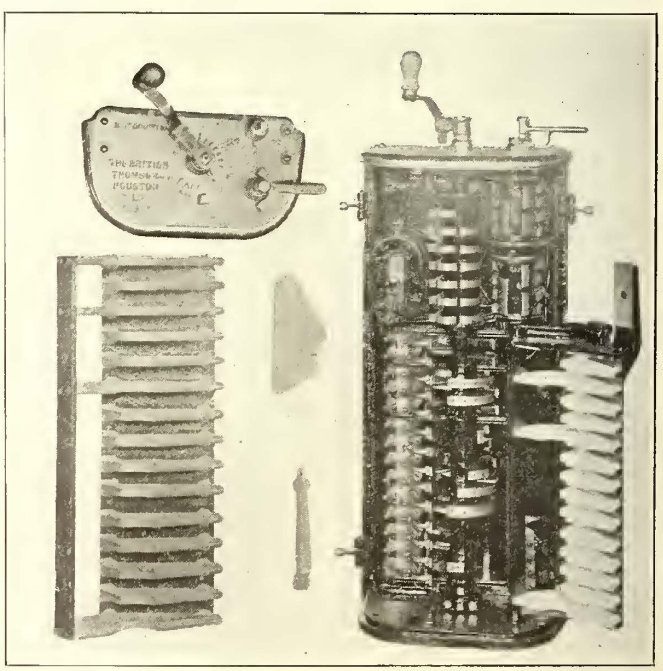
All the styles operate on the same principle and differ only in the details required for adapting them to various classes of service. The electrodes automatically maintain the arc at the focus of the reflector, thus eliminating from the duties of the motorman the trouble of frequent adjustment. The positive electrode consists of a stationary copper forging sheathed in suitable metal to prevent it from oxidizing. It has a life of 2000 hours to 3000 hours and may be considered as non-consuming. The negative electrode is a steel tube containing the mixture of iron oxide and other substances for forming the luminous arc. It has a life of 60 hours to 80 hours. The slow rates of consumption serve to maintain the arc within safe voltage limits.

The high efficiency of these headlights is due to the fact that the light of the luminous magnetite arc is emitted by the entire arc stream in which the vapors from the negatve electrode are heated to high incandescence. Therefore, the volume of light available is much greater than that obtainable from ordinary arc lamps, the luminosity of which is derived only from the incandescent tips of the carbon electrodes.

A BRAKING CONTROLLER EFFECTIVE IN BACKWARD RUNNING

Controllers of the braking type now in use are so arranged that if the car is running forward on moving the handle to the brake notches currents are generated in the motors to produce a retarding torque, the direction of the currents in the motors being such as to strengthen the magnetism of the fields. If, however, the car is running backward and the controller handle is moved to the brake notches, the direction of currents generated in the motors is such as to demagnetize the fields, so that no braking effect is produced.

To obtain braking when the car is running backward the British Thomson-Houston Company, Limited, of Rugby, England, has introduced controllers in which, when the controller handle is moved to the "off" position, connections are made which cause one or more of the motors to act as generators to produce the desired effect. These connections are such that no braking action is obtained during the forward running of the car if the handle is in the "off" position. An arrangement preferable to this, however, is one in which the motion of the control handle which produces braking for forward running will also produce braking for backward running. The B-49 controller shown in the illustration will give this result. The reverse switch handle may be in either the forward or reverse position, when by moving the main control handle to the braking notches a rheostatic braking effect will be obtained for either the forward or backward motion of the car. This controller is suitable for use with two 40-hp, 500-600-volt series motors and has four series, four parallel and seven brake controlling points.



Controller Arranged for Braking in Either Direction

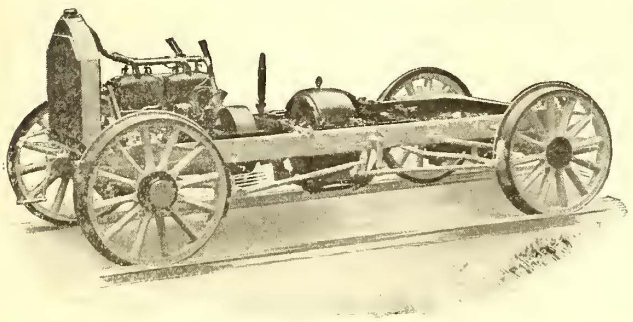
Another important new feature of the B-49 controller is the

mechanism by which a defective motor may be cut out of service without removing the cover of the controller. To cut out a motor it is only necessary to remove the reverse switch handle from its spindle and apply it to the cut-out spindle which projects through the cap plate, shown in the illustration near the back edge of the cap plate. This cut-out spindle has three running positions, a central position for which both motors are in circuit and a position on each side to cut out either motor. An interlocking mechanism prevents the moving of the reverse switch unless the cut-out switch spindle is in one of its three running positions. The usual interlocking mechanism is provided to prevent the reverse swtch from being moved unless the main cylinder is in the "off" position.

The arc deflector of the B-49 controller, consisting of fireproof barriers, is of strong mechanical construction. The large deflector plates are supported at both ends, and the small plates molded with large bosses for the fixing screws, thus providing rigid fixing for the plates. A magnetic blow-out is provided for all fingers of the main cylinder on which arcing takes place. An insulating trough surrounds the back half of the main cylinder to protect the frame from the influence of the arc or live parts. The trough is divided into sections by barriers; these, with the arc deflector which covers the front half of the main cylinder, form separate chambers for inclosing various sections of the cylinder which may be at different potentials. The brake cylinder is mounted on the main cylinder spindle in accordance with this manufacturer's standard practice. This prevents any possibility of change in the relative positions of brake cylinder and handle, which may occur due to wear on the gears or cams when the brake cylinder is mounted on a separate spindle.

GASOLINE SECTION REPAIR CAR

The accompanying illustration shows the frame work of a gasoline section repair car for railways recently built by the Otto Gas Works, Philadelphia. This car was designed especially for use on the Chicago, Rock Island & Pacific Railroad, but is, of course, adaptable to any interurban electric line. The power is supplied by 30- to 35-hp, four-cylinder, four-cycle gas engine. The car also carries a 10-hp Crocker-Wheeler electric generator which is arranged to be driven by the engine and thus supply power for operating electric drills, rail saws, portable emery wheels or any other electrical track repair tools. The truck frame shown in the illustration is surmounted by a body which will seat from eight to ten men, and will also carry a complement of tools, spikes, cable and other material.

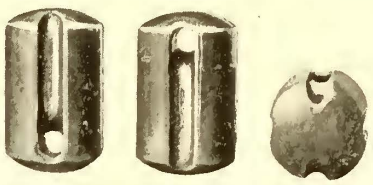


Gasoline Section Repair Car

The car is operated in the same manner as an automobile, but is provided with a clutch by which the engine can be disconnected from the driving axle and made to engage with the generator. When the site where the work is to be done is reached the engine is connected with the generator and two power cables, each about ¼ mile in length are stretched each way from the car. These cables are provided with plug switches every 20 ft., so that the electric portable tools can be used for ½ mile along the track without any change in the position of the car. The car weighs about 3000 lb.

PORCELAIN STRAIN INSULATORS

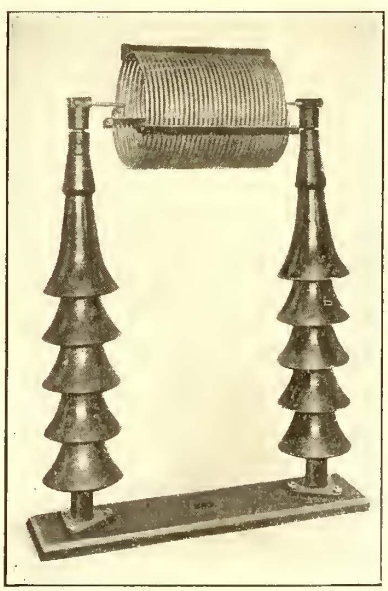
There are many conditions for which properly designed porcelain strain insulators are admirably suited. They are largely used in guy wires by street railway and by electric power companies. Groups in series are used at dead ends to take the strain of and to insulate the line wires. The Westinghouse Form P-2 porcelain strain insulators shown in the accompanying cut are made of a grade of porcelain said to be much superior to that ordinarily used for such appliances. The glaze is a dark brown, so the insulators do not readily attract attention in the air. Sharp corners that would be apt to chip have been avoided and the shape of the grooves is such that the wires lie naturally in them. The break-down voltage when the insulators are dry is about 20,000 volts for each of the three sizes. The approximate ultimate tensile strengths of the insulators, when wired up in guy wires, are respectively 14,000 lb., 16,000 lb. and 23,000 lb. Even if one of these insulators fails either because of excessive stress or through accident, the wires that it carries cannot drop because they are interlinked. Two of these insulators are often installed in series; then if one breaks the other provides insulation.



Porcelain Strain Insulators

AIR-COOLED CHOKE COILS

It is sometimes convenient to mount choke coils on ceilings so that the insulating coil supports hang pendent. At other times it is preferable to arrange them so that the coil rests on the supports, as shown in the accompanying cut of the new Westinghouse Dr coil. This coil can be mounted either way, because the insulating columns can be removed and inverted by taking out four bolts. An aluminum rod, bent into a helix of about 15 in. diameter and containing about thirty turns, forms the coil proper. Bracing clamps are provided to give mechanical strength to the helix. The aluminum rod used is of sufficient diameter to carry 200 amp safely. Each coil is supported on two insulating columns made up of porcelain insulators, which, except for the end pieces are interchangeable. The number of insulators used in any column depends on the voltage of the circuit in which the coil is to be used.



Air-Cooled Choke Coil

These coils can be mounted in any position convenient for the wiring on the floor, wall or ceiling. For floor mounting, the parts are arranged as illustrated, and for inverted mounting the insulator columns are inverted and the base is attached to the ceiling. The insulating columns are supported on substantial cast-iron blocks fixed on wooden bases. These choke coils are intended principally for the protection of transformers and should not be used for generators. Where greater reactance than is afforded by a single coil is desired for the higher voltage circuits, it is recommended that two or more coils be connected in series.

MOTOR TOWER WAGONS FOR THE UNION RAILWAY, NEW YORK

The Union Railway, New York, N. Y., is operating four Packard 3-ton tower wagon trucks for use in line repair work. The normal capacity of the truck is 6000 lb. and the maximum speed is 12 m.p.h. The trucks are the standard Packard 3-ton chassis, equipped with special bodies, built by John McCardell, of Trenton, N. J. The wheel base of the truck is 12 ft. It

One of Four Gasoline Tower Auto-Trucks for the Union Railway, New York

has a four-cylinder, water-cooled motor located in front of the driver's seat under the bonnet. The cylinders are 4½-in. bore by 5½-in. stroke, and 24 brake-hp is developed at 650 r.p.m. The distance from the ground to the top of the frame is 37 in. Each truck is equipped with a dry plate clutch, which operates without lubrication and, therefore, works equally well in both cold and hot weather. It has a delicate positive action at all times.

The regular brakes, operated by pedal, are on the ends of the countershaft, so that there is no braking strain on the trans-

OPERATING COST PER MILE IN CENTS OF GASOLINE AUTO TRUCKS, UNION RAILWAY

PACKARD	Jan.	Feb.	March.	April.
Gasoline	.0375	.0514	.0375	.0440
Lubricants	.0133	.0133	.0317	.0132
Labor	.1116	.2531	.2254	.2860
Totals	.1624	.3178	.2946	.3432
COUPLE-GEAR.				
Gasoline	.0524	....	.0612	....
Lubricant	.0133	....	.0133	....
Labor	.2729	....	.2783	....
Totals	.3386		.3528	

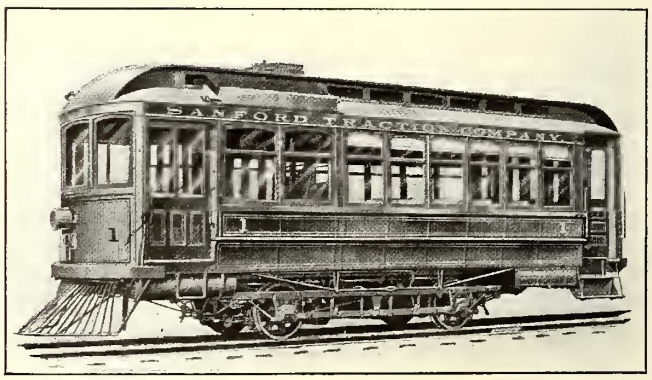
mission or bevel gears. The emergency brakes are expanding and operate on drums on the rear wheels. The over-all length of the body, not including the steps, is 12 ft. 3 in.; over-all length of body, including step, 13 ft. 6 in., and width of body inside the running boards, 4 ft. 1 in. The running boards are 13 in. wide. The inside measurements of the lockers back of the tower are as follows: Length, 16 ft. 2 in.; width, 14 in., and height, 14 in. The dimensions of the tower when telescoped are as follows: Base, 4 ft. 7 in. long; width, 4 ft. wide; height, 8 ft. 1 in. high from the top of the chassis. The height of the tower when raised is 14 ft. 2 in. from the top of the chassis. The measurements of the working platform are as follows: Length, 9 ft. 6 in.; width, 4 ft., and sides, 22 in. high from floor; approximate weight, 1600 lb.

In connection with the foregoing description, James D. Kent, electrical engineer Union Railway Company, has supplied the accompanying table of mileage operating costs on the four Packard trucks and the single 40-hp Couple-gear truck now in service. The Packard trucks weigh 8500 lb. and the Couple-gear truck, 10,400 lb. light. The January figures for the Packard truck can be disregarded in the comparison, as all labor was not included since this was the instruction period for the men. The Couple-gear costs for February and April, 1911, were omitted because of high charges for straight emergency service, due to the fact that the standby labor cost continued, although no mileage could be recorded against it.

GASOLINE MOTOR CAR FOR ALASKA

The Alaska-Northern Railroad, of Seward, Alaska, which is now operating 71 miles of track, has recently purchased a gasoline motor car from Fairbanks, Morse & Company, Chicago, Ill. The principal dimensions of this car, which is shown in the accompanying illustration, are as follows: Extreme length over the pilot, 34 ft. 2 in.; length over the vestibule, 32 ft.; length over the end panels, 26 ft. 3 in.; width, 8 ft. 6 in. The seating capacity is thirty-five. The rear platform is of the vestibuled type with folding doors on each side and with drop windows. The car is divided in two compartments, one for the engine room, baggage, etc., 11 ft. 1 in. long, and one for passengers exclusively, 15 ft. 2 in. long. The passenger compartment has reversible rattan covered seats for twenty-three passengers, drop windows and double-sliding doors at the rear. The engine room is separated from the passenger compartment by a partition with a swing door. It has baggage doors at each side. This compartment also has folding seats for passengers. The body is mounted on a single truck of 10-ft. wheel base, furnished by the Taylor Truck Company. The axles are of 4 in. diameter, 3¼ in. x 6 in. at the journals. The wheels are cast iron of 30 in. diameter. The body is carried on full elliptic springs which are independent of the engine and transmission.

The gasoline engine is of the water-cooled type with four 6¼-in. x 7-in. cylinders. It is rated at 50 brake-hp. The transmission is of the gear type. All gears are constantly in mesh and changes of speed are made by sliding jaw clutches. There are three speeds in each direction. The average running speed is 35 m.p.h. The transmission operates in conjunction with a master clutch of the disk type in the flywheel of the engine. The drive is accomplished by means of two chains attached to the front axle. All shafts run in roller bearings. The several control levers for the operation of the engine, transmission, brake and whistle are located in the front end of the car. The transmission is controlled by a



Gasoline Car for the Alaska-Northern Railroad

single hand wheel which shifts the jaw clutches and controls the master clutch through cams on a side shaft running parallel to the transmission. The speeds and the master clutch are so interlocked that there is no possibility of two speeds being engaged at the same time.

The car is equipped with straight air brakes and with a ratchet wheel for hand-braking. Other equipment includes an air whistle and foot gong at the front end, an acetylene headlight and oil interior lamps, and hot-water heating from a heater in the engine compartment. The weight of the car is 26,000 lb.

O-B THERMO BONDING PROCESS

The Ohio Brass Company has recently put on the market a patented process of soldering its standard all-wire compressed-terminal rail bonds to the rails after the bonds have been attached to the rail in the usual way. The additional tool equipments required are simple and low in cost and the operation can be performed by one man in a very few minutes. In fact, it has been possible to apply bonds by this process on electric railways which have a two-minute headway without delaying the traffic.

The process consists in heating the bond terminal after compression and the adjacent web of the rail practically instantaneously, independent of cold or windy weather conditions, by a chemical reaction. The heat produced is so concentrated that while the terminal and the adjacent web are quickly brought to a soldering heat the ball of the rail remains so cool that the hand can be laid upon it while the soldering is being done so that no injury to the rail or body of the bond can possibly result.

Figs. 1, 2 and 3—Process of Thermo-Welding Rail Bonds

The solder enters at *C*, Fig. 4, under the shoulder *B* of the terminal and firmly unites the entire shoulder to the web of the rail, forming a fillet at *C* and thus sealing the joint against the entrance of moisture between the head of the bond and the web of the rail and uniting the compressed portions of the terminal to the annular walls of the hole in the rail. In the section Fig. 4, *A* is the head of the bond, *B* is the extra contact surface gained by the process, *C* is the fillet of solder which seals the joint against moisture, *D* is the button head formed by the compressor, *E* is the thermo cup in position, *F* is the thermo compound, *G* is the ignition powder and *H* is the clamp which holds the cup in position.

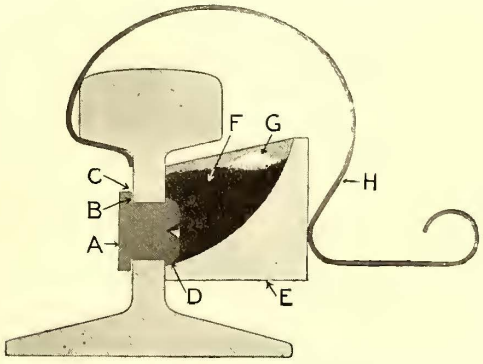


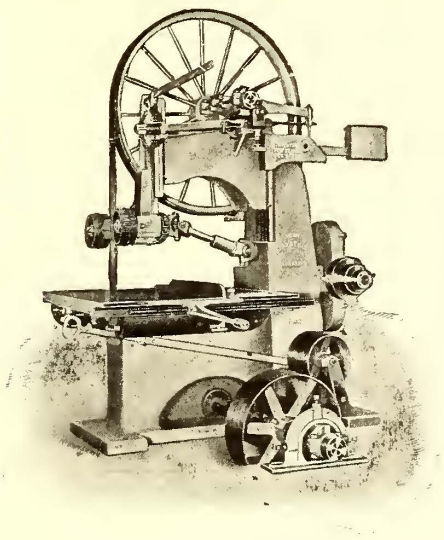
Fig. 4—Section Showing Rail, Bond, Thermo-Cup, Etc., Used in Thermo-Bonding Process

The manufacturers state that a number of trial installations of this process have been made with very satisfactory results and that strong patents have been issued under which its use is strictly limited to its application to rail bonds furnished by the Ohio Brass Company.

A HEAVY BAND RIP SAW FOR ELECTRIC RAILWAY CAR SHOPS

The use of the band rip saw as a substitute for the circular saw is increasing because of the saving on saw-kerf and the increase in efficiency and output. Hence the latest type of band rip saw, made by the J. A. Fay & Egan Company, Cincinnati, is of interest. This saw is designed for doing any kind of ripping in large and heavy timbers. It will rip with facility any thickness from ½ in. to 14 in. and 28 in. wide. While it is adapted for heavy work, it is equally efficient for ripping the finest lumber into small strips, and it is here that the thin blade of the saw will be best appreciated. In ripping heavy timbers that are very long the manufacturers recommend the use of a traveler on a track to insure a straight cut.

The table is 47 in. x 45 in. and has at the front a plainly stamped index. There are three driven feed rolls in the table. A cam lever releases, moves and clamps the fence, accomplishing its adjustment in the quickest possible manner. The wheels are 50 in. in diameter. The wheel shafts run in extra long bearings. The upper wheel is fitted with an improved sensitive straining device. The feed consists of five 8-in. feeding rolls. The upper rolls are adjustable up and down instantly and may be raised from the board, stopping the feed, or lifted quickly out of the way for use as a hand-feed rip saw, all being accomplished by a single movement of a long lever which is conveniently located for the operator. There are three speeds of feed. This machine is usually furnished with a 5-in. blade, 24½ ft. long. The driving pulley is 24-in. x 8-in. face, and should make 550 r.p.m. under regular operating conditions.



Heavy Band Rip Saw

LONDON LETTER

(From Our Regular Correspondent)

The Brighton Railway has completed the extension of its electrified lines to the Crystal Palace, and has opened the line to the public. The electrification of the line from Victoria to London Bridge, by way of East Brixton and Peckham, has been so successful that the company has regained the patronage of the persons that they had lost to the tramways. Similar hopes are entertained in regard to traffic to Crystal Palace, which it has always been difficult to reach. It took half an hour to make the trip by steam, whereas the through electric trains will cover the distance of nine miles in about fifteen minutes, and local trains in about twenty minutes. The work of construction was started about nine months ago by R. W. Blackwell & Company, who constructed the first section two years ago. The single-phase system is used the same as on the Victoria to London Bridge section. There is, however, a difference in the rolling stock. On the South London line the motor cars are equipped with four motors, rated at 115 hp for one hour, or 57 hp continuously, whereas those of the Crystal Palace extension are equipped with four motors rated at 175 hp for one hour, or 100 hp continuously. On the South London line the normal train-unit consists of one motor car and one trailer, whereas on the Crystal Palace service two trailers can be used for each motor car. When traffic is very heavy two of these trains can be united to make a train of two motor cars and four trailers. The side-corridor system introduced on the South London rolling stock has not been used on account of the restrictions imposed by tunnels. Thirty new trains have been built for this service. The electrical equipment was supplied by the Allgemeine Elektricitäts-Gesellschaft, Berlin, and the motor coaches and trailers were built by the Metropolitan Amalgamated Railway Carriage & Wagon Company, Birmingham. Philip Dawson, the consulting electrical engineer to the Brighton Railway, designed the electrical equipment and it was completed under his personal supervision. Lord Bessborough presided at the inauguration ceremony, which was somewhat more elaborate than usual, owing to the fact that the Festival of Empire at the Crystal Palace was to be opened by the King within a very few days.

James Dalrymple, general manager of the Glasgow Corporation Tramways, has reported to the finance sub-committee on the experiment which his department is making with two-stage tickets. These tickets were introduced to enable passengers to travel two ½d. stages for ¾d., but in order to avoid the necessity of farthings passengers had to pay 1½d. for the original ticket, which was retained and later presented in payment of the second two-stage journey on any part of the system. There has been a considerable reduction in the number of 1d. fares, but many passengers who formerly bought ½d. tickets now use the two-stage tickets. The tickets have increased the number of passengers for short distances so that the increase in revenue from the increased traffic has more than counterbalanced any reduction in revenue caused by the decrease in the number of 1d. passengers. Mr. Dalrymple has suggested that the experiment should be continued for another year.

The contractors have completed the installation of the overhead system through the center of Bournemouth, and the new system has been placed in operation. As already outlined in this column, the general manager hopes to make an annual saving of about £3,000 in operation by the change from the underground contact system.

The annual meeting of the Municipal Tramways Association will be held at Glasgow on Sept. 27, 28 and 29, 1911. An exhibition will be held in connection with the meeting. Information in regard to the meeting can be obtained from James Dalrymple, general manager of the Glasgow Corporation Tramways, who is president of the association.

As an aid to the success of the Festival of Empire at the Crystal Palace, a small electric railway has been constructed in the grounds by Dick, Kerr & Company from plans by A. T. Snell, consulting engineer. The line will be known as the "All-Red Route," and will run through scenery representing the industries and special features of the various colonies. It will be lighted at night by 10,000 incandescent lamps and eighty arc lamps. The route comprises about 1¼ miles of single track, is laid to 3 ft. 6 in. gage with 45-lb. rails, and the transmission is effected by a third and fourth rail. The line is equipped with automatic signals and is divided into sixteen sections. Nine trains have been provided. The motor cars are equipped with Dick, Kerr & Company standard type of motor controllers and appartus. Six stations have been provided. They are named respectively South Africa or Pageant Station, Newfoundland, Canada, Australia and New Zealand.

A. H. Stanley, managing director of the Metropolitan District Railway, various underground railways and the London United Tramways, has announced that an agreement has been provisionally arrived at between the London General Omnibus Company and the various companies which he represents and with the other tubes not controlled by the Underground Railways by which transportation facilities in London will be improved. A system of interchangeable and through tickets will be inaugurated which will afford the public considerable freedom of travel. A committee composed of two representatives of each of the companies has been formed so that it will soon be possible to secure in London a ticket which will enable one to ride in an omnibus, on a tram and on one of the underground tubes. This arrangement will meet the threatened invasion of London by another motor omnibus company which announced that it intended to organize a company with a capital of £1,000,000 to put about 1000 omnibuses of the Milnes-Daimler type in operation.

The East London Railway, which has more than 5 miles of double track, and connects the Liverpool Street Station and New Cross, will be equipped with electricity in the near future. The railway is worked by a joint committee formed of several railways, and was not electrified at the time the Metropolitan Railway and the Metropolitan District Railway were equipped with electricity, and has lost a large amount of traffic on account of the discontinuance of through trains. Electrification will make it possible to resume a continuous service between the Metropolitan and District Railways. As a matter of expediency the third-rail system will be adopted, as the Metropolitan Railway and District Railway are equipped with the third rail.

Horace F. Parshall, chairman of the Central London Railway, has stated that a determined effort is being made to improve the air in the Central London tube. At present large exhaust fans are used at certain localities, but other portions of the tube still suffer from a concentration of foul air. It is now proposed to pump in fresh air, mixed with ozone from a special ozone generator. The air will then be filtered and sterilized, and again enriched at the platform level with more ozone.

The London County Council's proposal to install electric tramways along the Edgware Road from Marble Arch to Cricklewood is being opposed. The total length of the proposed tramway is about 2½ miles, and the cost of construction would be £116,500. The widenings of the street, which are proposed, however, would entail an expenditure of £277,000. The matter has been taken up by the Home Office, which has issued a report stating that a dead-end terminus at Marble Arch would be dangerous. Mr. Fitzmaurice, chief engineer of the Council, in cross-examination stated that he did not agree with the report. He was also asked whether the Council intended eventually to continue the tramway through Park Lane, and replied that he had not recommended any such extension, although he had considered a scheme to carry a tramway under Hyde Park. It would appear that attempts are being made to discountenance further extensions of electric tramways in London, as motor omnibuses have become much more popular within the last year or two. Five years ago the noise and smoke created by motor omnibuses in the streets of London was intolerable. The most recent types of motor buses are operated silently, and emit practically no smoke, and are fast replacing the old vehicles.

Dundee Town Council has approved the penny-all-the-way tramway fare system, which involves the abolition of the workmen's fares and other preferential charges, and the making of all the halfpenny stages a uniform length of about half a mile, with a penny all the way to and from the High Street of Dundee.

A. C. S.

News of Electric Railways

Program of the Annual Convention of the A. I. E. E.

The official program of the annual convention of the American Institute of Electrical Engineers to be held in Chicago, Ill., June 26 to June 30, 1911, inclusive, has just been published by the Institute. The official headquarters will be at the Hotel Sherman, corner Clark Street and Randolph Street, where the technical sessions will also be held. The railway session is to be held Wednesday morning, June 28, when the following papers will be presented:—

"Some Data from the Operation of the Electrified Portion of the West Jersey & Seashore Railroad," by B. F. Wood.

"Analysis of Electrification," by W. S. Murray.

"Solution to Problems in Sag and Spans," by W. L. R. Robertson.

"Induction Machines for Heavy Single-Phase Motor Service," by E. F. W. Alexanderson.

The sessions of the Institute will meet in the following general order:

MONDAY, JUNE 26.

9.00 p. m., reception and dance, Hotel Sherman.

TUESDAY, JUNE 27.

10.00 a. m., power station session.

2.30 p. m., visit to Western Electric and Commonwealth Edison Companies' plants.

8.30 p. m., electric lighting session.

WEDNESDAY, JUNE 28.

10.00 p. m., railway session.

2.30 p. m., industrial power session.

2.30 p. m., telegraphy and telephony session.

Evening, boat excursion on Lake Michigan.

THURSDAY, JUNE 29.

10.00 a. m., high tension transmission session.

2.30 p. m., visit to Indiana Steel Company's plant, Gary, Ind.

8.30 p. m., conference of Institute officers and sections delegates.

FRIDAY, JUNE 30.

10.00 a. m., educational session.

Report On Public Service Commission of New York

John N. Carlisle, who conducted an investigation of the Public Service Commission of the First District of New York, at the request of Governor Dix, presented his findings to the Governor on May 29, 1911. He has condemned the proposal for the consolidation of the two public service commissions and also the suggestion for the re-establishment of a Rapid Transit Commission appointed by the municipal authorities. He has expressed the opinion that public officials should determine the routes of new subways without consulting the companies that would presumably operate them, and that thereby the delays caused by the present system would be largely avoided.

As to the suggested substitution of one State-wide commission for the present two commissions, Mr. Carlisle says:

"In my judgment this should not be done. As all public service corporations now are required to submit any franchise procured by them for approval, to procure consent for the exercise of any rights under any franchise, and to secure approval before issuing any stocks or bonds or certificates of indebtedness for a longer period than one year, the corporations subject to such control are entitled to prompt action upon applications of this character.

"I thoroughly believe that consolidation of the commissions would result in great delay in the work intrusted to them, which would seriously affect the corporations under their control, and would be detrimental to the service which such corporations are required to render to the public at large. The saving in cost would be small."

Passing on to consider the proposal to take the power of the old Rapid Transit Commission out of the hands of the Public Service Commission and intrust it to a separate body, Mr. Carlisle points out that the present commission has on hand a comprehensive plan for building new subways which it hopes soon to carry out. He says:

"An attempt at this time, when the work has progressed so far, to change the personnel of the commission would result in further delay in subway construction, and I do not believe would be tolerated by the people of New York, who are so greatly in need of additional facilities."

Mr. Carlisle devotes a good deal of space to the transit problem in New York and considers the criticisms over the delay in determining new subway routes in the light of history. In concluding his report he says:

"The only fair criticism that can be laid against the commission in connection with the delay is that after it had laid out the triborough route it was apparently willing to postpone action and negotiate for a change of route to suit the demands of proposed operators."

Cleveland Railway Requested to Reduce Fare

G. M. Dahl, street railway commissioner of Cleveland, Ohio, sent a communication to the Cleveland Railway on May 23, 1911, in which it was stated that the amount in the interest fund exceeds the required $500,000 by $200,000 and that under the conditions of the Tayler grant the fare must be reduced to the next lower point in the sliding scale, which would be straight 3 cents, with a penny for transfers, to be rebated when the transfers are presented. This would do away with the charge for the transfer, the payment being required by the conductors giving the transfers merely to prevent fraud. It is calculated that to eliminate the charge for the transfer would cost the company about $40,000 a month, or $480,000 a year. Should the lower fare be installed, it would under the ordinance have to remain until a deficit of $200,000 under the required $500,000 was shown, when the fare would increase automatically to the charge now made. Mr. Dahl argues that the increase in patronage will off-set the loss caused by doing away with the transfer charge.

On April 30, 1911, a surplus of $174,170.80 existed in the interest fund, with an even distribution of the interest charges over twelve months, but under the method of making the charges laid down in the ordinance, Mr. Dahl estimates that the amount on that date was $214,898. This, of course, brings it up to the amount named in the franchise, when a reduction fare is to take place automatically. Mr. Dahl's letter to the company follows:

"According to the books of your company, there was a surplus in the interest fund on April 30, 1911, over and above the original $500,000 of $174,170.80, without figuring the accrued proportional payments to be deducted when estimating the amount in the interest fund, in accordance with the last paragraph of Section 23 of your franchise. According to our figures, the surplus in the interest fund at the same time, without so deducting accrued proportional payments, was in excess of the amount shown on your books. However, in accordance with the surplus as set up on your books and deducting accrued proportional payments, as specified in the ordinance, viz., 7 per cent for January, 6 per cent for February, 7 per cent for March and 8 per cent for April, there was, on April 30, more than $200,000 surplus in the interest fund in excess of the original $500,000.

"In accordance with Section 23 of the ordinance, whenever the balance in the interest fund, less proportionate accrued payments to be made therefrom, shall be more than $500,000 by the amount of $200,000, the rate of fare shall be lowered to the next lower rate on the scale provided in Section 22, which is 3 cents cash fare and 1 cent for a transfer and 1 cent rebate.

"In accordance, therefore, with the ordinance, you are hereby requested to at once install that rate of fare."

A public meeting of the Council street railway committee was held on May 25, 1911, but the subject of doing away with the transfer charge was not mentioned, the reply of the company not having been submitted at the time. It is intimated that the company will contend that instead of a

surplus existing it is laboring under a deficit of more than $350,000, arising from the requirements of operation and maintenance.

Attorney Andrew Squire, acting for the company, opposed the proposed amendment to the Tayler ordinance which would give the city the right to control improvements to within 5 years of the expiration of the franchise. He said that city control for the first ten years of the life of the franchise was satisfactory, but that the company should have this privilege for the last fifteen years.

James R. Garfield, who served as a member of the Chamber of Commerce committee, argued against the extension of the 3-cent fare to suburbs annexed in the future. He contended that it would endanger the low fare for the entire city. Attorney Squire stated that the company did not object to the extension of this fare to the suburbs. Mr. Garfield also urged that some agreement should be had with the comany as to the manner of spending the $2,500,000 required by one of the proposed amendments. Attorney Squire said that the company would finance the requirement by the sale of bonds.

Pennsylvania Fare Act Unconstitutional

The Supreme Court of Pennsylvania has declared that the act of the Legislature to regulate the maximum fares of street railways in second-class cities is special legislation and unconstitutional, and the Pittsburgh Railways can legally resume double fares on its lines within the city limits between midnight and 5 a. m. In presenting its finding the court said:

"The right of the city of Pittsburgh under the constitution to impose terms on the defendant company, as a condition to granting it the privilege of constructing its railway within the City, is not involved in this case That is a constitutional right of which neither the Legislature nor the courts can deprive the municipality. The City may impose conditions as to rates of fare for permission to use its streets, but it is not the exercise of such power or authority that is invoked here as a justification for attempting to regulate the fares to be charged by the defendant company in Pittsburgh. That question, therefore, does not enter into the case. Our conclusion is that the act of 1907 does not relate to the exercise of the corporate powers, or to the corporate officers of cities of the second class, nor regulate the municipal affairs of such cities, and hence is not a subject for which cities may be classified. It follows that as the act applied to certain street railways located in but two of the cities of the State it is special and local legislation and, therefore, unconstitutional and void."

The Appraisal of the Toledo Property

At a conference between the city authorities of Toledo and the officials of the Toledo Railways & Light Company on May 25, 1911, Albion E. Lang, president of the company, and Mayor Whitlock differed in regard to the course to be pursued in appraising the property. As previously stated the city has selected Prof. E. W. Bemis to act for it on a board of appraisal. It seems that Mayor Whitlock decided to proceed without the selection of a third expert by the two selected respectively by the city and the company. His idea was that the negotiators themselves could adjust such differences as arose. To this Mr. Lang objected. He insisted upon the original plan of having an arbitor selected or, if more satisfactory to the city, a board of arbitration made up of experts, to settle differences between the two. He said that neither he nor Mayor Whitlock is competent to go into many questions that may arise and that only experts should be employed to consider them. Mayor Whitlock repeated that he had been authorized by the City Council to name only one man for the appraisal work and that he could not agree to the selection of a third by the two appraisers without further action upon the part of the Council.

Mr. Lang felt that every step should be taken that would hasten the settlement. He believed that the Mayor's plan would result in a long-drawn-out discussion over points that could be settled by an arbitrator within a short time.

On May 26 a resolution of the board of directors of the company was presented to Mayor Whitlock, supporting Mr. Lang and refusing to co-operate in the appraisement unless a third man was selected. The Mayor was assured that, if he desired Prof. E. W. Bemis to proceed with an appraisal, all the books and records would be at his disposal and he would be given any aid that the company was able to offer. Mayor Whitlock decided to submit the matter to the Council before replying.

F. T. Barcroft, Detroit, Mich., has been engaged to assist Prof. E. W. Bemis in appraising the property. He was considered for the place of chief appraiser.

The Council committee on railroads and telegraphs has decided to take the ordinance giving the company the right to lay a double track on Huron Street. The company had already given notice that the grant will not be accepted unless it is allowed to build certain side-tracks to its property at Huron Street and Beach Street. Underlying the refusal of the committee to recommend the ordinance for passage is the fear that such an action might complicate the final settlement of the fare question and the granting of a blanket ordinance, such as is now under discussion.

Chicago Subway Plans

The committee on local transportation of the Chicago City Council has held a number of conferences and public hearings recently at which plans for the construction of municipal subways were presented by their designers. On May 22, 1911, Bion J. Arnold, chief subway engineer of the city, described his latest plans. Briefly, they included a two-level subway system to be built section by section. The total cost of the subways, according to Mr. Arnold's plans, was estimated to be $21,000,000, and would require five years for completion. Mr. Arnold recommended that the river tunnels, which were recently completed for the Chicago Railways under the guidance of the Board of Supervising Engineers, should not be included in the proposed subways, although these tunnels have been provided with low-grade headings arranged for connection to subways. Mr. Arnold brought out the point that the city has decided to build its own subways and has defined its position clearly with regard to the use of the present tunnels by the surface lines and that joint use of the tunnels by such transportation systems as are designated to operate through the new city subways and by the surface system now operating through the tunnels, would undoubtedly bring about legal entanglements that it would be very desirable to avoid. Summing up his plans for the subways Mr. Arnold said he had considered three fundamental principles—maximum capacity, maximum extent and minimum cost. The plans do not include any grade crossings.

On May 24, 1911, George W. Jackson, of George W. Jackson, Inc., which has done considerable underground construction work in Chicago for the city, for the Illinois Tunnel Company and other large corporations, described the subway system proposed by him. He would build a group of single-level subway loops under the important streets of the downtown district with inclines to the surface at Chicago Avenue on the north, Halsted Street on the west and Sixteenth or Twenty-second Street on the south. Mr. Jackson would excavate the street from curb to curb and drive the lower half of the side subway walls as tunnel drifts, under air pressure, thus providing against damage to buildings which have floating foundations. Mr. Jackson recommended that five new tunnels should be driven under the branches of the Chicago River. His completed subway system would cost $2,600,000 per mile and would have 8 miles of bore, reaching from curb to curb, and provide a floored pipe gallery 5 ft. high located directly above the cars. Provision for through-routing from one subway loop to another would be had by switches and interlockings at the most important intersections. A foot-walk, which would serve as a platform, would be built throughout the length of each subway bore in the downtown district.

Association Meetings

Massachusetts Street Railway Association—Boston, Mass., June 14.

New England Street Railway Club—Boston, Mass., June 22.

Central Electric Accounting Conference—Springfield, Ill., June 10.

Central Electric Railway Association—St. Joseph, Mich., June 22.

Street Railway Association of the State of New York—Cooperstown, N. Y., June 27 and 28.

American Electric Railway Association—Atlantic City, N. J., Oct. 9 to 13.

National Society for the Promotion of Engineering Education.—The National Society for the Promotion of Industrial Education will hold its fifth annual meeting at Cincinnati, Ohio, Nov. 2, 3 and 4, 1911. One complete session of the convention will be devoted to a consideration of the industrial training given in the schools of Cincinnati.

Offices of Railway Appliances Association.—At the meeting of the executive committee of the Railway Appliances Association, held in Chicago, Ill., on May 23, 1911, John N. Reynolds, who has been secretary and treasurer for the last nine years, resigned both positions, effective on June 30, 1911. Mr. Reynolds was re-elected treasurer and Bruce V. Crandall was elected secretary.

Washington Water Power Company Improvements.—W. A. White, chairman of the finance committee of the Washington Water Power Company, Spokane, Wash., has outlined as follows work to be undertaken by the company at Spokane: Large amounts of money have been provided to develop the large power station at Long Lake and the Spokane & Long Lake Railway, and to complete the Little Falls plant, purchase additional cars and equipment, extend the local distributing lines within the city, install storage batteries, extend the underground conduit system and complete the transmission line from Post Falls to Newport.

Newark & Marion Railway to Operate by Steam.—The Newark & Marion Railway, Newark, N. Y., which operates 10 miles of standard-gage line between Newark and Marion, N. Y., will substitute oil for coal as fuel in the locomotives now in use on the road. Steam was adopted temporarily as motive power for the road, it being intended finally to operate the line by electricity. The residents of the district through which the road operates appealed to the Public Service Commission of the Second District of New York to order the company to substitute electricity for steam as motive power and the decision to substitute oil for coal as fuel in locomotives was based on the findings of the commission.

Additional Time Denied in Which to Comply With Commission's Order.—The New York & Queens County Railway has been served with an order denying its application for an extension of time in which to complete certain double-tracking work on its Flushing-Jamaica line, ordered by the Public Service Commission of the First District of New York in 1909. The original order called for the completion of this work by June 1, 1910, but, owing to the delay incident to the company's application to the Board of Estimate and Apportionment for a franchise for the new tracks, the commission from time to time extended this limitation to June 1, 1911. Recently the company made application for a further extension of six months in which to complete the work ordered to be done by the Public Service Commission.

Right of County Commissioners to Fix Franchise Terms in Georgia.—The right of the Fulton County board of commissioners to grant a 15-year franchise to the Georgia Railway & Electric Company, Atlanta, Ga., for the proposed Buckhead extension, on which the maximum fare of 5 cents from the city line to the end of the extension was fixed, has been denied by the Georgia Railroad Commission. In concluding its decision the Railroad Commission said: "The commission, therefore, declines to approve the grant to the Georgia Railway & Electric Company by the commissioners of roads and revenues of Fulton County, in so far as it relates to or proposes to fix or regulate fares to be charged by said corporation for transportation of passengers over the proposed extension or any part thereof. Upon proper application to this commission, it will hear evidence as to what is a reasonable and just charge for the transportation of passengers over the proposed extension, and will prescribe such a rate subject to revision or change under terms of the law."

LEGISLATION AFFECTING ELECTRIC RAILWAYS

MASSACHUSETTS

The bill regulating the hours of labor of street railway employees (House 204) was killed in the Senate, and a motion to reconsider was lost. This bill specified that a day's work for all conductors, guards, drivers and motormen should not exceed nine hours, and should be arranged to be performed in not more than eleven consecutive hours. House Bill 1479, to provide seats for motormen in the cars of street and elevated railways, has received a report of no legislation necessary by the committee on street railways. The Senate and House have accepted the report. A bill relative to an investigation of transit conditions on the Boston Elevated Railway has been read in the Senate. The Henebery bill to limit the terms of franchises to be granted by municipal authorities to street railways for the carriage of freight and express matter has been killed in the Senate for the third successive year. A bill has been reported by the committees on railroads and metropolitan affairs, sitting jointly, in favor of the Boston & Eastern Electric Railroad receiving a certificate of public convenience and necessity. The bill provides for the deposit of a substantial bond by the company as an evidence of its good faith, and requires the Railroad Commission and Boston Transit Commission to proceed in relation to the company's plans in the same manner as though the certificate had been granted by the Railroad Commission. The same committees have voted to report a redraft of the Matthews resolve on behalf of the electrification of steam railroads at Boston. The railroads are to file plans and specifications with the commission by Sept. 1, 1912.

PENNSYLVANIA.

The General Assembly of Pennsylvania adjourned sine die at noon on May 25, 1911, without enacting Governor Tener's principal pre-election promise to create a public utilities commission possessing rate-making and rate-enforcing powers. The bill, which was drawn by Attorney-General Bell, and presented to the Legislature by Representative Alter, passed the House by a vote of 1786 to 11, but was defeated in the Senate on second reading by a vote of 29 to 17. Senator Tustin contended that a measure to regulate twenty-nine different classes of corporations should be considered by a commission for at least two years before being enacted, and that the judiciary special committee of the Senate had not had time properly to consider the bill. The Senate also defeated a resolution to provide for a commission of five, to be appointed by the executive, and turn the bill over to the revenue commission. On the closing day of the session Governor Tener announced that he would not call an extra session for the reason that "to do so would be futile with the Senate as now constituted." He does not agree with those Senators who contended that the bill was too drastic, and states that he had informed the Senate of his willingness to have minor corporations eliminated from the provisions of the measure. The Governor concludes his statement with these words: "At the convening of the new Assembly in 1913 I shall again have introduced a bill substantially as drawn by the Attorney-General. This will afford the members of each body ample time to consider the bill and to amend it as above indicated, or otherwise, so as to bring this commonwealth abreast of our sister States in this respect."

The Dunn employers' liability bill, which passed the House by a vote of 112 to 53, and had been indorsed by the administration, was defeated in the Senate. The Ehrhart full-crew bill, which passed both branches, is in the hands of the Governor, who is allowed thirty days in which to dispose of the bills before him. This bill provides for an additional member upon the crew of each passenger, freight, mail or express train. The measure to make it a misdemeanor to use a street railway transfer issued to another person was passed by both houses. It provides a penalty of $5 fine. Measures defeated included the following: Providing that land taken through eminent domain laws be surrendered within thirty days; granting permission to the Valley Forge Park Commission to make franchise awards to railway companies; requiring electric railways to equip cars on suburban lines with toilet facilities; requiring trolley tracks to be removed from side to center of highways in villages upon petition of residents.

Financial and Corporate

New York Stock and Money Markets

May 29, 1911.

Business on the New York Exchange has dwindled, but optimism prevails, based on the maintenance of the higher price levels reached during the flurry and upon the strength of the bond market. The money market is still easy and rates are low. Quotations to-day were: Call, 2¼@2½ per cent; ninety days, 2¾@3 per cent.

Other Markets

Trading in Philadelphia has been light during the week. Demand for Rapid Transit shares followed failure of the strike movement and slight fluctuations were registered in Union Traction. Stocks were not influenced by rumors of new obstacles in the reorganization plan of the Philadelphia Rapid Transit Company.

Boston markets have experienced mild activity, and firmness ruled throughout the list.

The Baltimore market has been quiet and prices steady. Income bonds of the United Railways of Baltimore eased somewhat, in consequence of the announcement that payment of June interest is to be in cash.

Chicago trading has been light in volume and prices are well maintained. Elevated Railway shares advanced a point or so and show the influence of the merger in the transactions.

Quotations of traction and manufacturing securities as compared with last week follow:

	May 22.	May 29.
American Light & Traction Company (common)	a292	a295
American Light & Traction Company (preferred)	a107	a108
American Railways Company	a44½	a44½
Aurora, Elgin & Chicago Railroad (common)	a40	40
Aurora, Elgin & Chicago Railroad (preferred)	a86	86
Boston Elevated Railway	a128	a127½
Boston Suburban Electric Companies (common)	a15	a15
Boston Suburban Electric Companies (preferred)	a75	a75
Boston & Worcester Electric Companies (common)	10	a8½
Boston & Worcester Electric Companies (preferred)	a49½	a50
Brooklyn Rapid Transit Company	80⅝	80
Brooklyn Rapid Transit Company, 1st ref. conv. 4s	86¼	85½
Capital Traction Company, Washington	128	a130
Chicago City Railway	188	a195
Chicago & Oak Park Elevated Railroad (common)	2	2
Chicago & Oak Park Elevated Railroad (preferred)	6	7
Chicago Railways, ptcptg., ctf. 1	a85	a82
Chicago Railways, ptcptg., ctf 2	a22½	a22½
Chicago Railways, ptcptg., ctf. 3	a9	a10
Chicago Railways, ptcptg., ctf. 4	a5½	a6
Cincinnati Street Railway	*131	a130½
Cleveland Railway	a98	98
Columbus Railway (common)	*96	a96
Columbus Railway (preferred)	a100½	a101
Consolidated Traction of New Jersey	a77	a77
Consolidated Traction of N. J., 5 per cent bonds	a105	a105½
Dayton Street Railway (common)	*30	a30
Dayton Street Railway (preferred)	*100	a100
Detroit United Railway	72	71¾
General Electric Company	160½	167½
Georgia Railway & Electric Company (common)	136	136½
Georgia Railway & Electric Company (preferred)	95	92
Interborough Metropolitan Company (common)	18¾	18¾
Interborough Metropolitan Company (preferred)	53	53
Interborough Metropolitan Company (4½s)	79½	79⅜
Kansas City Railway & Light Company (common)	a19	a19
Kansas City Railway & Light Company (preferred)	a25	a49
Manhattan Railway	137½	136⅝
Massachusetts Electric Companies (common)	a20⅜	a21⅜
Massachusetts Electric Companies (preferred)	a89¾	a89½
Metropolitan West Side, Chicago (common)	24	a26
Metropolitan West Side, Chicago (preferred)	a71	a72½
Metropolitan Street Railway, New York	*15	15
Milwaukee Electric Railway & Light (preferred)	*110	*110
North American Company	76	75
Northern Ohio Light & Traction Company	46	46
Northwestern Elevated Railroad (common)	27	a27½
Northwestern Elevated Railroad (preferred)	67	a69
Philadelphia Company, Pittsburgh (common)	a57¼	57
Philadelphia Company, Pittsburgh (preferred)	a43¾	43¼
Philadelphia Rapid Transit Company	a18⅛	17¾
Philadelphia Traction Company	a83½	82½
Public Service Corporation, 5% col. notes (1913)	a101	101
Public Service Corporation, ctfs	a107	a107
Seattle Electric Company (common)	a108½	a109½
Seattle Electric Company (preferred)	a100½	a101
South Side Elevated Railroad (Chicago)	a75	a77½
Third Avenue Railroad, New York	123⅜	*123⅜
Toledo Railways & Light Company	a8	7¼
Twin City Rapid Transit, Minneapolis (common)	a110	a110
Union Traction Company, Philadelphia	a46½	a94¼
United Rys. & Electric Company, Baltimore	a18½	a18¼
United Rys. Inv. Co. (common)	41½	41½
United Rys. Inv. Co. (preferred)	72	*72
Washington Ry. & Electric Company (common)	a34¾	a34
Washington Ry. & Electric Company (preferred)	a90	a89¾
West End Street Railway, Boston (common)	a91	a90½
West End Street Railway, Boston (preferred)	a103½	a103⅛
Westinghouse Elec. & Mfg. Co.	74	78½
Westinghouse Elec. & Mfg. Co. (1st pref.)	117	118

a Asked. *Last sale.

ANNUAL REPORTS

Illinois Traction Company.

Earnings and expenses for the last two years compare as follows:

	1910.	1909.
Gross earnings.		
Interurban	$2,304,945	$1,980,778
Local street railway	2,027,206	1,754,893
Gas	357,315	293,072
Electric light and power	1,327,609	1,161,128
Steam heating	174,822	166,000
Miscellaneous	26,140	7,512
Total gross earnings	$6,218,037	$5,363,383
Operating expenses	$3,441,100	$2,874,340
General and overhead expense	58,596	43,150
Taxes	165,932	146,001
Total operating expenses	$3,665,628	$3,063,491
Net earnings	$2,552,409	$2,299,892
Net earnings, 1910 and 1909	$2,552,409	$2,299,892
Less net earnings of Des Moines and Topeka properties prior to purchase	54,182	372,628
Total net revenue of Illinois Traction Company	$2,498,227	$1,927,264

H. E. Chubbuck, vice-president executive, says in his report to the president and directors:

"The year 1910 marks in the history of the Illinois Traction Company the completion of its most important undertakings, which have been under construction during the past three years. On Nov. 10 the magnificent bridge across the Mississippi River at St. Louis was thrown open to the public. The terminal facilities in St. Louis were sufficiently completed to allow the operation of the interurban cars directly into the heart of the city, and local service between St. Louis and the Tri-Cities over the bridge was established.

"The Granite City, the Edwardsville, the Springfield and the Decatur belts have been either completed in whole or so far advanced that very little work is left to be done in 1911. These belt lines will enable the transportation of heavy through freight to and from the extensive freight terminals in St. Louis for which provision has been made—something which has not been attempted on the same scale by any other electrically operated railroad, and which will result, it is anticipated, in a heavy increase in the volume and ratio of freight traffic with a corresponding increase in the company's revenue.

"In the latter part of the year there was delivered to the company a large amount of new equipment for passenger and freight service. The benefit derived from changing the lines from Peoria to Bloomington and from Mackinaw Junction to Springfield from alternating to direct-current propulsion was marked, and justified this change in the operation of the property.

"Extensive betterments have been made in buildings—new substations, new depots and additional freight facilities having been provided. The terminal power station at Venice—typical of the most advanced power plant construction—has been completed.

"Improvements and additions to the Decatur shops have been completed and six advanced type locomotives of our own design have been built in these shops. We are now prepared to make repairs—heavy as well as light—and to construct a limited number of the different kinds of cars which are used by us.

"Referring to the report of 1909, the establishment of the Western Illinois Accident Association has been effective in protecting the operating accounts, as the serious collision near Staunton found the accident fund with $86,000 in cash available. The association will take care of this accident in addition to the minor claims upon it without resorting to the necessity of making any direct charge against operating, so that it is not anticipated that operating accounts will be directly affected by the accident. The membership of the Western Illinois Accident Association comprises the operating companies which are controlled by the Illinois Traction Company, and also the operating companies which are controlled by the Western Railways & Light Company, which is a corporation, organized under the laws of Maine, controlling street and interurban railway, electric and gas properties in Illinois. These companies contribute each month a percentage of their respective gross earnings to a general fund, from which disbursements are made within

the limitations prescribed by the association contract. The contributions to the fund are charged against the operating accounts of the participating companies.

"In the last quarter of the year an improved program of signal protection was developed and contracts were entered into with the Union Switch & Signal Company for automatic block signals of most modern development and design, and with the Blake Signal Company for the rebuilding of the signals previously in operation and the purchase of a large number of new ones. This signal work was well started at the close of the year.

"New contracts have been entered into with the trainmen, effective Dec. 1, for a period of three years, covering both the interurban lines and the St. Louis electric terminal service between St. Louis and the Tri-Cities. These contracts insure a continuation of the pleasant relations existing between the employees of the interurban lines and the management.

"Sleeping car service established last April between Peoria and St. Louis has been successfully and profitably operated. Two more of these specially designed sleepers have been ordered, but will not be completed and delivered before the close of the year.

"This year has seen the building and completion by farmers' elevator associations of eight elevators located on the right-of-way of the Illinois Traction lines. This is the nucleus of what will be in the future an extensive grain freight business.

"To the public utilities controlled by the Illinois Traction Company have been added during the past year those of the Topeka Railway and the Topeka Edison Companies operating the street railway and heating and lighting systems, respectively, in Topeka, Kan., a city of 43,684 inhabitants. The Topeka Railway operates 30 modernly equipped cars, about half being of double truck pay-as-you-enter type. The property comprises about 30 miles of track with strictly modern car houses and shops. The shops are equipped to do all necessary repair work, and in addition can and do make all special work. The Topeka Edison Company does the lighting and steam heating business of the city. Its brick and steel constructed power house and distributing system are of the most advanced type. The installation of a storage battery, which takes the fluctuations due to street car load, is only one of the economies affecting the low cost of operation of this plant. Both the Topeka Railway and the Topeka Edison Company operate under very favorable franchises. These properties have fully justified their acquisition."

During the last year $904.046 or 14.6 per cent of gross earnings, was expended for maintenance, renewals and betterments.

Albany Southern Railroad

During the twelve and one-half months ended Sept. 30, 1910, the results of operations were as follows:

Earnings:	
Railway	$321,345
Electric	112,852
Gas	42,540
Miscellaneous	3,325
Total gross earnings	$480,062
Total operating expenses	282,267
Net earnings	$197,795
Taxes	$26,562
Interest on bonds, rentals and amortization	68,064
	$94,626
Surplus	$103,168

R. A. C. Smith, the president, says in part:

"Almost immediately after the organization of your company, J. G. White & Company, Inc., New York, N. Y., were engaged as operating managers and engineers to supervise and direct the construction work and the operation of your company's properties.

"As you are aware, the plan of organization of your company was submitted in great detail to the Public Service Commission of the State of New York, and was approved by that commission, which further granted its consent to the issue of $1,250,000 first mortgage bonds out of a total authorized issue of $1,500,000. Of these bonds $765,000 were sold and the proceeds thereof used to purchase the Albany and Greenbush bridge, a modern double-deck structure connecting the cities of Albany and Rensselaer, and over which the cars of your company have entrance into the city of Albany.

"The remaining $485,000 of said $1,250,000 of bonds were sold and the proceeds used in the building of a second track between Rensselaer and the company's amusement park at Kinderhook Lake, involving the construction of 13 miles of track with the necessary third-rail installation, and the relocation of the road at several points, eliminating dangerous curves. At the same time the existing track was placed in good condition and all construction work was completed promptly and at a cost considerably less than the estimates. The new track was placed in service July 4, 1910. Improvements were also made at the power house resulting in greater efficiency.

"In addition to the above betterments and improvements paid for from the proceeds of the sale of the above bonds, your directors have made other expenditures amounting to approximately $62,000.

"As to the operation of your company, we beg to quote from a report made to your directors by J. G. White & Company, Inc., as follows:

"'During the past year the rolling equipment has nearly all been thoroughly overhauled, and the cost has been included in the operating expenses. Active campaigns for new business in the electric and gas departments have been carried on with satisfactory results. The entire property has been adequately maintained and is in good operating condition. Improvements where necessary are being made with a view to giving good and up-to-date service under the most economical conditions possible. The relations of your company with the municipal authorities and the public generally, are, in our judgment, very satisfactory, and the relations between the company and its employees are harmonious; the employees are loyal to the company, and their personnel is of high grade.'

"Your directors are considering a plan, and have appointed a committee to present a report to them on the same in the near future, by which the employees shall receive recognition for faithful and continued service."

Toledo, Railways & Light Company

Operations during the year ended Dec. 31, 1910, resulted as follows:

Gross income for the year	$2,985,382
Operating expenses, including maintenance, renewals and depreciation	1,868,600
Net income	$1,116,782
Taxes	$111,954
Interest	814,427
Total	$926,381
Surplus	$190,401

Albion E. Lang, the president, says in part:

"In addition to having properly maintained the properties of the company, $393,802 was spent for improvements and bettermens.

"The company again wishes to express its appreciation for the continued consideration shown by the committee representing the company's 4 per cent consolidated bonds, in permitting the company to continue to expend its net earnings in improvements and betterments to its properties, notwithstanding the principal of these bonds became due on July 1, 1909, and no interest has been paid on them since July 1, 1908.

"Negotiations between the city authorities and the company relative to the street railway franchises of the company were commenced last spring. The auditors appointed by the city for such purpose have finished their examination of the books and operations of the company and have made their report to the city. At the request of the city authorities we have had prepared and furnished them an inventory of the street railway properties of the company. The city authorities are now engaged in formulating the conditions desired by the city to be embraced in a new contract fixing the terms of the company's street railway franchises."

Chicago Elevated Merger

During the week which ended on May 27, 1911, the Blair interests submitted formal proposals to the directors of the Metropolitan West Side Elevated Railway and the South Side Elevated Railroad for merging the elevated railways in Chicago. The directors of the Metropolitan West Side Elevated Company voted on May 24, 1911, to accept the terms of purchase and to recommend them to the shareholders, and the directors of the Northwestern Elevated Railroad and the Chicago & Oak Park Elevated Railroad, both of which are controlled by the Blair interests, also voted to approve the merger. The directors of the South Side Elevated Railroad approved the agreement on May 25.

It was reported in Chicago that the Chicago & Oak Park Elevated Railroad, which is not earning the interest on the first-mortgage bonds, would possibly be placed in receivership in order that its financial affairs might be adjusted previous to the merger of this road. Rumor is current that the Commonwealth Edison Company, or influential interests in it, will become a factor in the merger. The new Illinois corporation which will take over the roads will be incorporated as the Chicago Elevated Railroad Company. It will be capitalized as follows: Three-year 5 per cent notes, $30,000,000; preferred 6 per cent cumulative stock, $16,000,000; common stock, $25,000,000. It is estimated that the economies which will be effected by the merger will enable the Chicago Elevated Railroad Company to pay 6 per cent dividends from the date of acceptance of the terms of the merger, and that after meeting all obligations, including dividends, on the preferred stock about $350,000 will remain to be applied to the common stock. This is about 1.4 per cent on the common stock.

Columbia Electric Street Railway, Light & Power Company, Columbia, S. C.—The stockholders of the Columbia Street Railway, Light & Power Company, on May 15, 1911, authorized an increase in the stock of the company as proposed and also a change in the name of the company to the Columbia Railway, Gas & Electric Company. There have been no changes in the officers of the company, but J. G. White and J. H. Pardee, of J. G. White & Company, Inc., New York, N. Y., and Franklin Q. Brown, of Redmond & Company, New York, N. Y., have been elected directors of the company.

Columbus Railway & Light Company, Columbus, Ohio.—A special meeting of the stockholders of the Columbus Railway has been called for June 26, 1911, to authorize an increase of $3,000,000 in capital to be divided equally into preferred and common stock, bringing the total authorized common up to $5,000,000 and the preferred up to $4,500,000. The additional capital is to be issued to reimburse the Columbus Railway & Light Company for expenditures for improvements and betterments on the Columbus Railway. Under the terms of the lease to the Columbus Railway & Light Company that company is to be reimbursed for permanent improvements or equipment either by repayment or in cash or by the securities of the Columbus Railway at par. Since the lease was made about $200,000 a year has been expended in such improvements, for which the Columbus Railway & Light Company has received $1,483,080 in cash and stock, leaving a balance still due to the leasing company of $113,390. The additional capital of Columbus Railway will provide for payments for improvements for some years to come.

Kansas City Railway & Light Company, Kansas City, Mo.—Robert J. Dunham, chairman of the board of directors of the Kansas City Railway & Light Company, has supplemented as follows the statement in regard to the passing of the quarterly dividend due on the company's preferred stock, on June 1, 1911, to which reference was made in the Electric Railway Journal of May 27, 1911, page 931: "It is thought that the ultimate interests of the stockholders will be best subserved by this course for these reasons: The company's $5,500,000 of 6 per cent notes mature on Sept. 1, 1912, when some arrangement must be made to meet or refund them. Meanwhile it is impossible to obtain new money for extensions and additions without giving security upon the new property acquired therewith. This security can only be given with the consent of the city, which apparently cannot be obtained. All resources must at the present time be conserved so that the present franchise requirements may as far as possible be met from the earnings without any increase of the floating indebtedness. The Kansas City bankers will not increase that indebtedness, but insist upon its reduction. The interests of stockholders are, of course, subordinate to the demands of creditors and rights of the public."

Ohio Valley Electric Railway, Huntington, W. Va.—It is announced that the American Railways Company, Philadelphia, Pa., will take over the Ohio Valley Electric Railway. The American Railways Company will issue $2,000,000 of 5 per cent collateral trust bonds, of which $1,700,000 will be given in exchange for the stock of the Ohio Valley Electric Railway, and $300,000 will be retained for extensions and improvements of the new lines. It is also stated that negotiations have been re-opened by the American Railways Company for the acquisition of the Joplin & Pittsburg Railway.

Piedmont Railway & Electric Company, Burlington, N. C.—J. W. Murray, president of the Piedmont Trust Company, has written the Electric Railway Journal that the Piedmont Railway & Electric Company, which was chartered recently, is being organized to take over and complete the 8½ miles of track which connects Burlington, Graham and Haw River purchased from the receiver of the Southern Traction & Power Company by Mr. Murray.

Dividends Declared

Chicago (Ill.) City Railway, quarterly, 2½ per cent. Second & Third Streets Passenger Railway, Philadelphia, Pa., quarterly, $3. United Railways & Electric Company, Baltimore, Md., 2 per cent, preferred.

MONTHLY ELECTRIC RAILWAY EARNINGS

ATLANTIC SHORE RAILWAY.

Period.			Gross Revenue.	Operating Expenses.	Net Revenue.	Fixed Charges.	Net Income.
1m.,	April	'11	$21,736	$18,593	$3,144	$8,337	†$5,193
1 "	"	'10	23,895	19,437	4,459	12,463	†8,005
4 "	"	'11	76,705	71,450	5,255	32,156	†26,900
4 "	"	'10	85,982	67,183	18,799	50,152	†31,353

CLEVELAND, SOUTHWESTERN & COLUMBUS RAILWAY.

1m.,	April	'11	$86,528	$49,374	$37,154	$30,091	$7,063
1 "	"	'10	80,003	47,082	32,921	29,794	3,127
4 "	"	'11	326,910	193,654	133,257	120,149	13,108
4 "	"	'10	296,123	188,553	107,570	119,176	11,606

EL PASO ELECTRIC COMPANY.

1m.,	March	'11	$57,090	$32,720	$24,370	$8,247	$16,123
1 "	"	'10	51,579	29,564	22,015	8,574	13,441
12 "	"	'11	650,990	379,983	721,008	98,152	172,856
12 "	"	'10	621,847	359,758	262,089	100,193	161,896

GALVESTON-HOUSTON ELECTRIC COMPANY.

1m.,	March	'11	$116,287	$70,985	$45,302	$24,682	$20,620
1 "	"	'10	105,144	67,673	37,471	23,080	14,391
12 "	"	'11	1,348,693	804,541	544,152	294,819	249,332
12 "	"	'10	1,228,619	734,835	493,784	266,126	225,658

MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY.

1m.,	April	'11	$400,099	$211,319	$188,780	$120,156	$68,624
1 "	"	'10	376,793	202,242	174,550	111,704	62,847
4 "	"	'11	1,597,892	852,630	745,262	474,777	270,485
4 "	"	'10	1,494,477	816,320	678,156	441,191	236,965

MILWAUKEE LIGHT, HEAT & TRACTION COMPANY.

1m.,	April	'11	$122,112	$36,640	$85,472	$69,159	$16,313
1 "	"	'10	116,202	33,891	82,310	67,281	15,029
4 "	"	'11	479,484	148,022	331,462	275,407	56,055
4 "	"	'10	455,866	136,670	319,196	268,935	50,261

MONTREAL STREET RAILWAY.

1m.,	April	'11	$372,309	$200,719	$171,590	$50,338	$121,252
1 "	"	'10	344,765	190,842	153,923	44,584	109,339
7 "	"	'11	2,575,224	1,571,191	1,004,032	279,543	724,489
7 "	"	'10	2,337,001	1,407,826	929,174	257,170	672,004

NORTHERN TEXAS ELECTRIC COMPANY.

1m.,	March	'11	$142,938	$74,894	$68,044	$25,138	$42,907
1 "	"	'10	128,679	67,290	61,389	18,786	42,603
12 "	"	'11	1,491,232	789,327	701,905	254,920	446,985
12 "	"	'10	1,306,550	710,483	596,067	207,820	388,246

SAVANNAH ELECTRIC COMPANY.

1m.,	March	'11	$53,062	$34,770	$18,292	$18,283	$10
1 "	"	'10	49,907	32,049	17,858	17,846	11
12 "	"	'11	646,587	428,504	218,083	216,984	1,099
12 "	"	'10	605,093	393,127	211,966	210,675	1,291

SEATTLE ELECTRIC COMPANY.

1m.,	March	'11	$458,458	$271,838	$186,620	$115,593	$71,027
1 "	"	'10	461,289	279,043	182,246	110,109	72,137
12 "	"	'11	5,593,870	3,155,242	2,438,628	1,313,098	1,125,530
12 "	"	'10	6,011,320	3,504,360	2,506,960	1,274,242	1,232,718

Traffic and Transportation

New York Company Converts Restaurant Profits Into Loan Fund for Employees.

The Metropolitan Street Railway, New York, N. Y., has announced that the profits from five lunch rooms, patronized and run by the men in the company's employ, have been turned into a loan fund, amounting now to about $2,000, from which the employees will be permitted, in times of emergency, to draw sums without paying interest. The fund is controlled by the trustees of the Metropolitan Street Railway Association, three of whom are motormen, three others officers of the company, and the chairman, Oren Root, general manager for the receivers of the company. Each of the 5000 members of the association is to be entitled to borrow an amount equal to two weeks' pay, and he is to be allowed two months in which to repay the loan. This he may do in instalments or in a single payment. Mr. Root has posted notices in all the carhouses announcing the establishment of the new loan fund. The notice follows:

"From time to time my attention has been called to instances where men have borrowed money from money lenders, commonly known as loan sharks, and have paid excessive rates of interest, sometimes several hundred per cent a year. A typical case was reported to me recently. A man borrowed $15 and agreed to pay to the money lender $1.95 a week for sixteen weeks, or $31.20 in all, of which $15 represented the actual amount borrowed, and $16.20 represented the interest for the sixteen weeks. The borrower, therefore, paid interest at the rate of considerably more than 300 per cent a year, whereas the legal rate of interest in this State is only 6 per cent.

"In order that members of the Metropolitan Street Railway Association may not be obliged to go to these loan sharks when the need for borrowing money arises, an arrangement has been made to turn into the treasury of the Metropolitan Street Railway Association all the profits obtained from the lunch rooms at the various carhouses in the system, and this money will be used to make loans to members of the association, without any interest charge whatsoever, under proper regulations, and for a certain length of time.

"It is desirable that every man should save money to meet emergencies which are likely to arise as the result of sickness or other causes, and it is hoped that this assistance which the association plans to extend will not cause its members to cease saving money on their own account. But the trustees realize that at cerfain times need for money arises which cannot be foreseen and which a man cannot always provide for from his regular wages. It is to afford assistance to members who find themselves placed in such a position that the trustees have arranged to make this fund available."

Increase in Wages in Syracuse

The Syracuse Rapid Transit Company, the Oneida Railway, Utica & Mohawk Valley Railway and the Syracuse & Suburban Railroad, Syracuse, N. Y., have announced an increase in the wages of the employees of the companies, effective from May 1, 1911. The increase affects 480 employees of the Syracuse Rapid Transit Company, 350 of the Utica & Mohawk Valley Railway, 42 on the Oneida Railway and 30 of the Syracuse & Suburban Railroad. The pay of the employees of the Syracuse Rapid Transit Company, Oneida Railway, and Utica & Mohawk Valley Railway, by the new schedule follows: First 6 months of employment, 22½ cents; second six months, 24½ cents; after first year, 26½ cents. Pay for service between Syracuse and Utica is made 31 cents an hour. The new schedule on the Syracuse & Suburban Railroad is: First year, 21 cents; second year, 22 cents; third, 23 cents; fourth 24 cents, and fifth, 25 cents. Pay on the Utica & Mohawk Valley Railway is made 28½ cents an hour. Since Jan. 1, 1899, employees of the Syracuse Rapid Transit Railway have had their wages increased nine times. The wage schedules as raised on Jan. 1, 1899, ranged from 14 cents to 16½ cents. They were raised again on Jan. 1, 1901, one cent an hour, as follows: First six months, 15 cents; second, 15 cents; second year, 16 cents; third year, 17 cents; fourth and fifth year, 16 cents. The next increase was on Jan. 1, 1903, one cent an hour, except employees in service more than five years, and they were increased two cents. On Jan. 1, 1903, another cent an hour advance was made, followed by another on Feb. 1, 1906, and still another July 22, 1906. At that time the wages were 18 cents, twenty cents and 22½ cents. July 1, 1907, they were increased to 20 cents, 22 cents and 24 cents. The next increase was May 1, 1910, when the wages were raised 1½ cents, as follows: First six months, 21½ cents; second six months, 23½ cents, and after first year, 25½ cents.

Charles N. Black On the Best Type of Car

Charles N. Black, vice-president and general manager of the United Railroads of San Francisco, San Francisco, Cal., in a letter on the new pay-as-you-enter cars of the company, which he addressed to the San Francisco *Call* recently to correct statements made in an editorial in that paper, said in part:

"The inside dimensions of the new cars are practically the same as the inside dimensions of the old cars, while the seating capacity of the new cars is actually 18 in. greater than in the old cars. The aisle space in the new cars is much greater than in the old cars, thus enabling passengers to pass in and out with greater facility and with less inconvenience. These so-called dangerous and uncomfortable cars, as far as seating arrangement is concerned, are patterned after the most modern, up-to-date vehicles of transportation which have been adopted and are in use in New York City, where the question of urban transportation has have given more thorough study than in any other community in the country.

"Cars with longitudinal seats are not confined to the surface roads in New York City, but are in use almost exclusively on both the elevated railways and the subway, where the trains make a much higher speed and where the acceleration and braking are much more severe. It is strange, indeed, that the greatest metropolis in the country should adopt a dangerous and uncomfortable type of car, especially in view of the fact that there exists in New York a public service commission with practically unlimited powers of regulation. You further state that 'In case of a collision this huddled mass of humanity would be flung violently against the nearest solid obstacle.' Our purpose has been to remove all obstacles as far as possible in these new cars, and it is perfectly apparent that in case of a collision there would be less danger with the longitudinal seat than with the cross seat, as there would not be the obstacles to be thrown against. The greatest and most difficult problem which every street railway has to face is the handling of the public during the hours of congestion of travel, and the car which solves this problem in the most satisfactory manner is the one which is for the best interests of both the community and the transportation companies."

New Transfers in Scranton.—The Scranton (Pa.) Railway is considering the adoption of a transfer with a shorter time limit so as to prevent passengers from taking advantage of the company by not using their slips on the next connecting car.

Complaint Against Ithaca Street Railway.—The Common Council of Ithaca has filed a complaint with the Public Service Commission of the Second District of New York in regard to the condition of the track and roadbed and the service of the Ithaca Street Railway. Complying with the request of the Common Council the commission has detailed inspectors to investigate the matters mentioned in the complaint."

Discrimination Charged in New York Seaside Service.—The Public Service Commission of the First District of New York has served upon the Brooklyn Rapid Transit Company a complaint order directing it to answer within ten days the complaint of the Luna Park Company and others asking for an order to compel the re-establishment of the express service to the center of Coney Island, formerly operated by the company.

Curtailing Stop-Over Privileges.—The San Bernardino (Cal.) Valley Traction Company has announced a change of service, requiring all purchasers of tickets from Redlands to Urbita to remain on the cars for the trip to the springs, not permitting of stops at San Bernardino and transfers to Urbita cars. Heretofore the company has sold tickets to San Bernardino and given transfers on them to Urbita. Extra fares will now be collected for all persons stopping in San Bernardino on the trip.

Chicago Schools to Help in Accident Campaign.—Mrs. Ella Flagg Young, superintendent of schools of Chicago, proposes to assist the surface street railways in Chicago in their campaigns to prevent accidents. She suggests instructing school children in regard to boarding and alighting from cars. Mrs. Young has volunteered to co-operate with the street railways by having the teachers present the subject of safety to the children in such a way that they will fully realize the dangers that come from playing in the street and in jumping on and off cars while they are in motion.

F. A. Delano on the Interstate Commerce Law.—F. A. Delano, president of the Wabash Railroad, at the luncheon of the Traffic Club, in the Hotel La Salle, Chicago, Ill., recently, spoke on the subject "Optimism." Mr. Delano said: "The Interstate Commerce Law was passed in 1887 and it was passed in the interest of the general public, particularly shippers. While railway officials at that time through the entire country feared the effect of the law, I sincerely believe that the law has been of great benefit to those who have capital invested in railway stock and property and that every change and amendment in the law has proved beneficial to honest railway methods."

Need of Cross-Town Lines in Milwaukee.—R. W. Harris of the Railroad Commission of Wisconsin, in a report to that body, in regard to the need for the construction of a cross-town line by the Milwaukee Electric Railway & Light Company, said: "A study of the total amount of this through-town travel for all the lines clearly indicates that there is a considerable demand for a cross-town line between Twelfth Street and Twenty-seventh Street, across the Sixteenth Street viaduct and along National Avenue. The amount of travel in Milwaukee has experienced a very material increase during each year for some time past and for this reason the demand at the present date is still much more pronounced than it was at the time this study was made, and consequently the demand is greater for a cross-town line now than it then was."

Conference in Regard to Terms of Service in Trenton.—Oscar T. Crosby, president of the Trenton & Mercer County Traction Corporation, Rankin Johnson, vice-president of that company, and J. C. Thompson, superintendent of the company, conferred with representatives of the employees recently in Trenton in regard to wages and terms of service of the men. The editors of the local newspapers and prominent citizens were permitted to attend the conference. As a result of the conference the employees will hereafter be paid for the ten minutes each day spent by them in reporting before going on duty and for the fifteen minutes spent by them after their run each day in submitting their accounts. The employees now receive 23 cents an hour and have asked for an increase in wages to 28 cents an hour. This request was discussed at the meeting and it was decided to consider this question in detail at a conference to be held in the near future.

Law Upheld Regulating Hours of Railroad Service.—In the test suit instituted by the Baltimore & Ohio Railroad the Supreme Court of the United States has unanimously upheld the law regulating the hours of service for railroad employees passed by Congress in 1907. The decision was announced by Judge Hughes on May 29, 1911. He said that the words of the statute were plain that only persons engaged in interstate commerce and interstate carriers were affected by the statute. In this particular, he said, the law differed from the Employers' Liability Law of 1906, and added that because interstate employees sometimes engage in intrastate business did not defeat the law. The act made it unlawful for any common carrier engaged in interstate commerce to permit any trainman subject to the act to remain on duty longer than sixteen consecutive hours, or any telegraph operator more than nine or thirteen hours, according to the time the telegraph station was open for business. The act also created periods of rest for the employees.

Combined Freight Service of Philadelphia Suburban System and City Lines.—A. Merritt Taylor, president of the Philadelphia & West Chester Traction Company, Upper Darby, Pa., has announced plans for a freight service to connect with the freight service of the Philadelphia Rapid Transit Company between Sixty-third Street and Market Street and Delaware Avenue. Mr. Taylor states that freight stations are to be erected at Sixty-third Street and Market Street, Ardmore and Clifton Heights, and that service on these lines of the company will be inaugurated within sixty days. With regard to the West Chester line the statement is made that the new service will be inaugurated before Sept. 1, 1911. The freight service of the company will be operated in conjunction with that of the Philadelphia Rapid Transit Company, traffic agreements having been made between the two corporations so that shipments from points on the lines of the Philadelphia & West Chester Traction Company will be transferred to cars of the Philadelphia Rapid Transit Company and taken to the freight station at Delaware Avenue and Market Street. Shipments from Philadelphia will be transferred from Sixty-third Street and Market Street for points on the line of the receiving company.

School Fares in New Jersey.—The formal reasons why the Public Service Railway, Newark, N. J., holds the order of the Board of Public Utility Commissioners of New Jersey directing it to resume the transportation of school children at reduced rates should be set aside, have been filed in the Supreme Court. The company has placed before the court for review the letter of Thomas N. McCarter, president of the company, to the Public Utility Board and the formal order of the board adopted May 5. The letter stated that it had been the practice of the company to carry school children and teachers in the same localities at reduced rates, but the practice had been discontinued after advice that it was illegal under the new public utility law. The order of the board directed the company to resume the special rate, or, in other words, to suspend the increased rate, pending a hearing and final determination of the question. Following the promulgation of this order, the Public Service Railway began this suit to set the order aside. The reasons assigned for setting the order aside are that the new law makes compliance with the order illegal; that the discontinuance of the special rate is not an increase, but the abolition of a discriminatory rate in compliance with the new statute; that the board had no authority to issue the order, and that the order is contrary both to the State Constitution and the Federal Constitution.

Summer Season at Winona Lake.—The *Winona Quarterly,* which is published by the Winona Interurban Railway, Warsaw, Ind., for gratuitous distribution outlines as follows the program of the company at Winona Lake for the summer season: "Glenn H. Curtiss, the noted aviator, with his hydro-aeroplane, guarantees us two great flights. W. D. Chenery, the author of last year's feature 'Egypta,' announces his new and surpassing sacred opera, 'Ahasuerus.' The American Brass Band of Providence, with fifty musicians, will delight music lovers for three days. Another welcome announcement is the return of the tuneful children's operetta, 'The House that Jack Built.' Under the able direction of Mrs. Hortence R. Reynolds this feature will again delight children and adults alike. Plans are laid for a more elaborate 'Venetian Night,' now almost as well known among water spectacles as is the Mardi Gras among the land pageants. The lecturers are stronger than ordinary, William Jennings Bryan heading an imposing list. Music runs at the top line of the season's offerings. The LeBrun Grand Opera Company, singing portions of the greatest operas in English, the Gamble Concert Party, the annual musical contest, the oratorios, the bands, the quartets and soloists combine to make the year a rich one musically. The leading entertainers and readers are engaged for 1911, and many of the country's leading preachers will be heard at the Sunday services." Following the special announcement the program of the attractions, including the lectures and recitals, is given in detail.

Personal Mention

Mr. John Blair MacAfee, president of the Norfolk & Portsmouth Traction Company, Norfolk, Va., will relinquish his active interest in that property and subsidiary companies on July 1, 1911, when the road is merged with the Virginia Railway & Power Company.

Mr. Carl A. Sylvester, retiring general manager of the Boston (Mass.) Suburban Electric Companies, was presented with a set of Thermos bottles at the regular May meeting of the Suburban Railway Club, and at the recent meeting and dinner of the New England Association of Purchasing Agents at the Boston Yacht Club he was presented with a loving cup.

Mr. A. A. Dunlap, who for the last five years has held various positions in the roadway department of the Indiana Union Traction Company, Anderson, Ind., from construction timekeeper to division engineer, has recently been appointed division engineer of the Tipton Division of the company, in charge of all track, bridges and buildings from Indianapolis to Logansport, Kokomo to Peru and Tipton to Alexandria, a distance covering 121 miles, exclusive of the city lines in Elwood, Ind.

Mr. C. H. Andrews has been appointed manager in charge of the North Carolina Public Service Company's properties at Greensboro and High Point, N. C., furnishing electric-lighting, gas and street-railway service in these cities. Mr. Andrews was graduated from Purdue University in 1908 and entered the employ of the North Carolina Public Service Company two years ago as a meter reader and tester. Since then he has been successively placed in charge of the electric lighting, commercial and gas departments, finally succeeding Mr. E. C. Deal, whose appointment as general manager of the Augusta Railway & Electric Company and the Augusta-Aiken Railway & Electric Company was noted in the ELECTRIC RAILWAY JOURNAL of April 1, 1911.

Mr. L. W. Jacques has resigned as master mechanic of the Ft. Wayne & Northern Indiana Traction Company, Ft. Wayne, Ind., to become master mechanic of the Rockford & Interurban Railway, Rockford, Ill. Mr. Jacques began his railroad career with the Baltimore & Ohio Railroad, which he served for fourteen years in various capacities, finally becoming roundhouse foreman at South Chicago. He then became connected with the Twin City Rapid Transit Company, Minneapolis, Minn., and was with that company three years as foreman of its Thirty-first Street shops. Mr. Jacques resigned from the Twin City Rapid Transit Company to become master mechanic of the Ft. Wayne & Wabash Valley Traction Company and has served that company more than five years.

Mr. Horace Field Parshall has been appointed chairman of the Central London Railway, London, England, which operates the original "Twopenny Tube." Mr. Parshall was electrical engineer for this line and has been closely connected with the work of the railway since it was placed in operation, about ten years ago. Mr. Parshall is an American, but has been in England about fifteen years. He was electrical engineer for the Dublin Tramways, the Glasgow Tramways, the London United Tramways and the Bristol Tramways, and has been connected with many other large electrical projects in Great Britain. He prepared the plans for the Central London Railway installation, the first railway in England to be operated on the multi-phase system with converting substations, and has been associated with the operation of the line ever since. He succeds Sir Henry Oakley as chairman of the Central London Railway.

Mr. Rankin Johnson, who was recently elected vice-president of the Trenton & Mercer County Traction Corporation, Trenton, N. J., was graduated from Sheffield Scientific School, Yale University, in the class of 1895. After leaving college he served in Mexico for about eight years as chief engineer of the Mexico International Railroad. On leaving this position he was for three years chief engineer and general manager of the Bolivia (S. A.) Railway, during which period he operated about 300 miles of track of a system which will embrace about 1000 miles of track when completed. Since September, 1909, Mr. Johnson has maintained an office in New York City as a consulting engineer and at present he devotes part of his time to consulting work. The Trenton Street Railway is now controlled by the Trenton & Mercer County Traction Corporation.

Mr. F. T. Hepburn has resigned as general manager of the Saginaw-Bay City Railway, Saginaw Power Company, Saginaw City Gas Company, Bay City Power Company and the Bay City Gas Company, of Saginaw and Bay City, Mich., to become a member of the firm of H. D. Walbridge & Company, bankers, New York, N. Y. Mr. Hepburn will, however, remain in Saginaw for the present or until a successor to him with the companies mentioned has been appointed. Mr. Hepburn was graduated from Rensselaer Polytechnic Institute, Troy, N. Y., in 1893, and for thirteen years was connected with the construction, maintenance and operating departments of the Pennsylvania Railroad. In 1906 he was appointed general manager of the Lima & Toledo Traction Company and the Indianapolis, Columbus & Eastern Traction Company, Lima, Ohio, which operated 250 miles of interurban electric railway in Ohio and now comprise what is known as the northern district of the Ohio Electric Railway. Mr. Hepburn was appointed general manager of the companies at Saginaw and Bay City in May, 1910.

Mr. George M. Cox has been appointed acting general manager of the subsidiary companies of the Boston (Mass.) Suburban Electric Companies, including the Middlesexes & Boston Street Railway, Lexington & Boston Street Railway and the Norumbega Park Company, to succeed Mr. Carl A. Sylvester, resigned. Mr. Cox was born in Waltham in 1866 and has lived in West Newton for the last forty-five years. He was graduated from the Pierce Grammar School of West Newton in 1880 and from the Newton High School in 1884. He entered the employ of the Boston Suburban Electric Companies on Feb. 18, 1902, in the capacity of bookkeeper. On Feb. 22, 1904, he was appointed chief clerk of the company and on Nov. 23, 1905, he was elected by the board of directors as assistant treasurer of the various companies.

G. M. Cox

Mr. G. Frank Hailman has been appointed superintendent of the Southern Pennsylvania Traction Company, Chester, Pa., to succeed Mr. Arthur G. Jack, whose appointment as general claim agent of the Wilmington & Philadelphia Traction Company was noted in the ELECTRIC RAILWAY JOURNAL of May 27, 1911. Mr. Hailman was born in Virginia, and after working on a farm until he was twenty-one years old he secured a position in 1892 as a conductor with the Eckington & Soldiers Home Railway, Washington, D. C. The following year he was made a clerk in the office of the company, but resigned from the company in 1896, when the Eckington & Soldiers Home Railway and the Belt Railway, Washington, D. C., were placed in the hands of a receiver. Mr. Hailman became connected with the Metropolitan Railway, Washington, D. C., under Mr. W. A. Heindel, superintendent. In 1898 he was made acting clerk of this company and was subsequently advanced to other positions until in 1900 he was made division superintendent of the company in charge of the Columbia Division under Mr. R. E. Lee, who now is superintendent of the Cincinnati (Ohio) Traction Company. In the fall of 1904 Mr. Hailman resigned from the Metropolitan Railway to go into business for himself. In 1906 he became connected with a firm in Philadelphia which makes a specialty of railroad investigation work and has been connected with that company since that time.

OBITUARY

Charles H. Shattuck, president and general manager of the Parkersburg, Marietta & Interurban Railway, Parkersburg, W. Va., died at his home in that city on May 27, 1911. Mr. Shattuck was also president of the Citizens' National Bank, Parkersburg. He was seventy-seven years old.

Construction News

RECENT INCORPORATIONS

*Bakersfield & Kern Electric Railway, Bakersfield, Cal.—Chartered in California to build an electric railway in Bakersfield. Capital stock, authorized, $250,000. Stock, subscribed, $5,000. Directors: C. R. Eager, S. B. Cushing, H. A. Blodgett, F. T. Whorff and C. N. Beal.

*Los Angeles & San Fernando Electric Railway, Los Angeles, Cal.—Incorporated in California to build an electric railway between Los Angeles and San Fernando, via Griffith Park. Capital stock, $25,000. L. C. Brand, president; W. C. Kerckhoff, vice-president; J. F. Sartori, treasurer, and H. Chandler, secretary.

*Ventura Railway, San Francisco, Cal.—Application for a charter has been made in California by this company to build a 30-mile electric railway to connect Hueneme and Oxnard with branches from Oxnard to the Patterson Ranch, McGrath Ranch and Browne Ranch in Ventura County. Capital stock $500,000. Incorporators: I. B. Bary, San Francisco; J. A. Driffel, A. M. Dupru and R. Beck of Oxnard, Ventura County.

*Chicago & Joliet Railroad, Chicago, Ill.—Incorporated in Illinois to build track in Cook County, which will enable the Chicago & Joliet Railway to move from the highway to a private right-of-way. It is also reported that this company will build an extension of several miles. Principal offices, Chicago. Capital stock, $5,000. Incorporators and first board of directors, J. R. Blackhall, Joliet; H. K. Crafts, George M. Stevens, William B. Stevens, Clayton E. Crafts, Chicago.

Duluth & Northern Traction Company, Duluth, Minn.—Application for a charter has been made in Minnesota to build a 4½-mile electric railway in Duluth. Capital stock, $500,000. Incorporators, Charles P. Craig, J. G. Williams, A. M. Marshall, Chester A. Congdon, M. H. Alworth, John Millen, Joseph B. Cotton, D. F. Cole, I. L. Washburn, Luther Mendenhall, D. B. McDonald, W. H. Cole, A. M. Chisholm and Dr. W. H. Magie, all of Duluth. [E. R. J., May 20, '11.]

*Lehigh Coal & Navigation Company, Philadelphia, Pa.—Chartered in Pennsylvania to build an electric railway from Summit Hill to Mauch Chunk.

*Centralia Electric Light & Traction Company, Centralia, Wash.—Application for a charter has been made in Washington by this company to build a 15-mile electric railway between Rochester and Centralia. Financial backing has been secured and most of the right-of-way has been obtained. The company will also furnish power for lighting purposes. Incorporators: Walter Copping, G. W. Muck, N. W. Mills, Bruce Richards and Dan Salzer.

FRANCHISES

*Redwood City, Cal.—Edward F. Fitzpatrick, Redwood City, has asked the Town Trustees for a franchise to build a line through Redwood City. This is part of a plan to operate a railway and bay steamer line between San Francisco and Redwood City.

Bridgeport, Conn.—The Connecticut Company has received a franchise from the Common Council to extend its Main Street line to Barnum dyke, in Bridgeport. It has also received permission to double-track and extend some of its lines on Baldwin Street and South Main Street, in Waterbury. The company has asked the Council for a franchise to extend its tracks through Homer Street and Thomaston Avenue, in Waterbury. This will necessitate the rebuilding of the bridge over Hancock Brook, on Thomaston Avenue, probably of reinforced concrete.

Waycross, Ga.—The Waycross Gas, Electric & Railway Company has received a franchise to build its tracks over certain streets in Waycross. [E. R. J., Nov. 27, '09.]

Indianapolis, Ind.—The Indianapolis, Nashville & Southern Traction Company has asked the County Commissioners for a franchise to build an electric railway through Marion County. This 108-mile railway will connect Indianapolis, Trafalgar, Nashville, Bloomington, Bedford, Mitchell, Orleans and French Lick. John A. Johnson, Indianapolis, president. [E. R. J., April 22, '11.]

*Gretna, La.—Leo A. Marrero has received a fifty-year franchise from the Council to build an electric railway between Gretna and Waggaman. Immediate steps will be taken to form a company to build and operate this proposed line.

Northampton, Mass.—The Northampton Street Railway has asked the Board of Aldermen for a franchise to double-track and extend some of its lines in Northampton.

Worcester, Mass.—The Worcester & Providence Street Railway, Worcester, has received a six months' extension of time on its franchise from the Council, in which to begin the construction of its railway in Worcester. It will connect Worcester and Providence. Walter F. Angell, president. [E. R. J., Dec. 24, '11.]

Langdon, Minn.—The St. Paul Southern Electric Railway, St. Paul, has received a franchise from the County Commissioners to build its tracks over certain streets in Langdon and Cottage Grove. It will connect St. Paul, Red Wing, Hastings, Point Douglas and Lake City. W. L. Sonntag, St. Paul, general manager. [E. R. J., April 15, '11.]

Vicksburg, Miss.—The Vicksburg Traction Company has asked the Board of Supervisors for a franchise to build an extension of its Water Street line to Waters.

Billings, Mont.—The Billings Traction Company has accepted the amended franchise granted it by the Council. It is said the company contemplates extending this line to Laurel. John A. Connolly is interested. [E. R. J., Aug. 10, '10.]

Asheville, N. C.—The Asheville Electric Company has received a franchise from the Board of Aldermen to extend its tracks in Asheville.

Fayetteville, N. C.—The Fayetteville Street Railway & Power Company has received a franchise from the Board of Aldermen to extend its tracks on Hay Street and over to Haymount.

Canadaigua, N. Y.—The Ontario Light & Traction Company has asked the Board of Trustees for a new franchise to extend its tracks through additional streets in Canandaigua.

Little Falls, N. Y.—The Little Falls & Johnson Railroad has asked the Common Council for a franchise to build its line over certain streets in Little Falls. J. L. Hess, 103 Park Avenue, New York City, president. [E. R. J., May 6, '11.]

New York, N. Y.—The Manhattan Bridge Service Company will ask the Public Service Commission and the Board of Estimate for a franchise to operate its railway across the Manhattan Bridge. This is part of a plan to build a 2-mile electric railway from Manhattan Plaza to Fulton Street and Flatbush Avenue, Brooklyn. Arthur C. Hume, 165 Broadway, New York City, N. Y., is interested. [E. R. J., May 27, '11.]

Dayton, Ohio.—The Dayton, Springfield & Xenia Southern Railway has asked the Council Committee for a twenty-five-year extension of its franchise and the right to build an extension of its tracks on Fifth Street from Ludlow to Main Street, and thence north to Third Street, in Dayton.

Toledo, Ohio.—The Toledo Railways & Light Company has received a franchise to double-track Huron Street, between Adams Street and Cherry Street, in Toledo.

New Castle, Pa.—The New Castle & Beaver Falls Street Railway has received a six months' extension of time from the Select Council in which to begin work on its proposed 22-mile electric railway to connect New Castle and Beaver Falls. [E. R. J., May 13, '11.]

Bristol, Tenn.—The Bristol Traction Company has asked the City Council for a franchise to extend its tracks over certain streets in Bristol to Virginia Park.

Memphis, Tenn.—The Memphis Street Railway has received a franchise from the Council to extend its tracks over certain streets in Memphis.

TRACK AND ROADWAY

Birmingham & Edgewood Electric Railway, Birmingham, Ala.—This company has completed and placed in operation its Edgewood line connecting the new South Highland suburbs with Birmingham.

Marked Tree, Harrisburg & Newport Railway, Harrisburg, Ark.—Preliminary arrangements are being made by this company to build a 50-mile electric railway between Marked Tree, Harrisburg and Newport. L. D. Freeman and J. C. Mitchell, Harrisburg, are interested. [E. R. J., May 13, '11.]

Fresno, Hanford & Summit Lake Interurban Railway, Fresno, Cal.—An extension from Fresno to Calwa is being considered by this company.

Pacific Electric Railway, Los Angeles, Cal.—Arrangements have been perfected by this company to build an extension from Homewood and Redondo, a distance of about three miles. Another extension will be built from Santa Ana to Anaheim.

***Marysville, Cal.**—G. W. Hall, Marysville, plans to build a 3-mile electric railway in Marysville. Eventually, it is said, the line will be extended until it is a belt line encircling Marysville.

Watsonville Railway & Navigation Company, Watsonville, Cal.—It is reported that contracts will be awarded at once and construction will begin in June by this company on its extension from Watsonville to Rowes Corners, thence to Corralitos and along the Santa Cruz road, returning to Watsonville. Another line is to be built along San Juan road. Driscoll's lane and Salsipuedes road, to a connection with the main line at Rowes Corners, and a branch may also be built to Pajaro and the Werner district. Concrete docks will be built at Port Watsonville. F. E. Snowden, 311 California Street, San Francisco, president. [E. R. J., May 6, '11.]

Kamouraska-L'Islet Railway, Ste. Anne De la Pocatiere, Can.—This company advises that it will soon begin the construction of its railway from Ste. Anne de la Pocatiere to connect with ship across Murray Bay and at Pointe de la Riviere Ouelle wharf and Moosehead Lake, Me. The motive power will be gasoline or steam. The repair shops will be located at Ste. Anne de la Pocatiere. Capital stock, authorized, $200,000, with authority to increase it to $10,000,000. Officers: Charles Kidd, Ste. Anne de la Pocatiere; Adolphi Stein, Fresserville, secretary, and G. A. Michand, Ste Anne de la Pocatiere. [E. R. J., Jan. 21, '11.]

Colorado Interurban Railroad, Denver, Col.—This company advises that it has awarded the contract to the Interurban Construction Company, Denver, for the construction and equipment of its 71-mile electric railway. Construction will begin as soon as pending financial deal is completed. The line will connect Denver, Ft. Lupton, Ft. Collins, Peatsville, La Salle, Evans, Fristown, Frederick and Longmont. Capital stock, authorized, $6,000,000. Bonds, authorized, $6,000,000. Eben N. Reaser, vice-president. [E. R. J, May 27, '11.]

Elberton & Eastern Railway, Augusta, Ga.—Z. B. Rogers, Elberton, of this company, states that as yet no definite plans have been completed for building this proposed railway to connect Elberton, Tignall, Washington and Lincolnton. [E. R. J., April 15, '11.]

Caldwell-Roswell Interurban Railway, Caldwell, Idaho.—This company advises that it is uncertain when construction will begin on its electric railway to connect Caldwell, Roswell, Greenleaf and Big Bend. H. W. Dorman, Caldwell, president. [E. R. J., June 4, '10.]

Springfield, Beardstown & Quincy Railway, Springfield, Ill.—This company advises that nothing definite has yet been decided as to when the construction of this line will begin. It will connect Springfield, Petersburg, Chandlerville, Beardstown, Mount Sterling and Quincy. Officers: G. L. Harnsberger, Springfield, president; H. H. Colby, Petersburg, vice-president; R. E. Bone, Petersburg, secretary, and C. W. Houghton, Petersburg, treasurer. [E. R. J., Oct. 15, '10.]

Alton, Jacksonville & Peoria Railway, Whitehall, Ill.—A contract has been awarded by this company to Grommett & Johnson to build an extension from Godfrey, Ill., northwest to Jerseyville and extending into Calhoun County.

Ft. Wayne & Winona Traction Company, Ft. Wayne, Ind.—The controlling interest of this company has been purchased by the Ft. Wayne & Northern Indiana Traction Company. The Ft. Wayne & Winona Traction Company was organized in 1908 to build a line from Ft. Wayne to Warsaw paralleling the Pennsylvania Railroad between those points. Preliminary surveys were made and franchises and right-of-way secured, but no construction work was ever done. It is stated that the line will be built next year by the Ft. Wayne & Northern Indiana Traction Company. [E. R. J., May 20, '11.]

Kokomo, Marion & Western Traction Company, Kokomo, Ind.—This company is asking for bids for the construction of its line from Kokomo to Terra Haute. George J. Marott, Indianapolis, president.

Creston-Winterset Interurban Railway, Creston, Ia.—This company advises that it will begin construction probably during the latter part of this year on its 60-mile electric railway to connect Spaulding, Macksburg, Winterset and Des Moines. The company intends to first build from Creston to Mackburg. The motive power will be steam for freight and gasoline motor cars for passenger service. The repair shops will be located at Creston. Capital stock authorized, $500,000. Officers: R. Brown, Creston, president; Clarence Wilson, Macksburg, vice-president; A. S. Lyon, Orient, secretary; W. W. Walker, Macksburg, treasurer, and C. B. Judd, Clarinda, chief engineer. [E. R. J., March 18, '11.]

Lewiston, Augusta & Waterville Railway, Lewiston, Me.—Plans are being considered by this company to build a 12-mile extension from Bath to Popham Beach.

Battle Creek, Coldwater & Southern Railway, Battle Creek, Mich.—Negotiations are being made by this company for the sale of $120,000 worth of bonds for the construction of its 28-mile electric railway to connect Battle Creek and Coldwater. An office has been opened in Coldwater and promotion work for the proposed line is now under way. Fred Warren is in charge. [E. R. J., March 5, '11.]

Springfield & Western Railroad, Springfield, Mo.—This company advises that preliminary surveys have been made, but contracts have not yet been awarded for the construction of this 90-mile electric railway to connect Springfield, Nichols, Halltown, Paris Springs, Mount Vernon, Hoberg, Freistatt, Monett, Pierce City, Wentworth, Diamond, Joplin and Springfield. Capital stock authorized, $2,000; bonds authorized, $1,500,000. Officers: H. D. Mackay, Springfield, president; I. N. Smith, vice-president; J. I. Woodfill, secretary and superintendent; J. P. McCammon, attorney, and M. M. Hollenback, Springfield, chief engineer. [E. R. J., May 13, '11.]

Piedmont Railway & Electric Company, Burlington, N. C.—J. W. Murray, president of the Piedmont Trust Company, advises that the Piedmont Railway & Electric Company, which was chartered recently, is being organized to take over and complete the 8½ miles of track which connects Burlington, Graham and Haw River, purchased from the receiver of the Southern Traction & Power Company by Mr. Murray. [E. R. J., May 20, '11.]

Hendersonville (N. C.) Traction Company.—This company is reported to be in the market for rail for 3 miles of track. [E. R. J., Oct. 23, '09.]

Hudson River & Eastern Traction Company, Ossining, N. Y.—The Public Service Commission, Second District, has given its permission and approval to this company to build its line in Sherman Park through Mt. Pleasant and North Castle and into White Plains. The company is authorized to exercise franchises granted by these localities. The consent now given permits the construction of a line from Ossining to White Plains.

Buffalo, Lockport & Rochester Railway, Rochester, N. Y.—This company is double-tracking about 5 miles of its line. Eventually the entire line from Lockport to Rochester will be double-tracked.

Syracuse, Watertown & St. Lawrence River Railroad, Syracuse, N. Y.—The Public Service Commission, Second District, has received a petition from this company asking for a certificate of convenience and a necessity and for authority to exercise franchises granted to it. It is proposed to build a railroad from a connection with the Syracuse and South Bay Electric Railroad at or near stop 9 in Cicero, to and into Brewerton, passing through Cicero and Brewerton, a distance of 6⅓ miles. The authorized capital stock of the company is $1,250,000. This electric railway will connect Syracuse, Watertown, Cicero and Brewerton, C. D.

Beebe and William Nottingham, Syracuse, are said to be interested. [E. R. J., May 6, '11.]

Midland Power & Traction Company, Cambridge, Ohio.—A contract has been awarded by this company to George Morehead, Senecaville, to build an extension from Byesville to Pleasant City.

Ohio Electric Railway, Cincinnati, Ohio.—Work has been begun by this company on its extension from Springfield to Dayton. A steel bridge over the Snyder Park entrance and over Buck Creek will be built at a cost of about $14,000.

People's Railway, Berlin, Ont.—The contract has been awarded by this company to the Acme Construction Company, Toronto, to build its line from Guelph to London.

Dominion Power & Transmission Company, Ltd., Hamilton, Ont.—This company is making a survey for an extension from Hamilton to Galt.

Williamette & Molalla Valley Railway, Canby, Ore.—This company will award contracts during the next month to construct its 12-mile electric railway through the Mollalla Valley to Canby. Surveys have been completed. W. J. Lee, Canby, general manager. [E. R. J., May 27, '11.]

Union Traction & Terminal Company, Marshfield, Ore.—Work will be resumed by this company at once for its electric railway between Marshfield and North Bend. J. M. Blake, Marshfield, president. [E. R. J., Feb. 5, '11.]

Middletown & Elizabethtown Street Railway, Middletown, Pa.—This company has secured right-of-way and has issued a mortgage for $35,000 to the Harrisburg Trust Company. Its line will connect Middletown and Elizabethtown, also the lines of the Conestoga Traction Company, Lancaster, thus making a continuous electric line between Philadelphia and Harrisburg. F. H. Alleman, Summit, N. J., is interested. [E. R. J., April 22, '11.]

West Penn Railways, Pittsburgh, Pa.—Reagom & Lynch, Uniontown, have been awarded the contract by this company to build an extension from Vance's Mills to Phillips, a distance of two miles. Work will be begun at once. This company has authorized the expenditure of about $100,000 for a 2½-mile extension from Masontown to Martin Station. The extension will require the construction of a $25,000 bridge over the Monongahela Railroad.

Columbia Electric Street Railway, Light & Power Company, Columbia, S. C.—This company has been authorized to increase its capital stock from $1,300,000 to $3,000,000. It expects to extend several of its lines in Columbia.

Kittitas Railway & Power Company, Cle Elum, Wash.—This company advises that work will begin about July 1 on the construction of its proposed electric railway to connect Cle Elum, Roslyn, Camp No. 5, Ronald and Janesville. Capital stock, authorized, $300,000. Bonds authorized, $500,000. Officers: Paul L. Richards, 909 Second Street, Tacoma, president; E. A. Watson, 912 South Sixth Street, Tacoma, vice-president and treasurer, and H. N. DeWolfe, Box 656, Tacoma, secretary. [E. R. J., April 8, '11.]

Morgantown & Dunkard Valley Railroad, Morgantown, W. Va.—This company has completed and placed in operation its extension to Barker.

Wausau (Wis.) Street Railway.—Plans are being made by this company for the expenditure of $50,000 this summer for improvements. These will include double tracking some of its streets in Wausau and a new amusement pavilion.

SHOPS AND BUILDINGS

British Columbia Electric Railway, Vancouver, B. C.—It is reported that this company will soon award contracts for building new carhouses and machine shops in Chilliwack. The cost is estimated to be about $20,000.

Fresno, Hanford & Summit Lake Interurban Railway, Fresno, Cal.—Plans have been completed by this company for its new office building on I Street, in Fresno. The structure will occupy two lots, 50 ft. x 150 ft. It will be two stories in the front and one story in the rear. The second floor will contain office rooms and accessories. Work will be begun in the near future. The cost is estimated to be about $20,000. [E. R. J., March 25, '11.]

Sacramento Electric, Gas & Railway Company, Sacramento, Cal.—This company will build a five-story building on Tenth Street, between K Street and L Street, in Sacramento.

Connecticut Company, New Haven, Conn.—Plans for the company's new carhouse in Waterbury have been completed and construction will begin within a short time. The proposed building will be located directly east of the present operating carhouse. It will be 360 ft. x 182 ft. On the second floor will be located the suite of offices for the officials, and there will be fourteen tracks in the carhouse capable of storing all the cars used in operating the Waterbury lines.

Ft. Wayne & Northern Indiana Traction Company, Ft. Wayne, Ind.—This company is considering plans to erect a new joint terminal station in Bluffton.

Southwestern Traction & Power Company, New Orleans, La.—This company is considering plans to erect a new carhouse.

Chambersburg, Greencastle & Waynesboro Street Railway, Waynesboro, Pa.—Plans are being considered by this company for a new carhouse in Waynesboro.

Galveston-Houston Electric Railway, Houston, Tex.—Work has been begun by this company tearing away the structure on the west side of Twenty-first Street, between Church Street and Post Office Street, in Galveston, on which it will erect a new carhouse. The building will be 65 ft. x 165 ft.

POWER HOUSES AND SUBSTATIONS

Sacramento Electric, Gas & Electric Railway Company, Sacramento, Cal.—This company has purchased five acres of land on the bank of the Sacramento River, in Sacramento, upon which it will build a new power house.

Wilmington & Philadelphia Traction Company, Wilmington, Del.—This company has purchased from the General Electric Company, through J. G. White & Company, New York, a 4000-kw turbo-generator, a 100-kw turbo-exciter and two 1000-kw, 250-volt motor-generator sets, which will be used on the three-wire lighting system.

Des Moines (Ia.) City Railway.—Among the improvements planned by this company during the year is an addition to its power house. The contract has been awarded to the General Electric Company, Chicago, for installing a to the General Electric Company, Chicago, for installing 4000-hp in generating equipment.

Southwestern Traction & Power Company, New Orleans, La.—A new power house will soon be erected by this company. F. W. Crosby, Tenegre Building, New Orleans.

Escanaba (Mich.) Traction Company.—It is reported that this company will construct a second power dam on the Escanaba River, capable of developing 2500 hp.

Omaha & Council Bluffs Street Railway, Omaha, Neb.—This company has ordered from the General Electric Company three 1000-kw, 600-volt rotary converters; four 1050-kw, 3-phase transformers; three 350-kw single-phase transformers; one 75-kw turbo-driven exciter; one blower set, one air compressor and one switchboard. Two of the 1000-kw rotary converter equipments will be installed in the new South Omaha substation, while the third is for installation in the company's power plant.

Tidewater Power Company, Wilmington, N. C.—This company has completed and placed in operation its new addition to its power house in Wilmington. It has purchased and installed one 500-kw rotary and one 250-hp Babcock & Wilcox boiler.

Tri-State Railway & Electric Company, East Liverpool, Ohio.—This company has ordered from the General Electric Company, through J. G. White & Company, New York, a 300-kw, 2300-600-volt rotary converter.

Washington Water Power Company, Spokane, Wash.—This company proposes to complete its Little Falls plant, extend many of its distributing lines in Spokane, install storage batteries, extend its underground conduit system and complete its transmission line from Post Falls to Newport.

Milwaukee Electric Railway & Light Company, Milwaukee, Wis.—This company has ordered four 9-retort Taylor gravity underfeed stokers, to be used with four 800-hp boilers.

Manufactures & Supplies

ROLLING STOCK

Piedmont Traction Company, Charlotte, N. C., will close contracts within a few days for twenty-three new cars.

Washington Water Power Company, Spokane, Wash., is reported to be considering the purchase of several new cars.

Mercer County Traction Company, Trenton, N. J., has ordered ten two-motor railway equipments from the General Electric Company.

Salem Railway & Light Company, Salem, Ore., has ordered six 22-ft. closed motor cars with Brill 21-E trucks from the Danville Car Company.

Union Railway, New York, N. Y., has ordered two 34-ft. 4-in. motor flat car bodies and four 27-G2 trucks without wheels from The J. G. Brill Company.

St. Louis, Monte-Sano & Southern Railroad, St. Louis, Mo., expects to purchase during the next two months two or three gasoline cars for hauling passengers.

Wausau (Wis.) Street Railway has purchased a quadruple equipment of No. 307 motors, with type K-35 control, from the Westinghouse Electric & Manufacturing Company.

Toledo Railways & Light Company, Toledo, Ohio, has ordered 100 type 310-C box frame interpole motors from the Westinghouse Electric & Manufacturing Company.

New York & North Shore Traction Company, Roslyn, N. Y., has ordered three 30-ft. 8-in. semi-convertible cars mounted on Brill 27-E-1 trucks from the G. C. Kuhlman Car Company.

Springfield (Mass.) Street Railway has ordered from the Wason Manufacturing Company one 33-ft. closed car body, two 32-ft. closed car bodies and six 28-ft. closed car bodies.

Guelph Radial Railway, Guelph, Ont., has ordered from the Westinghouse Electric & Manufacturing Company one 27-ton locomotive with four No. 101-B2 motors and type K-28B control.

Asheville & East Tennessee Railway, Asheville, N. C., has ordered one quadruple equipment of No. 307 motors, with type K-35-G control, from the Westinghouse Electric & Manufacturing Company.

Philadelphia & Easton Electric Railway, Doylestown, Pa., has ordered two quadruple equipments of No. 101 B-2 motors, with type K-28 control, from the Westinghouse Electric & Manufacturing Company.

New York, New Haven & Hartford Railroad, New Haven, Conn., has purchased four quadruple equipments of No. 409 a.c. motors with unit switch control from the Westinghouse Electric & Manufacturing Company.

Texas Traction Company, Dallas, Tex., noted in the ELECTRIC RAILWAY JOURNAL of March 25, 1911, as being in the market for three cars, has ordered three interurban cars mounted on Brill 27-MCB-3 trucks from the American Car Company.

Ft. Wayne & Wabash Valley Traction Company, Ft. Wayne, Ind., is in the market for ten center-dump ballast cars of 25-yd., 30-yd. or 35-yd. capacity; also for possibly five flat cars of 60,000-lb. or 80,000-lb. capacity, all to have M.C.B. equipment.

Omaha & Council Bluffs Street Railway, Omaha, Neb., has ordered from the General Electric Company twenty two-motor, GE-80 car equipments, five two-motor, GE-201 car equipments and five straight air-brake equipments, with CP-27 compressors.

Connecticut Company, New Haven, Conn., has ordered seventy-three pairs of Standard O-50 trucks from the Standard Motor Truck Company for the forty cars being built by the Osgood-Bradley Car Company and thirty-three by the Wason Manufacturing Company.

Buffalo & Lake Erie Traction Company, Buffalo, N. Y., has ordered four closed vistibuled motor cars from the G. C. Kuhlman Car Company. The length of the car bodies is 42 ft. 9⅝ in., over bumpers 53 ft. 6⅝ in. They are to be equipped with quadruple GE-205 motors.

Conestoga Traction Company, Lancaster, Pa., has included the following in its specifications for the three closed vestibuled motor cars which are being built by The J. G. Brill Company:

Seating capacity	44	Gears and pinions	West.
Weight (car body)	18,500 lb.	Gongs	Dedenda
Bolster centers, length,	18 ft. 8 in.	Hand brakes	vertical
Length of body	30 ft. 8 in.	Heaters	Consol.
Over vestibule	40 ft. 1 in.	Headlights	Imperical S. arc
Width over sills	7 ft 11½ in.	Journal boxes	Sym.
Over all	8 ft. 2 in.	Motors	4 West. 101-B
Body	wood	Motors	outside hung
Interior trim	cherry	Sanders	Dumpit
Roof	monitor deck	Sash fixtures	double sash
Underframe	steel	Seats	Winner
Axles	Brill std.	Seating material	rattan
Bumpers	Brill angle iron	Springs	Brill
Car trimmings	bronze	Step treads	wood
Couplers	Hovey	Trucks	Brill 27 MCB1
Curtain fixtures	C. S. Co.	Ventilators	regular
Curtain material	pantasote	Wheels	33-in. Nat.

TRADE NOTES

Ackley Brake Company, New York, N. Y., has received an order for additional Ackley brakes from the Basle Tramway, Basle, Switzerland.

Page & Hill Company, Minneapolis, Minn., has installed at its Minnesota Transfer yard a plant for giving cedar poles a preservative treatment.

Massachusetts Chemical Company, Walpole, Mass., announces that its Chicago office is now located in the Brooks Building, Jackson Boulevard and Franklin Street.

Griffin Wheel Company, Chicago, Ill., has purchased a tract of nearly five acres in West Forty-third Street, Chicago, on which it is said a new factory will be erected.

Pyrene Manufacturing Company, New York, N. Y., has moved its general offices to 1358 Broadway, New York. The factory will remain at 410 East Thirty-second Street.

Edgar Allen American Manganese Steel Company, Chicago, Ill., has appointed H. H. Hunt eastern sales agent with headquarters at New Castle, Del., to succeed V. W. Mason, Jr., resigned.

H. O. Fettinger has resigned as representative of the Safety Car Heating & Lighting Company, New York, to become connected with the Clement Restein Company, Philadelphia, Pa., as manager of the railway department.

American Steel & Wire Company, Worcester, Mass., has received through Stone & Webster, Boston, Mass., an order for cables to cost about $300,000 for the Boston Elevated Railway, for use in its distributing system from the new South Boston power station.

Perry Ventilator Corporation, New Bedford, Mass., has received an order for ventilators for forty all-steel cars for the Boston (Mass.) Elevated Railway, which are now being built by the Standard Steel Car Company. These cars have arch roofs and are for use in the new Cambridge subway.

United States Metal & Manufacturing Company, New York, N. Y., has appointed J. J. Ross manager of the western railroad department, with headquarters in the McCormick Building, Chicago, Ill. Mr. Ross was formerly connected with the Featherstone Foundry & Machine Company, and with the J. V. Dowling Company.

Bronze Metal Company, New York, N. Y., at the annual meeting elected Otis Cutler and Joel S. Coffin, directors of the company, in addition to E. H. Fallows, R. J. Davidson and Alexander Turner. The following officials were also elected: E. H. Fallows, president; Alexander Turner, vice-president and general manager, and C. D. Johnson, secretary and treasurer.

Southern Car Company, High Point, N. C., which was recently reorganized, expects to cater for business to the entire country, as its freight rates are so favorable that it can reach out in competition to any part of the United States. The company also expects eventually to do considerable foreign business. Its plant will be in operation in the early part of June.

Kingston Locomotive Works, Kingston, Ont., at a special meeting of the stockholders, on May 26, accepted the offer of Emilius Jarvis & Company, of Toronto, representing a syndicate of engineers and capitalists, including Lord Glenconner, Marlborough Prior, J. Leigh Wood and F. R. S. Balfour, of London, Eng., for the purchase of the works. The company will shortly be reorganized, the capital stock increased to $5,000,000, and the plant doubled in capacity. At present the capital is $500,000, and the number of men employed between 500 and 600.

Sargent & Lundy, Chicago, Ill., consulting engineers, announce that James Lyman, formerly district engineer for the General Electric Company, Chicago, Ill., has become a member of the firm and will assume the duties of chief engineer of the electrical department. Mr. Lyman was associated from 1884 to 1887 with Thomas A. Edison in installing the first lighting plants in Pennsylvania, Maryland and other states. After a period of several years in the manufacturing business Mr. Lyman entered the employ of the General Electric Company, being located first in Schenectady and, for the past sixteen years in Chicago as district engineer. W. S. Monroe, formerly in charge of the drafting room of Sargent & Lnundy, has been also taken into the firm and will hereafter assume the duties of chief engineer of the mechanical department under Mr. Sargent.

Electric Storage Battery Company, Philadelphia, Pa., has received the order for the battery equipment of the thirty-five new storage battery cars for the Dry Dock, East Broadway & Battery Railroad, of New York City, which will be placed in service this summer. These cars have been specially designed by the Third Avenue Railway. Each car is equipped with two motors and the batteries are installed under the longitudinal seats. The cars will have a maximum speed of 15 m.p.h. on level track with a schedule speed of 7 m.p.h. to 8 m.p.h., including stops. They are of the open platform single-truck type with 18-ft. bodies. The battery equipment of each car is to consist of fifty-eight cells of type 29 MV "Hycap-Exide." Cells of this type have been operated in street-car service in New York for about a year with marked success.

Sprague Electric Company, New York, N. Y., will be merged with the General Electric Company, Schenectady, N. Y., on June 1, 1911. Its business will be conducted under the name of Sprague Electric Works of General Electric Company. The manufacture and sale of the lines of apparatus and supplies heretofore exploited by the Sprague Electric Company will be continued by the Sprague Electric Works of General Electric Company under the same organization, with D. C. Durland in responsible charge as general manager. All correspondence should be sent to the Sprague Electric Works at the same address as in the past. The officers of the Sprague Electric Works will be continued as heretofore, with main offices at 527-531 West Thirty-fourth Street, New York, N. Y., and branch offices in the principal cities.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., reports the following recent orders: From the Toledo Railways & Light Company, 100 type 310-C box-frame interpole street railway motors; from the New York, New Haven & Hartford Railroad, four quadruple equipments of No. 409 a.c. railway motors with unit switch control; from the Guelph Radial Railway, one 27-ton locomotive with four No. 101B2 railway motors and type K-28-B control. Other recent orders for motors have come from the Hummelstown & Campbellstown Street Railway, Hershey, Pa.; the Nashville Railway & Light Company, Nashville, Tenn.; the Cumberland Electric Railway, Cumberland, Md.; the Frederick Railroad, Frederick, Md., and the Connecticut Company, New Haven, Conn. Recent foreign railway orders include one from the Takaski Water Power Electric Company, of Japan, for two double equipments of No. 12A street railway motors with type 210D controllers. This order was placed through Takata & Company, the Westinghouse Company's representatives in Japan.

Woodmansee, Davidson & Sessions, Chicago, Ill., has been formed to act as consulting engineers, with headquarters in the First National Bank Building, Chicago, Ill. The firm is composed of Fay Woodmansee, C. J. Davidson and E. O. Sessions. It is prepared to undertake consulting civil, electrical and mechanical engineering propositions of any character and magnitude. Fay Woodmansee began his first practical work in engineering with the government on the deep waterway survey of the Hudson River from the Troy State dam to Germantown, in 1898. He then became connected with the General Electric Company, and remained until Feb. 1, 1903, when he resigned to become electrical engineer for Sargent & Lundy, Chicago, Ill., consulting engineers. This position he held until his retirement from this company, on April 1, 1911. During his connection with Sargent & Lundy Mr. Woodmansee assisted in the rehabilitation of the International Traction Company of Buffalo, N. Y., and in the construction of several large power plants in other cities. C. J. Davidson formerly was chief engineer of power plants of the Milwaukee Electric Railway & Light Company, Milwaukee, Wis. A biographical sketch of Mr. Davidson was printed in the Electric Railway Journal of May 13, 1911, when he resigned from that company. E. O. Sessions entered the employ of the Thomson-Houston Electric Company, Lynn, Mass., in 1889, and became assistant superintendent of the Edison General Electric Company, New York, in 1891. From 1894 to 1896 Mr. Sessions was general superintendent for Frank Jones, and during this period he installed thirty power plants and three railways. He then became connected with the General Electric Company as engineer of construction, and from 1901 to 1908 was engineer for the Stanley-G.I. Company. In 1908 he joined the General Electric Company as special engineer, which position he held until his retirement from that company, on May 1, 1911.

ADVERTISING LITERATURE

Indianapolis Brass Company, Indianapolis, Ind., is mailing a circular which describes the I. B. C. section insulator.

U. S. Metal & Manufacturing Company, New York, N. Y., has issued an interesting booklet on the subject of varnish, its history and manufacture.

Electric Storage Battery Company, Philadelphia, Pa., is distributing a small pamphlet with the title "The Story of the Storage Battery." It describes briefly some of the many appplications of storage batteries of different sizes and types which the company makes.

Schuchardt & Schütte, New York, N. Y., have issued a pamphlet which describes and illustrates their hand tachometers for indicating accurately the speed of the shafts and spindles and also the periphery or belt speeds. The thumb-slide adjustment of the single spindle gives four ranges of speed.

National Carbon Company, Cleveland, Ohio, has issued a 4-in. x 6-in., 76-page, cloth-bound booklet, entitled, "Practical Operation of Arc Lamps." This publication describes fully the different types of a.c. and d.c. arc lamps and explains how their various operating troubles may be avoided or overcome. In addition to this, data are presented on wiring, line work, electrical instruments, etc., and tables are given on light reflection, interior illumination, wiring and miscellaneous engineering subjects.

General Electric Company, Schenectady, N. Y., has issued Bulletin Nos. 4826 and 4827, which describe the company's water and air-flow meters, respectively. Bulletin No. 4825 illustrates and describes a line of compact, accurate and moderate-priced instruments for use on alternating and direct-current switchboards. The bulletin contains dimension diagrams and also illustrations showing the actual size of the meter scales. The company has also issued Bulletin No. 4831, which describes briefly a type of oil switch suitable for installing in manholes. These switches are made single, double or triple pole, single-throw, and are for use on circuits on voltages up to 7500. The normal current rating is 200 amp.

NEW PUBLICATION

Locomotive Breakdowns. By George L. Fowler and William W. Wood. New York: The Norman W. Henley Publishing Company. 270 pages; illustrated. Price $1.

This is the 1911 edition of this well-known aid for steam locomotive engineers. A large portion of the book is devoted to air brake troubles.