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During 1907 the Street Railway Journal printed and circulated 427,250 copies, an average of 8216 copies per week. Of this issue 7500 copies are printed.

Facilities for Handling Heavy Apparatus in the Shop

Although in most electric railway shops it is necessary daily to lift and move from one end of the shop to the other heavy apparatus, it is not uncommon to find very scanty facilities for the performance of this work. In the design of a power station, it is the almost invariable custom to provide an overhead crane capable of handling heavy pieces of machinery, although there may be very little occasion to use the crane after the engines and generators have been installed. Lifting apparatus is just as important in the repair shop as in the power house, the only difference being that in the power station it is not often required, but when needed its use is very necessary. In case of a breakdown of the machinery it may prevent a shutdown of the station or at least lessen its duration. In the repair shop, however, its employment is constant, but the necessity for its use hardly ever arises to the critical point that it does in the power station. The saving in actual cost of labor is of course valuable, but is not the only advantage. The aisles and spaces between the machine tools do not have to be left as free as they do when trucks, motors and wheels are pushed over the floor. With overhead hoists, cranes or telphers, these heavy pieces can be carried or stored overhead so that it is not impossible that space could be economized to such an extent that a repair shop could be made much smaller than otherwise. Again, work can always be got out more quickly, and this means a smaller number of shop car days per year. On some systems it is possible that the decreased number of cars necessary to operate the road would pay interest on the investment in the cranes. There are certainly many cases when it would mean many dollars to the company in receipts to be able to get cars out in shorter time. There is another benefit which must not be overlooked. Much better and more conscientious work will in all probability be done by the workmen. They avoid strains due to heavy lifting and this should be a stimulant to better work in other directions and will encourage them to believe that the company puts a premium on brains, rather than on mere brawn.

The Cost of Operation Per Passenger-Mile

The refusal of Governor Hughes to sign the bill requiring the electric railway companies of Brooklyn to carry passengers to Coney Island, 10 miles, for 5 cents, is being attacked by demagogic editorials in some of the daily papers in New York. The Governor's action was based not upon the ground that the service would not pay, but because this subject was still under consideration by the Public Service Commission of the First District, to whom it had been assigned. We imagine, however, that there will be less hue and cry about a reduction of the fare to Coney Island this year than last. The commissioners and the public in general have become more enlightened on the cost of electric railway operation than ever before. It is no longer considered, either in New York or elsewhere, an El Dorado from which large returns can be secured from a small investment. Mr. Ivins has already acknowledged that the present conditions in Manhattan are such as to give a low earning power on a conservative capitalization. Mr. Arnold, as explained in his report this week, takes the same view in regard to subway operation. Finally, the experts of the Brooklyn Rapid Transit Company and of the Coney Island

& Brooklyn Railroad Company have demonstrated that there is no money in the Coney Island traffic, even at 10 cents.

Considerable space is given elsewhere in this issue to the arguments on this subject advanced by Frank R. Ford in the case of the Coney Island & Brooklyn Railroad. The method of analysis employed is novel, so far at least as published examinations of electric railway operation are concerned, and consequently possesses an interest much wider than that comprised in the local situation. Mr. Ford applies to the problem the passenger-mile, a unit of great importance, but very difficult to evaluate in electric railway service when a uniform fare is charged. Strictly speaking, the cost of, and the income from, a passenger-mile can be obtained only when the number of passengers riding on the cars at different points is counted, or else when a record is kept of the points at which each passenger enters and leaves the car. An alternative method can be used, however, by which the maximum passenger-mileage, or in other words the minimum cost per passenger-mile, can be determined. This figure can then be applied to those operating expense accounts which increase with the passenger-mileage in known ratios, to give the cost of added service on any particular line. The conclusions reached by applying this method to the Coney Island service are that it is not profitable with a 5-cent fare and that the loss sustained is increased owing to the short season during which the investment in extra equipment can be utilized.

The Arnold Report

An abstract is given elsewhere of the fourth report of B. J. Arnold on the New York subway, just made public. In this report the author takes up the subject of the capacity of the subway and makes radical recommendations both for the existing property and for the equipment of new subway lines. A striking feature is the statement that under present conditions the New York subway can earn only 7.33 per cent on the investment, after deducting operating expenses, and that the cost of the subway is probably less than that which would be required if it should be constructed at the present time. This makes it very important to increase the carrying capacity of the present subway, as well as to determine the possibilities of securing a relatively larger passenger carrying capacity and a larger earning power in future subways. According to Mr. Arnold, an increase of between 60 and 75 per cent in capacity is possible in the existing property without greatly changing its construction, and with new subways a capacity from two to three times as great can be secured without materially increasing the cost.

The capacity of any subway, like that of a pipe containing running water, is limited to the capacity of its most congested point. On the main line of the New York subway the points of greatest congestion are at the Grand Central and other express stations and at the combined station and cross-over at Ninety-sixth Street. The undue delays at the latter point will be eliminated by the changes now authorized and under way and need not be further considered. The time now required for stopping, unloading and loading the trains at the express stations, however, seems to Mr. Arnold unnecessarily long and unless some improvement is made will block any possibility of increasing the number of passengers carried. It is interesting to note in this connection that he does not consider any great advantage will be gained by more rapid acceleration, and as he has already considered the question of loading and unloading in his previous reports, maximum braking efficiency remains the only change to be further recommended. Quicker braking, he believes, can be obtained by training the men to more exact work, as the existing equipment is as efficient as the art affords.

For future subways a much more comprehensive plan is available and for such conditions Mr. Arnold makes the radical recommendation of a double-deck station. This he believes is essential if capacity and earning power, commensurate with the cost of a subway, are expected. A double-deck station means simply a doubling of the express tracks, and also possibly of the local tracks, at the stations, to get the greatest output from the tracks between stations. The station itself can be built either on two levels or spread out on one level if the width of the street permits. Express trains going in the same direction would then alternately enter the stations on different tracks, and would serve different platforms. This does not mean that they would necessarily have to use the same rails between stations and that switches would have to be installed on each side of the station, because gauntleted tracks could be used. Mr. Arnold's suggestion is a novel one, so far as we know, in rapid transit or other railway service. But it would give to the stations the reservoir capacity which the most economical use of the sections between stations seems to demand and embodies the fundamentally correct principle of equalizing the "use-factor" over all parts of the permanent way.

Variation in Coupler Heights

During the present month Justice Moody has delivered an opinion of the Supreme Court of the United States in a case where damages were sought because of an accident occurring while coupling two freight cars. This case is not an unusual one for the legal department of a large railway, but in this opinion, so lately given, is found a discussion of the requirements for standard coupler heights which, undoubtedly, should be of value to those interested in the standardization of electric railway equipment. In the opinion handed down the court clearly interprets one section of the Safety Appliance Law as promulgated by the Interstate Commerce Commission. The law in part reads:

"Resolved, That the standard height of draw bars for freight cars, measured perpendicular from the level of the tops of the rails to the centers of the draw bars, for standard-gage railroads in the United States, shall be 34½ in. and the maximum variation from such standard heights to be allowed between the draw bars of empty and loaded cars shall be 3 in."

The testimony in the case at bar was conflicting with regard to the difference in heights of the draw bars of the two cars which caused the accident. Of the two couplers to be joined one was of the automatic type and the other was a link and pin coupler. The testimony showed conclusively that because one car was loaded while the other one was empty the heights of the two couplers were not

uniform. Whether or not the heights came within the allowable limits of variation was not determined. Because of this debatable point the Supreme Court held that inasmuch as the presiding judge of the lower court had misinterpreted in his instructions to the jury that part of the Safety Appliance Law earlier quoted, there was reason for reversal.

The lower court based its instructions upon the theory that the height of the draw bars of unloaded cars may vary 3 in., while the Supreme Court holds that the height of draw bars of unloaded cars shall be uniform. It also holds that the law requires that the centers of the draw bars of freight cars used on standard-gage railroads shall be, when the cars are empty, 34½ in. above the level of the tops of the rails; that it permits, when a car is partly or fully loaded, a variation in the height downward, in no case to exceed 3 in.; that it does not require that the variation shall be in proportion to the load, nor that a fully loaded car shall exhaust the full 3 in. of the maximum permissible variation, and its draw bars be brought down to the height of 31½ in. above the rails. Briefly, if a car when unloaded has its draw bars 34½ in. above the rails, and in any stage of the loading does not lower its draw bars more than 3 in., it complies with the requirements of the law.

The standardization committee of the American Street & Interurban Railway Engineering Association will consider this year the question of standard coupler heights for electric railway cars. While it may not be feasible at this time for the association to make its standards especially definite in detail, it may be well for the committee to bear in mind these opinions of the Supreme Court with regard to the limits of variation in coupler heights.

Power Plant Auxiliaries and Continuous Service

Considering the variety of apparatus installed in the modern power plant it is surprising how much of it can be shut down without affecting the continuity of the service. The design must be flexible for the station as a whole, but if cross connections exist between different units and their auxiliaries, it is rare that the failure of a minor piece of apparatus in a well arranged plant produces a shut down. At the same time, it is a mistake to assume that no duplication or reserve capacity in auxiliaries is essential to a well-rounded power scheme.

Except in the very largest plants one system of coal handling by machinery, one engine room crane, one feed water heater, one stack for a given number of boiler units, one condenser per engine or turbine generating unit, one main steam header in the boiler room, one air compressor and one economizer, if the latter is used, are sufficient for the requirements of regular and economical power production. The failure of any one of these pieces of apparatus may be temporarily embarrassing in the matter of efficiency of power production, but if the station is properly arranged the service ought to be obstructed only a few minutes under the worst conditions, and in most cases the trouble should not be known outside the power plant building.

If the mechanical coal delivery ceases, provision should be at hand for supplying the furnaces by manual labor. If the feed water heater springs a dangerous leak, the by-pass connection should at once send cold feed water into the boilers rather than shut down the station, although the economy of the cold water is anything but pleasing and the capacity of the station at the peak may thereby be cut down to a considerable per cent. The breakdown of a crane ought not to stop the output of current for a single moment, unless some of the generating units happen to be short circuited or demolished by the failure of the hoisting apparatus. In a station with a single stack and no forced or induced draft, an accident to the former is likely to be the means of a complete shutdown, but if more than one chimney is included in the plant design and the flues are interconnected, the failure of one stack ought not to completely tie up the service. As there are no moving parts in the stack, such contingencies depend more upon the occurrence of rare casualties due to the weather conditions, and outside the cyclone belts do not have to be seriously considered.

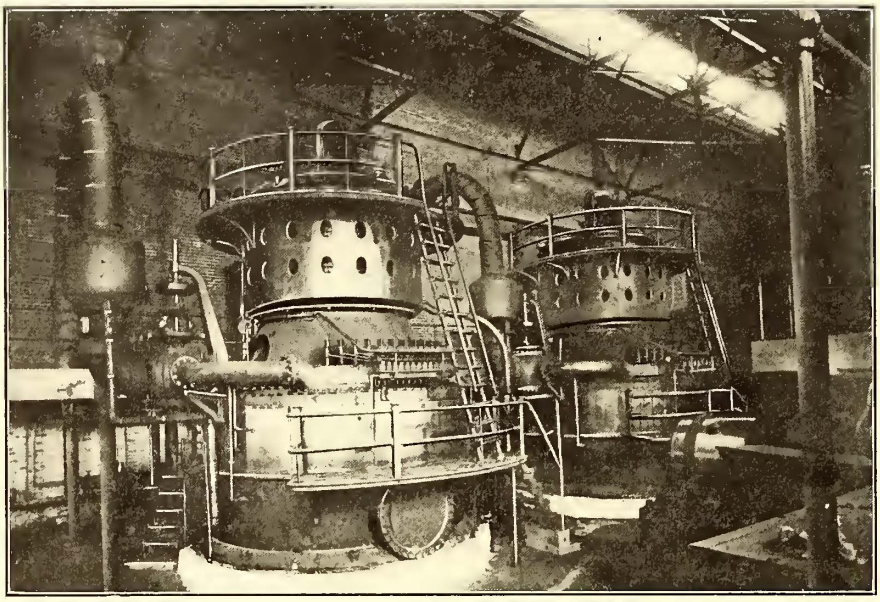
In case an individual condenser or one of its pumps goes wrong and has to be shut down, or if one or more of the economizer tubes give way, the bypass principle ought to take care of the emergency. Unless every condensing engine and turbine can be run non-condensing in emergencies, the installation is far from what the best practice demands. Still worse is the provision of enough condensing capacity to operate more than one unit at full load, with the lack of the necessary piping and valves to enable the capacity to be utilized in case of trouble. An economizer bypass is, of course, standard practice, and if the main steam header fails in any part, it ought to be possible to operate the balance of the line by sectionalization. The larger the auxiliary device, the less need there generally is for investing in a duplicate to insure continuous service, although for a time operating economy may have to be sacrificed.

With the boiler feed pump and the exciter, in alternating current plants, some provision for emergencies in the line of duplication or extra capacity is well-nigh imperative. The popularity of the injector has no doubt been augmented by its successful use in emergencies where the regular feed pumps were out of service. Either two feed pumps or one pump and an injector are the price of continuous service in the modern high-class steam plant. In like manner, one exciter in a plant composed of two or more alternators simply invites disaster, and few designers are rash enough to attempt to secure reduced first cost in this direction. On the score of service flexibility, the use of two or more exciters on one or more sets of bus bars is far superior to the earlier scheme of supplying each generator from its own belted or direct-connected exciter. Two pumps for the circulation of cooling water in a gas engine plant are better than one in the same ratio that two means of boiler feeding are essential to continuous steam plant service, but of almost equal importance is the provision of spare packing, valve parts, linings and contacts. Such parts cost little in relation to the increased efficiency of station operation with auxiliaries as soon as possible after a failure has occurred.

On the whole, duplication of auxiliaries is needed to a limited extent only under modern conditions, on the ground of service reliability, but it is a wise management that provides enough extra parts and sundries to enable quick replacements to be made when the auxiliaries do break down.

POWER PLANT DEVELOPMENT AT BIRMINGHAM, ALA.

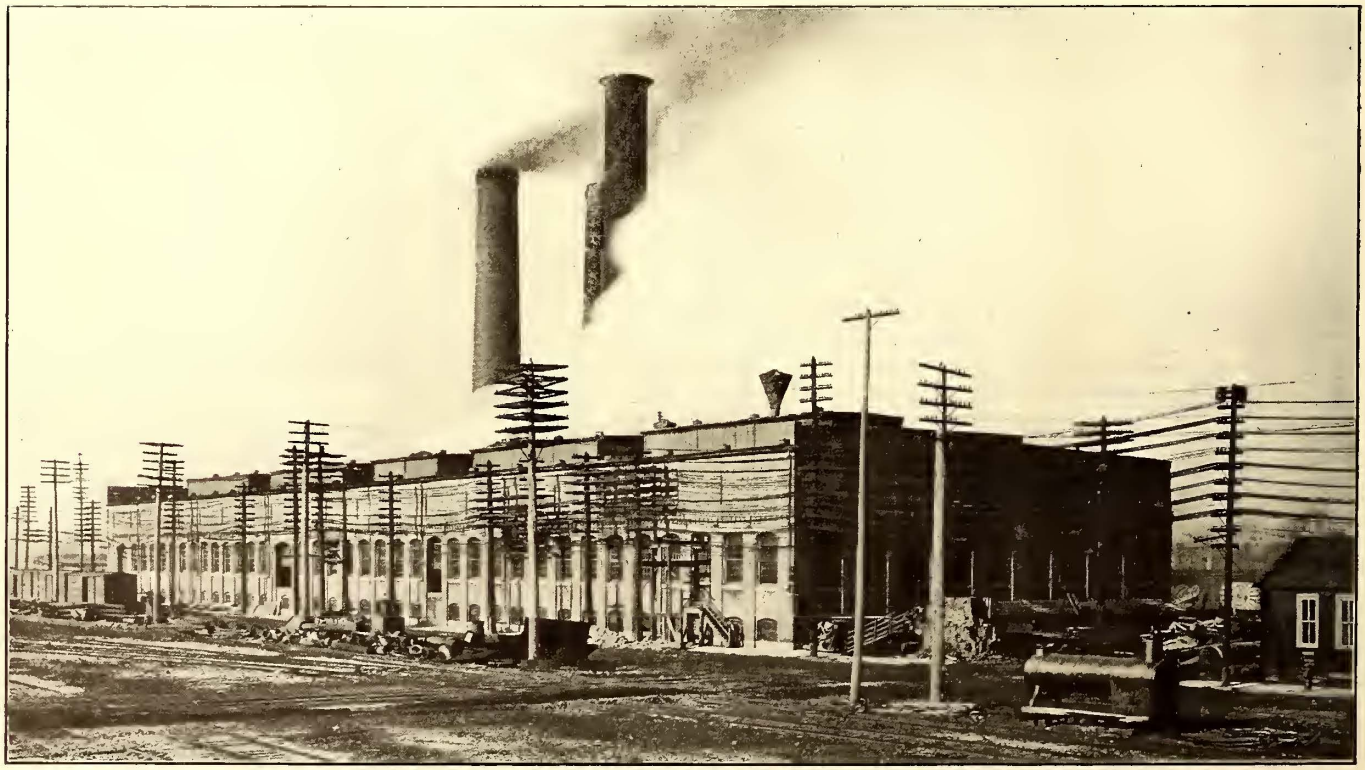
The Birmingham Railway, Light & Power Company has recently been making some extensive improvements in its main generating station, located near the business center of the city, in the block bounded by Powell Avenue, Eighteenth and Nineteenth Streets. The consulting engineers for the work are Ford, Bacon & Davis, of New York. The plant supplies all the power used in the Birmingham district for street railway service and furnishes current for general central station service, besides heating practically the entire business district with exhaust steam. The latter service extends for a maximum distance of about one mile from the station.



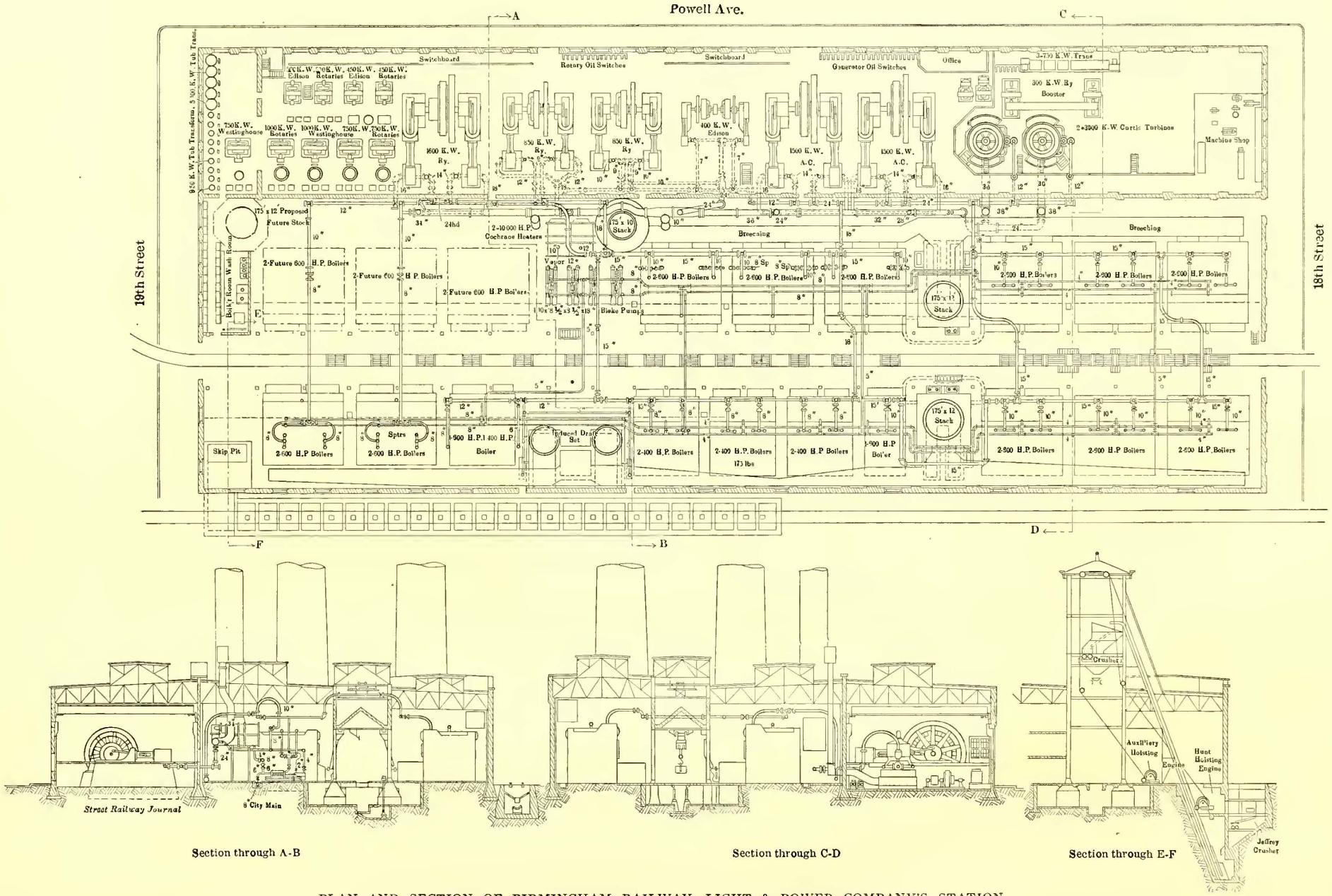
TWO 3000-KW TURBINES AT BIRMINGHAM

The development of the Birmingham station has proceeded along the line of eliminating all belt-driven machinery, and gradually swinging over to steam turbine practice. Like many other plants in the South, the Powell Avenue station at one time was largely made up of belted equipment, and in the earlier days of its service the boilers were all hand fired. The location of the plant on a site bounded on the one side by a street and on the other by a railroad yard has necessitated the expansion of the plant in a longitudinal direction, so that the present station is one of the longest in the South without wall or other obstruction from end to end of the engine room.

The power station building is 394 ft. long by 164 ft. wide. The building is divided into the conventional boiler and engine rooms, separated by a brick fire wall 24 in. thick. All but four of the boilers now installed are equipped with mechanical stokers. Coal is supplied to the station by hopper bottom cars which are delivered by the steam railroad company to a siding which parallels the west wall of the building. Below the track is a series of hoppers which deliver the fuel to a Robins belt conveyor 36 in. wide running parallel to the track in a horizontal plane about 9 ft. below the ground. This belt is driven by a 10-hp, 220-volt, d. c. motor. The horizontal belt conveyor discharges the coal into a Jeffrey crusher, driven by a 15-hp motor, and after the coal leaves the crusher it is delivered through a spout into a skip bucket which is hoisted by a Hunt engine up an incline to a point about 60 ft. above the boiler room floor. The capacity of the skip bucket is two tons, and the



EXTERIOR POWELL AVENUE STATION OF THE BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY



Section through A-B

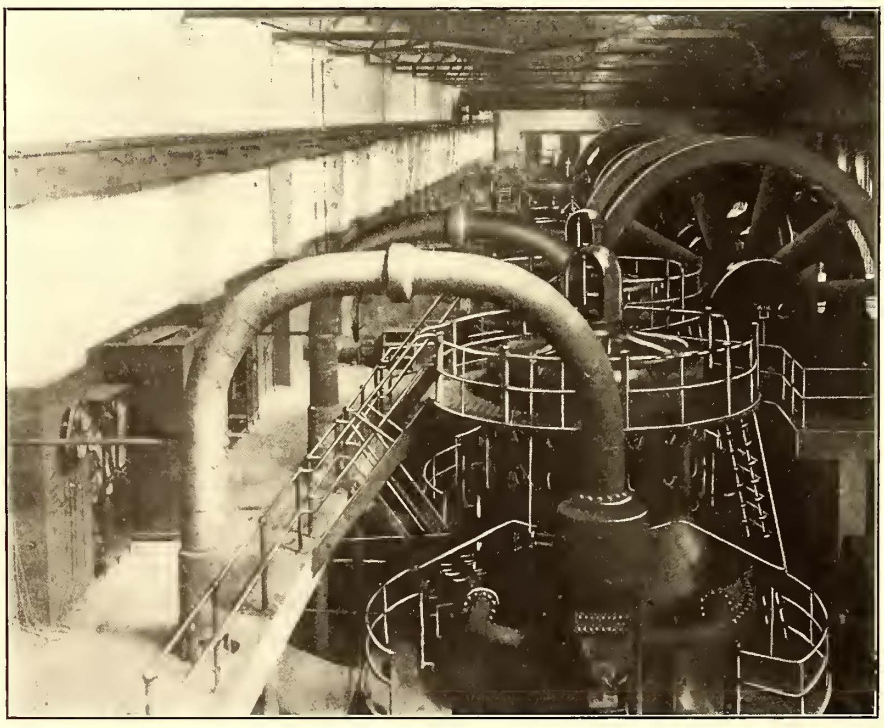
Section through C-D

Section through E-F

PLAN AND SECTION OF BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY'S STATION

coal handling system as a whole is capable of delivering 600 tons to the plant per day of 12 hours. The boilers are located on both sides of a central firing aisle with overhead coal bunkers between, as is shown in the accompanying cross-section. After the skip bucket has reached the limit of its travel it discharges the coal into a second Hunt crusher and thence is delivered to the bunkers by an 18-in. conveyor. This conveyor traverses the entire length of the boiler room. When the plant is completed the ashes will be removed by industrial cars running on rails in a sub-basement beneath the firing aisle.

The plant now contains 31 Babcock & Wilcox water tube boilers built for 175 lb. pressure. Seven of these boilers are rated at 400 hp each and the other 24 are rated at 600 hp each. Four of the 600-hp units are hand fired, the remaining 27 boilers being equipped with the Green Engineering Company's chain grate stokers. The boilers are all designed with a heating surface of 10 sq. ft. per hp. The 400-hp units are each built with 81 sq. ft. of grate surface and 192 4-in. tubes. The 600-hp boilers are provided each with 108 sq. ft. of grate surface and 294 4-in. tubes. The stokers are driven by three 15-hp engines, four 7.5-hp motors being held in reserve to operate them in case of a breakdown of the engines. Space is provided for the installation of six more 600-hp boilers.



THE GALLERY AND 12-IN. LINES LEADING TO TURBINES

Three stacks are in service at the plant, all being 175 ft. high. There are two Custodis stacks, each 14 ft. in diameter inside, and one steel stack 12 ft. in diameter. In connection with six of the 400-hp boilers and six of the 600-hp boilers there are two of the American Blower Company's induced draft fans, which are used to steady the demand upon the other boilers and to provide sudden increases in capacity momentarily. In operation the intensity of the draft varies from 0.1 to 0.4 in. maximum, and the fan engines, which are Harrisburg machines, are provided with electric contacts so that the boiler room foreman can tell by the flashing of a lamp the speed of the fans. The stacks run at about 0.3 in. natural draft over the fire.

Five feed pumps are installed in the boiler room near the induced draft set. These are all Blake compound duplex units, 10 in. x 18.5 in. x 8.5 in. x 18 in., cross-connected into two feed water delivery lines that traverse each side of the boiler room, four lines being installed in all. The temperature of the feed water is normally about 195 deg. Fahr. Close by the feed pumps are two 10,000-hp open Cochrane heaters. The exhaust of the auxiliaries is passed into this as is the usual practice. Alabama coal, costing about $1.45 per ton, is burned at the plant. This fuel is obtained from the mines near the city.

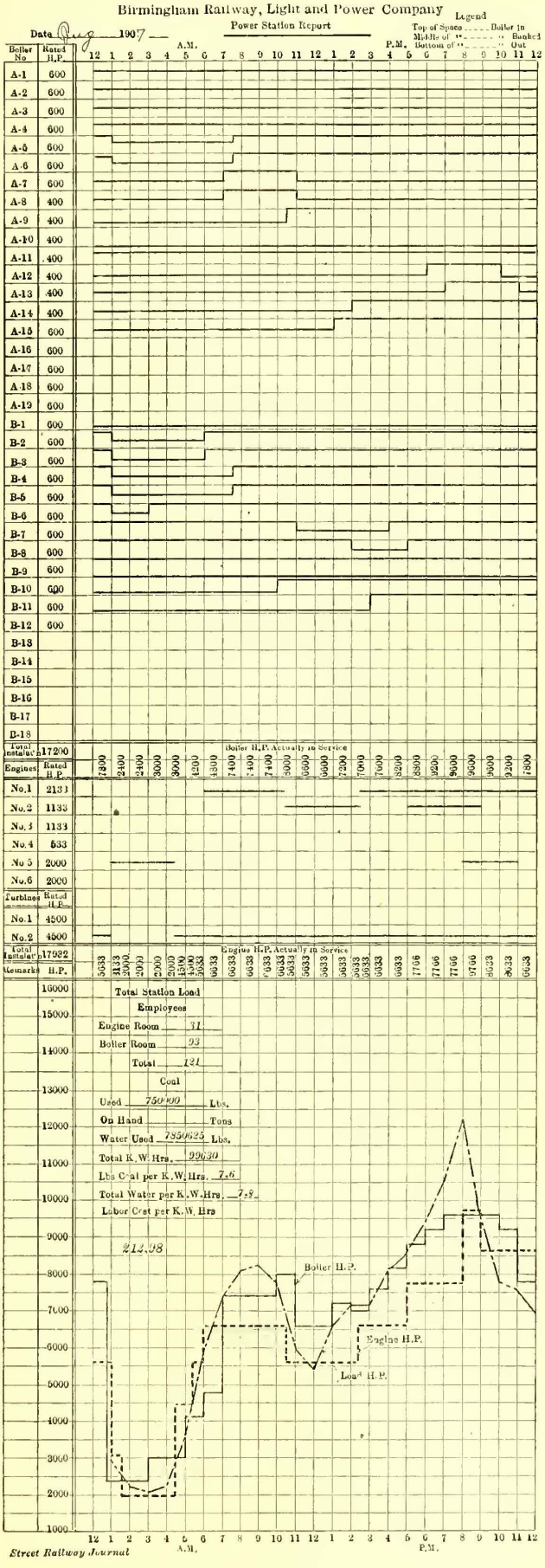
On account of the lack of a sufficient supply of water the station is at present run entirely non-condensing. It is probably one of the largest installations of this character in the country. The exhaust in part is utilized in the commercial steam heating system to greater or less extent according to the season. The boilers consume about 500,000 gal. of water per day and in addition the stokers are provided with water backs. The present load would call for about 25,000,000 lb. of condensing water per day, and it is probable that the total steam consumption could be cut from the present figure of 40 lb. per kw-hour to about 22 lb. if an adequate supply could be obtained. The city mains furnish the present supply of feed water.

The engine room is about 52 ft. wide and contains engine units, turbines, rotaries, a booster for railway service and the switchboards. Substations are located at Ensley, Brighton, Woodlawn, Eastlake, Fairview, Pratt City and Bessemer. With the exception of the first two, the substations are devoted to lighting service. At Brighton there are two 300-kw and one 500-kw rotaries. At Ensley there are 600 kw of lighting capacity and one rotary of 500-kw rating devoted to railway service.

The generating units include two 3000-kw Curtis G. E. turbo-alternators, 2300 volts, three-phase, 60 cycles; two 1500-kw General Electric alternators, each direct driven by two 36-in. x 60-in. single engines; one 575-volt G. E. direct-current generator, direct driven by two 36-in. x 60-in. single engines, and one 200-kw Edison three-wire generator. There are two 1000-kw Westinghouse railway rotaries and two 500-kw G. E. railway rotaries. The other rotaries are used in general lighting and power service. The turbines are each three-stage machines, designed with a capacity of 5000 kw each, if run condensing. The speed of each turbine is 600 r.p.m. At a test made by Ford, Bacon & Davis upon the turbines at the power plant the average speed was 596 r.p.m. The steam pressure at the throttle was 160 lb., with a steam pressure in the first stage of 59 lb. and the second stage 26 lb. The steam consumption per kw was a fraction over 34 lb. at 3300 kw.

To handle the lubrication of the turbine bearings water is supplied at a pressure of 500 lb. per square inch from a pump outfit consisting of two duplex 7.5 in. x 2 in. x 6 in. and two 6 in. x 2.125 in. x 6 in. duplex step pumps. Two motor-driven exciters wound for 125 volts are provided.

The motors are both wound for 2300 volts, three-phase induction type, one being rated at 75 hp and the other at 175 hp. The smaller exciter generator is rated at 50 kw and makes 720 r.p.m.; the larger generator is rated at 120 kw and its speed is 600 r.p.m. Both are three-bearing sets.



POWER STATION REPORT

The steam delivery outlets of the individual boilers vary from a diameter of 6 in. to 10 in. On the west side of the boiler room a steam header is run past all the boilers except the two batteries of 600-hp units nearest the skip pit. This header starts with a diameter of 15 in. near the southern end of the room, and retains this size until it reaches the cross-connection to the other side of the room, just before the last battery is reached in approaching the batteries of 600-hp boilers fitted with superheaters. On the other side of the room is another steam header running the entire length of the boilers, the latter being cross-connected with the west header at four points. A third header is run across the four 600-hp boilers at the north end of the plant, and this is cross-connected with the other side of the boiler room near the end of the station. The sizes of the cross connections vary from 15 in. to 18 in. The six 600-hp boilers on the east side of the room are also equipped with superheaters and the turbines can be easily supplied from these boilers in part by a cross-connection leading to a live steam trunk main 24 in. in diameter which serves the two turbines and the 1500-kw alternators nearest the former. Each turbine is supplied with steam through a 12-in. pipe leading from the trunk main, and each turbine is equipped with a 36-in. exhaust with atmospheric relief connection of the same size. All the exhausts are brought into a continuous main varying in diameter from 24 in. to 36 in., and a central atmospheric exhaust is provided 40 in. in diameter. The feed water heaters may be by-passed when desired. In general, the feed water lines are either 4 in. or 6 in. in diameter, the city supply being brought through a main 8 in. in diameter. The general plan shows that the chance of interruption on the piping is remote. Separate high pressure lines are fed to the twin engines on the older units as a measure of flexibility. The steam piping was done by B. F. Shaw & Company, of Wilmington, Del.

The log illustrated shows the hours of service of each boiler, the line in the top of the space indicating a boiler in service, the middle of the space showing banked fires, and the bottom meaning boiler cut out. The hours run by each engine and turbine are indicated by full or broken lines, and the log also shows the total station load in horse-power, the engine and the boiler horse-power in service to meet these load requirements and station data as to labor and coal used. On Aug. 3, 1907, the day shown, the number of engine-room employees was 31 and boiler room 93. The coal consumption was 375 tons, and the unit coal used was about 7.6 lb. per kw-hour. The average load was about 4130 kw, with a forenoon maximum of 6200 kw and an afternoon maximum of 9200 kw. With the exception of about three hours in the early morning one of the turbines was run practically all hours of the day. The total labor cost on this day was about $212. The necessity of operating so long a station results in an augmented labor cost which will undoubtedly be much reduced later, especially if turbines form the bulk of new equipment. The chief engineer is M. S. Sloan, and to him, W. F. Kelly, resident engineer for Ford, Bacon & Davis, and A. H. Ford, president, this paper is indebted for courtesies in connection with the preparation of this article.

Since the whole plant as redesigned, enlarged and improved has been under full operation, the economies effected have fully demonstrated to the satisfaction of the management the wisdom of the plans for this station as proposed and developed by Ford, Bacon & Davis.

COST OF CARRYING PASSENGERS TO CONEY ISLAND

Frequent analyses have been published in these columns and elsewhere of electric railway operating expenses, on a basis of car-miles or car-hours run, per passenger carried or per mile of track; but rarely, if ever, have the statistics been brought down to the basis of passenger-miles. Nevertheless this unit has become vested with considerable importance on account of its employment in the inquiry now being conducted by the Public Service Commission of the First District of New York in regard to the Coney Island traffic.

It will be remembered that the question of whether the street railways in Brooklyn had a right to charge 10 cents for a ride from New York to Coney Island became acute last summer. After some disturbances on the lines of the Brooklyn Rapid Transit Company, caused by persons who insisted upon paying only 5 cents, a temporary settlement was reached in the courts by a decision in favor of the higher fare. This year the Public Service Commission, which under the law has certain rights in regard to the fixing of fares, decided to institute an inquiry as to whether the companies could afford to do this transportation for a single fare, if not all the time, at least on Saturdays, Sundays and holidays. An order was consequently issued requesting the companies to show cause why the lower fare should not go into effect. The case of the Coney Island & Brooklyn Railroad Company has just been presented to the Commission, and as it includes an analysis of operating expenses, treated in a novel and interesting way on the passenger-mile basis, it will be briefly summarized. The hearings took place before Commissioner Bassett and the figures for the company were presented by Frank R. Ford, of Ford, Bacon & Davis, consulting engineers of the company.

Mr. Ford's contention was that in spite of the additional traffic which a reduction in fare might occasion, a rate of 5 cents would not pay the additional operating expenses necessary to provide the service, even if all additional fixed charges were excluded from consideration. In proof of this conclusion Mr. Ford presented the following statistics covering the operation of the company for the fiscal year ended June 30, 1907:

1. Total passenger receipts	$1,609,872.95
2. Total passengers carried, including transfers	37,254,925
3. Total car miles operated	6,781,723
4. Total single trips operated on all runs of the system	995,860
5. Average miles run per single trip	6.8
6. Average receipts per passenger carried	4.32c
7. Average passengers carried per single trip	37.4

To determine the present cost per passenger-mile Mr. Ford stated that it was first necessary to find the maximum loading of the cars. The De Kalb Avenue line, which does about 40 per cent of the business of the company and is the line of heaviest traffic of the company, was selected and various counts were taken of the distribution of its traffic. They showed that an average of 58.3 per cent of the total passengers carried by the car on each single trip are on the car at the point of maximum loading of the line, which in this case is at Gold Street. By applying this percentage to the average number of passengers per single trip as given above, or 37.4 passengers, it was found that the average number of passengers at the points of maximum loading of the various lines of the system would not exceed 21.8 passengers. In other words, the average of the greatest number of passengers on each car of the system for each single-trip run for every day of the year in question would not exceed 21.8 passengers.

To determine exactly the average length of ride per passenger on the entire system for the year it would be necessary to know the exact point where each passenger boarded and left each car. This, of course, is impracticable, but the information can be approximated by an accurate count over the entire system covering several average days of the year. The data already obtained, however, are sufficient to determine a length of ride per passenger which would not be exceeded by the average ride per passenger for the year. This, it was explained, could be found in the following manner:

The average number of passengers on all cars operated during the year on any line of the system at any point of the trip will not be more than the number on the car at the point of maximum loading. This average number of passengers on cars at the point of maximum loading as deduced above did not exceed 21.8 passengers. By multiplying this number of passengers by 6.8 miles, the average length of trip for all runs for the year, gives 148.2 passenger miles as the average traffic carried on the average trip for the year. Dividing this number of passenger miles by the total passengers on the average trip, or 37.4 passengers, gives as a maximum an average ride per passenger of 3.96 miles, or approximately 4 miles. Therefore, the maximum average ride per passenger for the year was not more than 4 miles. It was probably considerably less than 4 miles, due to the fact that the car for the entire length of trip would not contain as many passengers as at the point of maximum loading. If the average ride per passenger is 4 miles, or certainly not over 4 miles, the average rate of fare per passenger-mile can be obtained by dividing the average receipts per passenger carried (or 4.32 cents) by 4. This gives the average rate of fare or gross earnings of 1.08 cents per passenger-mile.

COST OF EXTRA TRANSPORTATION

To obtain the cost of operating additional car service for carrying additional passengers over those carried for the year 1907 will require a division of the expenses between those which will be materially increased by the operation of additional cars or car-miles and those which are more in the nature of fixed charges. The following may be said to belong to the former category:

OPERATING EXPENSES WHICH INCREASE MATERIALLY WITH ADDED SERVICE, EXPRESSED IN PERCENTAGE OF GROSS EARNINGS, FOR THE YEAR 1907.

	Per cent
1. Maintenance of track and roadway	3.9
2. Maintenance of electric line	0.9
Total maintenance of way and structures	4.8
Assume half of this amount varies as additional car miles	2.4
3. Maintenance of steam plant	1.6
4. Maintenance of electric plant	0.3
5. Maintenance of cars	3.4
6. Maintenance of electric equipment of cars	4.8
7. Fuel for power	12.0
8. Water for power	1.1
9. Lubricants and waste for power plant	0.3
10. Miscellaneous expenses and supplies for power plant	0.4
11. Hired power	2.5
12. Wages of conductors	11.1
13. Wages of motormen	11.1
14. Wages of miscellaneous car service employees	0.7
15. Wages of car house employees	0.1
16. Car service supplies	0.1

	Per cent
17. Miscellaneous car service expenses	1.9
18. Damages	5.5
19. Legal expenses—damages	0.5
	60.5

The total operating expenses for the year ended June 30, 1907, were 75.8 per cent of the gross receipts.

To determine these additional operating expenses per passenger-mile the percentage of 60.5 per cent should be applied to the gross earnings per passenger-mile of 1.08 cents. The result is 0.65 cent per passenger-mile, which would be the cost of operating the service necessary for carrying any more passengers than were carried in the year 1907.

The length of ride from the company's New York terminus at Park Row to its Coney Island terminus is 11.278 miles. A 5-cent fare for this distance is, therefore, equivalent to gross earnings of 0.44 cent per passenger-mile. As the cost of operating additional car service for carrying additional passengers is shown as above to equal 0.65 cent per passenger-mile, the company would lose 0.21 cent per passenger-mile on every additional passenger carried at the 5-cent rate between New York and Coney Island. This is without considering the additional loss by reason of the necessity of providing a larger investment in car equipment and power equipment for carrying this additional business, and the consequent interest, depreciation, taxes and insurance on this additional investment which would be used for a short part of the year only.

Continuing, Mr. Ford showed that the actual loss to the company on its 5-cent passengers from New York to Coney Island is more than the figures shown above, as the average ride per passenger shown at 4 miles is, as stated, the maximum length of such average ride possible to be deduced from the figures given. The probable average length of ride of all passengers on the system for the year in question was nearer 3 miles than 4 miles. If this average ride was 3 miles the loss per passenger-mile on additional 5-cent Coney Island passengers would be 0.43 cent instead of 0.21 cent, or practically twice as much.

The company had already shown that if its more profitable business were averaged up with the proposed unprofitable business the result would not enable it to show a profit on its total business. In fact, the reduction of its present 10-cent fare on Saturdays, Sundays and holidays would prevent it from earning the interest on its present funded debt, without considering any reserves or return on its present stock capital.

INCREASE IN CAR CAPACITY

Another point came up at the hearing which did not relate directly to the cost of transporting passengers to Coney Island, but is of interest in illustrating the changes in rolling stock during the last 10 years. A complaint had been entered with the board that the company had increased its car service during the past eight years from 5,675,770 car-miles to 6,781,723 car-miles, or only 19.5 per cent, while the passengers carried had increased 35.7 per cent. The company showed, however, that this seeming decrease in service was apparent only and was caused by the change in character and size of cars operated. The closed cars employed in 1899 had an average seating capacity of 27 passengers only and the open cars of 53. This, based on the proportion of open and closed cars run during the year, gave in 1899 a total of 227,030,800 seat-miles, or a ratio of seat-miles to total passengers of 8.1. In 1907, on the other hand, the closed cars had an average seating capacity of 36 and the open cars of 60. This gave a seat-mileage for the year of 325,522,704, or a ratio of seat-miles to total passengers of 8.7. In other words, while the car-miles had increased only 19.7 per cent, the seat-miles had increased 43.4 per cent as against an increase in passengers of only 35.7 per cent.

REPORT ON THE CAPACITY OF THE NEW YORK SUBWAY

A report on the capacity of the Interborough Rapid Transit Company of the New York subway was submitted on May 22 to the Public Service Commission for the First District of the State of New York by Bion J. Arnold, special consulting engineer. It constitutes the fourth of the series. The previous reports have been summarized in the STREET RAILWAY JOURNAL as follows: Preliminary report, Dec. 7, 1907; on cars, Feb. 29, 1908; on signals, March 21, 1908.

In his letter of transmittal Mr. Arnold speaks of the subway as a "monumental piece of work" and wishes the reports to be understood as "heartily commending those engineers and others who had to do with the design of the subway, for the many excellent ideas embodied in this work and for the character of its construction, rather than to criticize them adversely for the few things which now seem to me advisable and which they did not do. It should also be remembered that the pioneers in any field, acting without precedent to guide them, must overcome obstacles which are often lost sight of in subsequent criticisms and that it is always easier for those who follow these pioneers to point out what should have been done than it is to foresee these things and do them in advance."

CAPACITY AND EARNINGS

Mr. Arnold then states that the capacity of the subway decreases as the load, after it has reached a certain point, increases. This is exactly contrary to what should be expected. The speed of the trains is not maintained during rush-hour periods just at a time when an advantage of speed would be of benefit not only to the greatest number of subway patrons, but also to the operators of the subway. He also believes that the returns on the investment are not sufficient to pay the necessary operating and maintenance expenses, interest at a reasonable rate on the investment, the sinking fund as required by the city, and at the same time allow a sufficient fund to be set aside to take care of depreciation.

On this point he says that the total investment required to build and equip the subway amounts to approximately $75,000,000, of which $50,000,000 may be charged to the cost of the permanent way and $25,000,000 to the cost of equipment. In 1907 182,000,000 passengers were carried and during the present year 200,000,000 passengers may possibly be transported, giving an annual income of $10,000,000—that is, the gross income per annum from passenger traffic will be equal to only about 13 per cent on the actual investment. For the last two years the operating expenses have amounted to an average of approximately 45 per cent of the gross receipts. On this basis the annual operating expenses, with a gross income of $10,000,000, will amount to $4,500,000, leaving $5,500,000, or only 7.33 per cent, to be applied toward the payment of interest, depreciation, taxes, sinking fund and profit. Another serious defect of the present subway, under present operating conditions, is that it is capable of serving only about 50,000 passengers in one direction during each hour of the rush periods, and has no overload capacity.

Although the present subway is now carrying more passengers than it was, nevertheless, the number of patrons

who are demanding transportation is increasing yearly and demanding new subways. Under these conditions it is essential that the maximum carrying capacity of the present subway should be completely developed, and a comprehensive study should be made of the possibilities of securing a relatively larger passenger-carrying capacity, and also a larger earning capacity for all future subways.

Mr. Arnold believes that the capacity of the present subway can be increased fully 60 per cent, and possibly 75 per cent, without greatly changing its construction; that it will be possible to construct new subways with a capacity from two to three times as great as that now being realized with the present subway, and that the cost of operating expenses and fixed charges for future subways can be reduced to an amount that will make it possible not only to produce a satisfactory return on the investment, but also to set aside a fair amount each year to take care of depreciation.

HEADWAY

The capacity of the subway is primarily a question of headway and, as at present operated, the limiting factor to headway is the station stops; that is, trains can get up to certain express stations faster than they can get through these station blocks. The problem of increasing the capacity of the present subway resolves itself into a study of and the removal of the delay at the limiting points. The most serious delays at present occur at the Grand Central station and other express stations; at the combined station and cross-overs at Ninety-sixth Street, and at South Ferry station, where there is a situation which must be changed before the extension of the subway to Brooklyn can be used most effectively.

The delays at the Grand Central station and other express stations were considered in Reports Nos. 1, 2 and 3, in which it has been shown that the headway between trains which now often reaches 130 seconds can be reduced to 90 seconds. This would make it possible to maintain a train movement of 40 trains per hour upon the express tracks. The proposed changes at Ninety-sixth Street, already authorized, will greatly improve the conditions at this point. For the South Ferry condition Mr. Arnold recommends a double-decked station, a shuttle-train service between South Ferry and Bowling Green station, or else a moving platform. The shuttle-train service could be installed for immediate relief.

INFLUENCE ON HEADWAY OF IMPROVED ACCELERATION

A series of tests made upon the rate of braking indicate that the equipment of the subway cars is very efficient, but that the best results are not always secured by the motormen who apply their brakes too quickly. At least five seconds can be taken from the headway by bringing the trains up to express station platforms at a speed of at least 30 m.p.h. The fact that some of the motormen do this now shows that it can be done. Mr. Arnold says there is no improvement which will show such effective results in proportion to the time and expense involved as will additional attention paid to this detail of operation.

INFLUENCE ON HEADWAY OF IMPROVED ACCELERATION

Little improvement can be expected from quicker acceleration. The rate now varies between 1.1 m.p.h.p.s. and 1.4 m.p.h.p.s., and between these two figures fall all of the observations which have been made with varying loads and with different motormen. These correspond closely to the theoretical values of acceleration, based upon the motor curves, indicate 1.15 m.p.h.p.s. for trains loaded with 150 passengers per car to 1.55 m.p.h.p.s. for all cars empty. All eight-car express trains are provided with five motor cars each equipped with two 200-hp motors and all five-car express trains have three motor cars similarly equipped. Examination of other systems shows the following values of acceleration as the results of an average of a large number of observations:

Company.	Description of train.	Miles per hour per second.
Metropolitan Elevated—Chicago..	3 car train light, 2 motor cars	1.41
South Side Elevated—Chicago...	5 car train light, all motor cars	1.35
South Side Elevated—Chicago...	5 car train loaded, all motor cars	1.19
Metropolitan Elevated—Chicago..	5 car train loaded, 3 motor cars	1.06
Northwestern Elevated—Chicago..	3 car train loaded, 1 motor car	0.84

If all the cars of the subway trains were equipped with motors, the initial acceleration in starting could be increased from 1.15 m.p.h.p.s. to 1.65 m.p.h.p.s., with trains loaded with 150 passengers per car. This improvement in acceleration would cut down the time required for the train to leave the station platform by about two seconds, and this is practically the limit of improvement which can be expected upon the headway by equipping all the cars with motors. As far as the effect upon the capacity of the subway is concerned, the expense of increasing the present motor equipment would not be justified.

A study of the comparative effect of improving the braking and acceleration of the trains indicates that more advantages can be expected from increasing the braking efficiency than can be anticipated from increasing the acceleration of the trains.

MORE CARS PER TRAIN

Plans have been prepared to lengthen the platforms at 16 local stations south of Ninety-sixth Street from the present length of 200 ft. to 350 ft. each, so as to accommodate eight-car local trains. The estimates which have been prepared covering the cost of these changes run from $1,900,000 to $2,250,000. It is Mr. Arnold's opinion that the expenditure of this amount of money will not be justified at the present time. At the same time a car can be added at each end of each express train in the rush hours. They would be known as "through cars," and while they could not be loaded or unloaded directly from the platform of any station south of Ninety-sixth Street, they would prove useful to through passengers.

WIDER CARS

With the present subway, on account of the changes in stations, tracks, terminals and in the cars themselves, the adoption of a higher or a wider car would be impracticable. For future subways the use of a wider car should be seriously considered, but greater advantages can be obtained by double-decking the subways than by double-decking the cars themselves. A car 18 in. wider than the present car would increase by at least 25 per cent. the possible carrying capacity without adding materially to the amount of the investment and should be used in future subways unless reasons other than engineering and operating ones compel the adoption of cars having approximately the same width as those in the present subway.

MAXIMUM POSSIBLE CAPACITY OF SUBWAYS

Report No. 2 upon the "Signal System" shows that the minimum headway to be expected with the present subway upon tracks equipped with a block-signal system, is 90 seconds, corresponding to 40 trains per hour, due to the delay in the express station blocks. In future subways this limitation to capacity should be eliminated by providing two station tracks at each express station to serve each main line track, so that one train at a station plaform will not delay the following train, as is the case at present. In this way the tracks at the express stations would be arranged on

the reservoir principle, so as to equalize and maintain at its maximum the rate of movement of the trains passing from one station to another. In other words, the stations, which represent but a small portion of the cost of a subway system, should be designed in such a manner that the great investment in the subway between the stations could be utilized to its fullest extent.

If the tracks between stations can be worked up to a capacity of 60 trains per hour (60-second headway) then the train capacity of future subways will be 100 per cent greater than the capacity obtained under existing operating conditions in the present subway. If 10-car trains can be run every minute, a car capacity of 600 cars per hour can be secured with each track of a future subway. If each car carries 150 persons, the possible carrying capacity of a single track will be 75,000 passengers per hour, or 150,000 passengers for two tracks, whereas the possible capacity of two tracks in the present subway, as now operated, is less than 50,000 passengers per hour.

CARRYING CAPACITY OF A MOVING PLATFORM

It is possible to install and operate a moving platform for the transportation of passengers under sub-surface conditions and this method of solving the transit problem has been often advocated, but has never been put into practical every-day operation for city transit. Such a platform would have a number of loading and unloading platforms moving at different speeds, usually varying in steps of 3 m.p.h. The platform carrying the seats can thus be made to move at either 9 or 12 m.p.h., the latter speed being in excess of the average speed of a surface car.

A moving platform can be arranged to seat one passenger per lineal foot, or 5280 passengers for each mile of platform. If this platform moves at the rate of 12 m.p.h. its seating capacity will be 62,500 passengers per hour. This capacity is more than twice the possible seating capacity of 10-car trains running on 60-second headway with 50 seats per car—but the platform only moves at the rate of 12 m.p.h., whereas the train can move its patrons at an average schedule speed of 25 m.p.h. It is probable that for short distance the moving platform would be preferred, but that for comparatively long-distance speed is the result desired. There is therefore no question as to the advantage of the train method of operation for long-haul subway conditions.

DESIGN OF STATIONS FOR FUTURE SUBWAYS TO SECURE MAXIMUM CAPACITY

In conclusion Mr. Arnold advocates the novel idea for increasing the capacity of future subways by double-tracking the stations, at least on the express tracks at all express stations. Whether or not the local tracks should be double-tracked depends entirely upon the use to which the local tracks are to be put. If, as in the present subway, these local tracks are to be used more as a collecting and distributing system for the express service than as a separate system of transportation, then there will be but little need of increasing the possible capacity of the local tracks above the capacity which will be provided by a single local track at each station. If, however, an effort is to be made, as it should be, to cultivate the short-haul business by means of the local systems and at the same time encourage the use of the local trains for a certain amount of through travel, then arrangements should be made for double-tracking the local as well as the express tracks at all transfer stations. This plan of double tracks for the local service at the express stations would not necessarily mean double tracks for the local trains at intermediate local stations, as the stops at these stations would not require over 15 seconds, and this station wait would not materially affect the headway. At transfer stations, however, the local trains are liable to be held at the platforms as long as the express trains are held and therefore if there is a demand for frequent train service over the local tracks, these tracks should be provided with double tracks at the transfer stations, thus making each transfer station a double-decked station with four tracks on each deck. A series of suggested designs for double-deck stations is then presented. One of them is reproduced in Fig. 1.

THE CONCLUSIONS

The conclusions are:

(1) The present subway, although carrying more passengers than it was originally designed to handle, lacks sufficient passenger carrying capacity under the conditions that it is now operating to pay a fair return on the investment and at the same time allow for a suitable depreciation reserve.

(2) The present subway is also defective in not having sufficient passenger carrying capacity to take care of the demands

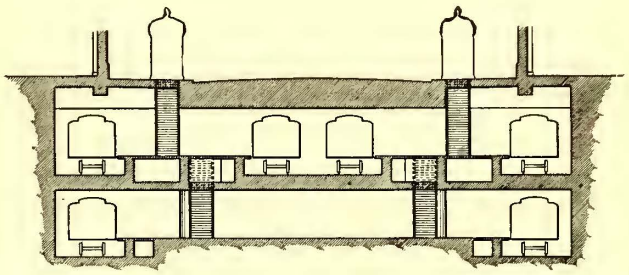


FIG. 1.—ONE PROPOSED ARRANGEMENT OF DOUBLE-DECKED STATION

of transportation along its route during the two rush-hour periods of the day; that is, the subway is lacking in what might be termed overload capacity.

(3) The headway and therefore the capacity of the present subway is governed by the "station headway"; that is, the number of trains is limited by the number that can be passed through the limiting station. The capacity of future subways should be limited only by the number that can safely be passed over the tracks between stations.

(4) The present rate of train movement of 30 trains per hour in one direction upon each track can be increased to 40 trains per hour by

a—Installing automatic closing door signals upon the cars;

b—Providing speed control signals auxiliary to the present block signal system at the approaches to the stations;

c—Altering the cars to provide more doors in the sides of each car.

These changes have been discussed in detail in Reports Nos. 1, 2 and 3.

(5) To most effectively secure the benefit of these changes the cross-overs in the tracks north of Ninety-sixth Street station should be removed in accordance with the plans, which have already been approved by the Public Service Commission.

(6) The Ninety-sixth Street changes can be made still more effective by adding to these plans, the feature of double decking described in this report, thus providing two additional express tracks in the station.

(7) To secure the same capacity for the Brooklyn extension that will eventually be obtained for the Manhattan subway, a plan for handling the South Ferry passengers should be worked out so that all express trains can be run through the Brooklyn tubes, thus increasing their present capacity at least 33 per cent.

(8) The train capacity of the subway cannot be increased by increasing the speed of the trains, as the increased length of the signal blocks necessary for the higher speeds more than offsets the advantage of the increased speed.

(9) The capacity of the subway can be increased by greater care in using the brakes at the stations. Very little effect upon the capacity can be expected by improving the acceleration of trains.

(10) Considerable improvement in the capacity can be secured by running longer trains, and a movement in this direc-

tion should be started, as it will eventually be found desirable to run 7-car local trains and 10-car express trains, both at the rate of 40 trains per hour. When this is done the capacity of the present subway will be increased 75 per cent, which is the maximum increase in capacity of the present subway that can be expected without double decking the stations, which for reasons previously given seems to be prohibitive.

(11) While double-deck cars in subways are impracticable, the possibility of using wider cars should be thoroughly considered in making plans for future subways, as there is apparently no difficulty in the way of using wider cars for such

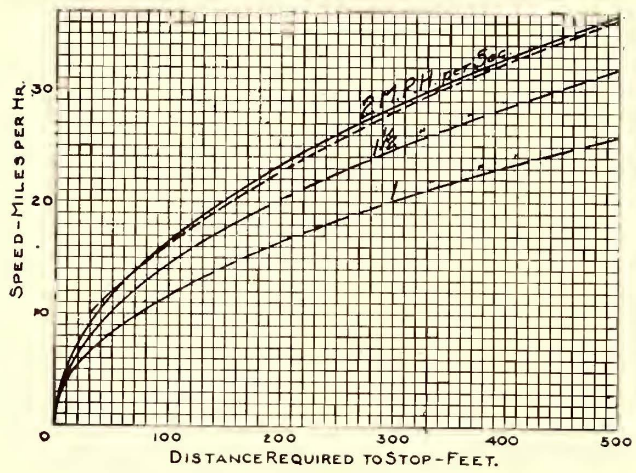


FIG. 2.—BRAKING CURVES

subways except the question of transferring the equipment between the present subway and future ones.

(12) To secure the maximum possible capacity of future subways, tests should be made to determine more accurately than has been done, the braking distance required to bring a subway train to rest from full speed when the emergency stop is used.

(13) An improvement in the block signal system which will have a material influence upon increasing the capacity of future

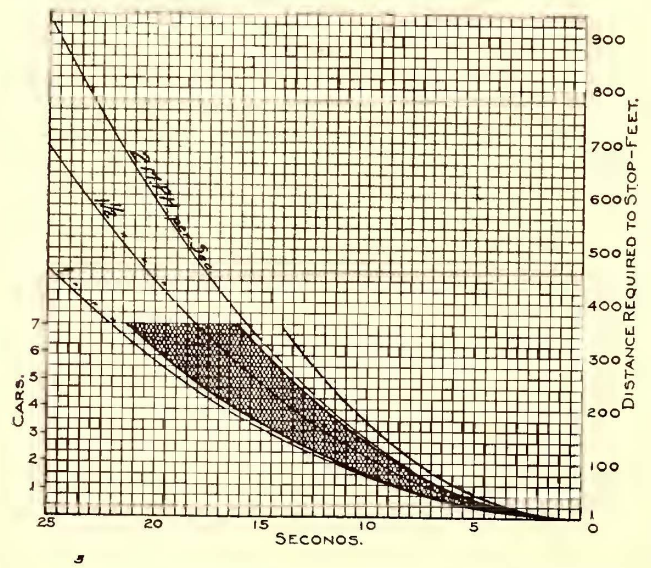


FIG. 3.—COMPARATIVE DECELERATION CURVES

subways can be secured by developing a traveling caution signal to act in conjunction with the present fixed one.

(14) Moving platforms have practically double the seating capacity of 10-car trains running upon 60-second headway, but on the other hand these moving platforms have a speed of only one-half the schedule speed of the train, and therefore the train method of operation is to be preferred for long distances.

(15) In order to secure maximum capacity for future subways these subways should be designed with double-decked stations provided with double tracks for each main line and the cross section of the subway between stations should also where practicable be double decked; this plan will allow the operation of 10-car trains on a 60-second headway on each track, thus providing a carrying capacity of three times that of the present subway.

RECOMMENDATIONS

The improvements suggested in the report are summarized as follows:

(1) The changes required in the present subway to increase its capacity from 30 trains an hour to 40 trains an hour, with a marked increase in its earning capacity, should be carried out; that is, the block signal system should be improved, a speed control system developed and the cars altered, all in accordance with recommendations made in Reports Nos. 1, 2 and 3.

(2) The Ninety-sixth Street alterations should include not only the removal of the cross-overs as already approved by the Commission, but also the altering of the station itself to provide a local track upon a lower level, allowing the four tracks upon the present level to be used by the express trains.

(3) A shuttle train service for the South Ferry station should be provided at once and a comprehensive study should be made of a plan for a double-decked station at this point which would not only give all South Ferry passengers a station on the main line, thus eliminating the shuttle train service, but also allow all trains to run through to Brooklyn.

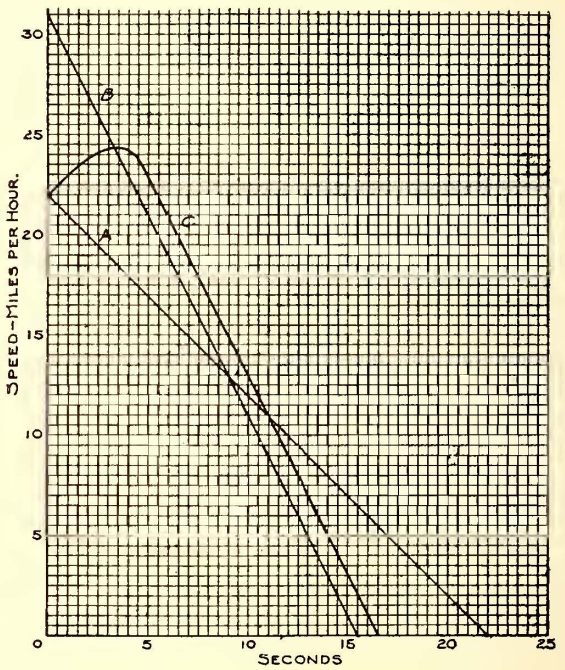


FIG. 4.—DIAGRAM SHOWING TIME REQUIRED TO STOP TRAINS

(4) The braking of the trains at the stations should be improved so as to save the 5 seconds which is now often lost by lack of skill in stopping the trains.

(5) One car should be added to the rear of each local train during rush hours and the public should be encouraged to use this extra car upon the local trains which, although not reaching the platforms, could be used for through travel with the idea of adding even more cars to the trains if the public can be educated to take advantage of this increased accommodation.

(6) A series of braking tests showing the distance required to stop a train by means of the emergency stop from full speed should be made in order to secure reliable data for planning the block signal systems for future subways.

(7) The manufacturers of block signal systems should be encouraged to develop a traveling caution signal to supplement the present fixed caution signal, as this signal could be installed to advantage not only in the present subway but in future subways.

(8) If future subways are to be built and operated independently of the present one, the plans should be made with the idea of using multiple side-door cars 18 in. wider than the present cars, thus adding at once 25 per cent to the capacity of each car and increasing the possible carrying capacity of such subways without proportionately increasing their first cost.

(9) In order that future subways shall not only pay a fair return on their investment but also allow for a satisfactory depreciation reserve, it is essential that such subways be located where there is sufficient density of traffic to justify their being built and at the same time they should be so designed as to handle the volume of traffic which must be passing through them during the rush hour periods in order to make them self sustaining.

(10) All future trunk line subways should be designed with stations on the reservoir principle, that is with double tracks in each station for each main line track. This can best be accomplished by not only double decking the stations, but also double decking the subways between stations and by this method secure the carrying capacity necessary to justify the occupancy of the street and at the same time produce a property which will justify its cost. Where a crosstown subway is to be provided for, the stations should be triple decked.

APPENDIX

Fig. 2 shows the distance in feet required upon a straight and level track to bring a train to rest from different initial speeds in miles per hour and at various rates of deceleration.

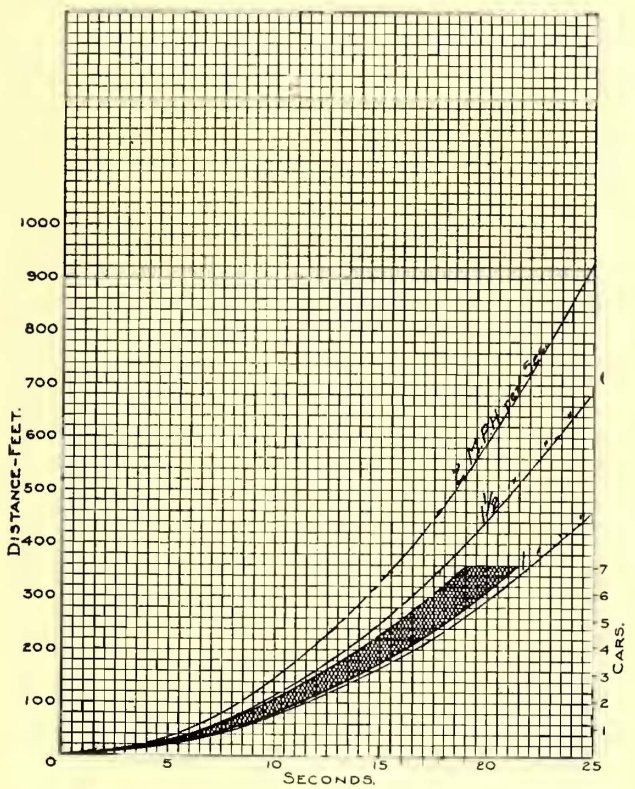


FIG. 5.—COMPARATIVE ACCELERATION CURVES

The dotted lines indicate the curve of braking distance which was used in laying out the subway signal system, and it will be seen that this curve, constructed from test data, corresponds very nearly to the theoretical curve of 2 m.p.h.p.s. The fact that with improved brakes it is possible to stop a train at the rate of 2½ m.p.h.p.s. or greater, suggests that possibly the braking distance—and therefore the lengths of the blocks and the headway—can be correspondingly reduced.

Fig. 3 shows the number of seconds required to stop a train at various rates of deceleration. The length of an express station platform is 350 ft. If the head end of a train coming to a stop at this platform runs the length of the platform in 15½ seconds, the train is braking at an average of 2 m.p.h.p.s. If, however, the time to run the length of the platform is 22 seconds, then the rate of retardation or braking is an average of but 1 m.p.h.p.s. The shaded portion of the diagram covers points of observation which were made on a great many trains and indicate that the braking practice in the present subway is varying through wide limits. In bringing a train to rest at a station platform, many motormen take at least 5 seconds longer than other or more skilled motormen. The single curve indicating a stop in the length of the platform of 14 seconds is the result of one observation in which an exceptionally quick stop was made, but this stop shows the possibilities of eventual improvement.

In Fig. 4, Curve A shows a train reaching the platform at a speed of 22 m.p.h. and stopping in 22 seconds, or at the rate of 1 m.p.h.p.s. Curve B shows the train stopping in 15½ seconds from a speed of 31 m.p.h. or a deceleration rate of 2 m.p.h.p.s. Curve C shows the first train which reached the platform at 22 m.p.h.—accelerating first to about 24 m.p.h. and then decelerating at the rate of 2 m.p.h.p.s., thus coming to a stop in 16½ seconds instead of 22 seconds. This latter curve shows the method of stopping which should be followed by all trains. An indicator should be located 100 ft. from the entering end of the platform and the motormen should be trained and instructed to reach this indicator with their trains running at a predetermined speed. The motormen become sufficiently expert in judging the speed of the train to make this rule practicable, and it can be carried out without the use of speed indicators in the motorman's cab. A strict adherence to this rule would reduce the operating headway of the present subway by at least 5 seconds, and there is no other improvement possible

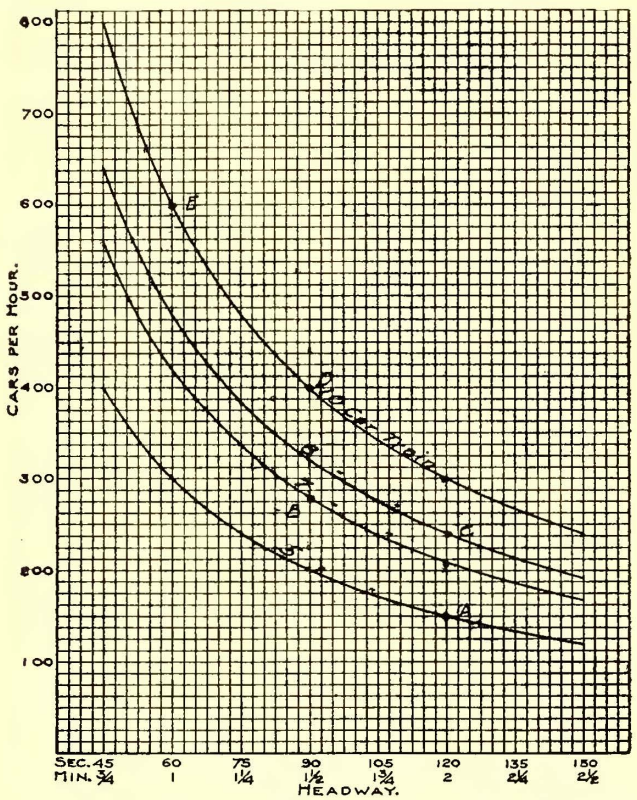


FIG. 6.—CURVES SHOWING CAR CAPACITY OF SUBWAY

which will add so much to the capacity of the subway in proportion to the amount of investment involved.

Fig. 5 shows the number of seconds required to accelerate a train through a distance equal to the length of seven cars at various rates of acceleration. As in the braking curves, if the rate is 2 m.p.h.p.s., it will require 15½ seconds to start from rest and run a distance of 350 ft., whereas if the rate is 1 m.p.h.p.s., it will require 22 seconds to run this distance. In actual practice the acceleration is ordinarily accomplished within the limits covered by the shaded area; that is, the trains are accelerated at the rates between 1.1 and 1.4 m.p.h.p.s., depending on the load, the motormen and the action of the controllers. It will be noticed that the difference between the most rapid acceleration and the slowest acceleration is very small. The only way that the acceleration can be improved to any great extent is to change the gear ratios with the present motors or to add more motors per train. The possibilities in these directions will be discussed under a separate part of the report devoted to the question of motors and speed.

Fig. 6 shows the total number of cars per hour that can be operated over a single track in one direction with various head-

ways and different lengths of trains. The curves show at once the benefits to be expected by decreasing the headway and at the same time increasing the length of the trains. The following points have been located on the diagram:

A—Present local trains,
Five-car train on 120-second headway.....150 cars per hour
B—Possible local trains,
Seven-car train on 90-second headway.....280 cars per hour
C—Present express trains,
Eight-car train on 120-second headway.....240 cars per hour

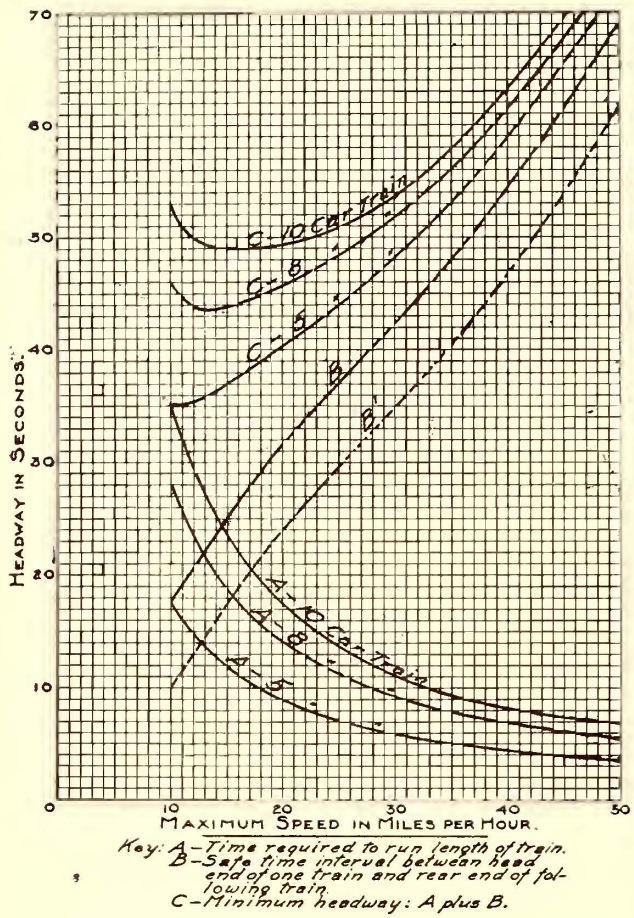


FIG. 7.—CURVES OF MINIMUM HEADWAY

D—Possible express trains,
Ten-car train on 90-second headway.....400 cars per hour
E—For future subways,
Ten-car trains on 60-second headway.....600 cars per hour

Fig. 7 shows the minimum "running" headway with different length of trains running at various speeds.

The minimum running headway between stations in the present subway is the sum of the following factors:

(1) Time required for the train to run through three block sections, plus
(2) Time required for the train to run its own length, plus
(3) Time required for signals to operate, plus
(4) Time required for motormen to observe signal and act.

In Fig. 7 each of these elements has been plotted showing the time required for each one at various maximum speeds. In this diagram Curve B-1 shows the time required for the train to run through three blocks of the signal system. Behind each train on the signaled tracks of the subway there are three signals, two of which are danger signals opposite automatic stops on the track, and the third or last is a caution signal. It requires about 2½ seconds for the caution signal to indicate clear after the preceding train has passed out of a block, and the motorman usually follows the direction of a signal at least 5 seconds before the train actually reaches the signal, so that 7½ seconds' time has been added to Curve B-1 to obtain Curve B, which represents the safe time interval between the head end of one train and the rear end of a following train. This time interval increases nearly directly as the maximum speed increases on account of the fact that the distance, which determines the length of the signal system block, increases approximately as the square of the speed, whereas the velocity of the train which overcomes this increasing block distance varies directly as the speed. On the other hand, the time required for the train to run its full length decreases directly with the speed as shown by Curves A for the different lengths of trains.

The Curves marked C, which show the increasing headway, are the result of adding the values shown by Curves A and B. Curves C indicate that there is a minimum headway for each length of train, at which point the car capacity of the subway for that particular length of train will be a maximum. For instance, with a 10-car train, the headway will be a minimum of about 49 seconds when the maximum speed of the train is 15 m.p.h. If the maximum speed is decreased below 15 m.p.h., the length of the block, and therefore the time required to run three times its length is decreased, but on the other hand the time required for the train to run its full length is increased at a greater ratio, and the corresponding headway is therefore increased. When the speed is increased above 15 m.p.h., the influence of Curve B is more apparent, and the headway increases as the maximum speed is increased. These curves show that as the maximum speed of the train is increased above the critical speed, the minimum headway is increased, and the corresponding train capacity of the subway, which is obtained by dividing the seconds in one hour (3600) by the headway in seconds is decreased; that is, after a critical maximum speed has been passed, the train capacity of the subway cannot be increased by running the trains at a higher rate of speed.

The curves marked A in Fig. 8 show first, the number of cars per hour resulting from the operation of different lengths of trains at various speeds. These curves were obtained by

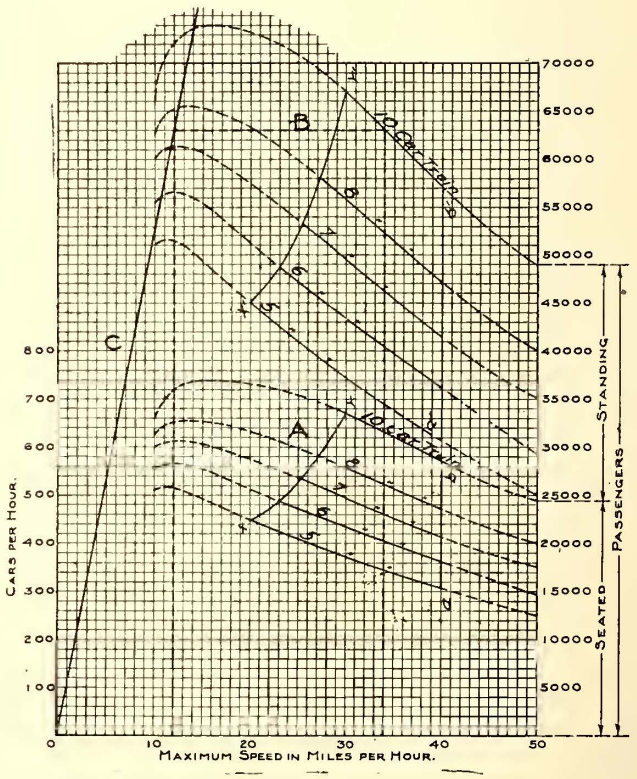


FIG. 8.—CAPACITY OF SINGLE TRACK PER HOUR COMPARED TO THAT OF MOVING PLATFORM

Key:
Curves A—Car capacity at various speeds on basis of 50 seats per car.
Curves B—Car capacity at various speeds on basis of 100 passengers per car.
Curve C—Capacity of moving platform on basis of seating capacity per lineal foot equal to that of cars.

dividing the seconds in an hour by the headway in seconds shown by Fig. 7 and then multiplying by the number of cars in the train. They indicate that although the headway of trains at a given speed increases with the length of the train, thus making it necessary to run the longer trains at greater intervals, the extra number of cars in the longer train more than compensates for the loss in the actual rate of train movement and therefore the greater the length of the train, the greater the possible car capacity. The maximum speed of the present subway cars with motors on about 60 per cent of the cars is

40 m.p.h. A vertical line (a. b.) has been shown on the curves at this 40-mile speed to indicate this limit.

All the blocks of the present signal system are equal to at least the length of the longest train. If this rule is followed, then the minimum length of block will be the length of the train and the minimum distance between trains will be three times this minimum length. Another line (x. y.) cutting the capacity curves and indicating the limit of maximum capacity with blocks shortened to the length of the train is shown on Curves A. Between these two limit lines (a. b. and x. y.) will be found the possible car capacity of any subway with different lengths of trains running at various speeds. A scale has been added to the right of the curves indicating at once the seating capacity of a subway corresponding to any given car capacity on the basis of 50 seats per car. These figures show that the maximum seating capacity may vary from 15,000 seats with 5-car trains running on a maximum speed of 40 m.p.h., to 33,500 seats with 10-car trains running at a maximum speed of 30 m.p.h. with signal blocks, in the latter case equal in length to that of the train.

Curve B shows the passenger carrying capacity on the basis of an average of 100 passengers per car—that is with as many passengers standing as are seated. These curves between the limits of a. b. and x. y. indicate that the maximum passenger carrying capacity of one track of the subway with 100 passengers per car varies from a minimum of 30,000 passengers per hour with 5-car trains to 67,000 passengers per hour with 10-car trains.

Curve C shows the capacity of a moving platform on the basis of one seated passenger per lineal foot of platform. This basis was arrived at by assuming that each seat on the platform would accommodate three passengers and that these seats are spaced transversely on the platforms a distance of 3 ft. from back to back.

Such a platform moving at a uniform rate of 12 m.p.h. would have a carrying capacity of 62,500 seated passengers per hour. This capacity (see Fig. 8) will be seen to be exactly equal to the carrying capacity of a road operated with 10-car trains having a maximum speed of 34 m.p.h. In the train service, however, one-half of the passengers would be standing, while with the moving platform seats for the entire number would be provided. If the 10-car trains do not make too frequent stops, an average schedule space of 24 m.p.h. can be maintained, and it will thus be seen that if transportation facilities are to be supplied by means of trains instead of moving platforms, each passenger will be carried at twice the speed that can be expected from a moving platform, but in order to secure this extra speed and retain the total carrying capacity equal to that of the moving platform, one-half of the passengers must stand.

SWISS REPORT ON AMERICAN ELECTRIC RAILWAYS

The Swiss Government Commission on Electric Railway Operation has just published a German report of 308 pages and 123 illustrations embodying the studies of American electric railways made in September and October, 1906, by Dr. W. Wyssling, secretary of the commission, and K. Wirth, engineer. The report, which is written by Dr. Wyssling, contains a careful classification of the different types of electric railways and comparisons are made with Swiss and other Continental practices. Special attention was given to the American interurban systems as they correspond more nearly to the trunk lines of Switzerland than do the electrification projects of American steam railroads. Dr. Wyssling was highly gratified with what he saw of American electric railways and is convinced that they have demonstrated the success of overhead and third-rail d.c. construction as well as the practicability of multiple-unit control and single-phase current for heavy work.

The report contains a description and running costs of every line visited together with comments on the equipment and methods of operation in addition to tables presenting a résumé of the principal features. Separate descriptions of Westinghouse and General Electric motor car and control apparatus are also included.

PARIS UNDERGROUND RAILWAYS

Out of a total of 57 miles authorized Paris has 32 miles of underground railways now open for traffic. Work is in progress to complete all lines not yet in operation. The Metropolitan scheme includes a double-track line parallel to the Seine, and serving the traffic of the central portions of the city, a circular line surrounding the city, and situated between the central quarters and the fortifications, occupying somewhat the position of the outer boulevards; and, lastly, two transverse lines at right angles to the course of the river. The portions of this system now in operation carry an average of 350,000 passengers daily. The other concession, called the North & South Railway, crosses Paris transversely from north to south, and has a total length of about seven miles, all of which is now under construction.

ECONOMY TEST OF STEAM FEED-WATER HEATER

An economy test of a steam feed-water heater was reported in a paper read recently before the British Institution of Mechanical Engineers and is attracting considerable attention abroad on account of the inference to be derived from it that there is no economy, so far as this particular test at any rate is concerned, in a feed-water heater, although every care seems to have been taken to get reliable results. The boiler was of the marine type, 8 ft. in diameter, 14 ft. long, with 60 return 3-in. tubes and two furnaces, and was fed by a pump on the main engine. There was a closed live steam heater in which the water fell in spray through the steam; the water, heated near to boiler temperature, flowing by gravity into the boiler. Tests made on two consecutive days with and without the heater showed almost exact identity in coal consumption in pounds. The actual result of the two 12-hour tests was that the evaporation per pound of coal was 0.6 per cent better without the heater. No claim is made that a test of this kind could be conducted within this degree of accuracy, but that the heater showed no marked economy. The same fireman was employed each day and great care was taken to have a uniform grade of coal. The boiler was not forced; it had a grate area of 30 sq. ft. and a heating surface of 924 sq. ft. and only consumed about 570 lb. of coal per hour, or 19 lb. per square foot of grate per hour.

DISSOLUTION OF HOLLAND-AMERICAN RAILWAY COMPANY

The Holland-American Construction Company, organized for the purpose of building an electric railway in Holland, connecting Amsterdam, Zaandam and Krommenie with branch lines to Wilkaan Zee on the North, and Edam, where the cheeses are made, on the Zuyder Zee, is to be dissolved. The company was capitalized at $1,000,000 and was incorporated on Sep. 26, 1905. The directors of the company were: J. George Kaelber, John F. Alden, John N. Beckley, Charles H. Palmer and George C. Buell, of this city; Joseph H. Lukach and Newcomb Carlton, of London, Eng.; Walter D. Uptegraff and George C. Smith, of Pittsburg. The other officers of the company are: Joseph H. Lukach, London, president; J. George Kaelber, Rochester, first vice-president; John F. Wallace, New York, second vice-president; B. E. Esseltine, Pittsburg, treasurer; W. G. Dunstall, London, assistant treasurer and assistant secretary.

TICKETS AS A FARE MEDIUM FOR STREET AND INTERURBAN RAILWAY TRAFFIC*

BY J. F. OHMER,
President of the Ohmer Fare Register Company, Dayton, Ohio.

Probably there is no commodity so popular and universally known as the card or scrap of paper, commonly called "railway ticket." In 1906 the Grosse Berliner Strassenbahn, of Berlin, Germany, made use of 480,000,000, and one of the omnibus companies of London disposed of 500,000,000 tickets in the same year. Tickets are supplied in dozens of ways and many designations and values. For city properties we have 5-cent tickets, six tickets for 25 cents, 11 for 50 cents, and 25 for $1; school tickets, employees' tickets, workmen's tickets, trip and time passes and all kinds of transfers. The latest innovation is Mayor Tom Johnson's aluminum slug, sold for 3 cents each by the Municipal Traction Company, of Cleveland.

Many city forms are used for interurban properties besides a multiple of tickets, good to and from all stations, round-trip tickets, excursion tickets, special tickets, half-fare tickets, coupon tickets, mileage, commutation and a variety of forms of duplexes. Some forms of all of these are adopted for the convenience of the public and to subserve the companies' interests. Is it to be wondered that the heads of certain auditors and passenger agents are fast turning gray?

A man lays down 50 cents and receives a transportation ticket. The presumption is that he paid the company 50 cents for the ticket, but as a matter of fact he paid for his ride. The company accepts the money and gives its promise to transport bearer in one of its cars to the agreed destination as evidenced by the ticket. In other words, the company issues its note to bearer. By that transaction the company becomes a debtor and the public a creditor for the money paid, and the company must deliver the goods or redeem its obligation by refunding the money. The obligation must be paid and the company can have no assurance of the liquidation of its indebtedness until the promissory note is cancelled. The railway may, in reality, pay its obligation to the original creditor, but does it by so doing always cancel its liability, its note, its promise to pay? That is the vital question to which I desire to direct attention.

While by the issuing of a ticket the company receives its money in advance for the ride, it is likewise true that the credit issued is, generally, transferable and negotiable, and therefore may be used by several people and several times. The loss to the railway because of its great number of miscellaneous credits distributed through so many agencies can scarcely be computed. This loss varies with the extent of operation and the number of weak channels opened to encourage manipulation.

Beginning with possibly the lowest denomination of credits issued by railway companies, I will, first, take up the ordinary city transfer. Although the usual transfer is issued with a limitation, and the opportunities presented are fewer and restricted as compared to the unlimited ticket, all managers know of the common practice of transfer manipulation by the public and conductors. It is also well known that conductors substitute 2½-cent or 4-cent tickets for 5-cent cash fares. Too often the busy manager does not examine the question sufficiently to realize that 100 substitutions of 2½-cent tickets for 5-cent cash fares mean a loss of $2.50. When told that his conductors are making no separate record of the $2.50 collections and $5 collections, but are recording both together with the option of accounting for either class to suit their convenience, the manager is astounded.

The conductor on an interurban line takes in exchange for a ride the ticket fare medium, but does the acceptance of that ticket cancel the obligation of the company? The conductor issues one part of the duplex ticket to a passenger from whom he receives a cash fare and the passenger accepts the ticket as evidence of payment. But, with the issuing of that ticket, does not the company issue its credit for the ride, limited perhaps to one day? Nevertheless the credit is made unconsciously, possibly by most managements from the presumption that the issuing of a duplex is merely a receipt to the passenger for his money. Another passenger procures the company's credit in the form of a 50-cent ticket for a ride to destination; in exchange for the ride the passenger pays to the company's conductor the credit, or promise of a ride issued to him by the company, but does the acceptance of that ticket by the conductor cancel the company's obligation? Although the conductor is instructed to punch the ticket upon receipt for the purpose of cancellation, does it necessarily follow that he will punch it, or that the ticket is cancelled even after being punched? So long as the ticket is not cancelled, is he not aware of the company's obligation extended by that ticket, and appreciating its value, is he not aware that advantage can be taken of the company by transferring it and retransferring the same obligation, which is good until properly cancelled or redeemed? Is he not also aware that the company's obligation, made when he issued a cash duplex receipt for a cash fare paid, goes with the receipt issued, and that, until cancelled by limitation, it has intrinsic value subject to resale? And, encouraged by the large number of patrons who would rather see the company victimized than otherwise, is he not subject to and does he not very often yield to temptations offered for the furtherance of his own interests? He finds it profitable to shave the company's credits.

All these are questions too well known to require further comment, but the remedy for this defective operation is the all absorbing topic. We are all looking for any prescription to guarantee a better operation, or at least to curb the chances of manipulation, if not entirely effecting a cure.

The practice of using discarded duplex tickets the second and often the third time is as well known as the practice of concealing different values on the same sequel, and thereby the company sustains the loss for the difference. If the use of the duplex ticket is for auditing the receipts paid the conductor, then why the necessity through that medium of permitting the conductor to extend the company's credit, and thereby continuing its liability? If a man gives a receipt for cash paid to him for services rendered, would he not be foolish to give a receipt that would in the least possible manner render him liable to perform the services the second time? Much less likely would he authorize his agents to bind him for further performance other than that for which the receipt is given.

Steam railroads take the precaution in all large cities to compel passengers to present tickets to gate keepers for cancellation before passing out to the train, but the punching of a ticket by the gate keeper does not cancel that ticket; if it did, it could not be used by the passenger, and if it can be used by the passenger to-day it can likewise be used by another passenger to-morrow. It is possible, however, that the passenger on the second trip would circumvent the gatekeeper and board the train without passing

*Abstract of paper presented before the May 26 meeting of the Central Electric Railway Association at Toledo, Ohio.

through the gate, or it may be possible for him to procure a low-rate ticket for presentation to the gatekeeper to insure his access to the train. While the gatekeeper's mission, if properly carried out, is a great safeguard, it does not insure to the company by any means that the same tickets cannot be used the second time or oftener, the extent of the manipulation being limited to the desires of an unscrupulous conductor and his correspondents. In my estimation, the fault is generally with the ticket. Whatever advantage is to be derived by the employment of the gatekeeper is limited to the large and terminal stations only, and the application of this system would be confined to very few interurban properties. It, therefore, behooves managements of interurban properties to provide themselves with the best opportunities offered for surrounding the sale and use of tickets with the greatest possible protection.

The tickets used on interurbans particularly should be printed with the shortest limitation, and it will be found profitable to have them devised to be self-cancelling by the first use of the ticket. Inasmuch as the ticket itself carries with it the company's credit to the extent of its value, it is analogous to the use of a government certificate for $1, which, on its face, reads as follows: "This certifies that there has been deposited in the Treasury of the United States of America one silver dollar, payable to bearer on demand." The certificate itself has only a circulating value, while its real worth is in the redemption feature, but so long as it is in circulation it has the value of a dollar's worth of silver back of it, which amount is made payable to bearer on demand; likewise with a railroad ticket. It constitutes a certificate for the amount deposited, and on its face it subscribes to perform its service to the holder thereof and is worth the amount deposited in exchange for its issue. I, therefore, contend that credits in the nature of transportation tickets issued by railroad companies are as valuable as the amount of money deposited against the issue of each, save and except the discount or "rake-off" required for its negotiation. It is, therefore, of the utmost importance that upon receipt of tickets paid to him in exchange for rides that the conductor should charge himself, and thereby credit the company for the cancellation of its obligation made by the issue of the ticket. The mere fact of a conductor charging himself with the receipt of a ticket irrespective of its value does not in any sense cancel the company's obligation made at the time the ticket was issued. It may, however, if the conductor charges himself by registering for a ticket, have the effect of discharging the company's obligation for the value of some form of ticket, but while the conductor receives a ticket which carries an obligation on the part of the company to the value of a dollar, he may, with the substitution of a 5-cent or 10-cent value ticket, release his responsibility to the charge of a ticket and still retain the company's larger obligation for subsequent use. This process makes it easy, by the continued liability, for the company unjustly to pay its obligation the second or third time or oftener. The opportunities presented are so varied that the unscrupulous conductor has his choice in many ways for manipulation without much fear of being detected.

As the rapid development of interurban properties and the expediency of making traffic arrangements for through traffic over several lines necessitate the sale of through tickets by all companies in the traffic compact, each company, by permitting the sale of tickets and by retailing its credits through the medium of tickets, further jeopardizes its interests by authorizing the agents of other companies to increase its obligations in proportion to the interchanged traffic.

One of the most important subjects which has been discussed and is now under discussion is the standardization of operation. It is also opportune to standardize the use of tickets. While uniform or standard tickets would be desirable themselves, it must necessarily be more desirable if some standard application should be adopted for the use and auditing of all tickets, surrounded with the best possible safeguards, whereby all companies in the traffic arrangement would be placed on an equal basis, thereby insuring equity to all parties in interest.

TRANSFERS

The transfer has come to stay, and while the best authorities agree that its use stimulates traffic, it also is admitted that, by reason of its abuse, it is causing much trouble and anxiety to the managements. The loss for which it is responsible is something appalling. From a careful canvass among some of the larger city officials, I am informed that there are issued from 25 to 30 per cent more transfers than the number collected. This great difference is caused primarily by the fact that conductors usually are informed that the transfer has no value. With that understanding they issue it indiscriminately, either singly or in bunches, it being a matter of indifference usually whether any or all of the transfers issued are ever taken up by the company. No greater error was ever advocated than the manager's edict which proclaims that the transfer has no value. It is because of this error that the losses, in a great measure, are sustained. Transfers, being numbered consecutively, enable the conductor to report as to the number he issues, and whether he issues them singly or in bunches is immaterial so far as making up his record is concerned. If an inaccessible record could be made of each transfer issued, by registering the issue of the transfer, it would reduce very largely the excess transfers issued and reduce the chances of manipulation accordingly.

2½-CENT, 4 1/6-CENT AND OTHER CITY TICKETS

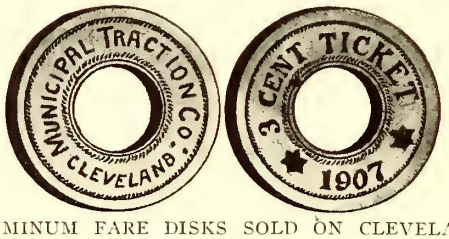
A ticket issued by the company for 2½ cents means a credit of 2½ cents, and 100 2½-cent tickets mean a credit of $2.50, and the enormous number of 2½-cent tickets and 4 1/6-cent tickets issued by many of our city properties means thousands of multiples of 2½ cents and $2.50, 4 1/6 cents and $4.16 2/3, so that in the aggregate the extension of credit through the medium of tickets is something enormous. Unless the collection of each ticket is properly audited, to a certain extent the credit is merely extended to the conductor with an opportunity to shave the company to suit his inclination; likewise with the transfer, which carries with it a limited credit. Unless it, too, is properly recorded, it may subserve its purpose to the conductor for manipulation. The remedy, then, is to devise ways and means for the conductor to record each collection by itself, and specifically under its own value; until this is done there can be no hope to obtain the best results.

If a workman is receiving for his services 22 cents per hour for certain hours of the day and 33 cents for certain other hours of the day, he would not, under any circumstances, permit his employers simply to add up the number of hours of service rendered and make settlement for so much per hour at the option of his employer. He would demand that a separate record be kept of each class of time and that settlement be made accordingly. Your employees are paid on a graded scale; some are paid 22 cents per hour; some are paid 25 cents per hour, and others are paid 27 cents per hour. Suppose the total number of hours for

all employees numbered 10,000 hours, and your paymaster was instructed to use his own discretion in designating the number of hours and the pay for each, would the employee be satisfied or accept any such auditing of his credits?

The first practical operation by municipal ownership in this country is probably that of the Municipal Traction Company, of Cleveland, Ohio, and the company immediately after taking over the property from The Cleveland Electric Railway Company elected to charge a straight 3-cent fare, and simultaneously issued a perforated aluminum disk about the size of a nickel. These disks are sold for 3 cents, and I am informed that 3,000,000 of these disks are to be provided and issued to the public in the city of Cleveland. These disks have no limits as to time. If the statement that 3,000,000 of them are to be issued is true, after they are put in circulation the company will then have issued its credit for $90,000. It is reported that these disks are to be in common circulation as a medium of exchange for bread or beer. While the issue of these disks, or coupons of a similar nature, may make it more convenient for the payment of fares, I doubt its expediency for no other reason than the fact that the disks can be so easily counterfeited, and with such a degree of perfection that it would be impossible to detect the counterfeited disks from the company's authorized issue. The company may ultimately find it expensive to redeem its credits, authorized and unauthorized.

The ordinary practice which has prevailed for years provides to the conductor limited means whereby he is

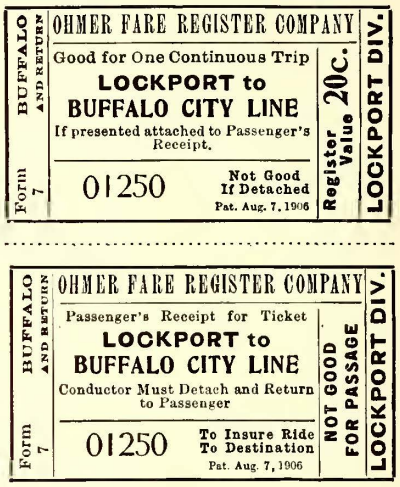


ALUMINUM FARE DISKS SOLD ON CLEVELAND THREE-CENT LINE

obliged to combine with his registrations different denominations of fares. His 5-cent fares, his 3-cent fares, his tickets of various values, and sometimes his transfers are registered together. Does that operation charge him with the collections according to the value of each, or does it charge him with just so many collections irrespective of the value? Does that operation audit his debits to the company and does it audit his work in advance for the auditing department? Acting as agent for the company, the conductor should, on receipt of his company's credits, charge himself for each particular credit received. Operating under the system of registering different values together, is the conductor wholly to blame if in making returns he gives a collection of some kind for each collection he charged himself with? Has he been given competent means under such circumstances for making the proper charges and audits which will conform to the collections made by him? Has he been given the means whereby he can best subserve the company's interests and at the same time protect his own integrity? No honorably disposed conductor will object to charging himself properly by making a separate record for each value collected by him for the company, and if he has any knowledge of business and appreciation of justice, he will prefer doing it for his own protection.

INTERURBAN TICKETS

Obviously the greater the number of tickets the greater the distribution of the company's credits and the more clerical work involved in properly accounting for them. The best companies are curtailing their forms and numbers to the minimum. Where tickets must be issued they should be, as previously stated, issued as much as possible with a limitation, and the shorter the limit the better. They should be self-cancelling. Attached to each ticket and each coupon of a ticket should be a passenger's receipt with the same consecutive number thereon and printed clearly to indicate its purpose. For example, I submit the following specimens from the International Railway Company, of Buffalo, N. Y.:



TICKET AND RECEIPT USED ON BUFFALO-LOCKPORT LINE OF THE INTERNATIONAL RAILWAY COMPANY

The consecutive number on the ticket and on the passenger's receipt is the same. Upon presentation of this ticket the conductor must detach the receipt and return the same to passenger to insure his ride to destination, and the conductor must register the ticket as 20 cents. With that operation the collected ticket would not only be cancelled, but the conductor would charge himself for the value of the ticket, viz.: 20 cents, and he immediately establishes an audit for the cashier and auditing department for that collection. The same application can be made for all one-way and round-trip tickets.

Public indication for each fare paid is a great guarantee and subserves its purpose to the company in a way that no secret or private record could possibly subserve. Besides, the direct registration or indication does not make a draft on the company's credits as with the issuing of a duplex.

Prof. Charles William Eliot, president of Harvard University, in a recent public address, referred to the acts of public officials as follows: "Publicity is the cure for many evils. Entire publicity is the greatest guarantee of official honesty. The smallest acts of the public official should be open to examination by every citizen."

I can conceive of no more pertinent application of this injunction than to the thousands of conductors acting in the capacity of official agents for railroad companies in the collection of the company's cash and credits.

I have referred to the enormous collections of tickets made by the Grosse Berliner Strassenbahn, of Berlin, and to one of the general omnibus companies in London. It might be pertinent to observe that in Great Britain and on the Continent of Europe, in the Latin American countries, and largely in the Oriental countries, the general system of issuing tickets for fares paid prevails on all city properties, even for fares collected in small amounts. For instance, The T. Tilling, Limited, Omnibus Company collects fares and issues a ticket receipt for each fare collected in de-

nominations as follows: ½d, 1d, 1½d, 2d, 2½d, 3d. In many cases the system prevails because of the city or country regulation which compels the giving of a receipt for each fare paid. The prevailing use of this system, with the opportunities for manipulation, the enormous cost of tickets and the great amount of clerical work involved in accounting for them are causing the managements much anxiety, and a better system for operation has for a long time been sought by the managers of the great properties in the Old World. The introduction into Europe of the multiple Ohmergraph promises completely to revolutionize the prevailing system of operation. I have, for some time, cooperated with the managements of a number of the largest companies in Great Britain and on the Continent of Europe, and only recently have devised a new form of tickets and prescribed specifications for a new system of operation for nine companies. In Germany the fares range from 5 to 35 pfennig; in France and Belgium they range from 5 to 30 centimes; in Great Britain from ½d to 1s.

I have in my office now the fare schedules and samples of tickets and copies of specifications showing the present modus operandi of what is probably the largest electric railway corporation in the world, that of the London United Underground Electric Railways. This company operates the Baker Street Waterloo Railway; Great Northern, Piccadilly & Brompton Railway; Charing Cross, Euston & Hampstead Railway. Its actual paid up capital is $110,000,000. The fares collected range from one penny in multiples up to a shilling, and its number of revenue passengers figure into the millions daily. Just what success I may have in solving the perplexing problem of the fare collection service of the London Underground remains to be seen, but suffice it to say that I feel highly honored in having referred to me the working out of a solution for the greatest electric properties in the world.

I believe in placing confidence in mankind; in fully crediting integrity until it is found guilty. Eliminate suspicion by removing the causes which produce it. Accord to every employee the means to do his work right and in a business-like way, equally fair to him as it is to the employer, and the causes for suspicion will, in a great measure, be removed. We must continue struggling after the remote ideal of perfection, even though we never expect to obtain it. We would be unhappy if we did obtain it, for the greatest joy in all things is the working for it. Let us continue to strive onward, always mindful of the injunction, "Fatherhood of God and Brotherhood of Man," and success will be ours.

INSULATION OF HIGH TENSION TRANSMISSION LINES

BY FRANCIS S. DENNEEN
Ohio Brass Company, Mansfield, Ohio

The general problem of high tension line insulation is too broad and complex to permit a thorough and exhaustive treatment within the limited scope of this discussion. The effort, therefore, will be to touch on those points of particular moment in the selection of line insulators, and to discuss briefly the performance of insulators in service and the elements to be considered in the design. At the present time glass and porcelain are the only materials used commercially for the insulation of high-tension lines, and the former is fast becoming limited to use on lines where the pressure does not exceed 10,000 to 15,000 volts.

In the earlier years of electric power transmission, the difficulty and expense of manufacturing porcelain of the requisite electrical strength, caused glass to be used almost exclusively. The great improvement in the methods of porcelain manufacture for this work, however, has entirely changed the situation, and to-day very few engineers are willing to risk using glass at voltages above the limits named.

Reasons for this change to the use of porcelain are numerous, but chief among them is that glass is very fragile and cannot be depended upon to stand up in service under varying operating conditions. Peculiar conditions existing in the manufacture of glass insulators cause these pieces to be all more or less under a state of constant internal stress, and it is not at all uncommon to have large numbers of glass insulators break open of their own accord without being subjected to any external disturbance other than temperature changes. Because of these internal stresses the insulator is much more readily punctured, and it takes but a slight blow to shatter such a piece entirely. The surface of a glass insulator "weathers" considerably, there being a tendency to pit, leaving the surface rough, so that dust and moisture is readily held. A glass insulator is also hygroscopic to a marked degree, giving rise to trouble from moisture deposits. Perhaps the greatest advantage offered by porcelain is its mechanical strength. These porcelain pieces are made so that they are not under any internal stresses, and a shell of moderate weight will stand a great deal of abuse without breaking.

Before discussing the theory of insulator design and the performance of an insulator in service, it would be well to devote a few moments to a brief study of the action of an insulator or dielectric when subject to electrical stress. The study must not be limited to the insulator alone, for it should involve a consideration of all of the effects of electrical tension upon the dielectric near the conductors. With an insulator, air is always a dielectric in combination with glass or porcelain or other insulating materials. When a difference of electrical potential exists, a condition of strain is produced in the surrounding media and this is called the electro-static field. This electro-static field is produced by applying electrical stress to the insulating medium. When subject to electrical tension, all dielectrics, including air, glass, porcelain, wood, etc., have produced in them a displacement in the molecular structure which, if the applied potential is carried to a sufficiently high value, results in a disruptive breakdown of the material. Before a difference of potential can exist, current must flow into the dielectric, and if the potential is not raised to a value which will cause rupture, current will flow from the dielectric whenever the tension is reduced or removed and a path formed for this current to flow in.

All dielectrics are capable of receiving strain to a certain point without rupture, and solids such as glass and porcelain possess this feature to a greater extent than air or gases. Generally, whenever the potential is brought to a sufficiently high value there is a structural failure of the dielectric, solids failing by mechanical rupture and gases by a change in the molecular state, which partially destroys their insulating qualities and makes them semi-conducting. An insulator under heavy load may show brush discharge, which is an indication that while the insulator remains intact, the dielectric surrounding it (the air) has broken down. The dielectric strength of air plays an important part in the design of an insulator, for it is well known that under ordinary temperatures and pressures this value is much below that of most solid insulating materials.

Let us consider the action of an ordinary insulator under varying service conditions. Assume that the one appear-

*Abstract of paper presented at May 26 meeting of the Central Electric Railway Association at Toledo, Ohio.

ing in Fig. 1 is operating at its normal line voltage and that all surfaces are dry and clean. If properly designed for this voltage the electrostatic field about the different shells will be too weak to break down the air, hence no brush discharge or "static" will be in evidence. Let the potential be increased and as the electrostatic field becomes more intense the air fails and brush discharge is seen around the different shells near the conductors and at the cemented portions. As the potential is raised stresses form, further increasing the zone of ruptured air until the air near the shells becomes sufficiently conducting. Then an arc forms from shell to shell and finally from the pin to the wire, the arc straightening out to nearly the shortest distance between them, but around the edges of the shells. This, of course, assumes that the insulator is sufficiently strong to withstand the flashing-over voltage without puncturing.

The entire top surface of the same insulator under heavy rainstorm conditions at once becomes wet and the potential of the line is immediately carried to the outer rim of this piece. Some of the rain beats against the lower shells, wetting them, not only where it strikes, but on the under surface of the upper shells, due to spattering. The amount of surface so acted upon depends upon the force and

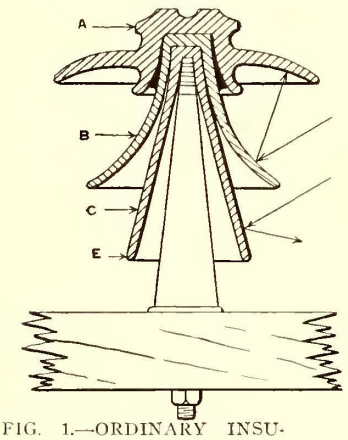


FIG. 1.—ORDINARY INSULATOR UNDER VARYING SERVICE CONDITIONS

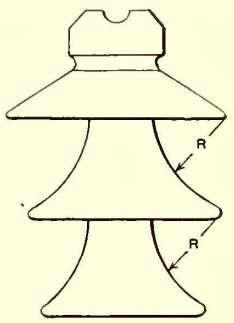


FIG. 2.—IDEAL MULTIPART INSULATOR

angularity with which the rain is driven and upon the design of the shells. Under a severe storm it is quite possible for practically all of the insulator surfaces to become wet and conducting except possibly the under surface of the center or bottom shell. If the insulator is properly mounted with respect to the cross arm and the center shell is correctly formed, this inner surface will remain dry. In the meantime the line potential has followed the wet surfaces of the insulator until it has reached the bottom edge *E* of the center shell, so that the full line potential is now being carried by the center shell alone.

The insulator can now fail in either of two ways: (a) By rupture of the air film adjacent to the inner surface, because of the intense electrostatic field, resulting in an arc from the shell to the pin, or (b) by puncture of the shell itself. In case of the formation of an arc the actual current flowing would be of low value, because of the high resistance of the thin film of pure water forming the conducting surface over the insulator, and this would at once result in a drying action due to the heat from the current. As this drying process continues the resistance becomes too high to permit maintaining the arc and the discharge between line and pin ceases. It is interesting to note that the drying action is maximum at the neck of the smallest shell, for here the current density is highest and therefore the heating effect is greatest. From the foregoing it is evident that the behavior of an insulator under severe weather conditions is of chief concern, and its ability to maintain dry surface under the most trying conditions is a direct measure of its value as an insulator.

The contour of the different pieces has much to do with the wetting of the shells in a storm. The shape of a shell may be such as to deflect the air currents, thereby carrying the rain up into recesses which would otherwise be dry. The flare of the skirt portion of the shells also plays an important part. Referring to Fig. 1 the second shell *B* is flared or curved outward at the bottom, and in a driving rain the drops will be deflected against the underside of the top portion as shown by the arrows because of the curved surface. The third shell *C*, however, is straight, and as the arrows indicate, the raindrops are deflected downward so that the shell above is not spattered.

There are other features which enter into the question of design, however, which make the curved shell particularly advantageous, and it is therefore necessary to regard these different points of merit of the two types carefully in making a choice for any particular design proposition. With a given diameter and height maximum sparking distances between the rim and shell of the adjacent parts can be obtained by using the curved type of shell, but there is a point where this advantage is lost because of spattering the other shells, as already described.

Another advantage possessed by the curved shell is, that for a given potential difference between the surface of the shell and the rim of the shell above, the tendency for discharge between these two points will be considerably lower than with the straight type of shell. It is well known that discharge between a point and a plane surface will take place at a lower potential difference than would be required to cause a discharge from such a point to the concave side of a spherical surface, all points on which are equally distant from the point forming the other electrode. In the case of an insulator (see Fig. 2) the rim of any shell corresponds to the point and the curved shell below to the spherical surface. In many designs the flare of the skirt is determined by a radius swung about the rim of the shell above as a center (see Fig. 2), the curve beginning at the theoretical dry line, based upon the assumption that the rain falls at a 30-deg. angle with the horizontal.

From the foregoing it would appear that the ideal multipart insulator of the umbrella type should have its center shell so designed that alone it could carry the full line potential for an indefinite period without puncture or arcing over. This condition actually obtains on many insulators for the lower voltages, but it is not always true of those for voltages of 60,000 or more.

An insulator in service acts as a condenser and the electrostatic capacity must be cut down to the lowest possible value to minimize operating troubles. This can be accomplished best by placing a considerable thickness of porcelain between the line and pin. It is important, however, properly to balance the design of a multi-part insulator so as to distribute the potential in such a way that each shell will carry its share of the load. Such an insulator acts as several condensers in series, and the voltage distribution on the different shells will be dependent upon the relative electrostatic capacities of the several condensers formed by the different shells.

It often happens that a single shell is forced to carry a large percentage of this total voltage because of faulty design, causing improper balance of the electrostatic capacity of the several individual shell condensers.

In asking a manufacturer to recommend insulators for a line, therefore, he should be given complete details covering the various points mentioned in order that he may intelligently consider the problem. It is often possible to get a good idea of the troubles to be met in the territory under consideration from other lines already operating in that territory or in the immediate vicinity.

Lightning troubles are not so marked on lines operating at voltages below 30,000, undoubtedly, because the insulation of these lines does not need to be nearly so perfect as for operating voltages of 50,000 or 60,000. With the moderate insulation required for 30,000 volts or less the loss of a static charge from the line would be rapid and this charge would not be built up to excessive values before arcing around the insulator would produce relief in the line. At the same time the line potential would not be high enough to cause the line current to follow, when discharge from line to pin occurs. Numerous methods have been devised and tried out for protecting the high-tension lines against atmospheric electrical disturbances, among which are included various types of lightning arresters and different schemes for shielding the lines by means of lightning rods on the poles and wires strung parallel to the lines and grounded at frequent intervals. This subject has been given considerable thought and study during the past two or three years, and from various reports submitted by those who have carefully watched the operation of the different devices, it would seem that the use of grounded wires placed above the transmission lines greatly minimizes insulator troubles from lightning.

(Note: In the May, 1908, Proceedings of the American Institute of Electrical Engineers will be found two excellent articles on this subject, one by J. F. Vaughn and the other by N. J. Neall.)

Measurement of the potential applied at the test racks is commonly made by the spark-gap method, the needle points on the spark-gap apparatus being set to discharge when the desired voltage is reached.

For low-voltage lines, where the insulators are small and the spans comparatively short, bringing light mechanical loads upon the pins, a good quality locust or oak pin thoroughly treated with oil or parraffine meets all requirements cheaply and effectively. It must, of course, be remembered that to get satisfactory service from a wood insulator pin, the design of the insulator itself must be such as to insure against burning the pin from brush discharge or leakage. For insulators of the larger type, where the pin must extend a considerable distance above the cross-arm, thereby placing a more severe load upon the pin, and where this load is further increased because of the use of longer spans, a metal pin should by all means be employed.

It is at once evident that dependence cannot be placed upon the insulation afforded by a wood pin, and therefore in selecting an insulator one should be chosen which under the most severe conditions will absolutely maintain the insulation of the line when the pin is a good conductor and thoroughly grounded.

It would seem that for pressures in excess of 75,000 volts it will be necessary to depart from the so-called umbrella type of insulator, as the insulator would be very tall and heavy, greatly complicating the mechanical problems of line construction, and at the same time the cost of such insulators would be excessive. The schemes now being tried for these high voltages involve the use of a suspended insulator, each insulator being made up of several units. Several advantages are claimed, among which are the separation of the insulator support and the conductor by a considerable thickness of porcelain, the reduction of the mechanical loads upon the supporting structure and upon the insulator itself and the possibility of replacing one or more broken sections without having to discard the entire insulator. As street and interurban railway work does not at this time contemplate the use of these high voltages, this type of insulator has not been considered in this discussion.

The following suggestions to aid in drawing insulator specifications are offered with an idea of making them cover all general insulator requirements. These specifications are made so that they can be commercially met by the manufacturer and at the same time insulators made in strict accordance with them should fulfil the requirements perfectly under all ordinary conditions.

SPECIFICATIONS

Insulators should be made of a grade of dense porcelain best suited for high-tension insulators and the burning should be so done as to insure thorough vitrification of the pieces without overfiring.

The porcelain body should be practically non-absorbent and pieces broken from any insulator should not show an absorption in excess of one-tenth of 1 per cent. The absorption test should be made by thoroughly drying the pieces in an oven before the first weighing; they should then be immersed in water for 48 hours, after which all surfaces should be carefully dried and a second weighing made. The increase in weight expressed as a percentage of the original weight will show the absorption.

All insulators should be given a dark brown glaze (or other color required) on all exposed surfaces. Those surfaces which are cemented together and those upon which the insulator rests in burning not to be glazed. The pin hole should be left unglazed if the insulator is to be cemented to an iron pin.

All cemented joints should be carefully made with neat Portland cement of the best quality and the assembly should be so done as to leave no hollow spaces or voids between the cemented surfaces. In assembling the cement should be mixed only as needed and in the portions of 80 per cent cement and 20 per cent water, and no cement which has been mixed for more than 30 minutes should be used. The assembling should be so done as to bring all of the various parts in correct alignment.

All parts should be carefully inspected as they come from the kilns and any which are chipped or cracked, particularly at the surface where the cells are cemented together, should be discarded. Badly warped or distorted pieces and those having checks of appreciable depth at any points on the surface should be rejected.

All parts should be tested for one minute at full line potential except in cases where the design of the piece will not permit reaching this voltage without flashing over. In such cases the test voltage should be within 5000 volts of the flash-over value.

Each assembled insulator should be tested to at least double the full line voltage for a period of not less than three minutes.

The insulator should be capable of withstanding a rain test at twice the operating voltage for a period of 10 minutes without flashing over or injury to the insulator, the precipitation being at the rate of 1¼ in. in five minutes and directed against the insulator in a fine spray at 45 deg.

All insulators to be operated at 23,000 volts or more should be tested with at least 1 kw of available generator capacity for each insulator under test.

In the part tests each piece should be immersed in water to completely cover the cementing surface and the inside should be filled with water to practically the same depth, and the potential should be applied to the two wet surfaces. In testing assembled insulators, they should be inverted with the heads immersed to the tire wire groove, the pin hole being filled with water to the full depth of the thread.

In conclusion, it is urged that the policy be a liberal one when it comes to the expenditures of the transmission line. As a general thing no expense or trouble is spared in making the power plant equipment complete and in fully safeguarding this equipment. On the other hand, the transmission line, which in the event of failure for any cause

makes the power house entirely useless until the line trouble is corrected, is often provided for last, the expense being cut down to the lowest possible figure. Such a system is bound to have line troubles causing heavy expense for repairs and losses due to interrupted service. These losses could be almost entirely prevented by the use of better insulators and proper line protection at the outset, and the cost of this insurance would be less in amount than the total for losses due to interruptions during a few months of operation.

EMPLOYEES' MUTUAL BENEFIT ASSOCIATION *

BY H. E. VORDERMARK,
Auditor of the Fort Wayne & Wabash Valley Traction Company.

The idea of a relief department or a mutual benefit association among employees is not a new one, as such organizations have been in existence for over a score of years on various railroad systems, particularly the Pennsylvania lines and the Baltimore & Ohio. Their first organization was induced by the necessity of some relief for the unfortunate fellow employee whose ability to earn his usual wages had been temporarily interfered with because of accident or illness. The old and still much used method of providing such relief by "passing around the hat" is not only embarrassing to the impoverished employee, but a very great burden upon his friends, who take it upon themselves to collect funds for their sick friend and his dependents.

Having observed for nine years the advantages of the relief department of the Pennsylvania Railroad, and being convinced as to its practicability, the general manager of the Ft. Wayne & Wabash Valley Traction Company introduced a discussion on the subject at one of the twice-a-month meetings of its Officers' Association with the result that a committee of three was appointed with the writer as chairman to study the different kinds of relief departments and benefit associations in operation on steam and electric railroad properties, on which to base recommendations looking to the establishment of such an association by the Ft. Wayne & Wabash Valley Traction Company.

This committee of the Officers' Association collected data from every street railway company in the United States and Canada which had an organization of this kind among its employees and also from the Pennsylvania and Baltimore & Ohio railroads. A great variation was found not only in monthly dues paid and benefits derived, but also in the method of dues collection and management. The result of the committee's studies was a unanimous recommendation for such a society. To start the same, a charter was drawn up, as follows:

CHARTER MEMBERS EMPLOYEES' MUTUAL BENEFIT ASSOCIATION, FORT WAYNE & WABASH VALLEY TRACTION COMPANY.

Whereas, The employees of the Fort Wayne & Wabash Valley Traction Company are about to organize an employees' mutual benefit association, the object of which shall be the relief of its members in case of sickness, injury or disability, and in case of death the payment of definite amounts to beneficiaries, and also to promote social relations and good fellowship among its members, and

Whereas, The Fort Wayne & Wabash Valley Traction Company, to further the interests of said employees' mutual benefit association has set aside the sum of $..... as voluntary contributions toward this cause, and does propose to further aid the same from time to time as it may become necessary, and also further proposes to have its officers and accountants devote such time at the expense of the company as may be necessary to conduct the business of said employees' mutual benefit association without further expense to the association, and

Whereas, It is proposed that prior to a definite organization a full list of two hundred employees shall have subscribed to the constitution and agreements attached hereto, and thereby become charter members of this organization,

Therefore, We, the undersigned officers and employees of the Fort Wayne & Wabash Valley Traction Company, hereby subscribe our several individual names as charter members for the purpose of organizing the employees' mutual benefit association of the Fort Wayne & Wabash Valley Traction Company, and upon the signature of 200 of such officers and employees to have it understood and known that we are thereafter organized as members of the employees' mutual benefit association of the Fort Wayne & Wabash Valley Traction Company, and agree to abide by the constitution and by-laws appended hereto, and made part of this proposal.

This paper was started for signature among the employees about June 1, 1907, and the date of Oct. 1 fixed for the time of closing the charter and starting the association. At this time 340 names had been signed to the charter paper and the association thus fairly launched.

The management of the affairs of the association was vested in a board of trustees consisting of a chairman and six members. The president of the association shall be chairman of the board of trustees and appoint three members of the board from the Officers' Association of the Ft. Wayne & Wabash Valley Traction Company. The other three members of the board are chosen every November, by ballot, to serve one year from the first day of January next succeeding, and are elected from the members of the Relief Association. The general manager of the company is ex-officio president of the association. Our present board consists of a conductor representing the Ft. Wayne city division, a motorman representing the Interurban division and a motorman representing the LaFayette division, in addition to the general manager and three members of the Officers' Association. It is proposed to increase this board of 11 to give other departments representation.

It was deemed advisable to be conservative in respect to dues and benefits, the result being that dues were fixed at $0.50 per month, with benefits of $0.75 for each day, when disabled by accident. The period of disablement was limited to 120 days in any one year, and $0.50 for each day when disabled by sickness, after the first seven days, and for a period not exceeding 120 days in any one year. In case of a member's death a payment of $100 is made to the person or persons designated in the application for membership to receive the same. Dues are paid in advance by deducting them from the last pay check of each month, so that there is no trouble in making collections.

The membership is limited to employees of the Ft. Wayne & Wabash Valley Traction Company over 16 and under 45 years of age, both inclusive, who shall have been in the service of said company for at least one month. The entire management is in the hands of the board of trustees, which meets regularly on the second Monday of each month, and whose officers are a president, vice-president, treasurer and secretary. No meetings of the association members at large are deemed advisable, as they are so widely scattered along the lines of the Ft. Wayne & Wabash Valley Traction Company.

It is the intention of the railway company that every cent paid into the association as dues shall be expended on account of relief in sick, accident and death benefits. Hence no charges are made against the association for clerical services, printing, supplies or wages of men who have been relieved to attend meetings of the trustees.

Besides this relief work, and in connection with the association, reading, card and pool rooms have been established at such division points as Ft. Wayne, Huntington, Logans-

*Abstract of paper presented before the May 26 meeting of the Central Electric Railway Association at Toledo, Ohio.

port and LaFayette, to which rooms all of the members of the association are cordially welcomed and which are always occupied and apparently appreciated. In addition to monthly magazines subscribed for by the company, a library has been started which consists of about 260 volumes.

As the association was started in October, 1907, it has been in existence only eight months. Its membership has increased from 340 to 500 members, and it has paid out about $900 for sick, accident and death benefits.

The blanks submitted are used to carry on the work of the association. They are entitled: Preliminary notice of application for membership, application for membership, notice of rejection, notice of election to membership, member's certificate book containing constitution and by-laws of the association, preliminary notice of disablement, disablement notice, certificate of attending physician, return to duty card, data for death benefit and release on account of death benefit.

EMPLOYEES' MUTUAL BENEFIT ASSOCIATION
Of The Fort Wayne & Wabash Valley Traction Company
RETURN TO DUTY CARD

.....19....

.....who has been disabled since
Name of Member recovered

.....19.., recovered on.....19.., and will be able to return to duty on.....19..
First day able to return to duty.

.....
Medical Examiner.

The above named reported for duty on .....19..

.....
Signature of person to whom the member reports for duty

The Medical Examiner will forward this part direct to the person to whom the member reports for duty, who will return the same to the Medical Examiner, without unnecessary delay, and not later than the Second day following its receipt.

The issue of Order for Benefits depends upon the prompt handling of this Card.

RETURN TO DUTY CARD

EMPLOYEES' MUTUAL BENEFIT ASSOCIATION
Of The Fort Wayne & Wabash Valley Traction Company
CERTIFICATE OF ATTENDING PHYSICIAN

Case.....
(Name of Member.)
.....19.....
(Physician's Residence.)

THIS IS TO CERTIFY, That.....was within my *personal knowledge* during the period named, entirely unfit for the performance of manual lakor, or of duty in ordinary business occupations, and had not at any time been so employed, from.....19....to.....19...., and that during all of said period he was under my professional treatment. Case first seen by me.....19..... Subsequently seen by me.....
.....
(Here Insert the Several Dates.)
Last time seen by me.....19..... His disablement was the result of.....as follows:
("Injury" or "Sickness.")
(If disabled from sickness, give diagnosis below in full. if from injury, give objective symptoms in detail.)
.....
.....
(Attending Physician)

Personally appeared before me, a.....in and for the county of.....and State of..... the above named.....,who being duly
(Attending Physician.)
sworn, deposes and says that the foregoing statement is true, as he has reason to know from *personal knowledge*.

Sworn to and subscribed before me this.....day of .....19.....

.....

N. B. The attending physician is to make oath only to *Facts within his personal knowledge*.

Certificate of Attending Physician

Employees' Mutual Benefit Association of The Fort Wayne & Wabash Valley Traction Company
NOTICE OF DISABLEMENT

DEPT.....

Notice sent from .....on.....190.....
Name and Occupation .....
Div. Dept. and Location .....
Cert. No. ..... Reported by the Member .....190.. First day full time not made .....
Acc. or Sick .....Residence.....
Signature and Title of Person Reporting .....

No. 1 Forward to Secretary of Employees' Mutual Benefit Association
Duplicate Sent to Medical Examiner, Dr.....

NOTICE OF DISABLEMENT

Statements Made to the Medical Examiner by the Applicant

What is your name (in full) and residence?.....
When were you born?.....
Since what date have you been in continuous service?.....
Have you ever been examined for employment in the service? If so, where and when?.....
Have you been a member of the Employees' Mutual Benefit Association before?.....
Are you single or married?.....
What is the name of your wife (or husband)?.....
What are the names and ages of your children, and of grand-children whose parents are not living? (Give names of living children first; following this, give names of children of deceased children, each respectively in the following form: "Children of....., deceased, etc.")
What are the names of your parents: If either not living note "deceased," and state age at, and cause of, death?.....
What are the names and ages of your brothers and sisters now living?.....
.....
.....day of.....1... Age.....years
Since.....1.....
.....
.....
Father.....
.....
Mother.....
.....

STATEMENTS MADE TO THE MEDICAL EXAMINER BY THE APPLICANT

Medical Examiner's Certificate

Name of applicant (Christian name, or names in full).....
Sex.....Intelligence.....
General Development. Height. Weight. Chest Measure. Abdominal measure, erect.....
Color of hair. Complexion. Eyes. Special senses.....
Head and face. Abdomen and groins. Spine and joints. General surface.
Heart { a. Number and character of pulse beats..... b. Where apex beats ..... c. Auscultation..... d. Blood-Vessels.....
Lungs { a. Number and character of respirations..... b. Percussion ..... c. Ausculation.....
Kidneys and Bladder .....
Remarks: Cachexiae, temperate, etc.....
Opinion of applicant's statements after physical examination .....
Opinion as to applicant's chance of longevity.....
Vaccinated by Medical Examiner (yes or no).....
If applicant is physically disqualified, state cause.....
.....
.....
.....feet.....inches
.....lbs.....
.....inches (full inspiration)
.....inches (full expiration) .....inches
.....
.....
.....

I Certify, That I have carefully examined the applicant named herein, and that the above is a correct description of his physical condition, and I hereby recommend the ‡.....approval of this application.
Place and date of examination.....190..
‡If applicant is physically disqualified write "dis" before approval.
.....Medical Examiner.

° Note answer below each ailment.
† Note "yes" or "no," and if "yes" give full particulars on right hand back of application.

Medical Examiner's Certificate

THE MERIT SYSTEM OF DISCIPLINE*

BY FRANK HARDY
Superintendent of the Fort Wayne & Wabash Valley Traction Company

The merit system consists of a debit and credit account with each employee kept in a book ruled for that purpose or in alphabetical files. An employee's violation of rules is charged against him by a certain number of demerit marks, the number depending upon the seriousness of the offense. As an offset against these demerit marks, he is entitled to receive a certain number of merit marks for acts considered worthy of recognition or for a clear record for one month. Every six months a cash prize is given to the motorman and conductor having the best record. Employees are allowed to examine their record at any time. When an employee's demerits exceed merits by 100 the employee is discharged.

The objects of the merit system are to avoid a loss of wages by persons employed and suffering to those dependent on their earnings; and to encourage employees in the faithful and intelligent performance of their duties.

The Fort Wayne & Wabash Valley Traction Company has a list of violations of rules and the number of demerits imposed; also a list of meritorious acts with number of merits given for each. This list is posted on all bulletin boards. Employees are notified when they receive merit or demerit marks on a blank form used for this purpose, giving date, time, number of charge, number of merits or demerits given. If necessary a letter is written calling attention to the offense and the course the employee should have followed. When an employee receives a merit and demerit blank this information is posted on all bulletin boards as a notice to trainmen.

We have a merit board or court of inquiry, which meets once a week, composed of the general manager, superintendent of transportation and all local superintendents. Its purpose is to investigate, produce evidence and pass judgment on all violations of rules or meritorious acts. The minutes of the meetings of the merit board are kept as a part of the records of the merit system.

Our reason for having a list of violations and meritorious acts open to employees is, that when a notice is posted that an employee has received marks for a violation, no one but the man receiving them knows to whom they apply. The employee who received marks will not be humiliated before the other employees, but each will know that some employee has received marks and the reason therefor. This will not only discipline the man in question, but also benefit the others by warning them of the offense and causing them to guard against it.

If the company makes a new ruling attention can be called to the fact very quickly by showing and imposing demerit marks on its violation. If the list of merits and demerits is always before an employee it will aid him in his work by showing him right from wrong.

The merit board meets on each Monday to act on all cases of the preceding week. The advantage of such a board is very evident. Many times the higher official insists on hiring the employees, afraid to risk the judgment of the lower officials, yet he will place this employee under a petty, perhaps tyrannical, officer. At least the latter will be partial, for any one in charge of men will have his likes and dislikes and favorites will receive more than their due. However impartially the official may try to administer discipline, his reasoning of the case will be in behalf of the favorites, although he may be unconscious of the fact. If the lower official makes a grave mistake in discipline and his superior corrects it the subordinate loses prestige with the employee and discipline has been destroyed instead of created. How often the general manager believes that the motorman, conductor or other employee is right, yet cannot take his side openly, for if he does the superintendent completely loses control of the men, as all cases of discipline would then be appealed to the general manager. The merit board overcomes this, as all employees are permitted to show in writing why they should not receive demerits and may ask the merit board to reconsider if dissatisfied with its ruling. Another advantage is that the men on all divisions receive the same treatment. A great many times a superintendent brings to notice violations on other divisions which have been overlooked. In this way the service on each division receives the benefit of the experience, knowledge and the attention of all the division superintendents.

Some of the advantages of the merit system are that it is fair both to employees and company; points out the right from wrong; is an incentive to do right; picks out the good men from the bad; and if handled carefully will defeat unionism, for unionism comes from the agitation of wrongs real and imaginary. If men believe that they are receiving just treatment; that their record is what they make it and that their services are appreciated, it is hard to produce ill-feeling or friction between employer and employee. The system teaches trainmen to be courteous, accommodating and careful and creates a better feeling between management and employees. Under the old system if a man is to be disciplined he is generally excused for a certain length of time. This means so many dollars lost to him and his family. It is true that this will touch his feelings, but nine cases in ten he is farther away from the management and his disposition toward the company is an ill one. If this same man does a meritorious act which saves the company hundreds of dollars, the company cannot reward him by giving him a hundred dollars. All it can do is to thank him. In other words, under the old methods of discipline the employee gives dollars for thanks, which is not a fair exchange. Under the merit system the employee gets merits for thanks and demerits for discipline, which is a fair exchange.

The story of discipline is an old one and perhaps this is why it is often considered lightly. Very few operators can say they are absolutely satisfied with their system of discipline. Under the old method men were handled with varied success owing to the fact that some operators gave discipline much thought and careful attention, while others paid little attention to the subject. The same is true of the merit system: if it is put in use and then expected to run itself without a thought or without careful supervision, it will fail. Most cases of failure can be traced to the fact that it has not had proper attention and that discipline has been administered by an individual instead of a merit board.

This system was first tried on the interurban division of this company and was put into effect on May 1, 1907. It has proved such a success that it was adopted for all of the city systems on Jan. 15, 1908, after which date all train and car men on all divisions were subject to its control.

The Superintendents' Association was formed Dec. 30, 1907, and when the merit system was adopted on Jan. 15, it was decided to have the Superintendents' Association form the merit board for passing on all cases subject to merits and demerits. The following bulletin, which is self-explanatory, was issued at the time this system was put into effect:

*Abstract of paper read before the Toledo meeting of the Central Electric Railway Association May 26, 1908.

NOTICE.

Better to promote the interests of this company and employees and at the same time discipline such employees on their individual performance, a change will be made in the method of discipline on Jan. 15, 1908.

First. The new method of discipline is what is known as the merit system and is introduced with the belief that it will be a benefit and that it will meet with the approval and cordial co-operation of all concerned.

Second. The objects to be obtained under the new system are: A. To avoid a loss of wages by persons employed and suffering to those dependent upon their earnings. B. To stimulate and encourage employees in the faithful and intelligent performance of their duties.

Third. Under this system a certain number of marks will be entered against the record of each employee for violation of rules, etc., instead of suspension as formerly. The discipline committee of the superintendents' association will administer such discipline. This discipline committee to meet on Monday of each week at the office of the superintendent of transportation.

Fourth. Where demerits are given for unsatisfactory service, it is logical that merits should be given for good service and merit marks will be credited on an employee's record whenever possible.

Fifth. There will be a motorman's prize of $25 and a conductor's prize of $25 for the motorman and conductor having the best record at the end of six months. If more than one conductor or motorman have an equally good record at the end of six months, the prize will be divided equally among them. The first prizes will be awarded on July 1, 1908.

Sixth. Each employee will be notified in writing of any favorable or unfavorable entry against his record, the reasons therefore, and the number of marks given. If any employee feels that he has been unjustly awarded demerits he will be given an opportunity to present his case in writing to the discipline committee at its next regular meeting, at which time his case will be reconsidered and a correction of record made if considered necessary and proper.

Seventh. Whenever merit or demerit marks are given, a notice will be posted stating how many marks have been given and on what charge, but omitting name, train or car number.

Eighth. When an employee's demerits have reached the number of 90, he shall be called in by the superintendent, duly cautioned and advised that when his demerits amount to 100 he will be dismissed from the service.

Ninth. Employees will be permitted to examine their record at any time upon application, but no employee shall be permitted to see the record of any other employee.

Tenth.—All employees affected by this system of discipline shall start on an even basis, that is, without merits or demerits.

APPROVED:

General Manager. Supt. Transportation. Local Supt.

MEETING OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

The Central Electric Railway Association held its regular meeting, the last until fall, at the Boody House, Toledo, Ohio, on Tuesday, May 26. The date for the meeting was changed to Tuesday from the regular time of Thursday in order to avoid conflict with the duties of members incident to the expected heavy traffic on Decoration Day.

After President F. D. Carpenter called the meeting to order and the minutes of the previous meeting were read, Mr. Carpenter, as chairman of the committee of Ohio railway officials appointed to consider the subject of uniform rules, reported progress. The committee is cooperating with a committee of officials of electric railways in Indiana, appointed at a conference with the Indiana Railroad Commission, to formulate uniform rules for the operation of trains and to govern maintenance of way employees. The latter committee has sent rules on these subjects to the companies in Indiana for consideration. These rules will be taken up at another conference with the members of the Indiana Commission.

COMMITTEE ON CLAIMS

The report of the committee on claims, presented by Ellis C. Carpenter, the chairman, outlined a systematic method of preserving in the office of the secretary of the association an index record of claimants for damages similar to that advocated by the American Street & Interurban Railway Claim Agents' Association. An abstract of the recommendations of the committee, which were adopted by the association, follows:

That cards be printed for the use of the various companies, showing name, residence and a short personal description of claimant, together with the name of his attorney and attending physician, these cards to be used by the various companies in reporting claimants who may have a claim of $100 or over, and others if there should be any reason to think they should be reported; the claim departments of the various companies to forward these cards to the secretary of the Central Electric Railway Association, to be kept in his office.

When a claim is made against any company, about which information is desired, the company will communicate with the secretary of the association. If there is any record of the claimant on file the secretary will notify the inquiring company, to whom it may apply for additional information.

Should the secretary find that he has more than one report upon a particular person with the same or similar name, he will immediately notify each company making the report.

This will, in effect, make the secretary's office a clearing house for information regarding claimants and the more nearly complete his records can be made the more benefit they will be, for none of us knows just when a fake claim is to be made.

We further recommend that this plan be enlarged upon by permitting other corporations, not members of the association, to become associate members for the purpose of reporting and securing information regarding claims and claimants. A small fee should be paid by the associate members to cover expenses incident to this work.

We would further recommend that the claim department of each company report to the secretary all claimants since Jan. 1, 1907.

MILEAGE BOOK

W. S. Whitney, of the Ohio Electric Railway, in speaking of the report of the committee appointed at the previous meeting to consider the question of the existing mileage book, said that the new book which the committee recommends will provide for transportation for 1000 miles for $17.50, redemption of any unused portion to be made on agreement for deduction at the rate of 2 cents a mile for the used portion. The report of the committee, which provides for the issue of "Central Electric Traffic Association Interchangeable Mileage Tickets," was adopted. The committee was continued, with instructions to cooperate with the chairman of the Traffic Association in settlement of the details of form and color of book to be used. Among the conditions on which the mileage book will be issued, in accordance with the report of the committee, are the following:

It is good for bearer or bearer and party.

It is limited to one year. No detachment will be made for less than 5 miles. One hundred and fifty pounds of legal baggage, not exceeding $100 in value, will be checked free on this ticket for each adult passenger.

NEW MEMBERS

The following new members were elected: Charles H. Hubbell, acting auditor Toledo & Chicago Interurban Railway; A. J. Purinton, general manager Toledo & Chicago Interurban Railway; George S. Henry, traffic manager Indianapolis & Cincinnati Traction Company; Stanley W. Midgley, Curtain Supply Company, Chicago; G. F. Faber, general superintendent Western Ohio Railway; Charles E. Sawtelle, Tool Steel Motor Gear & Pinion Company, Cin-

cinnati; W. K. Morley, general manager Grand Rapids, Grand Haven & Muskegon Railway; T. J. Hayden, Rand, McNally & Company, Chicago; Arthur E. Duclos, Massachusetts Chemical Company, Chicago; E. B. Lincoln, general manager Muncie & Portland Traction Company.

DISCUSSION ON MR. DENNEEN'S PAPER

Considerable discussion followed the reading by Francis S. Denneen, Ohio Brass Company, of his paper on "Insulation of High Tension Transmission Lines," which is abstracted elsewhere in this issue.

G. H. Kelsay, superintendent of power of the Indiana Union Traction Company, inquired whether the same insulator should be specified for iron and wood pins.

Mr. Denneen answered that he would specify an insulator suitable for an iron pin whether it was to be used for iron or wood. In case of puncture the discharge would probably be heavy enough to show immediately. The heat generated would probably cause the insulator to break or to fly into pieces and the defect would be apparent to an inspector. Mr. Denneen had heard of very few cases of puncture. Where an insulator failed it was usually by discharge down one side which would shatter the insulator. Mr. Denneen explained how punctures were produced. The dielectric has capacity to withstand a certain shock or blow and if the wave of current is abrupt or heavy the dielectric cannot adjust itself and a puncture occurs. Where the rise in current is slow the current will flash over rather than puncture.

F. J. J. Sloat, of the Ohio Electric Railway, asked whether the resistance of the insulator would be reduced if the glaze were left off the top. Mr Denneen answered that in good porcelain there is no absorption of moisture and hence the exposed surface is not a source of danger. Red ink is used as a test for absorption.

REPORT OF STANDARDIZATION COMMITTEE

The report of the standardization committee was read by the chairman, R. C. Taylor, of the Indiana Union Traction Company. The report states in part:

At a meeting of the standardization committee, it was the opinion of the members present that this committee should be enlarged, as it has been difficult in the past to get a majority of the committee together, and in consequence the work of the committee during the current year has not been as effective as it should have been; and we therefore respectfully suggest to the president that the following names be added to this committee: Ira Schofield, Toledo & Western Railroad; W. C. Ralston, Cleveland, Southwestern & Columbus Railway; Lee W. Jacques, Fort Wayne & Wabash Valley Traction Company; H. D. Murdock, Indianapolis & Louisville Traction Company.

In order to facilitate the work of this committee, it was further decided to hold regular meetings on the third Wednesday of each month alternately at the nearest accessible location to the cities at which the various members of the committee are located.

It is urged on the managers to see that their subordinates interested in this work attend every one of these meetings, as we consider that the work accomplished in the past, and the still greater work to do, is of sufficient importance to warrant the most earnest and persistent work on the part of all the members of the committee.

It was further decided by the members of the committee present that the next subjects for consideration and recommendation are: Standard height of draw bar for interurban cars, and standard form of car coupler. These two subjects require the settlement of standard height of car floor and standard height of bumper.

In connection with this subject the committee has in its possession, and has examined, drawings very kindly submitted by the McConway & Torley Company, Pittsburg, manufacturers of the Janney M. C. B. coupler; W. T. Van Dorn Company, Chicago, manufacturers of the Van Dorn draw bar and coupler; the Ohio Brass Company, representing the Tomlinson automatic car coupler; Washburn Steel Castings & Coupler Company, Minneapolis, manufacturers of the Washburn automatic traction coupler.

A modification of the M. C. B. coupler is being developed by Mr. Gibbs, one of the members of your committee, and it has been decided before making definite recommendation as to a standard form of car coupler for interurban cars, to issue a data sheet to the members of this association to be filled in and sent to the committee, and it is hoped that a ready and prompt response will be made to these inquiries. When this information has been received and tabulated an opportunity will be given the manufacturers to present the merits of their couplers to the committee. It is the wish of the members of the committee present to solicit the hearty co-operation of the members of the association in its work, which, as we all realize, is of such far-reaching importance to the association.

DISCUSSION OF MR. HARDY'S PAPER

The paper on "Merit and Demerit System of Discipline," published elsewhere in this issue, was read by the author, Frank Hardy, superintendent of the Ft. Wayne & Wabash Valley Traction Company.

L. K. Burge, general superintendent of the Lake Shore Electric Railway, asked how much time and money were required to keep the records necessitated by the system.

Mr. Hardy replied that the merit board had greatly simplified its work and that the clerical work was not excessive. The minutes of the meetings, which seldom last over two hours, are taken by a stenographer. A code is used in making the entries of records.

H. A. Nicholl, of the Indiana Union Traction Company, asked whether trainmen appear in person before the board.

Mr. Hardy said that after the board considered a case the employee could appeal in writing, and that in only one instance since that system was started had a man appeared personally before the board.

W. R. W. Griffin, general superintendent Rochester Railway, of Rochester, N. Y., said that that company had applied the merit system to 1100 men for three years. Specific penalties are provided for almost every imaginable offense. When discipline is demanded cases are reported to the superintendent of transportation, who determines the number of demerits to be imposed, if any are required. Notice of demerits is sent to the employee, who is obliged to acknowledge receipt and is allowed 10 days in which to make a reply. On notice of appeal the company investigates the case. Only cases of discharge are carried past the superintendent of transportation and in such instances the executive board of the union directs the appeal. Bulletins are posted at the end of each month giving the causes of demerits and the total number of demerits charged in each class, but names of employees are not published in these lists. Notice of the standing of each man is sent to him every six months. The entire time of one person is required to keep the records, and part of the time of another. An advantage of the system is that the heads of departments are not called upon to spend a great deal of time in interviews with employees.

C. D. Emmons, general manager of the Ft. Wayne & Wabash Valley Traction Company, said that the local newspapers had published accounts of the system and that the public is so much interested in its operation that the people report cases. In illustration of the statement that the system enables the company to recognize meritorious acts Mr. Emmons said that a motorman on an interurban car noticed a child approaching the track. The child started across and the motorman stopped his train just as it reached the child. He believes that fair judgment of the value of employees is gained by this method.

OTHER PAPERS READ

The papers by John F. Ohmer, president Ohmer Fare Register Company, on "Tickets," and by H. E. Vordemark, auditor Ft. Wayne & Wabash Valley Traction Company, on "Employees' Mutual Benefit Association," were then read. They are printed elsewhere in this issue.

Several of the members went to see a car of the Toledo Urban & Interurban Railway which is equipped with the latest type of truck manufactured by the Curtis Motor Truck Company, type J 6984. Six trucks of this type have been built by the Curtis Motor Truck Company for this road. The truck attracted much attention.

The next meeting will be held at Indianapolis on September 24.

CENTRAL ELECTRIC TRAFFIC ASSOCIATION

Announcement is made that the following companies have agreed to meet the expense of establishing the Central Electric Traffic Association, beginning on June 1: Western Ohio Railway, Lima, Ohio; Columbus, Delaware & Marion Railway, Columbus, Ohio; Columbus, Marion & Bucyrus Railway, Delaware, Ohio; Indiana Union Traction Company, Anderson, Ind.; Chicago, South Bend & Northern Indiana Railway, South Bend, Ind.; Ft. Wayne & Wabash Valley Traction Company, Ft. Wayne, Ind.; Ft. Wayne & Springfield Railway, Decatur, Ind.

HOW BEST TO MAINTAIN TRACK ON A NEW GRADE*

BY WILLIAM SMITH, Section Foreman

One of the problems in track construction is the best method of maintaining tracks on a new grade. The grade should be solid and well drained. If possible it should have been in place one year. The foundation of a fill should be so wide that it can be solidly packed by driving over it.

The cuts should be wide enough to allow a sufficient ditch on either side to carry all surface water. If it is not possible to maintain open ditches, drain tile should be used, as the surface of the track depends "wholly upon the solidity of the subgrade." All persons having charge of tracks should realize that the first thing to do is to dig ditches, and the second is, to dig them deeper. A ditch 1 ft. deep makes your track 1 ft. out of water, and 2 ft. deep 1 ft. more out of water. All springs should be tiled.

In laying track on new grade nothing but the best timber should be considered good enough for ties. The strain on the ties on new grade is 50 per cent greater than on old grades, as it is an impossibility to maintain the track in a perfect condition, and every jolt or side swing of a car causes extra strain on the spikes. Therefore, soft ties have no place in a track on a new grade where high speed is maintained. If possible use old rail on new grades for 18 months to 2 years, then replace it with new steel. In doing this we would save our new rail and could maintain a much smoother track, as the old rail would prevent surface bends.

After the grade I consider the ballast the next important factor. All track should be placed upon at least 10 in. of good clean gravel. Experience teaches me that 6 in. of ballast is not sufficient, particularly on new or soft grades. In soft or springy places it is a very good idea to use cinders for first ballast especially, as it will make a good bed for the top ballast. In all new and soft grades it is best to use a gravel of medium size with not too much sand. Avoid anything like quicksand or loam that washes with any little rain.

No section gang of less than eight men should be expected to keep more than six miles of track in good repair, especially in the spring and summer seasons, on new grade. New track differs from track that has been in service from five to ten years in various ways. There are no tie renewals in the former, but to take the place of tie renewals we have new grades settling continually, and instead of taking up a joint here and maybe a quarter mile yonder, we must raise hundreds of feet of track "out of surface" from 2 in. to 10 in. Then in a couple of weeks we must go over this work again in the same manner. On track where there are a great many fills we must hurry the work at other places to get ready to go to another fill. Our ditches should be kept clean and our banks in repair. We must watch our bridges and culverts, put in sewer tile and do a great deal of outside work, such as assisting in hauling gravel with work train to raise our fills, clean our cuts and haul dirt to widen banks, although dirt taken out of cuts and ditches goes on our banks in fills.

I will not try to tell any foreman how to tamp his track, as almost every one has a system of his own. My plan is this: Tamp each tie firmly from end of tie to a point about 17 in. inside of rail on each side of track, leaving a space in center of ties not firmly tamped, to be filled simply with loose gravel or such ballast as I may be using. As the center of the grade naturally is the most solid, I believe this a good cure for "center-bound" track. After all, no matter how well built the track may be, it takes eternal vigilance, good judgment and plenty of hard work on the part of the section men to keep the track in running order. We must learn our weak places, keep them in mind and watch closely that they do not "get away" from us.

*Abstract of Topic Talk before the May 20 meeting of the Fort Wayne & Wabash Valley Traction Company's Maintenance of Way Department at Logansport, Ind.

CORRESPONDENCE

CHICAGO & NEW YORK AIR LINE

Editors STREET RAILWAY JOURNAL:

In view of the discussion in the daily papers of the plans of the Chicago & New York Air Line, and the association of my name with that project, I should like to state my connection with the company. I was employed simply as chief engineer and general superintendent of the Co-operative Construction Company, to build and equip the line, and have had nothing to do with the financial or promoting end of the proposition, nor have I advised anyone to invest any money in the undertaking.

Five hundred and twenty-six thousand dollars were disbursed through my office at Laporte, Ind. Duplicate monthly statements, vouchers and trial balances covering this amount are in my possession and may be seen by the 15,000 stockholders at their pleasure. For the balance of the vast sum subscribed they must go higher up.

I stopped work on the main line last December for want of funds and resigned soon thereafter. The Laporte offices are closed and a $40,000 equipment is lying idle.

BLAKE A. MAPLEDORAM.

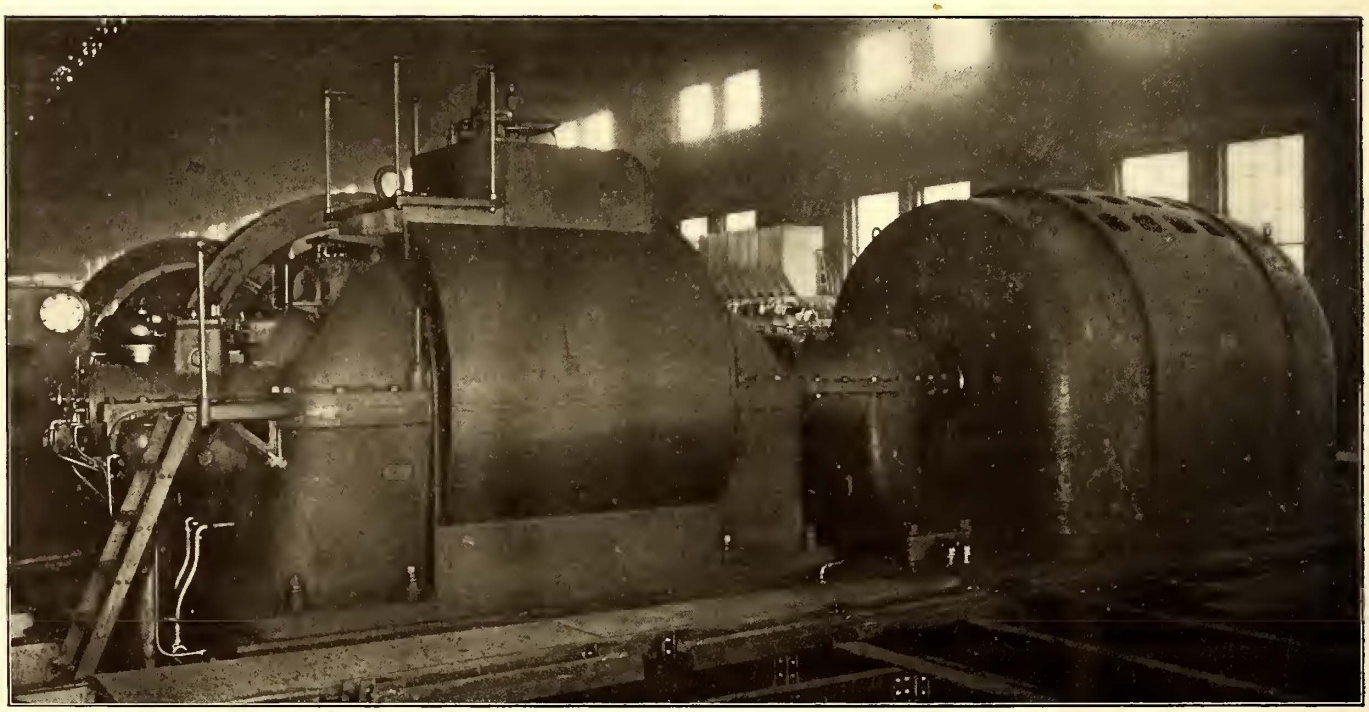
It is reported that the Grand Island Railroad Company has placed a contract with the St. Louis Car Company for several steam motor cars of the Wagenhalls type for operation over the company's St. Joseph-Highland line.

THE NEW DOUBLE-FLOW TURBINES AT THE BRUNOT ISLAND POWER PLANT, PITTSBURG

An unusual opportunity for comparison of the effect of the steam turbine upon power plant development is afforded in the recent increase of capacity of the Brunot Island station of the Pittsburg Railways Company, by the installation of steam turbines of the new double-flow design, recently perfected by the Westinghouse Machine Company. The Brunot Island plant is a mixed service plant, supplying power to both the Pittsburg and Allegheny street railways and also a large part of the lighting for the same district. It was originally designed for eight 1500-kw reciprocating engines, but after the initial installation of five units of this size a change was made to turbines, and in the space left for 4500 kw, 18,000 kw in turbines have been placed. The boiler equipment consisted of 20 Babcock & Wilcox water-tube boilers, each of 500-hp capacity. For the extension, a new boiler house is being erected parallel with the present building and will contain 16 400-hp Babcock & Wilcox water-tube boilers, all equipped with the Westinghouse new model Roney mechanical stokers. The boilers will, like those of the original installation, be arranged in pairs, discharging gases into eight independent stacks of 7 ft. internal diameter and 250 ft. high.

The new turbine equipment consists of one 3000-kw and three 5000-kw double-flow units, which are arranged axially crosswise of the engine room. The 3000-kw unit is in place and has been in operation for nearly one year, while the larger units are in course of erection. The condenser of each unit, which is, together with its pumps and auxiliaries, located in the basement between the turbine foundations, is of the Alberger centrifugal jet type and connects with its turbine through a short direct exhaust duct. The circulating and discharge pumps for each condenser are mounted in tandem in each case and driven by a single Westinghouse compound single-acting engine. A steam-driven, two-stage, dry-air vacuum pump is provided for each unit. The injection water for the condensers is pumped from the intake tunnel, which extends the length of the power house basement at one side of the foundations. The discharge from the condensers is through a similar conduit, parallel to and above the intake tunnel. As the water level in the Ohio River during times of flood is occasionally as much as 28 ft. above the tunnels, special provisions were necessary to guard against flooding the condensers. This has been accomplished by means of an adjustable gate in the intake tunnel leading from the screen house to a large central well in which the water level may be maintained at will at the desired point irrespective of the flood level.

An excellent example of the small foundations required for steam turbines is furnished in the design adopted at Brunot Island; each unit rests upon reinforced concrete plates supported entirely by six reinforced concrete columns, thus giving ample space around the condenser, which could have been placed entirely within the turbine foundations had this been necessary. It may be interesting to state here that the concrete employed to construct a foundation for one of the 1500-kw cross-compound engine units would be sufficient to build the four foundations required by the 18,000 kw in double-flow turbines.



THE NEW DOUBLE-FLOW TURBINE AT THE BRUNOT ISLAND POWER STATION

THE DOUBLE-FLOW TURBINE

The double-flow principle, as embodied in the large machines just installed at Brunot Island, is essentially a modern development brought about entirely by considerations of the requirements of mechanical construction. It is not without precedent, as the original Parsons turbine, constructed in 1880, was of the simple double-flow type, and in modern hydraulic practice the double-flow principle has been very largely employed to produce a rotary element running in perfect axial equilibrium. It has also been used in exhaust steam turbines. In the latter the Westinghouse-Parsons design consists of two identical Parsons turbines placed end to end, taking steam at the center and exhausting at both ends. As the two elements are identical, and the steam flows through them in opposite directions, the axial

thrust of the steam on the blades due to the difference of pressure between the inlet and outlet of each element, is exactly the same in both sections, so that perfect steam balance under all conditions of pressure, vacuum and load, is obtained without the use of dummy or balance pistons. As this low pressure design of turbine is intended to utilize all the exhaust steam from a non-condensing reciprocating engine, it is possible to tie the engine and turbine together electrically, thus making the use of a governor on the low-pressure turbine unnecessary.

In the high-pressure double-flow turbine an impulse wheel of large diameter is also used, and is mounted at the center of the rotor, as shown on this page, and serves in a capacity closely analogous to the high-pressure cylinder of a triple-expansion reciprocating engine. Among the advantages claimed for this arrangement, including the double-flow principle, are:

(1) Large reduction in bulk and in weight of individual parts to be handled in assembling, as a result of increased speed permissible, due to reduced span between bearings; low-pressure section in two parts, opposed in position, resulting both in axial equilibrium and permitting the use of low pressure blading of moderate length.

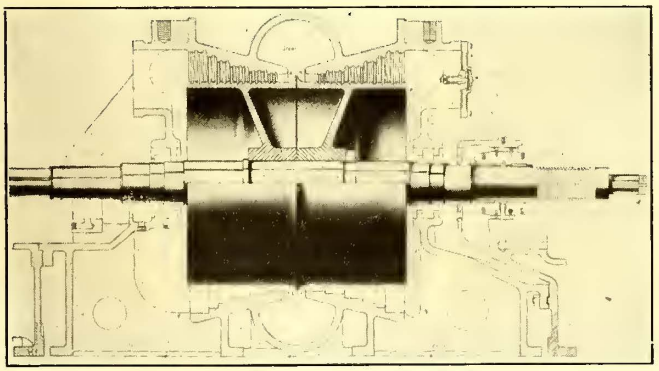
(2) Rotor cylinder not exposed to high-pressure and high-pressure steam; maximum pressure encountered about 75 lb.

(3) Only one balance piston is required—this of moderate diameter.

(4) Impulse element best adapted to high-pressure and superheat and well suited to the dimensional scheme, reducing the shaft length nearly 50 per cent.

(5) Exhaust connections passing through bed plate in two sections; largely reduced in size, due to divided flow.

Steam enters the turbine through a flanged opening in

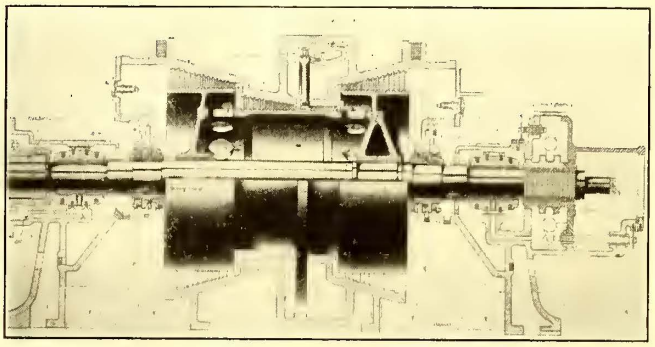


SECTIONAL VIEW OF ORIGINAL LOW-PRESSURE DOUBLE-FLOW DESIGN

the lower half of the casing, from which it is piped directly to nozzle blocks. For convenience in illustration, one of the nozzle blocks is shown in section at the top. The steam expands in suitable nozzles and impinges upon the impulse blades, then enters the impulse wheel chamber, and is distributed evenly around the casing so as to enter the intermediate Parsons section of the turbine, around the entire periphery of the rotor. As in the single-flow turbine, the steam then divides along two separate paths, one-half entering the left section of the low-pressure Parsons blading and the other half passing through the interior of the rotor shell which forms the connecting passage to the remaining low-pressure blading. The steam then passes into the exhaust connections and to the condenser.

As the same pressure exists on both sides of the impulse wheel disk, this is not subjected to any end thrust and requires no balancing. The difference of pressure between the inlet and outlet of the Parsons intermediate section is accurately balanced by a dummy piston of moderate dimensions, located between the impulse wheel and the right-hand low-pressure section. Finally, since the thrusts in the low-pressure sections are in opposite directions and therefore balanced, the entire turbine runs in perfect equilibrium under all conditions of vacuum, pressure and load. To fix accurately the axial position of the rotor, an adjustment bearing of the usual construction is fitted on the right-hand of the shaft; it consists of a number of collars turned in the shaft, into which fit corresponding brass rings fixed in the adjustment blocks. The upper and lower halves of the adjustment bearing may be moved by means of micrometer screws, thus permitting the axial position of the rotor to be accurately known at all times.

The cylinders of the double-flow turbines are made in two



SECTIONAL VIEW OF NEW HIGH-PRESSURE DOUBLE-FLOW TURBINE

parts, the upper and lower halves each being a one-piece casting. The design is symmetrical throughout and devoid of longitudinal flanges except those at the center required for bolting the two parts together. The rotor consists of five cast-steel members mounted on a through shaft, which carries its load at one-third distance from the points of support. This permits a lighter shaft than required for distributed loading and practically eliminates the possibility of deflection. These members are firmly pressed on the shaft and locked at one end to prevent movement, while to the opposite end of the rotor is fitted a bronze bushing surrounding the shaft, permitting it to move axially without appreciable resistance under any differential expansion of shaft and rotor body.

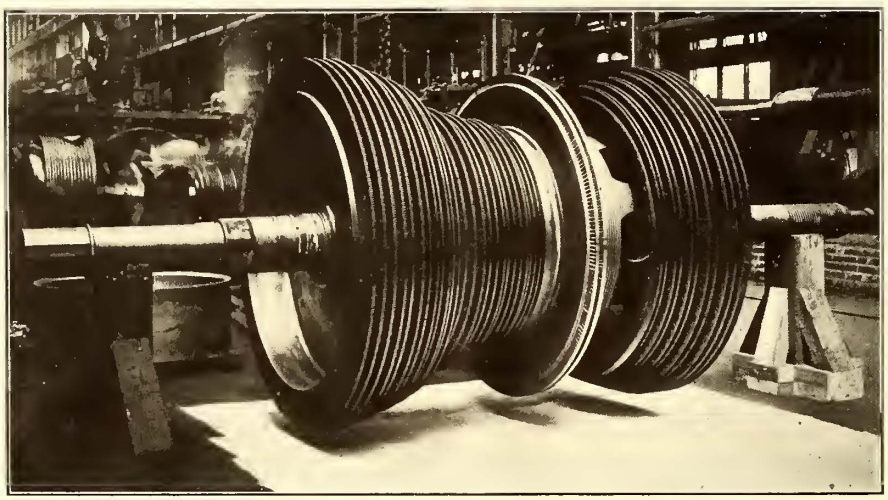
The impulse element consists of a flanged cast-steel disk forced onto the rotor body with a pressed fit and securely keyed. The flange at the base is grooved and forms the dummy or balance piston for the intermediate Parsons section. The nozzle block is an independent casting quite separate from the turbine cylinder and receives steam from the governor valve. This restricts high-pressure and high-temperature to a comparatively small casting, which is free to expand and contract with changes of temperature and may easily be designed with ample strength. As the steam is not expanded in the impulse element to less than about half of the initial pressure, nozzles of divergent bore are unnecessary and simple straight-sided nozzles are used. As in all high-pressure impulse turbines, the nozzle blocks cover but a small portion of the periphery of the impulse wheel, ample space being left around the remaining portion of the wheel to permit the free circulation of steam in all parts of the impulse wheel chamber before entering the Parsons element.

Except for the division of the low-pressure Parsons section into two sections, this part of the turbine is identical with the single-flow construction, consisting of a series of rows of moving and stationary blades increasing in height

into the required finished section without affecting in any to allow for the increased volume of the steam. In the Parsons section, it will be recalled, the velocities from stage to stage remain practically constant. The blades are mounted in grooves cut in the spindle and cylinder body and are securely held in place by spacers or distance-pieces inserted in the grooves between the bases of the blades. In the turbine described the diameters of the low-pressure section are so chosen as to permit the same size blades being used in both intermediate and low-pressure sections, thus simplifying the blading considerably.

As there are a number of improvements in the Westinghouse-Parsons blade construction that are now used on both the single-flow and the double-flow turbines, and have not been previously described, brief reference to them will be of interest.

It was early found that no one metal has all the physical characteristics desirable in a blading material, but recently a special compound metal has been developed which is exclusively used in Westinghouse turbines. It is known as "Monnot," and consists of a steel core covered with a thin copper sheathing chemically welded to the steel so that the blades may be drawn cold from the original ingot



VIEW OF THE ROTOR OF THE NEW 5000-KW DOUBLE-FLOW STEAM TURBINE

way the bond between the copper and steel. Experiments have been shown that pure copper offers the maximum resistance to chemical corrosion, while the steel core affords the strength required.

The original method for reinforcing long blades was by inserting heavy brass wire in slots cut in the entrance edge of the blade, then lacing to the blades by a thin copper wire and rigidly brazing the whole together. Now, comma-shaped holes are punched in the blades at any desired point of reinforcement. The blades are then strung onto a comma-shaped lashing wire through these holes. After the blades have been caulked into the rotor or stator, the tail of the comma lashing wire is sheared over by a tool. This process wedges the tail of the lashing wire into the contracting space between the face and back of the adjacent blades so that it acts as a strut while the lashing wire itself acts as a tie, thus securely interlocking the blades and preventing vibration. Moreover, the short section remaining in the blade after being sheared off acts as a key to prevent a possible broken blade from injuring adjacent rows.

A water-sealed gland is fitted on each end of the turbine shaft where it passes through the exhaust casing. This packing consists of a small centrifugal pump impeller, running in an enclosed chamber, to which water is supplied under a head of about 10 ft., or slightly in excess of the head due to the centrifugal force acting on the water in the impeller blades. At the starting, any external leakage water is caught in circular troughs and drained away. The action of this gland is always to maintain a solid mass of water around the periphery of the impeller, which effectually prevents the entrance of air to the condenser or the escape of steam to atmosphere when running non-condensing. As in all Westinghouse turbines running at or below 1800 r.p.m., self-aligning babbitt-lined bearings are used, of sufficient area to operate without the use of a forced-lubricating system.

As some form of flexible coupling is always desirable between the generator and turbine shaft to provide for any slight changes in the alignment of the respective bearings, an effective form has been developed for the Westinghouse turbines, consisting of two sleeves, one of which is permanently keyed to the generator shaft and the other to the turbine shaft. Each has a number of projecting teeth which engage with the projections on a surrounding collar. The latter is made in two parts to permit removing either the turbine or generator shaft without disturbing the other. With liberal end clearance, and all surface under pressure practically radial, the coupling allows considerable variations in the shaft alignment and permits the generator shaft to float in its bearings, limited only by a retaining ring at each end.

Essentially the same system of governing is used in the double-flow as has become familiar in the single-flow design, namely, the "puff" or "gust" system, comprising a constant number of admissions per minute with a variable duration of admission according to the load, which is distinctly different from the principle of governing by adding nozzle after nozzle, all at maximum pressure, as the load increases. The governor itself is of the fly-ball type and differs only in minor details from the standard governor for single-flow machines. A small relay steam piston does the actual work of moving the turbine valves, thus relieving the governor of all work except moving a small pilot valve. For convenience in synchronizing and distribution of alternating current load, the governor is fitted with a small motor and weight by which the governor spring tension may be controlled from a distance from the switchboard.

The United Railways of Baltimore, Md., has introduced a new system to acquaint its patrons with what it has to offer in the way of pleasant summer rides, and also to give words of caution to avoid accidents. Cars have been supplied with racks, and in them have been placed booklets bearing on the subjects. A special publication has also been prepared for the visitors to the Methodist General Conference to give information to strangers. As a guide book of the city it is valuable, apart from the fact that it is intended to attract attention to the railways and city facilities. It enumerates many of the points of the city most worth visiting, gives the suburban settlements, the population and attractions of each, and the time consumed in reaching and returning therefrom. Schedules of the steam roads are given, with the best routes to take in reaching the stations.

FINANCIAL INTELLIGENCE

WALL STREET, May 26, 1908.

The Stock and Money Markets

Dealings on the Stock Exchange continued upon a fairly large scale during the past week, but they were accompanied by sharp reactions in prices. At the beginning of the week there was a disposition on the part of the speculative element to take profits in view of the recent substantial rise in values, and the selling caused moderate recessions in practically all of the active issues. Later on the downward movement was helped by rumors that the dividend on one of the leading industrial stocks would be reduced at the next meeting of the directors of the company scheduled for next week, and also by the action of the Attorney-General in bringing suit against the New York, New Haven & Hartford Railroad Company. Other adverse influences were the continued heavy outflow of gold to Europe, the total shipment to date amounting to approximately $36,000,000, and the heavy loss in cash sustained by the banks as a result of the repayment of government deposits. As regards the report of a reduction in the dividend on the stock of the American Smelting & Refining Company's stock, it was stated in usually well-informed quarters that the regular distribution would be ordered by the directors next Wednesday. The details of the action of the government against the New Haven is awaited with much interest.

The continued shipments of gold to Europe and the reduction in the surplus reserve of the Clearing House banks, failed to exert the slightest influence upon rates for money, and interest charges for all maturities ruled practically unchanged from those heretofore prevailing. The railroad and other corporations continue to take advantage of the extreme ease in money, and during the past week several new loans were negotiated by railroad companies. The eager demand on the part of investors for choice railroad bonds and notes continues unabated as evidenced by the fact that the $16,000,000 Chicago, Burlington & Quincy Railroad Company's 4 per cent general mortgage bonds were three times over-subscribed, while the flotation of the $17,000,000 Tidewater Companies 6 per cent notes was also a decided success.

These and other favorable influences failed to check the heavy selling of stocks, and at the close the market was practically in the hands of the professional element. The week's losses in some instances amounted to as much as 10 points, the stocks which were conspicuous in the recent upward movement being the chief sufferers. At the close of the week the market was very unsettled and prices in many issues were at about the lowest of the week. The opinion seemed to prevail, however, that a dull market for a time would minimize the bad effects of recent incidents and that ultimately steady progress would be made toward higher figures.

The weakness in the general stock market, however, was not reflected in the traction shares, prices for these issues, and particularly Brooklyn Rapid Transit and Interborough Metropolitan preferred holding relatively strong.

Philadelphia

The weakness prevailing in the general securities market during the past week was reflected to a great extent in prices for the traction shares. During the first half of the week the movements were comparatively narrow, but toward the close rather heavy selling carried prices to the lowest levels reached for a long time. Philadelphia Rapid Transit, after an early advance to 16¾, broke 2¼ points, while Philadelphia Traction lost a full point to 91. Union Traction was unusually active, and very erratic, the stock sustaining an extreme loss of 4½ to 50. Subsequently there were recoveries in all of the above mentioned issues, but apart from Union Traction, which moved up to 51½, the improvements were confined to the fractions. American Railways sold at 44⅝; Philadelphia Company common at 39½ @ 39⅜; the preferred at 41¼ and Consolidated Traction of New Jersey at 71.

Baltimore

Trading in the Baltimore market was fairly active, and while prices moved with some irregularity, the general tone of the market was firm. United Railway issues again furnished the active features. The stock advanced fractionally to 10⅝ and the refunding 5s were steady at 79½ @ 79¼. The 4 per cents and the incomes, however, were slightly lower, the first named selling at 86½ @ 86⅛ and the latter at 52¾ @ 51⅞. Baltimore City Passenger 5s advanced ¼ to 101¼, and City & Suburban of Washington 5s moved up from 100 to 100½. Norfolk Railway & Light 5s sold at 90, and Charleston City Railway 5s brought 103½.

Other Traction Securities

Dealings in the Boston market, although not very active, were attended by an erratic price movement. Boston Elevated, after holding firm at 135¼, broke to 133, and sales of West End common and preferred were made at 84 and 100 respectively. Boston & Worcester lost a point to 10. Massachusetts Electric sold at 10, and the preferred stock ran up to 43½. Boston & Suburban stocks were strong, the common and preferred advancing a point each to 12 and 56 respectively.

The Chicago market was considerably less active, but generally steady. City Railway Stock sold at 165, and Chicago Railway series 2 sold at 46½. West Chicago receipts sold at 29½ @ 28¾, and North Chicago receipts bought sold at 46¼ and 45. Other transactions, including Metropolitan Elevated at 17 @ 17, preferred at 51 @ 54; Union Traction receipts at 3¾ @ 4; South Side Elevated at 62 and 4½ per cent bonds at 95.

Because of the strike and possible referendum vote upon the security franchise, Cleveland Electric stock was very quiet on the Cleveland Stock Exchange the past week, and as a result the price fell to 51½ at the close Tuesday. Washington, Baltimore & Annapolis pooling certificates have been active, but bids fluctuated quite a little. Tuesday 500 shares changed hands, the greater part of it going at 14¼ and the remainder at 14⅜. Aurora, Elgin & Chicago preferred sold at 71 or ½ point off. Northern Ohio Traction & Light has shown considerable strength since the dividend was declared a few days ago.

Security Quotations

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

	May 19.	May 26.
American Railways	44½	44¼
Boston Elevated	134	a135
Brooklyn Rapid Transit	50	51
Chicago City	160	160
Cleveland Electric	52⅜	51½
Consolidated Traction of New Jersey	70	70¼
Detroit United	35	34
Interborough-Metropolitan	11¾	12
Interborough-Metropolitan (preferred)	31⅛	32⅞
International Traction (common)	33	—
International Traction (preferred)	55	—
Manhattan Railway	136	136⅞
Massachusetts Elec. Co. (common)	9½	9
Massachusetts Elec. Co. (preferred)	42	44
Metropolitan Elevated, Chicago (common)	17	17
Metropolitan Elevated, Chicago (preferred)	53	53
Metropolitan Street	—	26
North American	59	60⅞
Philadelphia Company (common)	39½	39
Philadelphia Rapid Transit	16	14¾
Philadelphia Traction	91	90
Public Service Corporation, certificates	69	69
Public Service Corporation, 5 per cent notes	95	96
Twin City, Minneapolis (common)	91	89½
Union Traction (Philadelphia)	53¾	51¼

a Asked.

Metals

Further improvement was reported in the steel and iron trade during the week. The decision of the steel manufacturers to maintain prices is expected to result in an increased demand for material. Copper metal holds firm at 12¾ @ 12⅞, electrolytic 12½ @ 12¾, and castings 12⅜ @ 12½.

AMERICAN RAILWAYS YEAR

A director of the American Railways Company is quoted as saying: "At the recent meeting of the board, when the regular quarterly dividend of 1¼ per cent was declared, a review of the situation to date, and the prospects for the balance of the year were gone over. It was found that while the earnings lately have fallen off somewhat, there will nevertheless be earned a safe surplus over the dividend. The company has inaugurated a good many economies, but as they were not begun until the second half of the fiscal year, their beneficial effect upon net earnings will be reflected only to that extent in the current year's results. They will, however, be effective continuously over the whole of the coming year, and then the full effect of the economies will be felt.

"The recent collateral trust bond issue, due in 1917, should fully provide for the financing of all the extensions which the company has undertaken or projected."

The company began dividends in the first year of its operations, in 1900, and has maintained them regularly since, the rate having been 6 per cent per annum since December, 1901. While acquiring many new properties and extending lines already acquired, the company has added to its net earning power in the last few years, as may be seen from the accompanying table, and the prospective expansion of the net earning power of their properties operated should add materially to the American Railways Company's income in the next few years:

June 30.	Gross earn. Sub. Co's.	Net inc. A. R. Co.	Int. b'ds taxes and gen. exp.	Surplus.	Per cent. surp. on cap. stk.
1907...	$2,855,320	$527,062	$142,503	$384,558	7.6
1906...	2,099,806	486,711	141,482	345,229	6.8
1905...	1,471,937	444,254	180,757	263,467	6.7
1904...	1,406,965	443,196	172,733	270,642	6.9
1903...	1,245,298	423,028	148,336	274,691	7.0
1902...	1,006,496	370,381	67,652	302,732	8.0
1901...	274,623	48,517	48,517	226,106	6.0

EARNINGS IN ST. LOUIS

The report of the United Railway Companys of St. Louis for April shows a decrease in gross receipts and net income, but the statement for the four months shows an increase in net income as a result of a reduction in expenses. It is expected that with good weather the summer travel will overcome the loss incurred in traffic up to the present time. The gross earnings and other income for January, February, March and April this year, aggregated $3,327,451, as compared with $3,379,085 for the same months of 1907, a decrease of $51,634; the expenses, taxes and depreciation, $2,203,696, as compared to $2,305,634, a decrease of $101,938; the net earnings $1,123,755, as compared to $1,073,451, an increase of $50,304; the charges $932,437, as compared to $924,627, an increase of $7,810, and the net income $191,318, as compared to $148,834, an increase of $42,494. The comparative statement for April is: Gross earnings and other income, for April, 1908, $865,691, as compared to $884,923 for April, 1907, a decrease of $19,232; expenses, taxes and depreciation, $570,663, as compared to $583,039, a decrease of $12,376; net earnings, $295,028, as compared to $301,884, a decrease of $6,856; charges, $232,274, as compared to $230,892, an increase of $1,382, and net income $62,754, as compared to $70,992, a decrease of $8,238. Both statements point to strict economy in operation. The report follows:

COMPARATIVE STATEMENTS.

	1908.	1907.
FOR APRIL.		
Gross earnings	$865,691	$884,923
Expenses	570,663	583,039
Net earnings	$295,028	$301,884
Charges	232,274	230,892
Net income	$62,754	$70,992
FOR FOUR MONTHS.		
Gross earnings	$3,327,451	$3,379,085
Expenses	2,203,696	2,305,634
Net earnings	$1,123,755	$1,073,451
Charges	932,437	924,627
Net income	$191,318	$148,824

REPORT MERGER OF INDIANA AND KENTUCKY LINES

It is reported that plans are making for merging several companies operating in Kentucky with the Indianapolis & Louisville system and possibly the Indianapolis, Columbus & Southern. The result, it is said, will be the connecting up of Indianapolis, Ind., and Frankfort by way of Louisville. The plan is for the Louisville, Frankfort & Eastern Traction Company to take over the Louisville & Eastern Traction Company and complete the link between Louisville and Frankfort, Ky. That work will be done this summer. The money will be furnished by Samuel Insull, of Chicago, who is in control of the Louisville & Southern Indiana Traction Company and the Louisville & Northern Railway & Light Company, and John C. Mayo, who controls the Indianapolis & Louisville—all entering Louisville by way of Jeffersonville, Ind., over the Big Four bridge. The new company, for which articles of incorporation are now being prepared, will have a capital of $750,000 preferred stock and $2,500,000 common with $3,500,000 of bonds. It is understood that Mr. Insull is to be president of the merger company. It is not thought at Indianapolis that the Irwin lines will be included in the merger, although the link is necessary to include Indianapolis as the northern terminal.

STANDARD COVERING CONSTRUCTION AND FIRE PROTECTION FOR CAR HOUSES

The committee on car houses of the National Fire Protection Association, C. H. Patton, chairman, presented the following report at the meeting of that association held in Chicago May 26, 27 and 28:

After three years' work the committee on car houses has finally completed its labors so far as the adoption of a standard covering construction and sprinkler protection is concerned. The new standard has just been published and is a joint recommendation adopted by both the National Fire Protection Association and American Street & Interurban Railway Association [Street Railway Journal, Oct. 26, 1907, page 881], the latter named association having adopted the new standard unanimously at its convention held in Atlantic City, N. J., during October last. By the approval of the American Street & Interurban Railway Association of this standard, an acceptance of the same might indicate that the electric railways of the country will take a special interest in the construction and protection of their properties, realizing that the rules and requirements were accepted by their own association after several conferences by a special committee with the committee on car houses of the National Fire Protection Association.

The new standard deals with three types of construction of car houses, slow burning construction, protected steel and iron construction, and reinforced concrete construction. The standards recommended for these three classes are very complete, and give the builder an opportunity to select and compare in cost any one of which he may find it most convenient to construct.

The committee experienced some difficulty in harmonizing several features in the new standard relating to thicknesses of walls, size of tile blocks for fireproofing, and matters relating to reinforced concrete construction, which slightly conflicted with the national board building code and uniform requirements, but after several conferences with other committees these features were harmonized, concessions being given in favor of car houses, due principally to the fact that the buildings are but one story in height.

The new standard asks for both aisle and ceiling sprinklers in all instances, and permits of quite a liberal area for independent sections. All in all, the new standard, it is believed, will meet with general acceptance on the part of the railway people, and underwriters will hardly consider requirements as drawn up as being too rigid for actual results.

The construction and protection subject for car houses received not only a thorough discussion at three conventions of the National Fire Protection Association, but a wide-spread interest was taken in the subject, and practical tests and demonstrations were given. It is believed, therefore, that this new standard will tend to effect in the near future improved structures of car houses, as well as making a better protected class of them.

DATA SHEET ON STANDARDIZATION

The Committee on Standardization of the American Street & Interurban Railway Engineering Association has issued a letter and data sheet calling for certain information. The letter is addressed to the general managers and master mechanics of member companies and says:

The Standardization Committee takes advantage of this opportunity to express to you its keen appreciation of the very cordial and general co-operation of the member companies throughout the country, which resulted in the preparation and adoption of its report at the 1907 convention. A reprinted copy of this report is being sent you under separate cover so that you may have its provisions at hand for ready reference, and as a guide, so that your equipment will be as close as possible to the adopted standard.

The committee is thoroughly convinced that a very decided advantage will be gained if the standards as adopted can be followed as closely as possible, not only in the maintenance of your present cars, but particularly in the design of any new equipment which you may contemplate.

Following the line of work pursued last year, the committee has taken up for consideration the subjects of standard heights of couplers for city and interurban cars, standard automatic couplers for interurban cars, radial draft rigging, standard height of platforms, standard height of carsteps and standard height of bumpers.

You will find enclosed herewith a data sheet calling for considerable information in regard to the character of the equipment which you have upon your lines. This information is required by the committee in compiling its report, so that the standards to be recommended this year will represent the needs of the entire membership of the association rather than the preference of the individual members of the committee.

Accompanying this data sheet is a drawing which has been prepared to assist in identifying the dimensions called for in the data sheet. In this drawing corresponding dimensions for city and interurban cars are indictated by the same letter, but those for the interurban car are preceded by the letter "I," while those for the city car are preceded by a "C."

You will also note that you are asked to indicate in your replies only what is considered your latest practice. The committee realizes that upon many roads considerable variations exist in heights between the older and more recently built cars, but no report need be made of obsolete practice.

In addition, you are asked kindly to indicate what would be your recommendations for each dimension for a standard to be adopted by the association, bearing in mind that the general standard should not be unduly governed by any conditions which may apply to your lines alone, but should best suit the conditions of all lines.

The committee will greatly appreciate any photographs, cuts, drawings, suggestions or any information whatsoever which you may give bearing on the subjects under consideration outside of, or in addition to, that which we have indicated in our questions on the data sheet, realizing as it does that for the most part the subjects taken up this year are of the greatest importance and are among the most difficult to standardize.

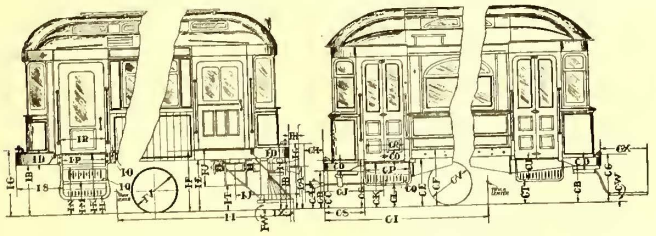
While the committee would like complete information in reply to this data sheet, it wishes to urge upon all the necessity of forwarding the required information as early as possible. Kindly do not hold your reply pending any particular investigation which you may have in mind, but return the data sheet promptly and follow it up by letter, giving any further suggestions which you may have for the consideration of the committee. If possible, all replies should be received by June 15, 1908.

Your hearty co-operation in this matter will be very greatly appreciated by the committee.

DATA SHEET NO. 31.—STANDARD COUPLERS, DRAFT RIGGING, BUMPERS, PLATFORMS AND CAR STEPS

City cars operated: Single truck? Double truck? Interurban cars operated: Passenger? Freight? To what extent do you operate two or more cars together in trains in city service? In interurban service? Number of cars with automatic couplers? Of link and pin type? Of M. C. B. type? Are there any state or municipal laws regulating any of the dimensions called for in this data sheet?

The companies are requested to indicate in inches the following dimensions for their city and interurban cars, using the accompanying diagram



as a guide. They are also asked to give their recommendations for general standards.

Height from top of rail to the center of coupler; height from top of rail to the bottom of bumper; height from top of rail to the top of bumper; width of bumper; height from top of rail to bottom of side sills; height from top of rail to floor of car; height to the center of bumper pocket coupler casting; distance that coupler extends beyond bumper; distance from truck center to end of bumper; the length of radial coupler from the pocket pin to the face of the coupler; height from top of rail to the top of platform floor; height from top of rail to the top of tread on first step; height from top of rail to the top of tread on second step; height from top of rail to the top of third step; height of raise from vestibule platform to the floor of car; length of step treads; width of step treads; width of door or opening, from step to platform; length of overhang between the center of step treads and end of bumper; height of motorman's step above rail; height of motorman's step to platform of car; diameter of wheels; height from top of rail to the bottom of pilot board or lifeguard; distance pilot or lifeguard extends beyond bumper.

The committee also requests drawings, cuts, photographs, suggestions or other information bearing on the above subjects, as well as any information as to the style of couplers and of bumpers which are used, arrangements for a connecting bar between interurban and city cars of unequal height of drawbars and suggestions of means to prevent interurban cars from telescoping or passing over cars with lower bumpers.

THIRD AVENUE RAILROAD TO SPEND $2,500,000

In the United States Circuit Court last week Judge Lacombe issued an order authorizing Frederick W. Whitridge, as receiver of the Third Avenue Railroad Company, Forty-second Street, Manhattanville & St. Nicholas Avenue Railway Company, the Dry Dock, East Broadway & Battery Railroad Company, and the Union Railway Company, to issue receiver's certificates to an amount not to exceed $2,500,000. For the improvement of property and service of the Third Avenue Railroad Company the following expenditures will be made:

1. $135,000 for sprinkling and other fire apparatus and their installation at the company's barns.
2. $300,000 for repairs to cars and for purchasing new motors, controllers and other electrical equipment.
3. $436,000 for renewals and repairs to and maintenance of tracks and electrical equipment and paving.
4. $151,000 for alterations and repairs to building at 65th Street and 3d Avenue.
5. $106,000 for alterations and repairs to building at 129th Street and 3d Avenue.
6. $109,000 for repairs to Bayard Street and 129th Street and 65th Street subway station.
7. $1,500,000 for the purchase of new cars.
8. $30,000 for repairs to and maintenance of the tracks of the 42d Street, Manhattanville & St. Nicholas Avenue Railway Company.
9. $4,000 for repairs to a building at 177 Manhattan Street.
10. $10,000 for repairs to and maintenance of tracks of the Dry Dock, East Broadway & Battery Railroad Company.
11. $225,000 for the erection upon land in Pelham belonging to the Union Railway Company of a car barn for storage and repairing of cars.
12. $225,000 for the erection of a new power station at 161st Street.
13. $225,000 for the erection of a new power station upon some suitable site to be determined on by the receiver in the neighborhood of the Kingsbridge plant of the Union Railway Company.
14. $250,000 for the completion and construction of a street railway on the Bronx and Pelham Parkway from Fordham Station to a point beyond the Zoological Gardens and the acquisition of all necessary franchises, permits and rights of way and property; for taxes lawfully assessed against or which may be payable by the Third Avenue Railroad, etc.

KEY ROUTE EXTENSION TO SAN JOSE

A bond issue of $7,500,000 has been authorized by the directors of the San Francisco, Oakland & San Jose Consolidated Railway, of which E. A. Heron is president, and notice of the intention to make the issue has been filed with the county clerk. The corporation is an enlargement of the old Key Route ferry system, contemplating, in addition to lines in operation, a line to the proposed capitol site in North Berkeley by way of Sacramento Street, and also a line through the county of Hayward, and from there to San Jose. The issue will cover $3,000,000 of new bonds. The company took over a bonded indebtedness of $4,500,000 which the Key Route had floated. Samuel J. Taylor, vice-president of the company, says: "The action is in reality a legal step in the furtherance of the plans of the corporation already made public. The market for bonds is very poor just now, and we cannot say when we will put the $3,000,000 of new bonds on the market. As the bond issue is for the purpose of purchasing rolling stock and the construction of new lines as planned, we cannot say when actual work will begin. It may be some time during the summer, possibly later, but depending very much on the market for bonds." The bonds will have a face value of $1,000 each and will pay 5 per cent interest.

The company has announced the general route to be followed by the road through Oakland and suburbs. The extension will be made from the Fortieth Street or Piedmont line, past Bates' quarry, through East Piedmont Heights, Fourth Avenue, Terrance extension and Dimond, or North Fruitvale. The road will then run to Hayward, where it will branch to San Jose.

THE BOSTON ELEVATED DIVULGES PLAN FOR "L" AND SUBWAY CONNECTION

Now that the Boston Elevated Railway has applied to the Massachusetts Railroad Commission for approval of its curves and connections between "L" and subway lay-outs opposite the Boston & Maine Railroad terminal in Causeway Street, the company has allowed its general plan of reconstruction at that important traffic center to be made public.

At this point, under present conditions, the two "L" tracks ascend from the old subway with the surface-subway tracks between them. The station for the elevated is now an island station at the head of the incline, so near the slope that anything more than a four-car train leaves the cars standing down the gradient. The surface cars make their stops at platforms on either side, under the elevated tracks. The elevated at present curves only toward the east in Causeway Street, just after leaving its station; the surface tracks swing both ways in Causeway Street. A covered passage connects the elevated station with the sidewalk in front of the Boston & Maine terminal, bridging Causeway Street.

All this will eventually be changed. Neither elevated nor surface cars will in future make their stops at the point where the present elevated station is located. Instead, at that point there will be an imposing steel and concrete portal, formed by two monumental pillars to be erected one on either side of the "L" location and marking the trackage that will lie between Causeway, Canal and Haverhill Streets as Boston Elevated property.

Two "L" tracks will emerge through this portal, close to the easterly pillar, forming connection between the new Washington Street Tunnel tracks and the existing "L" running easterly in Causeway Street toward Sullivan Square. Two other "L" tracks will emerge from the through tracks of the old subway, and swing westerly in Causeway Street, to a connection with the proposed East Cambridge Elevated, now under construction across the Charles River. Two surface-car tracks will emerge from the Scollay Square loop of the old subway, connecting with lines both east and west in Causeway Street. The approval now asked for covers only the curves and connections mentioned in this paragraph, with the addition of a cross-over connection from the East Cambridge "L" structure down into the Washington Street tunnel over the other "L" trackage.

The company plans to have two stations in Causeway Street, each with separate platforms for inward and outward passengers. The East Cambridge elevated station is intended to be in front of the main section of the Boston & Maine terminal, with an overhead passage connecting the "L" platforms with the edge of the midway in the railroad train shed. But nothing is likely to be done on this station until the main section of the East Cambridge overhead line is started, a year from this coming summer. The other elevated station, which will be built as soon as the work can be suitably advanced, will be in Causeway Street opposite the easterly end of the Boston & Maine property, with platforms extending from Beverly to Medford Streets. It will have sub-passages connecting its platforms, and other passages extending down Causeway Street to the East Cambridge elevated platforms, and across Causeway Street to the sidewalk in front of the Boston & Maine waiting room. All these passages will be above street level, and will allow free transfer between all overhead lines. Ticket windows and choppers will be so placed that passengers will pay at the heads of the stairways, immediately on ascending from the street level, no matter which stairway they use.

A new feature of the plan is the relocation of the present middle siding near Beverly Street, at a point several hundred yards farther toward the east, on the Atlantic Avenue loop. Here, opposite the North End Park, the company plans to build a new middle siding, capable of holding two eight-car trains. Instead of the one displaced, the company will build a new third track, beginning with a stub on the other side of the north-bound elevated platform near Beverly Street, and extending to the junction whence the main-line trains swing out over the river to Charlestown, where the third track will merge with the south-bound track looping back through Atlantic Avenue. By means of the stub of third track, the company plans to maintain a special shuttle-train service between the north and south terminals of the steam railroads.

This will make the shuttle service between the railroad centers practically independent of the elevated main line, and is expected to relieve the congestion and give opportunity for a better schedule.

There will be many complications in connection with the change from the present "L" station at the head of the subway incline to the proposed station at Causeway and Beverly Streets. In order to maintain the service while the work is going on, a temporary curve track outside the present south-bound curve will be built of timber. By its aid, first one and then the other of the existing tracks can be reconstructed in such a manner as to eliminate the present "island" platform. A temporary north-bound platform will have to be built outside the present elevated location, above the present surface-car stop; and first one, then the other, of the proposed two permanent platforms will come into use at the new station. It can be seen that the whereabouts of the elevated stops will be considerably mixed while the work is at its height, so far as the ordinary traveler is concerned, but the engineers have planned the process all out to the minutest detail, and have a progressive series of blue prints that will carry the work from start to finish without actual confusion at any point.

THE FLOODS IN TEXAS

Electrical interests in Texas are said to have suffered severely as a result of the floods. At Dallas on May 25 all the street railway bridges were under water, and traffic on the lines crossing these structures had to be suspended. Traffic on the Fort Worth & Dallas Interurban Railway also had to be discontinued. As an instance of the severity of the flood, Trinity River rose from 28 ft. at 10 p. m. Sunday to 41.5 ft. at 3 a. m. with no sign of subsiding. The Santa Fé Railroad bridge was carried away. In North Dallas only one street railway line was operating May 25. The waterworks plant was compelled to shut down, and the lighting station was inundated so that the city is in darkness. The telegraph and telephone wires also are down. Estimates made of the extent of the damage places it at $1,000,000 to $1,500,000. Next to Dallas, Fort Worth is said to have been hardest hit.

MASSACHUSETTS FARE INCREASE APPROVED

When the Taunton & Pawtucket Street Railway patrons were before the Railroad Commissioners of Massachusetts recently, protesting against the increase of fares by the company between Taunton and Rehoboth, the commissioners' citation of the company's growing deficit had the effect of practically quashing the protest. The commission has now found for the company. The Taunton & Pawtucket Company worked out a plan for increasing its revenue by inserting a third fare-limit where there had previously existed only two. The territory covered by the third limit was sparsely settled, on the outskirts of the city; and the most vigorous protest at the hearing was from patrons located outside the former second fare-limit who had been accustomed to walk to it. When the commissioners came to pass on the case, they practically threw out this local protest as unworthy of consideration, and dealt with the matter on the question whether a 20-cent instead of 15-cent fare between Taunton and Attleborough was unreasonable and excessive. The distance is 13 miles. In view of the fact that the Taunton & Pawtucket Company was formed to take over the old Bristol County Street Railway, which was unsuccessful financially, and has never realized a satisfactory return on the investment, the board deemed the 20-cent fare justifiable. It reached this decision, however, only after requiring a daily comparative statement of the company's gross income since the increase in fares. The statements showed that the earnings remained substantially the same, a fact which is accounted for by decrease in riding due to financial depression. Yet the board says finally: "Making due allowance for the income so to be received by the company under its newly established fare in times of normal travel, the board learns nothing from its examination of the company's financial condition that justifies it in finding the fare now established to be excessive, and when compared with existing fares for like service under like conditions in the commonwealth, the fare does not appear to be unreasonable."

AFFAIRS IN NEW YORK

The Public Service Commission has awarded contracts for the construction of five of the sections of the Fourth Avenue subway in Brooklyn. These were the awards: Contract No. 2, extending from Willoughby Street to Ashland Place, William Bradley—railroad work, $3,436,019; pipe galleries, $58,695; total, $3,494,714. Contract No. 3, from Ashland Place to Sackett Street, William Bradley—railroad work, $3,392,091.50; pipe galleries, $208,135; total, $3,600,226.50. Contract No. 4, from Sackett Street to Tenth Street, E. E. Smith Contracting Company—railroad work, $2,283,533.30; pipe galleries, $206,672; total, $2,490,205.30. Contract No. 5, from Tenth Street to Twenty-seventh Street, the Tidewater Building Company and Thomas B. Bryson—railroad work, $1,945,640.50; pipe galleries, $251,076; total $2,196,716.50. Contract No. 6, from Twenty-seventh Street to Forty-third Street, E. E. Smith Contracting Company—railroad work, $2,008,982.80; pipe galleries, $173,665; total, $2,982,647.80. The total of the awards for railroad work is $13,866,267 and for pipe galleries $898,243, making an aggregate cost for the five sections of $14,764,510.

The general investigation of the traction companies of Greater New York by the Public Service Commission was formally ended May 21, when William M. Ivins, the special counsel for the commission in the investigation, spread on record the results of the work he and his assistants had been engaged in since the public sessions were temporarily discontinued last November. Mr. Ivins requested the commission to consider his work concluded. The matters spread on the record at the closing session included the minutes of the Interborough-Metropolitan Company, the Interborough Rapid Transit Company, and the various companies entering into the old New York City Railway Company, and the Brooklyn Rapid Transit Company. There was also a special report on the Third Avenue Railroad, copies of leases, a map showing franchise routes, and a history of the old Metropolitan Traction Company. Mr. Ivins stated that this information, along with that previously obtained, gave a comprehensive history of the traction companies of the city. It would, he believed, prove invaluable to the commission in its future work. The special report on the Third Avenue Railroad submitted by Mr. Ivins traces so far as possible the disposition of the proceeds of the $35,000,000 issue of bonds in 1900, following the leasing of the road by the Metropolitan. It is pointed out by Mr. Ivins that the purpose of the parties to the transaction at the time of providing for the retirement or acquisition of the funded debt of the Third Avenue and its constituent companies has not been realized and that such funded debt remains the same now as at the time of the execution of the $50,000,000 mortgage. From the books of the Third Avenue it appears that there came into the treasury of the Third Avenue from the sale of the bonds after the payment of its indebtedness, other than its funded debt, as the same existed at the time of the mortgage, the sum of $10,554,352, the expenditure of which was entirely in the hands of the Metropolitan. How this was spent is not known, and Mr. Ivins concludes that inasmuch as both the Third Avenue and the Metropolitan are in the hands of the court, the matter is not one which is subject to determination by the Public Service Commission. The liabilities of the Third Avenue, as of April 30, 1907, according to records, were: Capital stock, $15,995,800; funded debt, $42,560,000; current liabilities, $108,457; due lessee companies for advances for construction purposes, $2,340,648; total liabilities, $61,004,905.

Governor Hughes has signed the Frawley bill, giving the Public Service Commission and the Board of Estimate authority to purchase the Steinway tunnel. In his memorandum the Governor says the bill gives power which the authorities should possess, although whether or not the power should be exercised in a particular case depends upon the conditions surrounding the matter. He believes the bill should have added to it a provision for condemnation.

The Public Service Commission has directed its counsel to apply to the Supreme Court at once for a writ of mandamus compelling the New York City Railway Company and Adrian H. Joline and Douglas Robinson, its receivers, to obey the terms of Order No. 403 issued by the commission. This order required the company, or its receivers, to forward daily to the commission a transcript of the daily entries in its "run-in" book, which shows the cars out of order and sent in to the barns for repairs. Order No. 403 was issued on April 7, following a hearing held by Commissioner Maltbie to inquire into the overhauling and repairing of the New York City Railway Company's cars. The order directed the company to have all its open cars—about 370 in number—overhauled and repaired by May 30th, and that the company notify the commission daily of the number of open cars so turned out and for this purpose to forward daily to the commission a transcript of the daily entries in the so-called "run-in" book or books showing among other things which of said cars are out of order. In this appeal to the court the commission will set forth that the company or its receivers have failed and omitted to observe and obey this order in so far as the furnishing of the daily entries from the "run-in" book is concerned, and will ask that a writ of mandamus be issued directing the company or its receivers to observe and obey said direction in the order.

The commission has adopted a resolution directing the Interborough Rapid Transit Company to proceed with the construction of additional tracks north of 96th Street in the Broadway branch of the subway, in accordance with plans previously adopted. This is the improvement so long contemplated and involves the building of another track at 96th Street. According to the testimony of engineers, this improvement will increase the capacity of the subway 33 per cent. This improvement was briefly described in the STREET RAILWAY JOURNAL for Feb. 29, 1908.

The Public Service Commission of the First District has awarded the contract for the first section of the Fourth Avenue subway, Brooklyn, to James B. Graham, the lowest bidder. His bid was $1,020,476 for the railroad and for the pipe galleries $101,374. Mr. Graham asked permission to withdraw his bid, but it was refused.

Commissioner Maltbie, at the meeting of the Public Service Commission, Tuesday, submitted a report from A. W. McLimont, an electrical engineer, on overhauling and repairing the open cars of the New York City Railway Company, in which the engineer says that the company is now showing continued improvement, and that suggestions made by the Public Service Commission's bureau are readily accepted and adopted by the railway company. Mr. McLimont says that the commission's bureau is inspecting the repaired cars at the rate of sixteen per day.

The validity of the charter of the company which built the Steinway tunnel was upheld by the Court of Appeals May 19, when a decision was handed down through which New York City loses its contention to prevent the completion of what is known as the Belmont tunnel, running from Forty-second Street to Long Island City under the East River. In 1906 the city attempted to stop the work on the ground that the railroad company no longer had any corporate power. An injunction was secured restraining the city from interfering with the work, and it was sustained by the Appellate Division. The Court of Appeals affirms the lower courts.

The Long Island Railroad doubled its electric service between Brooklyn and Jamaica on May 20 and added many trains to the schedules for other divisions of its lines. On Monday 50 local trains were operated between Brooklyn and Jamaica and 56 express trains. Tuesday 96 local trains and 85 express trains ran. The new electric line to Hempstead was also started Tuesday. Hempstead expresses will hereafter run from and to Brooklyn, connecting at Flatbush Avenue with Manhattan subway trains, thus enabling passengers to go to all parts of Manhattan with but one change of cars at Flatbush Avenue, Brooklyn.

The Interborough Rapid Transit Company made an offer Tuesday to the Public Service Commission to construct a railroad between Fulton Street and Flatbush Avenue, Brooklyn, and Canal Street, Manhattan. The line would run for about three-quarters of a mile as a subway under Flatbush Avenue and its extension, and would emerge to the street level at the Manhattan Bridge plaza at Nassau and Sands Streets. It would cross the Manhattan Bridge on the lower tracks, and would then become an elevated line joining with the Third Avenue road. The proposed road would run in almost a direct line from Flatbush Avenue across the bridge to Canal Street and form one side of a triangle, of which the present subway, with its Brooklyn extension, describes the other two sides. The company points out that Atlantic and Flatbush Avenues, in Brooklyn, will undoubtedly become a great traffic center for persons who must find their way to all parts of Manhattan. It will also make access to Long Island very easy by affording a connection with the Long Island Railroad.

ANNUAL REPORT OF NORFOLK & PORTSMOUTH TRACTION COMPANY

The annual report of the Norfolk & Portsmouth Traction Company and allied companies for the year ended Dec. 31, shows as follows:

	1907.	1906.
Gross receipts	$2,616,458	$1,719,546
Operating expenses	1,655,654	1,113,883
Net earnings	$960,803	$605,663
Additions and deductions	2,283	169
Total income	$958,520	$605,832
Taxes and interest	704,808	501,556
Balance	$253,712	$104,276
Extraordinary expenses	126,507	12,032
Surplus	$127,204	$92,244

Traffic statistics of all the lines of the company compare for the past three years:

	1907.	1906.	1905.
Revenue passengers carried	29,239,843	14,454,451	12,925,851
Free passes	1,043,820	379,099	366,719
Transfers	2,032,503	1,338,889	1,452,153
Car miles run	6,253,638	3,587,128	3,474,167

The general balance sheet as of Dec. 31, 1907, shows as follows:

ASSETS.

Property rights and franchises	$10,434,639
Investments	1,045,897
Stocks and bonds of other companies	977,797
Other investments	68,100
Real estate	33,302
Advances to controlled companies	520,947
Material and supplies	133,419
Accounts receivable	160,435
Bills	275,537
Prepaid accounts	25,285
Cash	15,702
Total	$12,645,167

LIABILITIES.

Capital stock	$6,000,000
First mortgage 5 per cent bonds	4,417,000
Equipment trusts	20,000
Bills payable	1,346,128
Accounts	641,410
Reserve liabilities	22,600
Account bonded interest	48,910
Surplus	149,117
Total	$12,645,167

President Williams says in part: "An examination of the treasurer's report will show that during the year the company expended $1,867,399 in improvements and betterments to the properties, in additions and extensions, and in the construction and acquisition of new properties.

"The improvements to the property, some of which have already been stated, and the acquisition of new property and equipment will, it is believed, result in a very decided increase in the revenues of your company, not only at present, but in the future, and will enable your company constantly to improve its service and reduce its ratio of operating cost, and at the same time care for the large increase in business incident to the demands of the growing community. The standard of the entire system has been materially raised.

Financial conditions have been such that it has been impossible for the company to sell upon advantageous terms sufficient bonds to take care of its construction expenditures. Arrangements have been completed for notes of two, three and four-year maturities, secured by collateral. A large proportion of the floating debt of the company has been liquidated through the sale of these notes since the close of the fiscal year Dec. 31, 1907.

Notwithstanding the difficulties attendant upon the operation of the properties during the period of reconstruction, and the disappointment in attendance on the Jamestown Exposition, the results of the operations of the properties owned and controlled by your company during the year 1907 were, upon the whole, satisfactory.

During the year the company purchased 84 new cars of approved types, 45 of which were equipped with motors, and all but eight of which were equipped with air brakes for train service. It is not intended to permanently increase the equipment by this number of cars. The single-truck cars used prior to the Exposition, in the city service, are now being sold. The result will be the standard equipment of the different lines of railway with new improved semi-convertible cars with double-trucks. The effect of the new equipment will be to enable the company to render better service and handle more passengers at slight, if any, increased cost of operation.

POWER PLANT IMPROVEMENTS OF THE NORTHERN TEXAS TRACTION COMPANY

The Handley power plant of the Northern Texas Traction Company has recently added 1000-kw to its capacity under the direction of the Stone & Webster Engineering Corporation. The original generating equipment consisted of three 600-kw Westinghouse three-phase, 400-volt, 25-cycle generators direct-connected to Cooper-Corliss horizontal cross-compound engines. The new unit is a 1000-kw Allis-Chalmers 400-volt generator direct-connected to a Hamilton-Corliss cross-compound engine. In connection with this generator three 400/15,000-volt Westinghouse transformers have been added. This additional generating machinery required two further 460-hp Stirling boilers with superheaters. The plant also contains Sturtevant forced-draft fans, Cochrane feed-water heaters, together with Worthington and Alberger barometric condensers.

BOSTON & EASTERN HEARINGS TO BE CONTINUED

The hearings before the Massachusetts Railroad Commission on the proposed Boston & Eastern Electric Railroad have been continued until June 10 and 30 and July 1, on account of the remaining rebuttal testimony to be presented by the Boston, Revere Beach & Lynn Railroad and other parties opposed to the road. President Adams, of the Revere Beach line, expects to introduce expert testimony on June 10, and on the two later dates it is expected that the final arguments of counsel on both sides will be presented. The question then before the Board for decision will be whether public convenience and necessity require the issuing of a certificate to the new company.

At the hearings on May 20 and 21, Chief Engineer Bickford, of the company, was cross-examined by Attorneys Warren, Coolidge and Adams, and Prof. Breed, of the Massachusetts Institute of Technology, appeared as an expert civil engineer in opposition to the project on the ground of the sufficiency of the present transportation facilities, if extended, to care for the situation. The company was represented by Ezra Thayer, of the firm of Story, Palmer, Thorndike & Thayer.

MICHIGAN ELECTRIC ROADS

Capital to the amount of $38,031,000 is invested in electric railways in Michigan, according to the annual report of Commissioner of Labor M. J. McLeod. There are 23 separate lines. The mileage is 1253, of which 705 is operated by the Detroit United Company, 183 by the various Grand Rapids lines, 160 by the Michigan United (with headquarters at Kalamazoo), and 205 by all the other railways in the State. There was expended last year for improvements a total of $2,133,767. Only 20 miles of new line were built. Of the 23 railways, 12 do not run freight cars, and 6 are operated entirely within cities. The aggregate income last year was $10,458,589, apportioned as follows: Passenger traffic, $9,717,474; freight traffic, $533,329; other sources, $207,785. The passengers carried numbered 222,783,795 ,a very large percentage of these on transfers, however. The regular fares are 5 cents, though in practically all cases six tickets are given for 25 cents, and in Detroit workingmen's tickets are sold at eight for 25 cents. The Michigan electric railways have a total of 1803 passenger and 102 freight cars. Employment was given to 1405 conductors last year, at an average daily wage of $2.21, and 1399 motormen were employed at an average wage of $2.205. The whole number of employees was 6534; the average daily wage, $1.995.

THE FATE OF RAILROAD BILLS IN NEW YORK—CONEY ISLAND BILL DEAD

The Robinson bill, making general amendments to the rapid transit law designed to facilitate subway building in New York by offering more attractive contracts to private capital, died May 22 with the expiration of the thirty-day bill period. Governor Hughes declined to give his approval to the measure. The Governor's memorandum follows, in part:

The salient features of this bill is the provision for the sale of the privilege or franchise to construct, maintain and operate rapid transit railways in the city of New York, with the reservation to the city of the right to purchase and take the privilege or franchise and the plant and property of the grantee at the expiration of a fixed period, which is not to exceed fifty years. These railways, except in the case of certain extensions of existing lines, cannot now be constructed, save by the use of public moneys. The purpose of the bill is to authorize construction also by private capital and thus to provide additional transportation facilities which are greatly needed. I am convinced, after careful consideration of the matter, that the plan proposed by this bill is illusory and injurious.

This bill, in its main feature, means that to have additional rapid transit in New York we should give 50-year grants. I do not believe in that policy. The city should not lose its control over its highways for rapid transit purposes for such a period. Any one who reflects upon what the city was fifty years ago and upon what it is likely to become in the course of the next fifty years must realize this.

It is most important that we should have a development of transit facilities in New York City. There is nothing in which I am more interested. But even on the improper terms proposed I do not believe that this bill assures it or gives reasonable promise of it. On the contrary, I believe that it will postpone rapid transit development.

We need, in the first place, a better understanding of the financial condition of the city. And the exact margin which the city has within its debt limit should be ascertained as promptly as possible, and in a manner which will put the present controversies at rest. We should know precisely where the city stands, and make our plans for the future in the light of this knowledge. In connection with this, it is to be noted that the Legislature has passed a concurrent resolution for an amendment to the constitution providing that indebtedness incurred for rapid transit improvements should not under specified conditions be considered in estimating the debt limit. If this is again passed by the next Legislature it can be adopted in November, 1909.

But, to whatever extent it may be deemed advisable or necessary that there should be construction by private capital, it is clear that franchises must not be inconsiderately granted, and that the law must not permit terms which we do not wish to see yielded. I believe that, with due consideration, this matter will be settled in the near future. But proper control over the highways and public improvements of the city must be reserved, and we must not allow temporary exigencies to force grants contrary to sound judgment and wise policy.

The present bill, with what amounts, as I read it, to a practical provision for 50-year franchises, is thoroughly objectionable. There are some other features of the bill which have been criticised, but I do not think it necessary to discuss them, as I cannot in any event approve it.

Amendment of the Elsberg rapid transit law to aid subway building was one of the important recommendations made by the Governor at the beginning of the legislative session and urged vigorously by him. Coupled with this was a proposition to relieve the transit situation by eliminating from New York City's debt limit subway bonds which were self-supporting. This matter, in the form of a constitutional amendment, passed both houses, but cannot be effective until it has passed the next Legislature and been ratified by a popular vote.

Other transit measures of considerable interest to New York City failed to become laws. The Coney Island 5-cent fare bill died in the ruck of thirty-day bills. This measure was a substitute for four measures introduced largely to gain political favor with a constituency, which resented failures to vote for a similar measure in 1907. The bill was somewhat ambiguous, since it established the 5-cent fare only in case the Public Service Commission did not sanction a higher rate.

In disapproving the so-called Coney Island bill the Governor, in a memorandum, said in part:

It is plainly intended to affect charges over existing lines. It establishes a maximum rate of 5 cents without regard to the length of the route or the reasonableness of such a fare. In other words, it is an arbitrary maximum imposed by legislative fiat.

The attempt to enforce such a rate under such circumstances would be abortive, as a successful appeal could be made to the courts. It is idle to suppose that the companies can be compelled to reduce their fares to 5 cents merely because the Legislature says so.

Whether a 5-cent fare is a fair one depends upon facts and not upon sentiment, desire or prejudice. Whether the result be agreeable or disagreeable, it inevitably will be reached only after the facts have been ascertained and considered. Justice requires this, and under the constitution the requirement will be enforced.

The proper way to deal with these matters is to provide for investigation in which the whole subject can be considered, specious claims sifted out, and a result just both to the corporations and to the public arrived at.

It may be said that the provision of this bill with regard to the Public Service Commission has this effect. But this is not the case. The bill provides for a flat rate of 5 cents unless the commission consents to a higher fare. It does not provide that the commission shall ascertain or fix a just and reasonable rate or that an increase shall be allowed because it is just and reasonable.

It is highly important that we should have transportation in our cities at the lowest fair rates. It is desirable that in New York City there should be low rates from the congested quarters to the breathing spots in the outlying districts and by the sea. The sure way, and the only way, to make real progress in this direction is through the ascertainment of the essential facts and the making of reasonable rates in accordance with the facts. This bill is wrong in principle and is not adapted to secure the desired result. I cannot approve it.

Still another transit measure which died was that permitting the Interborough to charge an additional fare over an extension of the present system to be built in the "annexed district." This was designed to bring residents of White Plains to New York City without their present difficulties, and they were willing to pay the extra fare for the proposed facilities.

Chairman William R. Willcox, of the Public Service Commission, said, regarding the veto of the Coney Island 5-cent fare bill by Governor Hughes: "I believed all the time that the commission had power to deal with the matter of the 5-cent fare to Coney Island. Of course, the question of confiscation can be raised under the decision of the commission, just the same as it could have been raised in the case of legislative enactment. I do not care to give my views regarding the merits of the 5-cent fare issue, for the reason that several hearings involving this very question are now before the commission."

UNITED RAILWAYS COMPANY RESISTS PASSENGER TAX

The United Railways Company will make another appeal to the courts to resist the payment of the 1 mill per passenger tax levied by the city of St. Louis, which is held to be constitutional by the Supreme Court of the United States in a decision briefly referred to in the STREET RAILWAY JOURNAL of May 23. Judge Henry S. Priest, counsel for the company, after learning of the decision, said:

The Supreme Court decision does not end the matter. Until I see the opinion I can not tell just how far it goes; but at any rate the decision embraces only one feature of the law involved. This, in the main, was the question of whether the ordinance impaired a contract obligation in violation of the Constitution of the United States. In advance of the opinion, I can not say whether we will apply for a rehearing in the Supreme Court.

We have other grounds on which the company can continue resistance by going into the State courts. These include the contention that the tax is unreasonable and excessive, points over which the Federal Court had no jurisdiction and which have not been tried. The company will certainly go as far as it can in resisting and exhaust every remedy at law before it submits. The tax is unfair and unjust, and, we believe, illegal.

The decision terminates four years of litigation in the Federal courts, in which the city was twice defeated on injunction suits brought to prevent the collection of the tax by the St. Louis Transit Company, its successor, the United Railways Company, the St. Louis & Suburban Railway Company and the St. Louis & Meramec River Railroad Company, all of whose lines are now consolidated into the United Railways system. The three suits brought were consolidated for the purpose of appeal to the Supreme Court after Judge Adams and Judge Finkelburg, of the United States District Court, at St. Louis, had both decided adversely to the city. These decisions are now reversed by the higher tribunal.

The ordinance provides a license tax of 1 mill for every pay passenger carried, payable in quarterly installments. The company's sworn return for 1907 shows 216,779,000 pay passengers carried. The tax represents 2 per cent of its gross earnings on car fares. The 1-mill ordinance supplanted a former ordinance under which the city collected a license tax of $25 a car. This was repealed by the 1-mill tax law, and since the passage of the latter the city has not been able to collect either tax.

ANNUAL VOLUME

Owing to the fact that the name of this publication will be changed with the issue of June 6 from STREET RAILWAY JOURNAL to ELECTRIC RAILWAY JOURNAL, the current volume (Vol. XXXI,) will end with this issue. An index covering the numbers contained in Vol. XXXI will be mailed to all subscribers within two weeks. Vol. XXXII will commence with the issue of June 6 and will continue throughout 1908.

THE CLEVELAND STRIKE

The officers of the traction company and their attorneys, members of the State Board of Arbitration, representatives of the strikers and officers of the United Trades and Labor Council spent the greater part of Wednesday night in consultation over the proposed terms of peace. Up to that time arbitration was prevented by the refusal of President DuPont to agree that the strikers should take their places under the seniority rule to the detriment of the old employees who had continued to operate the cars. He expressed his willingness, however, to do this if these men would agree to it. On Wednesday evening the Forest City employees met and waived their rights on this rule in order to promote a settlement of the trouble. This was a move that was, perhaps, not anticipated by the branch of the union on the old Cleveland Electric system as the union had taken away the charter of the Forest City branch some time ago and it was believed that the men were not altogether friendly or in sympathy with the strike movement.

Thursday and Friday efforts were made to complete the arrangement for arbitration and overcome the objectionable points, but President DuPont would promise nothing more than to waive his objections to taking the men back. Vice-president Behner insisted that the men be given their old places as indicated by the seniority rule, pending the arbitration. Mr. DuPont's proposal was to take enough of the men to fill the vacant places at present and allow the positions of the men to be decided by the arbitration board. In that case the seniority rights of all the men would be a subject of arbitration. The questions for arbitration as they stood after Thursday's meeting are as follows: The seniority rights of low-fare employees, Cleveland Electric employees and men employed since the strike started. The bearing it would have upon a labor agreement with a division should the national association suspend the charter of that division. The bearing of the low-fare agreement upon the Cleveland Electric agreement. The present obligation of the Municipal Traction Company to abide by the Cleveland Electric labor agreement.

Two men have been agreed upon as members of the committee on arbitration. One of them is Elroy M. Avery, a well-known educator and historical writer, and the other is Arthur A. Stearns, an attorney and author of several legal works. The third man suggested was G. K. Shurtleff, general secretary of the Young Men's Christian Association, but because of ill health he declined to accept. Saturday a number of other men were considered, but it was found difficult to secure one satisfactory to all concerned.

The latter part of the week, the labor organizations began the circulation of petitions to have the new franchise ordinance of the Cleveland Electric Railway Company submitted to a vote under the Schmidt law, enacted by the last Legislature, which provides for a referendum vote on all public utility grants. It was thought that this franchise had escaped liability to this test, but it seems that the law may be applied, and the probability is that the City Council will be called upon to provide for a vote on the question either at a special or regular election. Business men are in favor of submitting this matter to a vote and it is said that many of them have signed this petition. The number of signatures necessary to secure a vote is 15 per cent of those voting at the last election, which would be something over 13,000. Should a sufficient number of names be secured and the petition presented to the Council, it is said that the matter would stand just where it did before the properties were taken over by the Municipal Traction Company and that the status would not be changed until after the vote had been taken. Should the people decide against granting the franchise, then the Cleveland Electric Railway Company would be in the same position it occupied three months ago and the City Council would be under the necessity of either allowing the company to operate its lines on the West Side, where it is claimed the franchises have expired, or make a grant that would enable it to continue its operation under a city ordinance.

Chief of Police Kohler, of Cleveland, announced May 25 that Otto Posehke, a striking conductor on the St. Clair line, had confessed that he dynamited a St. Clair Avenue car Thursday night. Chief Kohler said he also had a confession from James J. Stanard, another St. Clair Avenue striking conductor, who admitted showing Posehke where the dynamite was hidden. Two other St. Clair Avenue strikers, he said, had confessed that they burned and cut feed wires.

President DuPont, of the Municipal Traction Company, announced May 25 that the motormen and conduetors now employed by his company had, by an overwhelming vote, declined to submit their rights to seniority of position to arbitration. Therefore it had been decided that the men who worked during the strike should have first choice of runs. Many of the strikers, it is said, returned to work May 25, aecepting whatever runs were assigned to them.

THE TOLEDO, BOWLING GREEN & SOUTHERN AND THE TOLEDO URBAN & INTERURBAN CONSOLIDATION

A conference was held a few days ago in Cincinnati at which it was decided to appoint two committees to investigate the financial plan by which the Toledo, Bowling Green & Southern is to take over the Toledo Urban & Interurban property. One of the committees, consisting of five members, will examine the financial plan of the proposed merger and another committee of three members will loqk into the physical condition and management of the Toledo Urban & Interurban Company. Both committees are made up of Cincinnati men and will report to a meeting of the stockholders in that city on June 2. The stockholders of the Toledo, Bowling Green & Southern will meet at Findlay on June 19 to vote on the plan, it is said. The companies are owned largely by the Estate of Charles Kilgour, John Kilgour, George B. Kerper and other Cincinnati men. The Toledo Urban & Interurban Company has been operating the Toledo, Bowling Green & Southern under a lease in conjunetion with its own property, which extends from Toledo to Perrysburg. It is said that the Toledo Urban & Interurban failed to pay its rental to the Toledo, Bowling Green & Southern when due on April 1 of this year and forfeited its lease. The plan outlined is said to provide for the purchase of the Toledo Urban & Interurban property by an issue of $500,000 in 6 per cent bonds and $250,000 in 5 per cent preferred stock. The capital stock of the Toledo, Bowling Green & Southern is to be increased by an issue of $500,000 preferred stock, the remaining $250,000 to go to the stockholders, who are to exchange half of their common stock and receive one share of preferred for every three shares of common, the surrendered stock to be canceled.

STREET RAILWAY STRIKE IN CHICAGO SETTLED

Following a conference on Wednesday, May 20, between President Roaeh, of the Chicago Railways Company, and officers of the carmen's union, the 20 employees whose resignation from the union caused the strike vote, addressed a letter to President Roach saying that out of loyalty to the company they would pay up their baek dues to the union and ask to be reinstated in good standing. They declared that they had no desire to involve the company in any strike or difficulty with the union. The cause of the dissatisfaction among the men having thus been removed, the strike vote was officially declared void.

NEW PUBLICATIONS

Standard Handbook for Electrical Engineers. Second edition, corrected. New York: McGraw Publishing Company, 1908; 1285 pages; illustrated. Price, $4.

The first edition of the Standard Handbook for Electrical Engineers, which was written and eompiled by a staff of specialists, was 5000 copies. It was published about four months ago, and its success has been so great that a new edition has become necessary. No change has been made in the subject matter in the second edition, except that the pages have again been very carefully read for typographical and other errors. A number of other improvements, however, have been made in the book. A lighter and thinner paper has been used, so that the thickness has been decreased by about ¼ in., and the weight by a corresponding amount. Another important improvement in the book is that it has been provided with a thumb index. This change is of especial value in this particular book since the index references are all made to sections, and with the thumb index one is able to turn immediately to the part of the book where the reference is given. Since its publication, the handbook has been adopted as offieial text in 30 engineering clubs and universities. The price remains the same as before.

STREET RAILWAY PATENTS

UNITED STATES PATENTS ISSUED MAY 12, 1908.

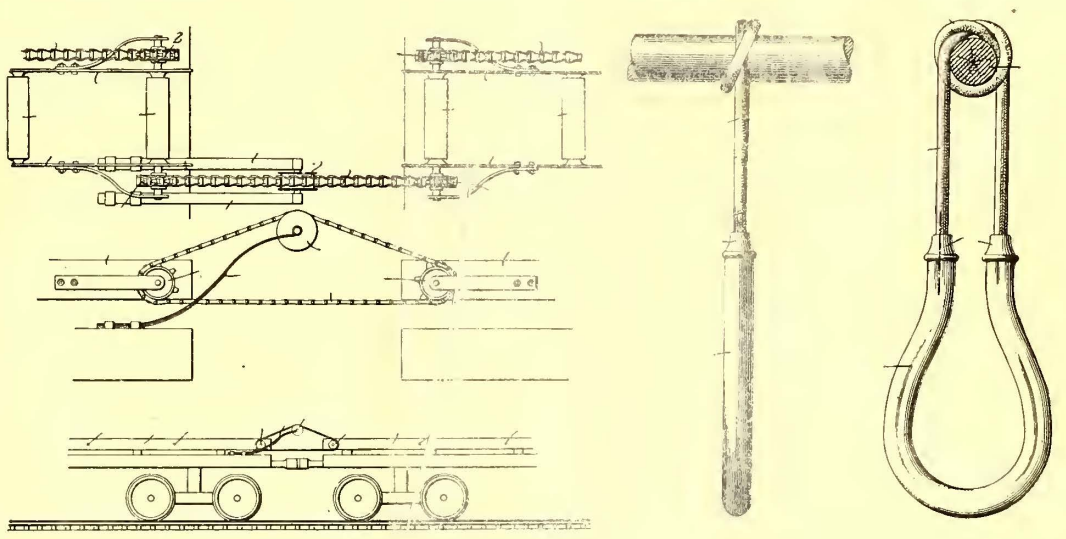
[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

887,077. Sleet-cutter and Scraper; Frank L. Dye, Springfield, Ill. App. filed Jan. 28, 1908. Provides a supplemental wheel mounted on a supplemental pole section, and which has a toothed tread so as to cut away ice in advance of the trolley wheel.

887,082. Amusement Device; Edgar M. Fraser, New York, N. Y. App. filed Feb. 28, 1908. Consists of a hollow spherical casing adapted to revolve on any surface and made in two halves capable of being opened and closed. This frame is provided on its inner surface with swivel casters, which rolls a semispherical car equipped with seats for passengers, the car carrying a ballast whereby it will always tend to remain at the bottom of the inner surface of the spherical frame while the latter revolves.

887,161. Track Laying Machine; Charles O. Wescott, Puyallup, Wash. App. filed Sept. 23, 1907. Relates to improvements in track laying machines and is more particularly an improvement in the tie conveyor for use on a track laying machine previously patented.

887,169. Signal or Switch Apparatus and Signaling System; Adoniram J. Wilson, Westfield, N. J. App. filed Oct. 15, 1902. Provides a signal arrangement to assume three positions. Operated by fluid pressure motors preferably using liquid gas, the liquid gas being stored in a tank in proximity to the signal.



PAT. NO. 887,231

887,218. Tamping Tool; Gaston Oliver, Lynchburg, Va. App. filed March 2, 1908. A tamping tool particularly adapted for tamping the earth under railway ties, comprising a shoveling device, a bar carried thereby, a tamper carried by the car, and means for reciprocating the bar to operate the tamper.

887,226. Railway Switch-throwing Mechanism; John N. Quinn, Cincinnati, O. App. filed Aug. 12, 1907. Relates to a switch of that character adapted to be thrown by a passing train and afterward automatically thrown back to its initial position. Means whereby the switch may be operated manually independent of the automatic control.

887,234. Brake Shoe; Joseph D. Gallagher, Clenridge, N. J. App. filed Oct. 19, 1907. Consists of a sectional body, and a back made of a single piece of metal and removably secured thereto.

887,235. Hand-Strap; James S. Doyle, New York, N. Y. App. filed Sept. 7, 1907. A hand grip for street railway cars comprising a yoke-shaped tubular metal member having a surface of hard enamel, and a flexible suspending member adapted to pass over the pole of the car in such a way as to produce a hitch around the pole and prevent swinging.

887,274. Brake Shoe; William H. V. Rosing, St. Louis, Mo., and Frank L. Gordon, Chicago, Ill. App. filed May 3, 1907. Comprises a tread-bearing part, and insets of a different material in said bearing part, said insets being of greater width than the remainder of the tread-bearing part.

887,287. Railway Switching Apparatus; John D. Taylor, Pittsburg, Pa. App. filed March 5, 1907. A switch apparatus in which a number of switches are operated and controlled from a central station, the controlling levers interlocking with one another to prevent conflicting routes. Includes complete electrical and mechanical features and has means for governing the passage of cars along a railway.

887,288. Apparatus Governing the Passage of Cars or Vehicles Along a Railway and the Control thereof; John D. Taylor, Edgewood Park, Pa. App. filed Sept. 4, 1904. Relates to modifications of the above.

887,289. Apparatus for Controlling the Passage of Trains; John D. Taylor, Wilkinsburg, Pa. App. filed Oct. 26, 1904. Relates to additional modifications.

887,290. Control of Apparatus Governing the Passage of Cars or Vehicles Along a Railway; John D. Taylor, Pittsburg, Pa. App. filed Aug. 23, 1906. Covers still further modifications.

887,291. Safety Controller for Electric Switch-Operating Apparatus; John D. Taylor, Pittsburg, Pa. App. filed Dec. 8, 1906. Relates to electric switches and means by which they are successively displaced to one position or the other by successive closures to an operating pilot circuit.

887,299. Derailer; Edwin H. Alfree and William H. England, Chicago, Ill. App. filed Aug. 8, 1907. This device is adapted to be attached to the base flange of the rail, the operating parts being hinged so that they may be swung into or out of position while still attached to the rail base.

887,324. Switch Mechanism; Charles F. Gay, Spokane, Wash. App. filed July 24, 1907. Consists of a pair of arms mounted on opposite sides of the main line rail and adapted to swing in a horizontal plane toward and away from the rail, a connection between the arms and the switch tongue whereby the movement of the arms will move the tongue, and means carried by a car for operating said arms to move the switch tongue in the desired direction.

887,362. Rail Truck; Aaron Warfield, Toronto, Ontario, Canada. App. filed May 19, 1906. Provides a truck for steam and street railways, having cast side frames designed to eliminate as far as possible bolts and rivets in the construction of the frame.

887,426. Switch Operating Device; Thomas W. Rich, San Diego, Cal. App. filed July 9, 1907. Mechanical means for throwing a switch from a moving car.

887,429. Trolley Wheel for Electric Cars; George C. Stratton, Camden, N. J. App. filed July 18, 1907. The trolley wheel is mounted between a pair of concentrically revoluble plates having radially projecting spokes or arms designed to close over the trolley wire.

887,483. Electrically Propelled Vehicle; Joseph Ledwinka, Philadelphia, Pa. App. filed Aug. 3, 1907. A driving unit comprising two vehicle supporting wheels which are maintained in axial alignment, but are relatively rotatable by independently controllable motors. Is particularly applicable to trucks for trolley railway cars.

887,488. Combined Railway Chair and Rail Fastener; Vincenz Malik, North Braddock, and Ernest W. Cook, Wilkinsburg, Pa. App. filed May 18, 1907. Comprises a base or body

portion having extended ends adapted to rest on the ties, upwardly extending splice-bars to overlap the base and web portions of the rails, a strengthening rib depending centrally from the body portion, and transversely disposed reinforcing webs for said splice-bars and rib.

887,489. Automatic Train-Pipe Coupling; Norman E. Marvin, Springfield, Mass. App. filed Nov. 19, 1907. An automatic coupling device comprising head-pieces having channels therein, a valve in each head-piece and surrounded by the channels, which channels are normally closed by the valves, means forming a part of the valves and projecting beyond the face of the head-pieces for operating oppositely disposed valves, and simultaneously uncovering the channels.

887,504. Automatic Switch for Trolley Lines; Joseph Nelson, Cape May, N. J. App. filed Aug. 30, 1907. The trolley pole has a pair of special contact rollers adapted to engage plates alongside the trolley wire and selectively energize magnets controlling the switch point.

887,576. Railway Signal. Sofrony Bayas, Los Angeles, Cal. App. filed April 15, 1907. A pair of special trolley wires are provided which are adapted to be energized by a generator within the locomotive cab and actuate alarm signals in case another train should be on the same block or section.

887,599. Railway Track Cleaner; Theodore Develer, Lancaster, Pa. App. filed Sept. 25, 1907. Details of construction.

887,607. Track-Laying Machine; Charles E. Drummond, Twin Falls, Idaho. App. filed Oct. 26, 1907. An auxiliary track extends along one side of the train and has small cars for transporting material throughout the length of the train.

887,617. Car Brake; Jacob Fine, Louisville, Ky. App. filed Feb. 21, 1908. A combined wheel and rail brake, the shoes of which are mounted on an integral bracket so as to be simultaneously applied.

887,637. Brake Slack Adjuster; Maury W. Hibbard, Chicago, Ill. App. filed May 4, 1899. Comprises a two-part overlapping tie rod between the brake levers and a spring cooperating with such rod and adapted to be compressed by an excess travel of the levers upon application of the brakes and reacting to eliminate slack on the release of the brakes.

887,649. Wheel; Julian Kennedy, Pittsburg, Pa. App. filed Nov. 30, 1906. The wheel is composed of a center portion and a rim portion, the two portions being separately and independently formed and united by an electrical weld extending between and throughout the directly contacting surfaces thereof.

887,652. Device for Conveying or Transporting and Affording Amusement; Imre Kiralfy, South Kensington, London, England. App. filed Nov. 18, 1907. An endless cable for conveying passenger cars in an extended circuitous course.

887,691. Electrically Driven Vehicle; William B. Potter, Schenectady, N. Y. App. filed June 25, 1903. A trolley for use on vehicles adapted to run over a highway without tracks. Has a pair of trolley wheels connected by a universal joint to the trolley pole and maintained by springs in contact with a pair of trolley wires, regardless of the position of the pole.

PERSONAL MENTION

MR. JOSEPH A. McBRIDE has been appointed auditor of the Pacific Electric Railway Company, vice G. W. Mulks, resigned.

MR. JOSEPH L. HAGEN, who has been connected with the purchasing department of the United Traction Company for a number of years, with headquarters at North Albany, has been placed in charge of the Troy office.

MR. WILLIAM P. BOARDMAN, the builder of the first street railway in America, died at his home in Desmet, S. D., on May 21, and will be buried in Binghamton, N. Y. Mr. Boardman superintended the construction of the old New York & Harlem Railway, the line which now nearly corresponds with the Fourth Avenue Railway. It connected the Bowery with Harlem.

MR. D. A. CALHOUN, in the past connected with railroad location and construction work in the United States, Mexico, South America and the Philippine Islands, has become a member of the firm of Caccavajo, Pruyn & Calhoun, of New York, consulting engineers. These gentlemen have now also become associated with Dr. Louis Duncan and Mr. Lamar Lyndon, consulting electrical engineers.

MR. B. E. TILTON has resigned his position as engineer of maintenance of way for the Municipal Traction Company, and will take up similar duties with the railway company at Rochester, N. Y., at once. The men who have been in the employ of Mr. Tilton presented him with a silver military set as a token of their appreciation before he left the city. Mr. Harry Bunning, engineer of the Forest City Railway Company, has been appointed to succeed Mr. Tilton.

MR. D. H. HERFLICKER has been appointed supervisor for the Southern Division of the Public Service Railway Company, at Camden, N. J. The position was made vacant by the resignation of Mr. H. H. Patterson, assistant division superintendent, who accepted the superintendency of an electric railway in Pennsylvania. Mr. Herflicker started as conductor with the Philadelphia Rapid Transit Company 14 years ago, and has filled a number of responsible positions with the Wilmington Railway Company and the Scranton Railway Company.

MR. ROBERT DAHLANDER, who was in charge of the electrification plans of the Swedish State Railways, has resigned to become president of the Stockholm municipality's gas and electric undertakings. Mr. Dahlander was born in Göteburg, Sweden, in 1870, and was graduated from the Stockholm Technical University in 1890. After graduation he was employed as engineer in several large electrical works in Sweden and abroad, and from 1903 has been connected with the electrification projects of the Swedish State Railways. Mr. Dahlander's report has been published in Swedish and is to be translated into English and German.

SIR J. CLIFTON ROBINSON, managing director of the London United Electric Tramways Company, who has recently completed a tour around the world, has written a valuable article on "The Railway Problem in Japan" for the April 29 issue of the *London Times' Engineering Supplement.* Sir Clifton describes the physical difficulties which have prevented the rapid and unified growth of the Japanese steam railways and states that government ownership was adopted for strategic rather than economical reasons. The government is finding it difficult to raise money for extensions and improvements and Sir Clifton believes it would be better if some partnership agreement were made with some powerful financial interests to carry out the desired ends. Japan has 5014 miles of steam railroads for about 50,000,000 people; the average number of journeys per head is 2.4, and the average distance traveled per head is 42 miles. Sir Clifton also writes that the government is considering concessions for the construction on a large scale of electric railways of interurban type as feeders to the steam trunk lines.

MR. A. F. CLARK has been appointed acting superintendent of shops of the United Railways & Electric Company, of Baltimore, Md., to succeed Mr. H. H. Adams, who as previously noted in the STREET RAILWAY JOURNAL has been appointed superintendent of rolling stock and shops of the New York City Railway Company. Mr. Clark formerly was assistant to Mr. Adams, having acted in that capacity since July, 1907, when he resigned from the J. G. Brill Company. Mr. Clark is only 29 years old, and is a graduate of the Sheffield Scientific School with the degree of M.E. Subsequently he pursued the evening course in electrical engineering in Drexel Institute, Philadelphia, while with the Brill Company. He was born in Oakland, Cal., and received his elementary education in the public schools of that city, and prepared for Yale at the Central High School in Philadelphia. For a short time after graduation he was employed as an apprentice in the erecting shop of the Southwark Foundry & Machine Company, of Philadelphia, Pa., but later resigned to enter the draughting room of the Bethlehem Steel Company, of South Bethlehem, Pa. In 1901 he became connected with the Link-Belt Engineering Company, of Philadelphia, but in 1903 resigned from this company to become connected with the Brill Company, in charge of the designing of the details of car bodies and with special supervision of brake designs. Later he had charge of checking all drawings for the company. When the Brill Company opened its department for the construction of steel underframes in 1907, Mr. Clark was appointed foreman of the department. It was during this connection that he pursued his studies at the Drexel Institute.