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Of this issue of the Street Railway Journal, 8200 copies are printed. Total circulation for 1906 to date, 212,600 copies, an average of 8177 copies per week.

The New York Inter-Line Coupon Book

One of the most important subjects discussed at the Saratoga Convention of the New York State Street Railway Association this week was that relating to the adoption of an inter-line coupon book. The advantages of a book of this kind have already been demonstrated by the interchangeable mileage books of the steam railroad companies, and still more directly by the interchangeable coupon book employed by

the Central Electric Railway Association. There is no doubt that a plan of this kind stimulates riding, especially through travel, and saves a great deal of trouble to both the passenger and conductor in the way of making change, so that it is worth all it costs. The rate at which the book is sold, 240 coupons, or \$12 worth of travel, for \$10, is the same as that adopted by the Central Electric Railway Association, and the clauses covering the use and redemption of these coupons, proposed for adoption at the Saratoga Convention, are also very similar. We shall not comment in detail upon the various provisions of the interchangeable coupon book contract until the final form as adopted at Saratoga this week is available, but touch upon the plan this week as a step in the right direction.

T-Rails in the Convention City

Sensational daily newspapers of Columbus, Ohio, are making an uproar because the Columbus, London & Springfield Railway wants the privilege of removing the grooved rail on its interurban loop and on the track leading out of the city and substituting high T-rail in its place. The company offers to use suitable paving for such rail and keep it in repair. Recently the company took a party of city officials to Dayton, Indianapolis, and several other places, and showed them the use of T-rails on paved streets, and part of the daily press is now endeavoring to show that the company's methods look like graft, and that the company wants to operate freight trains and high-speed passenger trains through the city. There is no question that the company's objection to grooved rail in this case is well founded. Its cars are unusually heavy, and are built for high speed, and to insure safety a wheel flange is used that is too large for the groove of the present rail. The danger of operating under such conditions is well known to every traction manager. The wheels bear only on the flange instead of on the tread, and in wet weather it is almost impossible to secure proper braking effect. In severe winter weather the conditions are even worse. The groove fills with ice and snow, derailments are liable, and it is almost impossible to handle the car properly or even safely. Two recent accidents in Cleveland, where cars crossing viaducts were derailed by small obstructions in the groove, and where great loss of life was prevented only by miracle, afford the best possible argument in favor of the contention of the company in Columbus, and elsewhere where the same conditions prevail. That the power consumption is greatly increased and wear on the flanges is excessive are of course among the objections which the company has against this track. Some years ago, at Springfield, Ohio, the former manager of the Columbus road, after several accidents caused by grooved rails, armed a force of men with cold chisels one night and chipped the groove from a mile of track through Springfield, and then defied the authorities to take action. The track remains in that condition to-day. It is to be hoped

that a similar measure will not be necessary in Columbus, although there would be strong provocation for it if the city insists upon the use of a piece of track which is dangerous to the public and needlessly expensive to the company. There are many miles of T-rails on city streets in large municipalities in the Central West, and where a street is properly paved and maintained there is no more, if as much, danger of annoyance to drivers of horse-drawn vehicles, as with the grooved or girder rail.

Track Layouts at Summer Resorts

Electric railway systems at seashore and other summer resorts do not usually do a very profitable business on account of the shortness of the season, and for this reason this class of railways is looked upon with considerable disfavor by investors. Nevertheless, the conditions under which they operate have their compensating advantages. One is that people visit a resort of this kind to spend money, and higher fares can and ought to be charged for transportation compared with those in force on roads elsewhere. Again, the construction and equipment need not necessarily be of as high class, nor need the power station and distribution system be as efficient, owing to the short period for which they are called upon to transmit the maximum output. Again, it is nearly always possible to develop a considerable excursion business. Residents of one seashore resort can be encouraged to visit other resorts by a proper amount of advertising or something in the way of attractions, such as fireworks or park amusements. And if the line runs by the shore for any considerable distance, or through an attractive territory, considerable purely pleasure riding can be developed. Of course, owing to the short season, a system of this kind can best be worked in connection with a city property, because the power required during the summer months can be secured without any large permanent investment in power generating or translating apparatus, and because a satisfactory arrangement for the use of cars and labor can usually be planned.

The determination of the best track layout for a road of this kind is an interesting question. The geography of the city or town served is, of course, the principal factor in the problem, although the location of special attractions for the public is of almost equal importance in its bearing upon the best track location.

In most resorts located on the sea coast or on the shores of any considerable body of water, the visitor soon discovers that the town consists in the main of a narrow strip of streets and buildings skirting the shore. Width does not count for much in these communities. Rockaway Beach and Far Rockaway furnish an excellent illustration of attenuated topography, and the Jersey seashore resorts of Long Branch, Elberon and West End another. Perhaps the most typical layout of this sort is in Atlantic City, N. J.—a town whose fixed population is some 28,000, with a summer population of 200,000. In Atlantic City the main line of electric railway service traverses the town in a double-track route parallel to the ocean shore, and consequently parallel to the famous seven-mile Board Walk, but about a third of a mile distant. A few branch lines intersect the main line at right angles, but they are far between. Eight-cent exchange tickets are furnished between the main line and the spurs.

In all of the seashore resorts of the kind we have been

considering, the center of interest and activity is, of course, on the shore, and if the railway company wishes to secure any considerable amount of business it is self evident that the line must be near enough to the shore so that it is a convenience and saves time and distance as compared with walking. Of course in all of these resorts there is a permanent population in the village away from the shore, so that the best location for winter traffic is not necessarily the same as that for summer. What we wish to emphasize, however, is that persons wishing to travel from one point to another on the shore in one of our elongated summer resorts will not walk back to a trolley line a quarter or a half mile away if they can avoid it.

Alcohol Motors

Since the passage of the free alcohol bill we have been pleased to see the favorable information regarding alcohol motors which has come to hand. Alcohol has so many advantages for use as fuel in internal combustion engines that its advent at a low price should work, not perhaps an industrial revolution, but very material changes in practice. Looking at the matter in its broader aspects, the greatest advantage of alcohol as a fuel lies in the fact that it makes very little draft on the world's capital account. It is practically an agricultural product instead of a rather meager by-product of the petroleum industry, the resources of which are in the nature of things limited. At the present range of prices abroad gasoline is ranked as slightly cheaper than alcohol, but with the rapidly increasing demand of internal-combustion engines this condition can not long be maintained. Gasoline has, it is true, the advantage in thermal value, but alcohol can be worked at enough higher economy to nearly offset the difference. During the hearings on the free alcohol bills, the evidence given by experts on engines was very definite upon this point. Prof. Elihu Thomson, who has studied internal-combustion engines for years, was very explicit in this regard, stating that, gallon for gallon, alcohol can develop substantially the same power as gasoline, less energy being rejected in the exhaust, and the conditions of combustion being more favorable. Mr. Goebels, of the Otto Gas Engine Company, went even further, stating as a result of experiment that with engines of the same cylinder capacity the alcohol engine would give about 20 per cent more power than the gasoline engine, and would give a thermal efficiency of 30 per cent.

Such a gain in output, even were it accompanied by no gain in efficiency, would be of considerable value in the automobile industry, leading to a lighter engine. In larger industrial work the gains are perhaps less material, but it seems certain that in alcohol we have a fuel of about the same present cost as gasoline and having advantages in safety, cleanliness, and freedom from offensive odors. Reports from abroad on locomotives driven by internal-combustion engines were referred to briefly in an editorial way last week, and indicate that for light work and industrial purposes very excellent results can be attained. Considering the interest now increasing in independent motor cars for casual railway purposes, the advent of alcohol motors is of particular importance. That it will greatly change the conditions of economy in such cases can hardly be expected, but it will at least keep them from becoming more unfavorable owing to

increasing cost of fuel. All sorts of waste material now thrown away can be worked up in the alcohol industry, so that there is no danger of the supply running short even in years of meager crops, and with the product duty free there can be an interchange of resources that will be very helpful in steadying prices. The main industrial danger is the creation of an alcohol monopoly, which will have to be watched for and guarded against from the very outset. With the duty off, such a combination will not be easy to create or maintain, but it will infallibly be tried. Meanwhile we hope that the makers of engines will busy themselves to meet the demand which certainly will arise. The alcohol engine must be slightly modified from the gasoline type in order to reach the best results, but in the long run it should be rather less than more difficult to make and to maintain.

Hydro-Electric Power for Railways

With the increasing availability of transmitted power, more and more railways are enabled to take advantage of it, and the questions of economy connected with it are therefore to the front. Electric railway plants have generally undesirable load factors and heavy losses in distribution. On the other hand, they are often of large output, and hence in a position to put power on the bus-bars at a comparatively low figure. With respect to load factor two entirely distinct conditions arise. First, the load factor for the station as a whole may be low; second, the working load factors on the machines may be low. If both conditions coexist, the outlook for economy is bad, but the load factor of the machines affects the economy of operation, while the load factor of the station affects mainly the fixed charges. In planning for the use of transmitted power, it is the machines that should particularly be borne in mind, for ordinarily the existing equipment will still be carried, with somewhat lessened maintenance charges, it is true, although disuse cannot cut off all expense. In contracting for transmitted power it therefore behooves the manager to make plans for decreasing his operating losses. This can be done in two ways, first by cutting off distribution losses and, second, by improving the load-factor conditions. It will often happen that in arranging for transmitted power a considerable saving in the total amount of energy furnished can be made by one or more deftly-arranged sub-stations, and when possible this is a very profitable use to make of transmitted power.

In the main station attention should be directed to applying the power under conditions that will enable the steam-driven units in use to work at or near full load, in case transmitted power for the whole load is unavailable. So long as a direct-connected unit is running in the vicinity of its rated load, it makes little or no difference in economy whether the total output of the station is caring for a peak or not. It strikes us as important, therefore, so to draw contracts for power that even if the hydro-electric source wishes to avoid peak loads it shall still be able to carry through load until an added steam unit can be put into service at a fair load factor. In buying power, therefore, it is better not to buy a block with sharply-defined limits, but rather to make a contract with a certain amount of leeway above the block guaranteed, so as never to run engines badly underloaded. We believe an arrangement of this kind is better than any maximum-demand system both for buyer and seller. The former knows

exactly what his power is costing, and the latter knows that he can be called upon for a reasonable amount of extra power and no more, which is very important in a hydro-electric plant of limited capacity. The fact is that when the maximum-demand system is arranged so as theoretically to protect the seller's capacity it is almost invariably disadvantageous to the buyer. The simpler a contract for power and the more definite the rates, the less likelihood of misunderstandings. Peak loads are undesirable for all parties concerned, and have to be paid for, but certainly the buyer does not want to pay for hypothetical peaks, particularly if he can carry them himself on well-loaded generators. As to equitable prices, the railway manager knows, or ought to know, how much his power is costing at the bus-bars and how much output he can save by the installation of sub-stations, and he can very generally show a saving by buying transmitted power, particularly in buying a considerable block on a long-term contract. It may pay handsomely to buy power for outlying districts, even when the costs of central station generation are too low to show economy in purchase.

Sub-Station Lighting at Night

In the operation of electric roads covering a large amount of suburban or rural territory, the question of lighting sub-stations and sometimes small shops in the small hours at remote points on the system assumes a certain importance. The lighting load in such cases is often entirely too small to be efficiently handled by a single large generating unit in the power house, and yet light must be had from some source. It is not feasible either to inspect or repair equipment with any thoroughness by the light of an oil lantern, although in an emergency an oil headlight with a locomotive type of reflector is better than nothing. The installation of a small storage battery for sub-station lighting is generally too expensive a way out of the trouble, and the combined load of half a dozen sub-stations is too small to be handled economically by the exciter plant in the main power house, supposing two or three of these units were connected in series to give a fair value of voltage at the nearer sub-stations.

When a sub-station is equipped with a regulating battery for railway service, ample light can, of course, be had for any purpose whatever, and in shops where machine work is carried on at night by motor-driven tools, it is a simple matter to obtain all the light which is required from the power circuits. Sometimes a company can fall back upon the local central station with advantage. A case of this kind occurs in Southern New Hampshire, where the Rockingham County Light & Power Company, of Portsmouth, supplies eight sub-stations of the New Hampshire Traction Company with lighting current in the small hours in the form of 600-volt single-phase energy transmitted to the sub-stations through the trolley wire, using the regular ground return as one side of the circuit. In this scheme the most distant sub-station is about 60 miles away, on the borders of Nashua, but the total load for lighting seldom exceeds 8 kw or 9 kw. On roads where current is available for moving cars at any time of night the lighting problem cannot be said to exist, but some provision is desirable in all cases, either by local arrangement, the use of large acetylene or oil lamps, or the installation of a small generating unit at the main power house which can be run with fair earning at light loads.

IMPROVEMENTS ON THE ST. LOUIS & SUBURBAN RAILWAY

Occasioned partly by the World's Fair, just previous to the opening of the exposition, the power house of the St. Louis

The more extensive of these improvements has been the reconstruction and double tracking of the Florissant-Ferguson division, together with the erection of a new sub-station on the line to meet the demands of the heavier loads occasioned

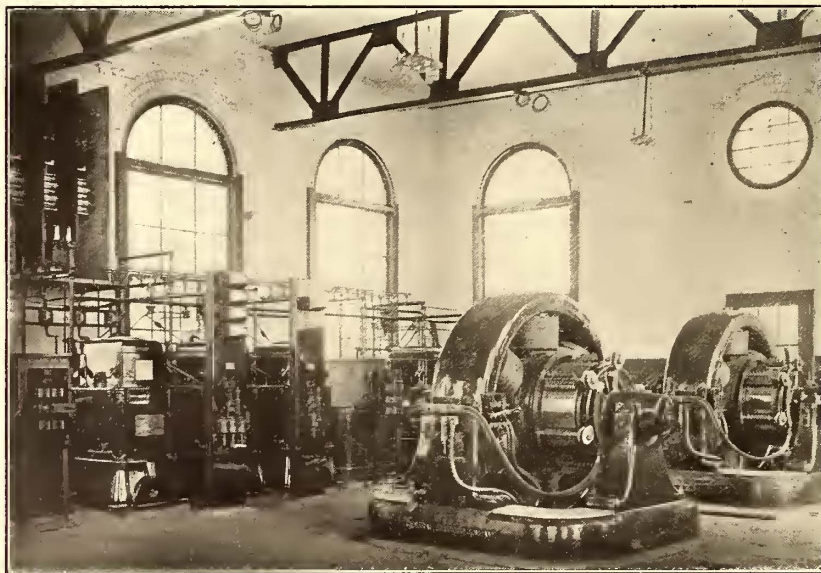


MAP OF TERRITORY TRAVERSED BY THE ST. LOUIS & SUBURBAN RAILWAY

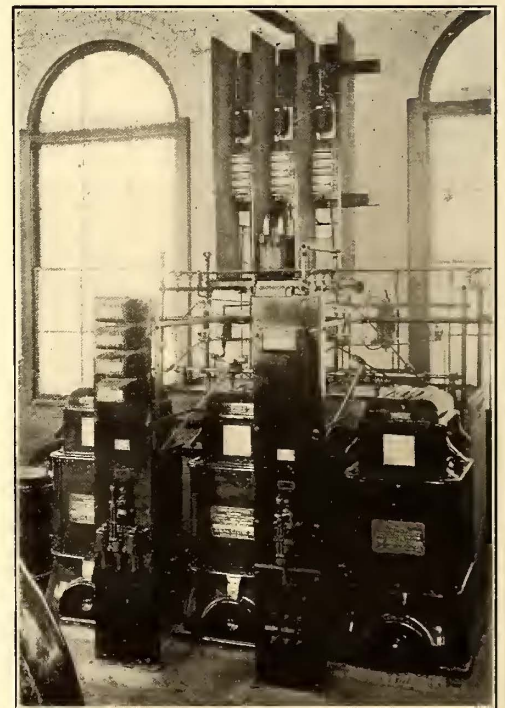
& Suburban Railway Company was overhauled and new generating units were installed, several new cars added to the equipment and new extensions of the lines were made to the fair grounds. Because of the preparations made at the time for handling visitors to the Exposition the company has not since been compelled to make any extensive improvements on the portion of the line in the city. However, the location of factories and the building of suburban residences in the

by the increased number of cars operated. The relative location of this division, as well as that of the newly built sub-station, may be understood by reference to the accompanying map of the system. The track improvements consisted in reconstructing and laying a double track from Suburban Garden the entire distances to both Florissant and Ferguson. The original single track to Florissant was laid about 25 years ago by the Narrow Gage Steam Railroad Company. It is interesting to note that this rail was in constant service up to the time of its removal, and when taken up was in good relaying condition and is now in use in side tracks and switches. In the work of reconstruction the greater portion of the track was laid with an 80-lb. rail of standard cross section. However, some rails of 70 lbs. were also used. Span wire construction is employed to support the trolley, one set of poles carrying the high-tension wires, while telephone wires and direct-current feeders are carried by a single cross arm on the poles on the opposite side of the track. Practically the entire line is ballasted with cinders.

The line passes over the tracks of the Wabash Railroad near Normandy Hills on a steel structure. Several heavy grades are encountered on the route. As it was necessary to do all the grading with pick and shovel, and the workmen



INTERIOR OF ST. LOUIS & SUBURBAN RAILWAY COMPANY'S SUB-STATION, SHOWING ROTARY CONVERTERS, TRANSFORMERS, ETC.



THE ENTERING HIGH-TENSION WIRES, DISCONNECTING KNIFE SWITCHES AND CHOKE COILS IN SUB-STATION

outlying district west and northwest of the World's Fair grounds since the Exposition has made necessary considerable improvements in the suburban divisions of the road which penetrate this suburban district.

moreover were compelled to be continually on the alert for cars, the cost of the work was much in excess of that for similar construction of new roads where the necessity of maintaining a schedule does not handicap the work and

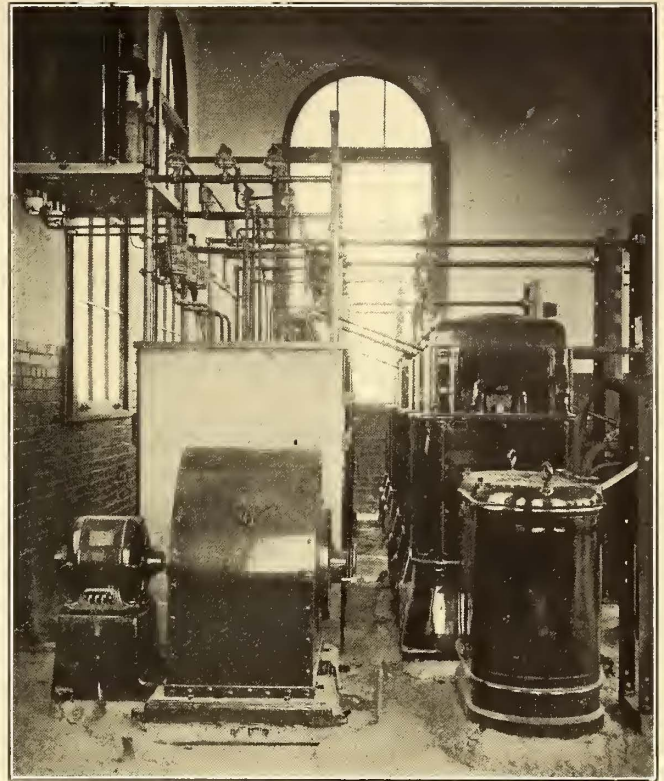
where steam shovels and other appliances can be employed. The cost of the line was materially increased by the cost of the right of way for the additional track. The distance from Suburban Garden to Florissant is 10 miles, and the Ferguson branch adding three miles gives a total of about 13 miles over which right-of-way for the double track was acquired. With property ranging in value from \$5 to \$15 per foot the amount invested in the division will easily reach over half a million dollars.

The whole region traversed by the line will ultimately be built up with suburban residences. The fact that the city lines of the railway company is operated on a private right-of-way well into the center of the city brings the district comparatively close to the business portion of the city. The country is somewhat rolling and by reason of this, and the fact that much of it is in natural woodland, many excellent sites are offered for suburban residences of the costly type. Already several of these have been built adjacent to the line. Some of the more wealthy property owners have provided elaborate private stations on their grounds. One of these, a stone structure with tile roof and cement platform, immediately in front of it, is shown in an accompanying illustration. People of modest means are also being attracted to the district. Several large tracts which have been acquired by real estate dealers have been plotted and lots are being disposed of at reasonable prices.

The vicinity of Suburban Garden is desirable property for factory sites. It is convenient both to the west belt of the Terminal Railroad and to the Wabash Railroad. Two factories, each employing several hundred men, have already located here and several others will follow in a short time. Both gas and oil have been located on the property of the railway company and this has given quite an impetus to this district.

At the present time no attempts are being made to handle freight on the Florissant-Ferguson division. The location of the road, however, is such that it can be made to serve as feeders to the steam railroads, and the company is contemplating hauling freight with this purpose in view, in the near future and the location of the Florissant offers special induce-

and Ferguson divisions at 6600 volts. The sub-station building is of brick with concrete basement and floors. Installed at the present time are two 330-kw rotary converters, but in the construction of the building space has been provided for

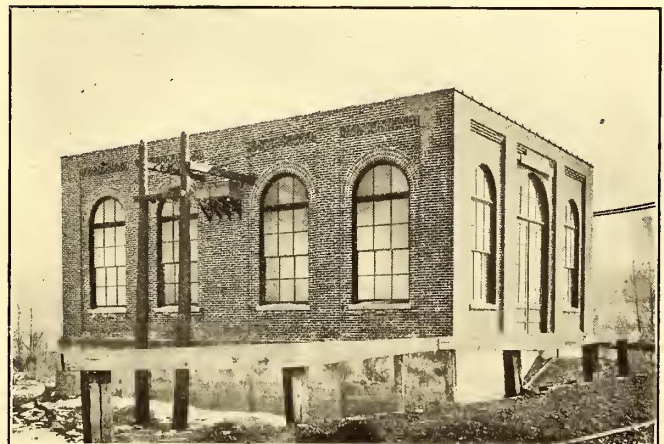


SWITCHES AND TRANSFORMERS IN ST. LOUIS & SUBURBAN RAILWAY COMPANY'S SUB-STATION, ALSO SHOWING METHOD OF CARRYING HIGH-TENSION BUS-BARS

an additional one. The main floor of the sub-station contains but one room and all of the electrical apparatus is installed in this. The high-tension wires enter through the wall of the building in a manner well shown in one of the ac-



PRIVATE WAITING STATIONS ON THE FLORISSANT-FERGUSON DIVISION OF THE ST. LOUIS & SUBURBAN RAILWAY



EXTERIOR OF SUB-STATION, SHOWING ALSO ARRANGEMENT FOR ENTRANCE OF HIGH-TENSION WIRES

ments for the development of freight and express traffic. The town has a population of 1500 and the electric line is the only railway entering it.

THE NEW SUB-STATION

Current for operating the Ferguson-Florissant division is obtained from the power house at DeHodiamont and is transmitted to the new sub-station at the junction of the Florissant

companioning views. Protection from moisture is afforded by a head house built over the square openings in the wall through which the wires pass. The three legs of the circuit after entering the building are separated from each other by slate barriers and the disconnecting knife switches, choke coils and lightning arresters are placed in the compartments formed by the barriers. The ground for the arresters is run

down the wall of the building and terminates in a buried ground plate set in pulverized coke. After passing through the choke coils, the high-tension wires drop along the wall to the General Electric hand-operated oil switches.

By reference to the plan it will be observed that all the high-tension apparatus has been so placed as to require the minimum length of high-tension cable. The bus line is immediately over the oil switches and is carried on an iron frame supported partly by the switch structures. This frame is of wrought iron pipe, the insulators being supported by pins clamped around the pipe. From the bus-bars leads to the oil switches for the machines drop directly down. The emerging wires from the switches are carried up over the frame again and into the air blast transformers. The secondaries of the transformers are taken out through the base into the air chamber in the basement and then along the underside of the floor to the machines. The direct current leads from the machines drop down through porcelain insulators and are carried to the switchboard on the side of the room opposite the entering high-tension wires. At present two blowers for the transformers and the reactance coils are installed. The blowers are of the Buffalo Forge Company type and are driven by 1-hp induction motors. Plans, however, provide for four separate blowers, one for each of the three sets of transformers and an extra one for emergency.

The converters are started from the alternating-current side by means of the reactance coil previously mentioned. A starting panel for each machine is located near the reactance coil and adjacent to the alternating-current machine panel upon which is the control for the high-tension oil switches. The equalizer stands for the separate machines are located at the direct-current end and nearest the switchboard. The switchboard consists of four direct-current feeder panels and three direct-current rotary panels. The feeder panels are provided with General Electric form K circuit breakers and Thomson recording wattmeters. The outgoing feeders drop

down below the floor immediately behind the switchboard and are then carried up along the wall to a point near the roof trusswork, where they pass through the wall to a pole line. The sub-station was built and designed under the supervision of John A. Kreis, Jr., master mechanic and superintendent of power stations of the road.

One express aim in the design was the accessibility of apparatus and cables, and reference to the plans will show that the idea has been well carried out. It may be noticed that the wiring of the cables is all open work. No tubes or ducts are employed except where the wires pass through floors or partitions.

THE OPERATION OF CARS IN TRAINS AT COLUMBUS

A novel method of train operation has been inaugurated by the Columbus Railway & Light Company, of Columbus, Ohio. Practically all of the city cars are operated over High Street,



FIG. 2.—A TWO-CAR TRAIN IN COLUMBUS, OHIO

in the downtown district, and the tracks in this street have about reached the limit of their carrying capacity. To lessen the congestion on this street, as well as to increase the carrying capacity during rush hours, some of the city cars are operated in two-car trains, with two motors on each car. Only



FIG. 3.—CABLE RECEPTACLE ON THE DASH



FIG. 4.—JUMPER TERMINAL WITH WIRE EXPOSED



FIG. 5.—COUPLING BETWEEN TWO CARS

one of the cars of each train is provided with a multiple-unit control system. The rear one has a controller of the K-10 drum type, and the motor circuits of the two cars are connected by means of jumpers between the cars. The accompanying drawing, Fig. 1, shows the wiring of the two controllers and the manner in which the connections are made. Fig. 2 shows a train of two motor cars, as operated at Columbus.

Each of the cars is equipped with two motors, but the forward car of the train is provided with a type-M General Electric multiple-unit equipment for four motors. The wiring of the multiple-unit controller is identical with that of an ordinary four-motor equipment, with the exception that the leads for motors No. 3 and 4, instead of going to motors, are tapped into a bus line, extending the full length of the car, and terminating in receptacles on each dash. On the rear car wires leading from the receptacle on each dash are tapped in on the motor leads, and other than this addition no changes from the usual K-10 controller wiring is made.

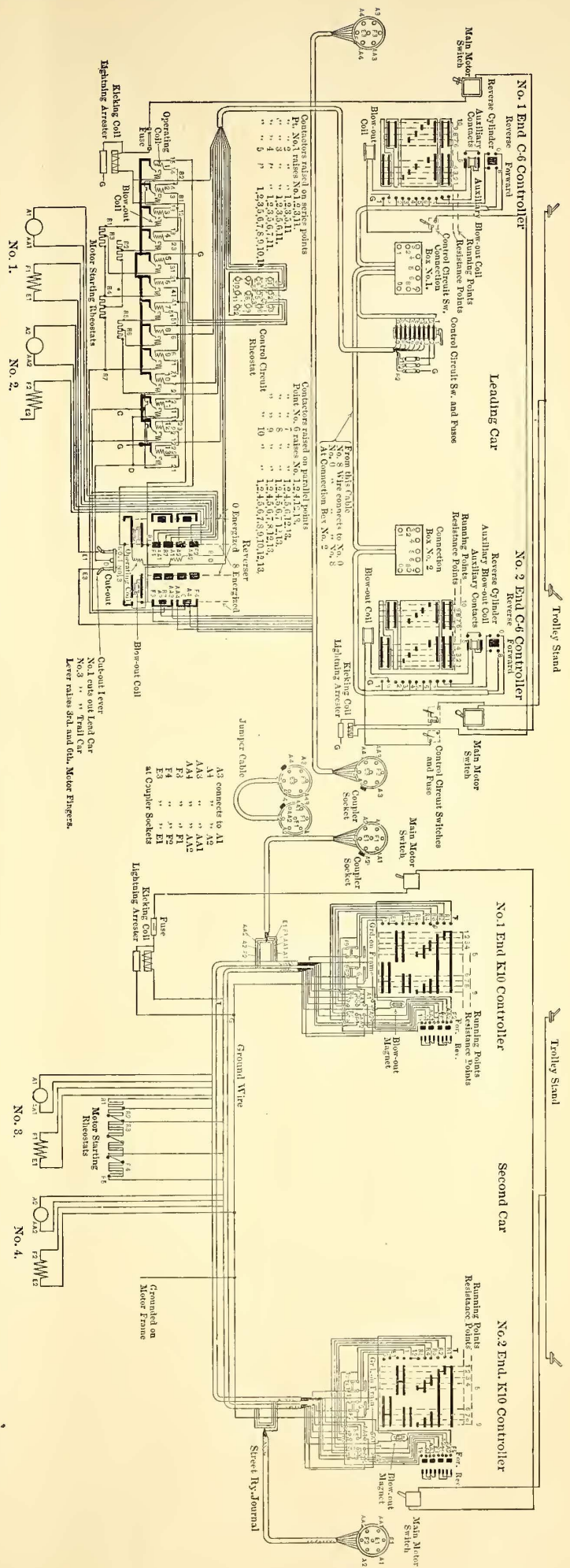
Fig. 3 shows the receptacle on the dash, while Fig. 4 is a view of the jumper terminal inserted in the receptacle, with the outer insulation pulled down to show the wires. As all the current for the rear car is carried by the jumper, the wires in it are necessarily larger and the sockets and terminals are much heavier than are the jumpers for the control circuits of multiple-unit equipment. Fig. 5 shows the electric and air couplings.

The cars are equipped with controllers at each end. The terminals of the wires of the bus lines in the receptacles are so arranged that the proper connections are made, no matter what end of the cars is connected. A lug on the jumper terminal, which fits into a slot in the receptacle, prevents the terminal being inserted in any other than the proper position.

The chief advantage of the employment of the two different kinds of controllers is that the extra expense of installing a multiple-unit controller on the rear car is avoided. The plan was first suggested by M. S. Hopkins, general superintendent of the railway system, and was afterward worked out by Charles E. Hott, master mechanic, and his assistants. Up to the present time ten cars have been fitted for operation in trains in this manner, and ten more are now being equipped.

The Supreme Court of Ohio has handed down an interesting decision on transfers in the case of the Cleveland City Railway Company vs. John Connor. Mr. Connor was a passenger on the Franklin Avenue line and asked for a transfer on St. Clair Street. The transfer was punched so as to make it good on the Woodland line, and on refusing to pay another fare Connor was ejected, and he then sued for damages. In the trial the attorneys for Mr. Connor asked the court to order the jury to return a verdict for damages, if they found that an error had been made by the conductor who issued the transfer, and that it could not have been obviously correct to Connor, but the court refused to do so. On that as an error, the case was carried up and the Circuit reversed the Common Pleas, and now the Supreme Court affirms the Circuit, so the case will now go down for new trial, and in that trial the court will be required to instruct the jury as Connor contended it should be instructed.

FIG. 1.—WIRING DIAGRAM OF TWO-CAR TRAIN, ONE CARRYING COMPLETE MULTIPLE-UNIT SYSTEM AND THE OTHER THE STANDARD K-10 TYPE CONTROL



ACCIDENTS FROM RUNAWAY CARS

One person was killed and several were seriously injured as a result of the failure of the brakes of a car on the Orange Mountain Traction Company's reconstructed line up Orange Mountain in New Jersey on Sunday. According to an unofficial account, the car to which the accident happened had recently been received from the builders, and was the first to be operated over the line experimentally since the substitution of electricity for the cable as motive power on the road. It is said that in the test up the grade the car behaved well and was under complete control of the operator until the summit of the mountain was reached. Here the grade is steepest, and although the emergency brake was applied the car failed to respond. It slid backward gently at first, and then soon was speeding down the grade. All but one of those on board jumped from the car, with casualties mentioned above. The man who remained on the car received only slight injuries.

The accident in London occurred in the vicinity of the Archway Tavern, Highgate, on June 23, when an electric car became uncontrollable while descending a hill and dashed into a motor omnibus. Of the passengers on the runaway car and motor omnibus three were killed, two others are not expected to recover, twenty were seriously hurt, and many received slight injuries.

COOLING THE NEW YORK SUBWAY

The Interborough Rapid Transit Company is planning to install an ammonia refrigerating plant at Times Square, so as to reduce the temperature on hot days. The plant will be ventilated to the street, so that the ammonia fumes may pass directly to the outside air. There are to be brine tanks and mains to distribute the refrigeration to the proper points in the Times Square and Grand Central stations. Chief Engineer Rice, in commenting on the plan, recommends it for temporary use, but thinks there may be too much danger of leakage of anhydrous ammonia to permit of permanent, wholesale refrigeration by this method. The cost of the proposed refrigerating plant is said to be \$45,000. The subject of the best method of cooling other important stations along the line is under consideration by the company and the Rapid Transit Commission. Thus, for the Brooklyn Bridge station a plan has been proposed by Mr. Rice of sinking wells beneath the Bridge station, evaporating the water secured therefrom by fans, and distributing the cooled air along the platforms. No definite decision has been made upon this scheme.

GROSS RECEIPTS FOR 1905

The publication of "American Street Railway Investments," the Red Book for 1906, makes available the operating reports for 1905 of the principal electric railway companies of the country. The gross earnings for this period, and also in most cases for 1904, of 437 companies, as printed in the Red Book, are presented herewith. The figures given do not in all cases represent the same trackage for each year, both on account of extensions and consolidations. The fiscal year of the companies also varies. Thus the fiscal year of the Pennsylvania and New York State companies in most cases ends on June 30, and of the Massachusetts companies on Sept. 30. Other companies have their fiscal year end Dec. 31.

The 1906 edition of the Red Book contains 432 pages of statistical matter, an increase of 17 pages over the edition of 1905. There are 49 maps this year, on which the systems of fifty-two separate companies are shown. A comparison of gross receipts follows:

COMPANIES HAVING GROSS RECEIPTS FOR 1905 OF OVER \$1,000,000.

NAME OF COMPANY.	1904.	1905.
New York City Ry. Co., New York, N. Y....	\$21,894,004	\$17,789,490
Manhattan Ry. Co., New York, N. Y.....	14,529,190	17,328,411
Brooklyn Rapid Transit Co., Brooklyn, N.Y.	14,950,562	16,585,580
Philadelphia Rapid Transit Co., Philadel- phia, Pa.....	16,096,362	16,188,646
Boston Elevated Ry. Co., Boston, Mass....	12,436,594	12,714,569
Pittsburg Railways Co., Pittsburg, Pa.....	8,665,196	9,597,171
Public Service Corporation of New Jersey, Newark, N. J.....	8,529,822	9,145,165
United Railways Co. of St. Louis, St. Louis, Mo.	19,977,564	8,460,016
Chicago City Ry. Co., Chicago, Ill.....	6,668,979	7,322,080
United Railroads of San Francisco, San Fran- cisco, Cal.....	6,652,630	7,066,892
Massachusetts Elec. Companies, Boston, Mass.	6,380,863	6,734,128
United Rys. & Electric Co. of Baltimore, Baltimore, Md.....	5,451,180	6,026,423
Cleveland Electric Ry. Co., Cleveland, O....	4,544,943	5,308,780
Detroit United Ry., Detroit, Mich.....	4,584,582	5,169,639
New Orleans Ry. & Lt. Co., New Orleans, La.	4,674,344	5,121,103
Twin City Rapid Transit Co., Minneapolis and St. Paul, Minn.....	4,308,080	4,759,263
International Traction Co., Buffalo, N. Y....	4,088,426	4,484,643
Kansas City Ry. & Lt. Co., Kansas City, Mo.	3,403,125	3,923,346
Cincinnati Traction Co., Cincinnati, O.....	3,770,022	3,806,705
Milwaukee Elec. Ry. & Lt. Co., Milwaukee, Wis.	3,285,378	3,348,696
The Rhode Island Co., Providence, R. I....	2,754,655	3,242,972
Washington Ry. & Elec. Co., Washington, D.C.	2,644,360	2,905,907
Toronto Ry. Co., Toronto, Ont.....	2,444,534	2,747,324
Montreal Street Ry. Co., Montreal, Can....	2,463,825	2,707,474
Seattle Electric Co., Seattle, Wash.....	2,321,235	2,565,914
Georgia Railway & Electric Co., Atlanta, Ga.	2,112,973	2,500,574
Metropolitan West Side El. Ry. Co., Chicago.	2,160,941	2,452,327
Louisville Ry. Co., Louisville, Ky.....	2,048,263	2,298,619
Consolidated Ry. Co. (The), New Haven, Conn.	1,542,415	2,112,460
Indianapolis Traction & Terminal Co., In- dianapolis, Ind.....		1,915,104
Toledo Railways & Light Co., Toledo, O....	1,752,602	1,913,456
Columbus Ry. & Light Co., Columbus, O....	1,328,802	1,798,463
Rochester Ry. Co., Rochester, N. Y.....	1,499,719	1,787,862
Northwestern Elev. R. R. Co., Chicago, Ill.	1,724,930	1,786,414
United Traction Co., Albany, N. Y.....	1,704,742	1,732,452
South Side Elevated R. R. Co., Chicago, Ill.	1,574,828	1,713,348
Capitol Traction Co., Washington, D. C....	1,536,080	1,656,659
Birmingham Ry., Light & Power Co., Birm- ingham, Ala.....	1,424,146	1,630,514
Connecticut Ry. & Ltg. Co., Bridgeport, Conn.	1,426,160	1,627,483
Coney Island & Brooklyn R. R. Co., Brooklyn.	1,648,995	1,605,861
Havana Electric Ry. Co., Havana, Cuba....	1,270,624	1,542,870
Indiana Union Traction Co., Anderson, Ind..		1,522,229
Oakland Transit Consolidated, Oakland, Cal.	1,258,136	1,441,471
Cincinnati, Newport & Covington Ry. Co., Cincinnati, O.....	1,293,419	1,406,295
Worcester Consolidated Street Ry. Co., Worcester, Mass.....	1,336,441	1,379,015
American Light & Trac. Co., New York....	1,151,503	1,373,620
Washington Water Power Co., Spokane, Wash.	1,029,006	1,277,919
Nashville Ry. & Light Co., Nashville, Tenn.	1,010,081	1,174,377
Winnipeg Electric Ry. Co., Winnipeg, Man..	831,737	1,119,769
Memphis Street Ry. Co., Memphis, Tenn....	979,513	1,114,022
Springfield St. Ry. Co., Springfield, Mass...	947,863	1,013,396
Total, 51 companies.....	\$212,114,374	\$227,946,916
†Exposition period.		

COMPANIES HAVING GROSS RECEIPTS FOR 1905 BETWEEN \$1,000,000 AND \$500,000.

NAME OF COMPANY.	1904.	1905.
Northern Ohio Traction & Light Co., Akron, O.	\$895,731	\$963,187
Hartford Street Ry. Co., Hartford, Conn....	898,001	962,462
Fort Wayne & Wabash Valley Traction Co., Fort Wayne, Ind.....	597,611	949,298
Dallas Electric Corporation, Dallas, Tex....		934,707
Scranton Ry. Co., Scranton, Pa.....	873,627	916,684
British Columbia Elec. Ry. Co., Ltd., Van- couver, B. C.....		903,014
Syracuse Rapid Transit Co., Syracuse, N. Y..	839,373	894,622
Hamilton Cataract Power, Light & Traction Co., Hamilton, Ont.....	761,170	878,164
Chicago & Oak Park Elec. Ry. Co., Chicago	824,931	842,945
Wilkes-Barre & Wyoming Valley Traction Co., Wilkes-Barre, Pa.....	805,179	840,067
United Power & Transportation Co., Phila..	708,512	809,720
Utica & Mohawk Valley Ry. Co., Utica, N. Y.	728,811	798,796
Lake Shore Electric Ry. Co., Cleveland, O..	659,873	788,268
St. Joseph Ry., Light, Heat & Power Co., St. Joseph, Mo.....	683,954	754,954
Tri-City Ry. & Light Co., Davenport, Ia....	645,380	748,684
New York & Queens County Ry. Co., Long Island City, N. Y.....	661,760	745,734

NAME OF COMPANY.	1904.	1905.
Schenectady Ry. Co., Schenectady, N. Y.	\$837,119	\$726,542
Portland R. R. Co., Portland, Me.	732,969	724,798
North Shore R. R. Co., San Francisco, Cal.		721,897
Fonda, Johnstown & Gloversville R. R. Co. Gloversville, N. Y.	675,575	705,583
United Traction Co., Reading, Pa.	609,806	666,111
Northern Texas Trac. Co., Ft. Worth, Tex.	564,711	661,037
Tacoma Ry. & Power Co., Tacoma, Wash.	579,367	657,451
Michigan United Rys. Co., Lansing, Mich.		649,872
Terre Haute Electric Traction & Light Co., Terre Haute, Ind.	569,429	629,760
Lehigh Valley Transit Co., Allentown, Pa.	837,632	616,346
Charleston Consolidated Ry., Gas & Electric Co., Charleston, S. C.	558,046	614,963
Chicago & Milwaukee Elec. R. R. Co., Chicago, Ill.	464,655	609,335
Savannah Electric Co., Savannah, Ga.	544,144	586,236
Cleveland & Southwestern Traction Co., Cleveland, O.	475,361	543,226
San Francisco, Oakland & San Jose Ry., Oakland, Cal.	419,349	535,133
Central Pennsylvania Traction Co., Harrisburg, Pa.	510,860	529,526
Conestoga Traction Co., Lancaster, Pa.	468,762	525,078
Pueblo & Suburban Traction & Ltg. Co., Pueblo, Col.		524,559
Houston Electric Co., Houston, Tex.	366,591	517,315
Puget Sound Electric Ry. Co., Tacoma, Wash.	499,148	511,339
Cincinnati Northern Trac. Co., Cincinnati, O.	504,387	508,332
Hudson Valley Ry. Co., Glens Falls, N. Y.	488,672	506,317
Aurora, Elgin & Chicago Ry. Co., Chicago, Ill.	427,530	505,454
Total, 39 companies,	\$21,718,026	\$27,507,516

COMPANIES HAVING GROSS RECEIPTS FOR 1905 BETWEEN \$500,000 AND \$100,000.

NAME OF COMPANY.	1904.	1905.
Little Rock Ry. & Elec. Co., Little Rock, Ark.		\$496,259
Mobile Light & R. R. Co., Mobile, Ala.	\$427,008	482,142
Canton-Akron Ry. Co., Canton, O.	424,326	480,251
Lexington & Interurban Rys. Co., Lexington, Ky.		471,324
Norfolk Ry. & Light Co., Norfolk, Va.	429,845	471,272
Elgin, Aurora & Southern Traction Co., Aurora, Ill.	379,045	454,814
Trenton Street Ry. Co., Trenton, N. J.	421,941	453,650
Ottawa Electric Ry. Co. (The), Ottawa, Ont.	384,939	449,634
Boston & Worcester Street Ry. Co., Boston, Mass.	400,022	448,366
American Railways Co., Philadelphia, Pa.	443,196	444,254
City Ry. Co., Dayton, O.	423,804	442,174
Altoona & Logan Valley Elec. Ry. Co., Altoona, Pa.	395,590	439,210
Holyoke Street Ry. Co., Holyoke Mass.	383,411	420,652
Tampa Electric Co., Tampa, Fla.	364,645	411,763
Detroit, Ypsilanti & Ann Arbor & Jackson Ry. Co., Detroit, Mich.		406,539
Pittsburg, McKeesport & Connellsville, Ry. Co., Pittsburg, Pa.	514,886	404,388
Northern Indiana Ry. Co., So. Bend, Ind.		394,514
Norfolk, Portsmouth & Newport News Co., Norfolk, Va.	342,247	376,904
New Jersey & Hudson River Ry. & Ferry Co., Hackensack, N. J.	293,490	376,618
Union Street Ry. Co., New Bedford, Mass.	369,420	371,563
Halifax Elec. T'way Co., Ltd., Halifax, N. S.	379,465	370,368
Manchester Trac., Light & Power Co., Manchester, N. H.	285,827	358,505
Johnstown Passenger Ry. Co., Johnstown, Pa.	340,070	341,189
Chicago & Joliet Electric Ry. Co., Joliet, Ill.	316,867	341,030
Indianapolis & Northwestern Traction Co., Indianapolis, Ind.	302,283	334,423
Rockford & Interurban Ry. Co., Rockford, Ill.	250,499	330,524
Richmond Light & R. R. Co., Richmond, S. I., N. Y.	329,934	329,355
Alton, Granite & St. Louis Trac. Co., Alton, Ill.	98,524	324,188
Newton St. Ry. Co., Newton, Mass.	283,542	323,743
Schuylkill Valley Traction Co., Norristown, Pa.	212,463	320,224
Southwest Missouri Elec. Ry. Co., Webb City.	267,115	317,812
Lincoln Traction Co., Lincoln, Neb.	272,314	316,922
People's Traction Co. (The), Dayton, O.	298,158	308,391
Toledo, Urban & Interurban Ry. Co., Toledo, O.		307,571
Jacksonville Electric Co., Jacksonville, Fla.	290,498	305,639
Chester Traction Co., Chester, Pa.	320,419	303,113
Wilkes Barre & Hazelton R.R. Co., Hazelton, Pa.	290,666	294,592
Manchester Street Ry. Co., Manchester, N. H.	285,827	291,730
El Paso Electric Co., El Paso, Tex.	250,510	288,934
Michigan Traction Co., Kalamazoo, Mich.	236,199	287,384
Augusta Ry. & Electric Co., Augusta, Ga.	250,317	286,023
St. John's Ry. Co., St. John's, N. B.	264,141	280,569
Springfield Ry. & Light Co., Springfield, Mo.		280,000
Binghamton Ry. Co., Binghamton, N. Y.	251,230	277,032

NAME OF COMPANY.	1904.	1905.
Wilmington & Chester Traction Co., Wilmington, Del.	\$240,652	\$275,781
Macon Ry. & Light Co., Macon, Ga.	237,035	273,673
Auburn & Syracuse Electric R. R. Co., Auburn, N. Y.	240,335	269,574
Los Angeles & Redondo Ry. Co., Los Angeles, Cal.	280,210	269,347
Atlantic Coast Elec. Ry. Co., Asbury Park, Pa.	231,142	267,675
Niagara, St. Catharines & Toronto Ry. Co., St. Catharines, Ont.	223,924	264,311
Peoria & Pekin Terminal Ry. Co., Peoria, Ill.	210,722	262,376
Erie Electric Motor Co., Erie, Pa.	264,902	262,367
Washington, Alexandria & Mt. Vernon Ry. Co., Washington, D. C.	246,491	252,999
Topeka Ry. Co. (The), Topeka, Kan.	218,000	252,000
Easton Transit Co., Easton, Pa.	44,519	251,365
Toledo & Western Ry. Co., Toledo, O.	222,005	251,125
Pottsville Union Traction Co., Pottsville, Pa.	227,267	251,123
Knoxville Ry. & Light Co., Knoxville, Tenn.	193,473	249,290
Columbus, Buckeye Lake & Newark Traction Co., Columbus, O.	225,410	248,912
Beaver Valley Traction Co., Beaver Falls, Pa.	233,017	248,248
Cleveland, Painesville & Eastern R. R. Co., Cleveland, O.	225,751	245,089
Albany & Hudson R. R. Co., Hudson, N. Y.	232,790	242,866
Fitchburg & Leominster Street Ry. Co., Fitchburg, Mass.	226,403	242,002
Columbia Electric Street Ry., Light & Power Co., Columbia, S. C.	153,576	241,197
Lewiston, Brunswick & Bath Street Ry. Co., Lewiston, Me.	235,335	237,814
Evansville Electric Ry. Co., Evansville, Ind.	209,202	230,987
Western Ohio Ry. Co., Lima, O.	205,806	230,758
West Penn Ry. Co., Pittsburg, Pa.		228,587
Columbus, London & Springfield Ry. Co., Columbus, O.	157,200	223,990
Dayton, Springfield & Urbana Electric Ry. Co., Dayton, O.	231,143	223,605
Rochester & Eastern Rapid Ry. Co., Canandaigua, N. Y.	76,615	221,331
Wisconsin Traction, Light, Heat & Pwr. Co., Appleton, Wis.	123,423	218,671
Springfield, Ry. Co., Springfield, O.	203,107	212,839
Cape Breton Electric Co., Ltd., Sydney, N. S.	202,019	211,980
Indianapolis, Columbus & Southern Traction Co.		210,259
Interurban Ry. & Terminal Co., Cincinnati, O.	160,852	208,614
Asheville Electric Co., Asheville, N. C.	178,630	203,026
Whatcom County Ry. & Light Co., Bellingham, Wash.	163,058	195,009
Elmira Water, Light & R. R. Co., Elmira, N. Y.	106,924	194,334
London Street Ry. Co., London, Ont.	180,018	194,026
Bangor Ry. & Electric Co., Bangor, Me.		193,866
Columbus, Delaware & Marion Electric Ry. Co., Columbus, O.	115,518	192,785
Consolidated Railways, Light & Power Co., Wilmington, N. C.	154,909	192,198
Dayton & Western Traction Co., Dayton, O.	106,295	191,477
Fort Smith Light & Traction Co., Fort Smith, Ark.	147,153	191,428
Berkshire Street Ry. Co., Pittsfield, Mass.	200,295	188,736
Newport & Fall River St. Ry. Co., Newport, R. I.	180,586	187,461
Toledo & Indiana Ry. Co., Toledo, O.	65,172	186,239
Phila. & West Chester Traction Co., Phila., Pa.	174,085	182,737
Montreal Park & Island Ry. Co., Montreal, Can.	165,890	179,559
Columbus Railroad Co., Columbus, Ga.	155,078	173,999
Staten Island Midland R. R. Co., S. I., N. Y.	165,655	170,949
Pittsburg, McKeesport & Greensburg Ry. Co., Greensburg, Pa.	159,058	168,541
Houghton County Street Ry. Co., Hancock, Mich.	199,513	167,067
Wichita R. R. & Light Co., Wichita, Kan.	119,106	166,910
Hoosac Valley Street Ry. Co., No. Adams, Mass.	155,530	166,900
Lehigh Traction Co., Hazleton, Pa.	155,379	166,544
Mansfield Ry., Light & Power Co., Mansfield, O.	147,311	163,702
Long Island Electric Ry. Co., Jamaica, Long Island, N. Y.	133,127	162,416
Lexington & Boston St. Ry. Co., Boston, Mass.	161,995	162,404
Pittsfield Electric St. Ry. Co., Pittsfield, Mass.	154,168	161,635
Coeur D'Alene & Spokane Ry. Co., Ltd., Coeur D'Alene, Ida.	127,125	158,783
Cincinnati, Georgetown & Portsmouth R. R. Co., Cincinnati, O.	142,966	157,464
Jackson & Battle Creek Traction Co., Jackson, Mich.	148,549	156,257
Dartmouth & Westport St. Ry. Co., Natick, Mass.	147,963	154,499
Dayton & Troy Electric Ry. Co., Dayton, O.	130,960	154,098
Jamestown Street Ry. Co., Jamestown, N. Y.	150,163	153,358
Waterloo, Cedar Falls & Northern Ry. Co., Waterloo, Ia.		152,658
Interstate Consolidated Street Ry. Co., North Attleborough, Mass.	150,665	152,036

NAME OF COMPANY.	1904.	1905.	COMPANIES HAVING GROSS RECEIPTS FOR 1905 BETWEEN		
			\$100,000 AND \$50,000.		
			NAME OF COMPANY.	1904.	1905.
Northampton St. Ry. Co., Northampton, Mass.	149,387	151,205			
Milford & Uxbridge Street Ry. Co., Milford, Mass.	142,745	150,927			
York Street Ry. Co., York, Pa.	136,128	150,362			
Fries Manufacturing & Power Co. (The), Winston-Salem, Del.	130,118	148,997	Syracuse, Lake Shore & Northern R. R., Syracuse, N. Y.	\$ 83,791	\$99,815
Rockford, Beloit & Janesville R. R. Co., Rockford, Ill.	136,918	147,851	Cleveland, Painesville & Ashtabula R. R., Cleveland, O.		98,503
Hartford, Manchester & Rockville Tramway Co., Hartford, Conn.	139,704	147,795	Augusta, Winthrop & Gardiner Ry. Co., Augusta, Me.	91,592	97,989
Lansing & Suburban Traction Co., Lansing, Mich.		146,860	Southern Lt. & Trac. Co., Natchez, Miss.		97,955
Allentown & Reading Trac. Co., Allentown, Pa.	132,494	145,699	Portsmouth Street R. R. & Light Co., Portsmouth, O.	81,876	97,876
Portsmouth, Dover & York Street Ry. Co., Portsmouth, N. H.	143,050	145,011	Citizens' Electric Street Ry. Co., Newburyport, Mass.	102,060	96,227
Interurban Ry. Co., Des Moines, Ia.	130,244	144,042	Indianapolis & Martinsville Rapid Transit Co., Indianapolis, Ind.	107,000	96,011
Valley Traction Co., Harrisburg, Pa.	127,539	143,643	Northampton Traction Co., Easton, Pa.	85,171	94,872
Stark Electric R. R. Co., Alliance, O.	130,535	142,883	DeKalb-Sycamore Elec. Co., DeKalb, Ill.	82,922	95,898
Meridian Light & Ry. Co., Meridian, Miss.		142,168	Danbury & Bethel St. Ry. Co., Danbury, Conn.	86,566	92,747
Boston & Maine R. R., Concord, N. H.	106,653	141,685	Woronoco Street Ry. Co., Westfield, Mass.	82,725	92,720
Atlantic Shore Line Ry., Sanford, Me.	85,944	132,332	Syracuse & Suburban R. R. Co., Syracuse, N. Y.	84,007	92,678
Camden & Trenton Ry. Co., Camden, N. J.	117,965	131,308	Augusta & Aiken Ry. Co., Augusta, Ga.	87,868	91,753
Tamaqua & Lansford Street Ry. Co., Lansford, Pa.	108,669	128,758	Media, Middletown, Ashton & Chester Elec. Ry. Co., Chester, Pa.	72,232	91,206
Hartford & Springfield Street Ry. Co., Warehouse Pt., Conn.	81,033	128,169	Warren St. Ry. Co., Warren, Pa.	89,560	90,147
Kingston Consolidated R. R. Co., Kingston, N. Y.	124,783	126,230	Natick & Cochituate St. Ry. Co., Natick, Mass.	89,438	90,138
New York & Stamford Ry. Co., Port Chester, N. Y.	122,527	125,894	Delaware Co. and Philadelphia Electric Ry. Co., Philadelphia, Pa.	89,392	89,986
Winnebago Traction Co., Oshkosh, Wis.	133,887	125,831	Evansville & Princeton Trac. Co., Princeton, Ind.	73,517	88,720
Oklahoma City Ry. Co., Oklahoma City, Okla.	86,353	125,768	Peekskill Lighting & R. R. Co., Peekskill, N. Y.	82,303	88,698
Richmond Street & Interurban Ry. Co., Richmond, Ind.	135,000	125,602	Ponce Elec. Co., Ponce, P. R.		88,574
Oakwood Street Ry. Co., Dayton, O.	125,494	125,240	Pennsylvania & Ohio Ry. Co., Ashtabula, O.	84,872	88,255
Rockland, Thomaston & Camden St. Ry. Co., Rockland, Me.	135,091	125,225	Washington, Arlington & Falls Church Ry. Co., Washington, D. C.	65,065	87,456
Southern Street Ry. Co., Chicago, Ill.		123,764	Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Co., Geneva, N. Y.	78,574	86,414
Citizens Ry. & Light Co., Muscatine, Ia.	112,130	123,627	Burlington Traction Co., Burlington, Vt.	84,882	85,862
Kokomo, Marion & Western Traction Co., Kokomo, Ind.	81,437	122,860	Bristol & Plainville T'way Co., Bristol, Conn.	75,744	85,788
Niagara Gorge R. R. Co., Niagara Falls, N. Y.	107,829	122,311	Dayton, Covington & Piqua Traction Co., Dayton, O.	84,395	85,637
Worcester & Southbridge Street Ry., Worcester, Mass.		120,958	Providence & Danielson Ry. Co., Providence, R. I.	80,809	84,346
Green Bay Traction Co., Green Bay, Wis.		120,887	Hudson, Pelham & Salem Electric Ry. Co., Hudson, N. H.	83,906	84,176
Connecticut Valley Street Ry. Co., Northampton, Mass.	57,666	119,803	Dover, Somersworth & Rochester St. Ry. Co., Dover, N. H.	83,069	82,945
Orange County Traction Co., Newburgh, N. Y.	113,615	119,731	Atlantic City & Suburban Traction Co., Atlantic City, N. J.	78,419	82,363
Seattle, Renton & Southern Ry. Co., Seattle, Wash.	100,002	118,916	Lebanon Valley Street Ry. Co., Lebanon, Pa.	79,654	82,148
Oneonta, Cooperstown & Richfield Springs Ry. Co., Oneonta, N. Y.	77,979	118,362	Greenwich Tramway Co., Greenwich, Conn.	64,699	80,566
Olean Street Ry. Co., Olean, N. Y.	102,717	118,306	Ohio Central Traction Co., Galion, O.	85,055	80,098
Williamsport Pass. Ry. Co., Williamsport, Pa.	107,686	116,231	Pascagoula St. Ry. & Pwr. Co., Scranton, Miss.		79,701
Springfield & Eastern St. Ry. Co., Palmer, Mass.	110,450	114,348	Blue Hill Street Ry. Co., Canton, Mass.	72,864	78,294
Zanesville Ry., Light & Pwr. Co., Zanesville, O.	98,621	113,921	Lewistown & Reedsville Electric Ry. Co., Lewistown, Pa.	72,860	78,193
Shamokin & Mt. Carmel Electric Ry. Co., Shamokin, Pa.	84,039	113,569	Milford, Attleboro & Woonsocket Ry. Co., Milford, Mass.	78,875	77,928
Bridgeton & Millville Traction Co. (The), Bridgeton, N. J.	117,910	113,060	Philadelphia, Bristol & Trenton St. Ry. Co., Philadelphia, Pa.	68,402	76,348
Haverhill & Amesbury St. Ry. Co., Haverhill, Mass.	109,725	111,486	Athens Electric Ry. Co., Athens, Ga.	67,131	76,321
Central Market Street Ry. Co., Columbus, O.	51,512	109,981	Hudson River Traction Co., Rutherford, N. J.	61,955	75,897
Dayton & Xenia Transit Co., Dayton, O.	110,736	109,961	Trenton & New Brunswick R. R. Co., Trenton, N. J.	72,404	75,152
Columbus, Newark & Zanesville Electric Ry. Co., Newark, O.	86,302	108,418	Joliet, Plainfield & Aurora R. R. Co., Joliet, Ill.		75,076
Lorain Street Ry. Co., Lorain, O.	95,862	108,240	Black River Traction Co., Watertown, N. Y.	70,877	74,700
Stamford St. R. Co., Stamford, Conn.	98,985	107,098	Electric Ry., Lt. & Ice Co., Junction City, Kan.	60,873	73,548
Washington & Canonsburg Ry. Co., Washington, Pa.	90,614	106,756	Berkley Street Ry. Co., Berkley, Va.	65,396	72,496
Poughkeepsie City & Wappingers Falls Electric Ry. Co., Poughkeepsie, N. Y.	102,305	106,712	Nashua Street Ry. Co., Nashua, N. H.	72,286	72,458
La Crosse City Ry. Co., La Crosse, Wis.		105,750	Raleigh Elec. Co., Raleigh, N. C.		71,830
Dayton & Northern Traction Co., Dayton, O.	94,537	105,654	Columbia & Montour Electric Ry. Co., Bloomsburg, Pa.	59,982	71,225
Hamburg Ry. Co., Hamburg, N. Y.	88,538	104,930	South Middlesex St. Ry. Co., Natick, Mass.	69,591	70,812
New York & Long Island Traction Co., Long Island City, N. Y.	133,127	104,806	Worcester & Blackstone Valley Street Ry. Co., Worcester, Mass.	67,685	67,064
Denison & Sherman Ry. Co., Sherman, Tex.	89,449	104,591	West Chester Street Ry. Co., West Chester, Pa.	56,586	66,532
Indianapolis & Cincinnati Traction Co. (The), Indianapolis, Ind.	93,800	104,448	Conneaut & Erie Trac. Co., Conneaut, O.		66,436
Ithaca Street Ry. Co., Ithaca, N. Y.	99,721	103,946	Chambersburg, Greencastle & Waynesboro Street Ry. Co., Waynesboro, Pa.	65,184	65,337
Woonsocket St. Ry. Co., Woonsocket, R. I.	102,619	102,567	Erie Traction Co., Erie, Pa.	64,650	65,279
Brockton & Plymouth Street Ry. Co., Brockton, Mass.	104,059	102,143	Tarentum Traction Passenger Ry. Co., Tarentum, Pa.	56,904	64,859
New Jersey & Pennsylvania Traction Co., Trenton, N. J.	90,184	101,326	Waverly, Sayre & Athens Traction Co., Waverly, N. Y.	64,116	64,593
Holmesburg, Tacony & Frankford Electric Ry. Co., Philadelphia, Pa.	108,395	100,954	Freeport Ry., Light & Power Co., Freeport, Ill.	57,500	64,289
Youngstown & Sharon Street Ry. Co., Youngstown, O.	108,291	100,897	Butler Passenger Ry. Co., Butler, Pa.	48,641	64,264
			Lawrence & Methuen Street Ry. Co., Lawrence, Mass.	55,335	63,867
			Portsmouth Electric Ry., Portsmouth, N. H.	66,487	63,864
			Sea View R. R. Co., Wakefield, R. I.	56,051	63,614
Total, 170 companies.	\$29,472,956	\$37,199,011			

NAME OF COMPANY.	1904.	1905.	NAME OF COMPANY.	1904.	1905.
Olean, Rock City & Bradford R.R. Co., Bradford, Pa.	63,106	63,400	Exeter, Hampton & Amesbury Street Ry. Co., Exeter, N. H.	47,296	45,226
Bradford Electric St. Ry. Co., Bradford, Pa.	54,759	63,354	Slate Belt Electric Street Ry. Co., Bethlehem, Pa.	5,748	44,586
Newton & Boston Street Ry. Co., Newton, Mass.	62,074	63,323	Kittanning & Leechburg Rys. Co., Kittanning, Pa.	40,323	44,015
Meriden, Southington & Compounce Tramway Co., Meriden, Conn.	65,087	62,553	Erie Rapid Transit Street Ry., Erie, Pa.	40,640	43,318
Northern Illinois Lt. & Trac. Co., Ottawa, Ill.	61,504	62,431	Valley Street Ry. Co., Sharon, Pa.	36,504	43,091
Gardner, Westminster & Fitchburg Street Ry. Co., Gardner, Mass.	44,269	62,300	Citizens' Electric Co., Eureka Springs, Ark.	38,789	43,080
Burlington County Ry. Co., Mt. Holly, N. J.	63,512	62,162	Phillipsburg Horse Car R. R. Co., Phillipsburg, N. J.	42,502	42,868
Warren, Brookfield & Spencer Street Ry. Co., Brookfield, Mass.	58,498	61,416	Portland & Brunswick Street Ry. Co., Brunswick, Me.	39,978	42,604
Biddeford & Saco R. R. Co., Biddeford Me.	73,380	60,990	Haverhill & Southern New Hampshire Street Ry. Co., Haverhill, Mass.	36,789	42,409
Rochester & Suburban Ry. Co., Rochester, N. Y.	59,111	58,907	Kenosha Electric Ry. Co., Kenosha, Wis.	3,521	42,214
Dunkirk & Fredonia R. R. Co., Fredonia, N. Y.	58,789	58,789	Ocean Electric Ry. Co., Rockaway and Far Rockaway, N. Y.	40,302	42,120
Quebec Ry., Lt. & Pwr. Co., Quebec, Ont.	62,771	58,641	Meadville & Cambridge Springs Street Ry. Co., Meadville, Pa.	41,833	42,043
Toledo, Fostoria & Findlay Electric Ry. Co., Findlay, O.	58,542	58,542	Corning & Painted Post Street Ry. Co., Corning, N. Y.	37,898	42,005
Steuenville & Wheeling Traction Co., Steuenville, O.	58,291	58,291	Barre & Montpelier Traction & Power Co., Barre, Vt.	39,681	41,676
Sterling, Dixon & Eastern Elec. Ry. Co., Sterling, Ill.	58,258	58,258	Bennington & Hoosick Valley Ry. Co., Hoosick Falls, N. Y.	36,244	41,673
Philadelphia & Eastern Ry. Co., Doylestown, Pa.	22,626	57,220	Worcester & Holden Street Ry. Co., Holden, Mass.	39,513	41,598
Wilkes-Barre, Dallas & Harvey's Lake Ry. Co., Wilkes-Barre Pa.	57,166	57,090	Athol & Orange Street Ry. Co., Athol, Mass.	40,876	40,654
Newtown Electric St. Ry. Co., Newtown, Pa.	61,375	56,820	Berlin Street Ry. Co. (The), Berlin, N. H.	40,876	40,560
International Transit Co., Sault Ste Maire, Ont.	48,439	56,517	Meadville Traction Co., Meadville, Pa.	39,310	40,329
Chillicothe Elec. R. R., Light & Power Co., Chillicothe, O.	56,229	56,229	Springfield Electric Ry. Co., Springfield, Vt.	34,201	39,578
Wrightsville & York St. Ry. Co., York, Pa.	10,640	56,065	Titusville Electric Traction Co., Titusville, Pa.	22,517	39,103
Southern Street Ry. Co., Philadelphia, Pa.	55,445	55,804	York-Haven Street Ry. Co., York, Pa.	38,692	38,692
Norfolk & Bristol Street Ry. Co., Norwood, Mass.	50,011	55,719	Railways Company General, New York.	38,215	38,215
The Suburban R. R. Co., Chicago, Ill.	49,487	55,040	Ballston Terminal R. R. Co., Ballston Spa, N. Y.	37,417	37,417
Van Brunt St. & Erie Basin R.R. Co., Brooklyn.	55,794	55,010	Sarnia Street Ry. Co., Sarnia, Can.	32,577	36,962
Jersey Central Traction Co., Keyport, N. J.	33,802	54,277	Oley Valley Ry. Co., Boyertown, Pa.	42,373	36,503
Bristol Gas & Electric Co., Bristol, Tenn.	37,372	53,455	Templeton Street Ry. Co., Templeton, Mass.	24,392	36,394
Ohio River Electric Ry. & Power Co., Pomeroy, O.	45,591	53,197	DuBois Traction Co., DuBois, Pa.	35,977	35,977
Norton & Taunton Street Ry. Co., Norton, Mass.	48,864	52,930	Groton & Stonington Street Ry. Co., Groton, Conn.	35,122	35,122
People's Light & Ry. Co., Nanticoke, Pa.	36,042	52,609	Elmira & Seneca Lake Ry. Co., Elmira, N.Y.	39,461	34,714
Lake Erie & Bowling Green Ry. Co., Bowling Green, O.	51,834	51,834	Columbus, New Albany & Johnstown Ry. Co., Columbus, O.	31,999	34,513
Farmington Street Ry. Co. (The), Hartford, Conn.	48,850	51,029	Vallamont Traction Co., Williamsport, Pa.	32,060	33,798
Concord, Maynard & Hudson Street Ry. Co., Maynard, Mass.	53,946	50,556	East Taunton Street Ry. Co., Taunton, Mass.	34,644	33,731
Providence & Fall River Street Ry. Co., Swansea Centre, Mass.	46,938	50,537	Buffalo Southern Ry. Co., Buffalo, N. Y.	26,767	33,352
Ashtabula Rapid Transit Co., Ashtabula, O.	54,322	50,489	Willimantic Traction Co., Willimantic, Conn.	31,385	33,129
Monmouth County Electric Co., Red Bank, N. J.	46,923	50,408	Montgomery Traction Co., Norristown, Pa.	20,660	32,948
Waterville & Fairfield Ry. & Light Co., Waterville, Me.	44,576	50,402	Millville Traction Co., Millville, N. J.	32,810	32,810
Torrington & Winchester Street Ry. Co., Torrington, Conn.	54,251	50,251	York & Dallastown Electric Ry. Co., York, Pa.	32,343	32,343
Tiffin, Fostoria & Eastern Electric Ry. Co., Tiffin, O.	49,088	50,115	Shamokin & Edgewood Electric Ry. Co., Shamokin, Pa.	32,828	31,970
Total 100 companies,	\$5,731,417	\$7,145,504	Marlborough & Westborough Street Ry. Co., Westborough, Mass.	33,703	31,884
			Troy & New England R. R. Co., Troy, N.Y.	29,577	31,631
			Amherst & Sunderland Street Ry. Co., Amherst, Mass.	31,634	31,423
			Webster, Monessen, Belle Vernon & Fayette City Street Ry. Co., Webster, Pa.	23,966	30,883
			Henderson City Ry. Co., Henderson, Ky.	22,223	30,416
			Waterville & Oakland Street Ry., Waterville, Me.	29,225	30,204
			Bangor & Northern R. R. Co., Bangor, Me.	24,980	30,017
			Buffalo & Williamsville Electric Ry. Co., Williamsville, N. Y.	30,510	29,575
			Sharon & Newcastle Street Ry. Co., Sharon, Pa.	29,332	29,332
			Price Hill Inclined Plane R. R. Co., Cincinnati, O.	25,853	28,339
			People's Traction Co., Galesburg, Ill.	4,242	28,335
			Lancaster & York Furnace Street Ry. Co., Lancaster, Pa.	28,469	28,190
			Somerset Traction Co., Skowhegan, Me.	45,995	28,144
			Coal Belt Electric Ry. Co., Marion, Ill.	27,953	27,855
			Calais Street Ry. Co., Calais, Me.	28,029	27,686
			Ogdensburg Street Ry. Co., Ogdensburg, N.Y.	18,250	27,439
			Galesburg & Kewanee Electric Ry. Co., Kewanee, Ill.	26,844	27,312
			Keene Electric Ry. Co., Keene, N. H.	25,871	26,695
			York & Dover Electric Ry. Co., York, Pa.	23,909	26,586
			Susquehanna Traction Co., Lock Haven, Pa.	25,867	26,487
			Laconia Street Ry. Co., Laconia, N. H.	47,922	25,883
			Wellston & Jackson Belt Ry. Co., Wellston, O.	46,666	25,744
			Trinidad Electric Co., Trinidad, Col.	46,433	25,594
			Penn Yann, Keuka Park & Branchport Ry., Penn Yann, N. Y.	44,082	25,316
			Lancaster Traction Co., Lancaster, Pa.	46,339	25,042
			Pawtucket Valley Street Ry. Co., Westerly, R. I.	46,061	25,005
			Latrobe Street Ry. Co., Latrobe, Pa.	45,907	25,005
			Total, 77 companies,	\$2,957,803	\$2,800,225

COMPANIES HAVING GROSS RECEIPTS FOR 1905 BETWEEN

\$50,000 AND \$25,000.

NAME OF COMPANY.	1904.	1905.
Branford Street Ry. Co., Branford, Conn.	44,060	49,690
Cortland County Traction Co., Cortland, N.Y.	47,985	49,627
Oswego Traction Co., Oswego, N. Y.	47,178	49,585
Uniontown & Monongahela Valley Electric Ry. Co., Uniontown, Pa.	59,825	49,249
Centre & Clearfield Ry. Co., Phillipsburg, Pa.	22,795	48,979
Citizens' R. R., Light & Power Co., Fishkill, N. Y.	51,081	47,922
Columbus, Grove City & Southwestern Ry. Co., Columbus, O.	40,258	46,666
Sharon & Wheatland Street Ry. Co., Sharon, Pa.	48,503	46,433
Coney Island & Gravesend Ry. Co., Brooklyn, N. Y.	44,082	46,339
Chautauqua Traction Co., Chautauqua, N.Y.	46,061	46,061
Escanaba Electric Street Ry. Co., Escanaba, Mich.	45,907	45,907

PAPERS AND REPORTS, NEW YORK STATE CONVENTION

CONTRACTING FOR USE OF HYDRO-ELECTRIC POWER ON RAILWAY SYSTEMS

BY G. A. HARVEY,

Electrical Engineer International Railway Company, Buffalo.

The majority of railway managers and engineers in this section of the country have had occasion during the past few years to consider the subject of using electric power developed from water-power for the operation of their cars. The first point for definite investigation is invariably the matter of cost, as it has long ago been shown that electricity can fulfill all the power requirements of any sort of transportation system. If the system of the prospective purchaser happens to be so fortunately located that he can receive offers from different sources, his inquiries are apt to bring together figures which at first sight appear to be widely at variance and cause him to conclude that there are excellent opportunities for bargaining. Investigation soon shows, however, that the prices are not very unequal if the use of power under the different proposals is reduced to a uniform footing, and the fact at once becomes apparent that the most advantageous conditions are those under which the consumer uses power at a high load-factor.

The effect of load-factor on cost of power is thoroughly understood where steam plants are concerned, but it might be supposed in the case of hydraulic power, where no furnaces have to be banked and inefficiency at light loads becomes unimportant, that the conditions would be different. Hydraulic turbines of modern design, however, usually have such characteristics that their over-load capacity is very slight, and it therefore becomes necessary, if peak-loads are to be handled, to provide extra machinery to take care of these. With no provision for peaks it is still necessary to hold at least one generating unit in reserve, and a margin of capacity must be left unused in the operating turbines for gate travel in regulation, and to allow for partial clogging of distributors by refuse which accidentally enters the penstocks. As the water is available and costs no more if used to the full capacity of the plant, it is plain that the power-selling company will strive vigorously for a uniform load as high as is practicable for the installed machinery to carry. This results in making peaks a prohibitive element to power deals where the hydraulic plant has been some time in the field and has been able to discriminate in the choice of its customers. The plants now operating at Niagara Falls have been particularly fortunate in this respect, one of the oldest having a twenty-four-hour load-line of about 26,000 hp and fluctuations not exceeding 5 per cent of the average load. Needless to say the portion of this power supplied for railway and lighting purposes is very small. The Niagara conditions are unique on account of the electro-chemical plants which provide an ideal load and consume the greatest part of the power now developed.

The foregoing is not intended to convey the idea that railways cannot contract advantageously for hydro-electric power. The typical street-railway load necessarily has prominent peaks, and, if these cannot be smoothed down by adjustments of service, it is still possible, where a fair price is asked for the water power, to carry the heaviest part of the all-day load by means of this and the remainder by steam engines, gas engines or storage batteries, or combinations of engines and batteries.

The point is frequently raised that power companies undertaking to supply customers of any sort should be equipped to take care of all requirements of these customers, including peak-loads. This is done in some cases, the power companies going so far as to provide steam plants for reserves and peak purposes. The character of local demands for power will usually determine this matter, and if the power companies eventually install auxiliary steam plants, it will be only because they are forced to it by periodic shortages of water or inability to obtain customers whose aggregate use of power results in a high yearly load-factor. The power company wants to sell all of its power all of the time, and in a thriving, progressive community it is probable that it finally will come very near doing this. The load-factor will improve as customers increase in number, and as the load approaches the full capacity of the plant the power company will become more discriminating about closing new contracts, or renewing old ones, that involve conditions tending toward poor load-factor. When power plants are new, and struggling for an early return on investment, there are good chances of railway companies being able to contract with them for power to cover full requirements. In making such agreements it is well for railway companies to make the contract period of considerable duration, as there is little likelihood of rates being dropped by competition, except in such localities as Niagara, and there is also small chance of any other power being able to underbid the price of hydro-electric power where conditions are at all favorable to the latter. Power contracts covering periods of twenty years or more are not unusual. In drawing such agreements there should always be provision for increasing the amount of power, at the same or better rate, as the railway service grows, and it is well to specify that if power is later sold at a lower rate by the power company to other parties no more favorably situated, the railway company is also to have the benefit of such rate.

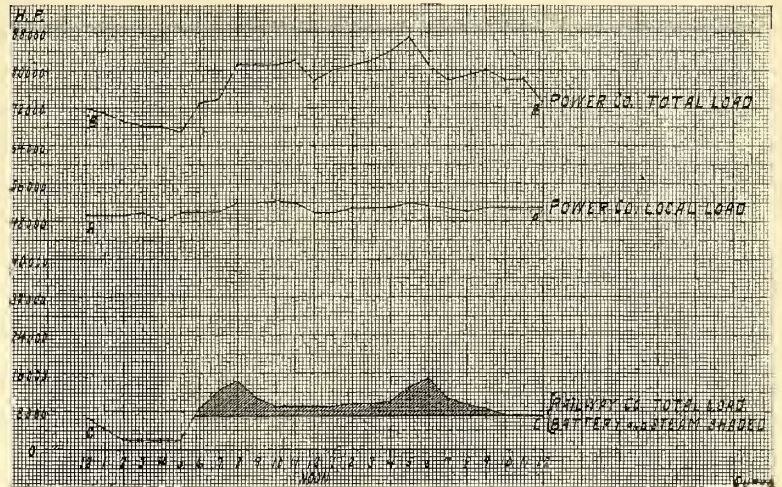
If it is possible to make contracts for full power requirements, it is usual for power companies to place some penalty rate on the peak-power or to arrange the terms of charge so that there are distinct advantages to the purchaser in keeping the load-line as nearly straight as possible. The most common method is to sell a solid block of "firm" power, which can be used at a load-factor of 70 per cent to 80 per cent or better, charging the minimum flat rate for this, and providing power above the firm amount on a kilowatt-hour basis at rates gradually increasing with the height of the peaks. Sometimes provision is made for charging extreme rates for possible peaks of such height that the railway company has no expectation of ever reaching them. These clauses should be avoided, if possible, as the unexpected is constantly happening in the operation and growth of a railroad. Where measurement of peaks is dealt with at all, it should be specified that they are not to be counted unless they continue for two minutes or longer. Uncontrollable occurrences, such as the partial grounding of a feeder, or the performance of a defective car, may produce peaks of short duration which are of small consequence to the power company, but might be very costly to the railway company under an unreasonable power agreement.

A very fair method of billing for power is on a sliding rate depending on the monthly load-factor. The maximum two-minute peaks are recorded in kilowatts each day and averaged for the month. The total number of kilowatt-hours for the

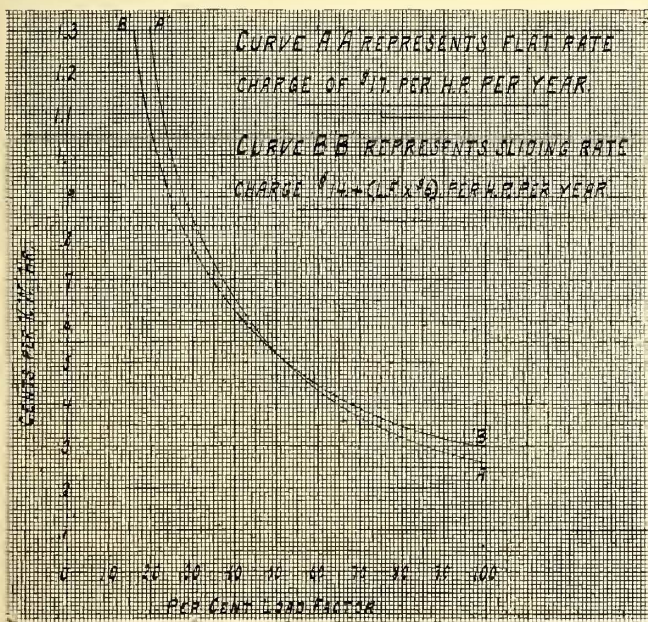
month, divided by the kilowatt of this average peak times the number of hours in the month, represents the monthly load-factor. The charge for the month is then made up as follows: A definite service charge plus (load-factor times a fixed amount) times average daily maximum kilowatts. A moderate penalty for peaks is thus included, and the customer pays, according to the load-factor, as nearly for what he consumes as can be expected. This method of charging is now being offered extensively by one of the companies which is about to do business over a large portion of New York State. In effect it corresponds very closely with a flat-rate charge, but gives the purchaser a slightly less cost per kilowatt-hour at low load-factors, as shown by the examples on curve sheet No. 1. The total load of most any street railway is pretty sure to have a load-factor of less than 50 per cent. If the details of peak-power measurement are successfully carried out in practice, this plan of charging will probably prove popular when customers become familiar with it.

If power companies cannot entertain peak propositions at all, or if they place prohibitive rates thereon, the purchaser must then provide the steam plant or storage battery, or both, to care for a part of the load. In this case the hydro-electric power purchased should form the solid twenty-four-hour base of the area inclosed by the total load-curve, and should extend up to such height as to cover a chart-area bounded at the top by a line closely corresponding with the base of the average daily fifteen-hour load-line (fifteen-hour load-peak). The purchaser should be allowed, without charge, swings of about 10 per cent above the firm line of purchased power, provided the kilowatt-hours used above the line do not exceed those unused below it. It is impossible to always carry the

steam-generated power at 100 per cent load-factor, assuming reasonable first cost of plant and moderate distance of transmission in the first case and average cost of coal and labor in the second. Obviously the bulk of the load should be carried by the purchased power, but the higher the limiting firm line of this power is raised the lower will the load-factors



CURVE SHEET NO. 2.—SHOWING LOAD CURVES OF ONE OF THE NIAGARA COMPANIES



CURVE SHEET NO. 1, SHOWING SUGGESTED PLAN FOR CHARGING FOR ELECTRIC POWER

load directly on the limiting line, even with the aid of batteries and the most approved regulating devices. The 10 per cent swings should be allowed for this reason.

Very careful consideration must be given to proportioning the division of load to water power and steam power. The cost of hydro-electric power at 100 per cent load-factor should be somewhere in the neighborhood of one-third the cost of

of both steam power and purchased power become, and the cost per kilowatt-hour of each will increase. There is a certain critical point, however, to which the firm purchased power line may be raised before the total cost (which is of prime importance) of combined purchased power and steam power will commence to increase. In raising the firm line of purchased power to this point the total cost will be decreasing. It is hardly possible to evolve an exact formula for the location of the firm line of purchased power, and if one were worked out the weekly variations of load conditions would probably make its accuracy look doubtful. A safe point for this line (about as previously described) is at such height that the fifteen-hour daily use of purchased power will be fairly close to it at all times. It is important, in starting to make this adjustment, to know the cost of steam power per kilowatt-hour at various load-factors under local conditions.

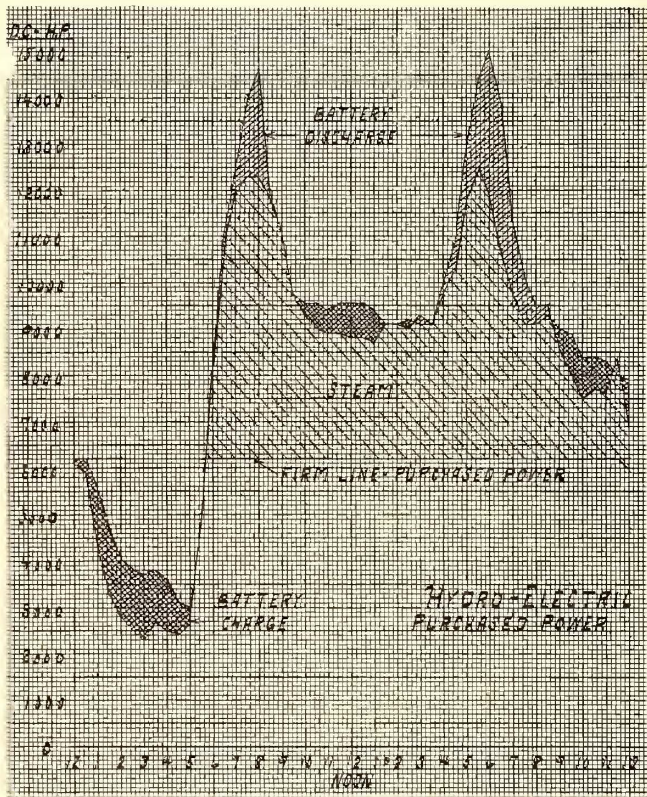
Railway systems supplied with purchased hydro-electric power afford ideal opportunities for application of storage batteries. The batteries can be charged at night with power that otherwise could not be used, and the discharge of the load-peak provides power at an extremely low load-factor which costs only the fixed charges, operation and maintenance of the battery.

The possibility of power interruptions should be recognized in agreements and have penalties placed upon them. An interruption of six minutes is of comparatively small consequence to the railway and might be ignored if not repeated too frequently. Interruptions due to lightning, mistakes in switching, cable burn-outs, etc., are bound to occur, and six minutes is a reasonable allowance for testing cables and lines and returning power. Longer interruptions should entail forfeitures by the power company, increasing considerably in amount as the length of interruption increases. A mere abatement of power charge during an interruption is practically no consideration at all. Power companies by providing sufficient reserve in apparatus, lines, cables, etc., will protect themselves against penalties and insure their customers against interruptions.

Purchased power should be delivered on the premises of the purchaser by means of cables and lines installed and

operated by the power company. Measurements for determining monthly bills should be made on the purchaser's premises, the power company supplying and maintaining the meters for this purpose. These meters should be checked each month. The railway company should take daily readings from them, keeping a permanent record in chart form which will show hourly changes of total load and any important subdivisions of load. Such records are invaluable in adjusting the use of power to the most economical conditions and in figuring on extensions of the system. They are needed for daily reference, and, if the meters on which readings are taken for rendering bills do not provide proper character of measurements for making up load-curves, other suitable instruments should be installed.

Curve sheet No. 2 shows at "A-A" the remarkably straight local load line of one of the Niagara power companies. At "B-B" is shown the total load line, including the long-distance



CURVE SHEET NO. 3.—SHOWING LOAD LINE REPRESENTED AS C-C ON CURVE SHEET NO. 2

load, of the same company. "C-C" shows a railway load, the shaded portion of which is carried by the railway company's steam engines and storage batteries. The unevenness of the power company's total load is not contributed to by the railway company except to the extent of a dip during the early morning hours. The peaks of the railway load would, if included in the power company total load, distort it considerably in an undesirable way. The curves are all plotted from the same base line and represent the same day.

Curve sheet No. 3 shows on a more open vertical scale the same railway load that is represented at "C-C" on sheet No. 2. The firm line of purchased power is here located lower with reference to the total load than has been described as the economical point. This is partly for the reason that the chart represents a winter day (the heavy load season of the year). The total load drops below the firm purchased power line during the middle of the day at some seasons, and, as the firm line can not be shifted back and forth, there are necessarily times when the proportions of purchased power

and steam are not the most economical, as in the instance of this particular day.

In cases where steam plants are already in service on railway systems when the companies commence buying additional power, the interest, depreciation, etc., on these plants, although charged to total cost of power, should not enter into the cost of steam-generated power when balancing up the amount of this to be used in conjunction with the purchased power. The steam plant fixed charges continue, regardless of the power turned out, and only the actual operating expenses (coal, labor, etc.) should be figured against the steam power in this case. If the steam plant is installed, either at or after the time of contracting to buy power, the fixed charges might be considered as against "peak-power," but it does not alter the case materially in proportioning the amount of steam power to be used. Operating cost per kilowatt-hour at various load-factors and the normal capacity and dependable overload capacity are the governing features.

THE SALE AND MEASUREMENT OF ELECTRIC POWER

BY S. B. STORER,

General Manager Niagara, Lockport & Ontario Power Company.

Since the day when the first commercial electric light entered the field of artificial illuminants, there have been endeavors to find an equitable way of charging for energy supplied in the form of electricity. At first, in the absence of any measuring instruments, the flat rate was the only method. This was soon found to be impractical for most cases, and the ampere-hour meter, followed by various types of integrating and recording wattmeters, soon brought into use the idea of paying for the exact amount of energy used, at a given price per ampere-hour or per kilowatt-hour. This method is still in very general use in its simplest form, but there has been dissatisfaction with it from the time it started. The fact of the matter is that neither the straight flat rate nor the straight kilowatt-hour rate is equitable except when applied in connection with a definite load factor—and even then it may not be entirely so, due to uncertainty as to the number of hours per day that full-load conditions prevail, with corresponding high efficiency, and to the hours during which operation continues at light loads with resultant low efficiency.

It is fully recognized now, however, that the load factor is the root of the trouble, and unless a system of charging gives due consideration to it there will always be inequality of rates and dissatisfaction on the part of the power company or of its customers, or of both. This has been shown in all classes of service,—incandescent and arc lighting, heating and power purposes, including railway lines,—and in power companies and consumers of all sizes.

Nor are power companies the only ones so affected by the load factor. No manufacturing company is entirely successful in the ordinary sense of the word unless it keeps all of its tools and equipment in use all of the time. No railroad can earn its full quota until it finds its tracks carrying their maximum number of trains every twenty-four hours and every train carrying fully loaded cars throughout. Robbed of unnecessary verbiage, it means that on every investment the interest, tax, insurance and depreciation charge—commonly referred to as the fixed charge—continues at a uniform rate over twenty-four hours of every day in the year, and unless the apparatus or material representing that investment is put to its maximum use every hour in the day and every day in the year, there is an opportunity for increase in efficiency

until the theoretically possible condition of maximum use is reached. And the ratio of the use actually obtained to that theoretical or possible maximum use is the load factor of the manufacturing establishment and of the railway line just as it is of the power house or transmission system.

Before taking up the question of rate-making and methods of charging, brief reference will be made to the cost of production of power from hydro-electric plants and from steam plants. In the former the cost is almost solely one of fixed charge, while the latter is made up from fixed charge coupled with variable items of coal, water, oil, waste and incidentals. With the hydro-electric plant, consequently, the cost per horse-power per year is almost constant regardless of whether supplied one hour per day or twenty-four hours per day. Repairs are about the only variable, and they may be considered as increasing in direct proportion to the load factor. Labor, oil, waste, etc., are nearly the same irrespective of the proportion of light loads to full load.

With the steam plant, on the contrary, the items of coal, labor, etc., increase rapidly with the load factor, and hence the cost per horse-power per year increases in almost the

that marked "Steam Plant" represents cost at the power-house switchboard. These curves are about the best obtainable from any power houses of 5000 to 10,000-hp capacity with coal from \$2.50 to \$2.75 per ton.

In Fig. 2 the same costs are shown, but plotted in terms

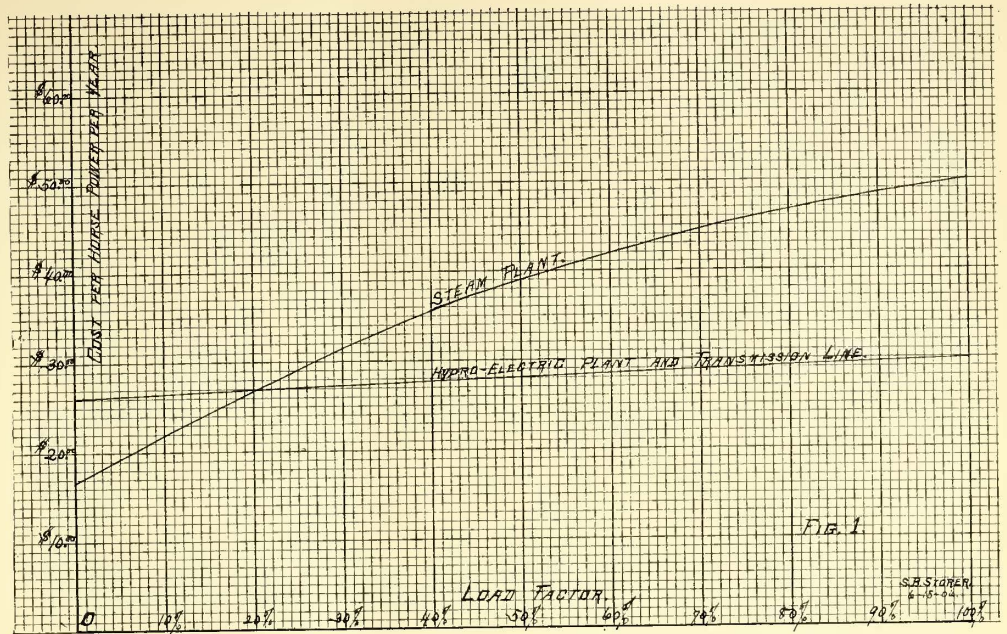


FIG. 1.—METHOD OF PLOTTING COSTS PER HORSE-POWER PER YEAR IN TERMS OF LOAD FACTOR, AND PRICE PER HORSE-POWER PER YEAR

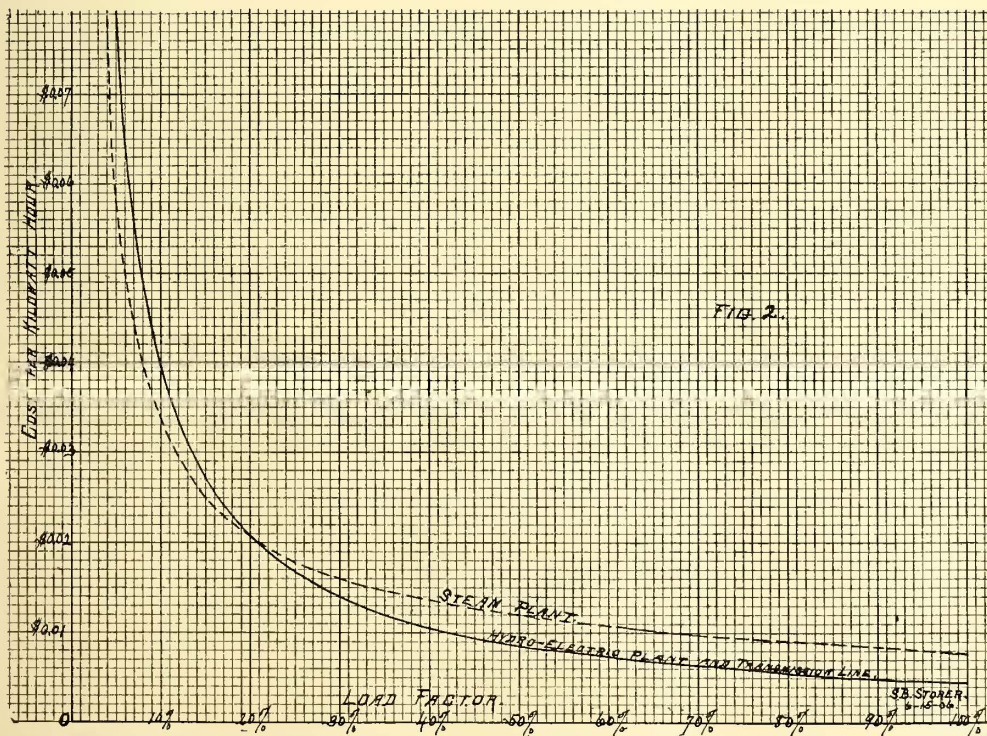


FIG. 2.—METHOD OF PLOTTING COSTS PER HORSE-POWER PER YEAR, IN TERMS OF LOAD FACTOR, AND PRICE PER KW-HOUR

same proportion. The costs per horse-power per year may be shown graphically, as in Fig. 1, the curves being plotted in terms of load factor and price per horse-power per year.

The curve marked "Hydro-Electric" is intended to represent cost of power after transmission for some distance, while

of load factor and price per kilowatt-hour. Particular notice should be given to the wide variation in cost per kilowatt-hour, it ranging in the steam plant from 9 cents at a load factor of 4 per cent to about three-quarters of a cent at 100 per cent load factor. The hydro-electric plant varies under the same range of load factors, from 10 cents to less than half a cent per kilowatt-hour.

In Fig. 3 is given a very convenient and easy method of changing cost per horse-power per year at various load factors to equivalent cost per kilowatt-hour or vice-versa. The method to be followed in making the change is self evident, so no explanation of it is needed.

If we now take up the case of a hydro-electric plant and transmission system with a wholesale cost of \$30 per horse-power per year, and attempt to make a flat rate to all consumers, we quickly find there is little demand for power, as nearly every consumer has an intermittent load, or, in other words, a low load-factor, and cannot afford to pay or will not pay the price it is

necessary to ask for flat rate twenty-four-hour power. It then becomes incumbent on the power company to devise a system of charging that will not only enable it to market its output but to do so at prices that will secure a net revenue for the power equal to \$30 per horse-

power-year, besides an additional amount sufficient to cover the cost of retailing or distributing it, but to further enable it to sell at rates low enough to be attractive to consumers. It is believed that the method described hereinafter offers a

The maximum demand is taken as being the highest rate of consumption for any one minute during the day; or, as it is perhaps more commonly expressed, the highest one-minute peak occurring during any day is considered as the maximum demand for that day. The average of these highest daily one-minute peaks occurring during any month then becomes the average maximum demand for that month and is so used in the calculation of load factor.

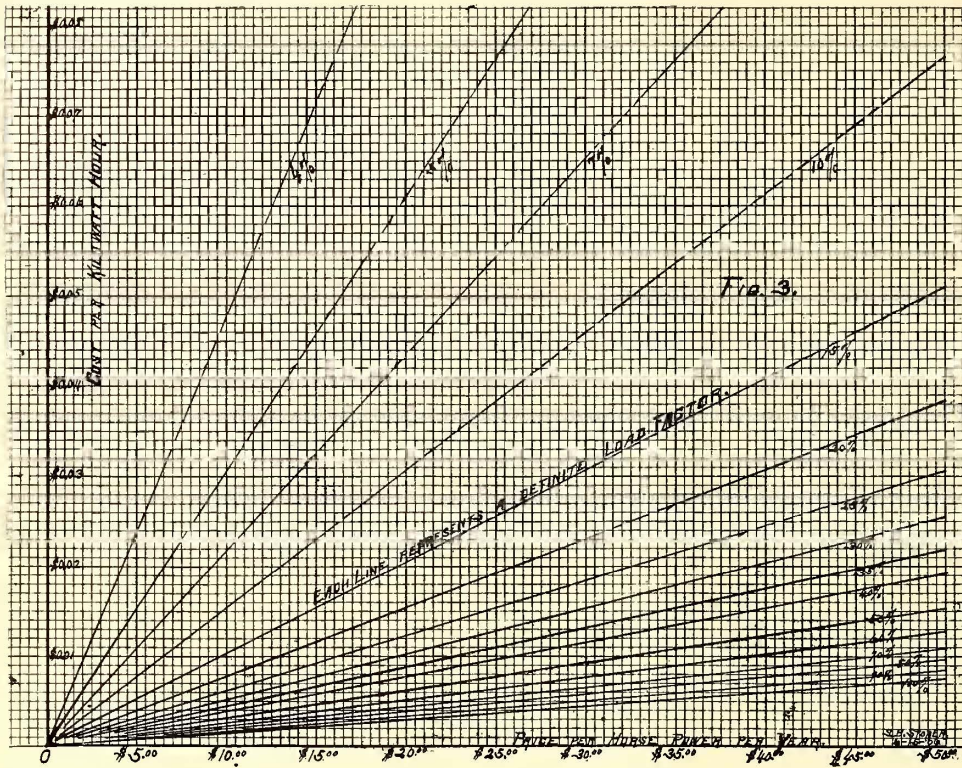


FIG. 3.—METHOD OF CHARGING COST PER HORSE-POWER PER YEAR AT VARIOUS LOAD FACTORS, TO EQUIVALENT COST PER KW-HOUR, AND VICE VERSA

solution that is equitable to both power company and consumer, and at the same time gives the ordinary small consumer a low rate per horse-power per year in spite of heavy distributing cost, and also gives the power company the necessary return on its maximum demand output.

In the proposed system everything is sold on a maximum demand basis, with the rate per horse-power per year varying between fixed limits in accordance with the consumer's load-factor. In order that this method may be clearly understood, mention is here made of the fact that the load-factor is computed on the basis of a twenty-four hour day; the kilowatt-hour consumption per day, divided by 24, being taken as the average demand, and dividing this average demand by the maximum demand for that day, we have a fraction—or in one case unity—representing the load-factor for the given twenty-four-hour period. In the same way the load-factor for any month may be obtained by dividing the average rate of consumption for the entire month by the average of the daily maximum demands, thus obtaining the average load-factor of all the days in the month.

If the rate per horse-power year varies between \$16 and \$43, it will be evident that the variable quantity is the differ-

Assuming that a manufacturer has made a contract to buy 400 horse-power for the operation of his factory, and that the rate per horse-power year varies between the limits of \$16 and \$43, depending on the load factor, the determination of his rate per horse-power per year for any given month would be as follows:

If the kilowatt-hours consumed during a thirty-day month are 43,200, then the average demand for power is 43,200 divided by 720 (the number of hours in the month), equal to 60 kw or 80 hp. Assuming further that his maximum demand each day was just 400 hp, then, of course, his average maximum demand for the month will be the same amount, and the load factor is 80 divided by 400 = .2, or, as commonly expressed, 20 per cent.

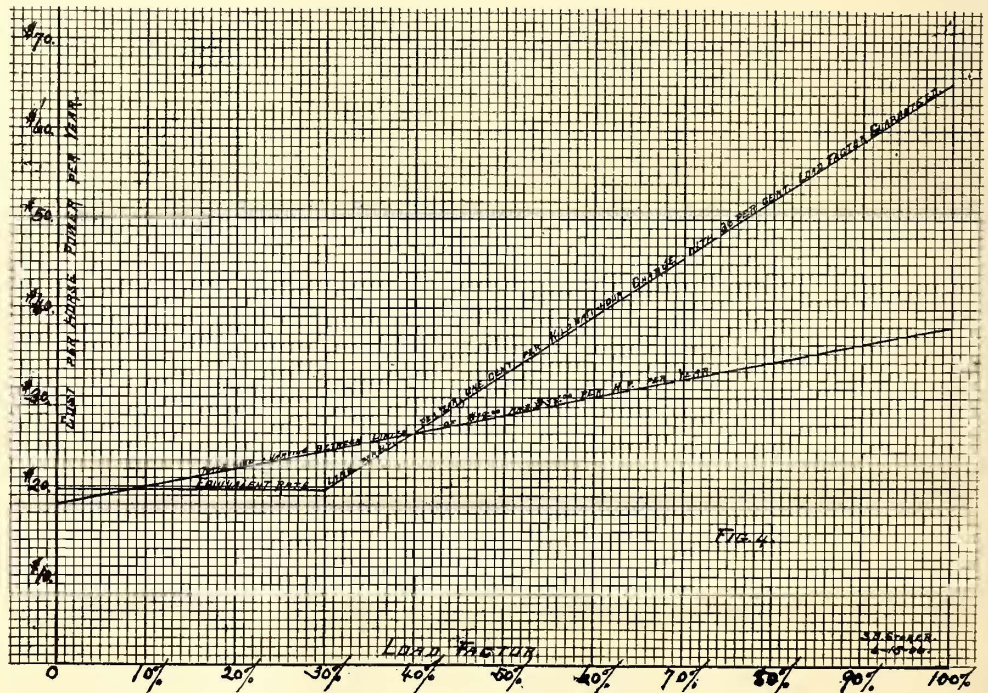


FIG. 4.—SUGGESTED PLAN OF CHARGING FOR ELECTRIC POWER

ence between \$16 and \$43, or \$27. The rate is therefore equal to the minimum rate (\$16) plus the load-factor (.2) times the variable (\$27). Two-tenths of \$27 is \$5.40, so the rate per horse-power per year for that month will be \$16 plus \$5.40 equals \$21.40. The total charge for the month would there-

fore be 400 times \$21.40 divided by 12, or \$713.33. This is equal to 1.65 cents per kilowatt-hour. If his use of the power had been such as to give a load factor of 30 per cent, the rate per horse-power per year would have increased to \$24.10, but the equivalent cost per kilowatt-hour would have decreased to 1.24 cents—a reduction of almost 25 per cent in cost per kilowatt hour due to increasing the load factor to 30 per cent.

This may readily be put in the form of an equation which, if the desired rate per horse-power per year is R the minimum rate limit is A the maximum rate limit is B and the load-factor is L is expressed by $R = A + L(B-A)$.

This method is much more equitable than that sometimes used, of selling all the power on a kilowatt-hour basis with a guarantee from the consumer of a specified load-factor. By referring to Fig. 4, there will be seen the diagrammatic equivalent of such a method of charging converted into a cost per horse-power per year basis. The example given there is that of a kilowatt-hour cost of one cent with a guaranteed load-factor of 30 per cent. This simply means that the consumer pays a flat rate per horse-power per year of \$19.60 at all points from zero load-factor to 30 per cent load-factor inclusive, and from 30 per cent to 100 per cent load-factor the rate increases in direct proportion until it reaches the limit at \$65.35 per horse-power per year at 100 per cent load-factor.

This method is bad for both parties to a contract. For the power company, if we assume that any considerable transmission is involved, and that a relatively large amount of power is under contract to be delivered, the price of \$19.60 per horse-power per year is too low to cover cost—much less than necessary to pay a profit. There is also no probability that the rate will ever be much higher than this, as there is no inducement to the consumer to increase his load-factor above the guaranteed 30 per cent.

On the other side, the consumer has a right to assume that the price at the guaranteed load-factor offers a fair return per horse-power per year to the power company, and consequently no effort is made to increase his load-factor, particularly as his cost per kilowatt-hour remains the same. If, however, the contract is one of long duration and, due to natural causes beyond control of the consumer, the load-factor should increase to a high value, say 75 or 80 per cent, the consumer would be paying over \$50 per horse-power per year for power that he is justified in thinking does not cost over \$20 or \$25.

A better way of charging—certainly a much more equitable way—would be to sell the power on a maximum-demand basis with the rate varying between the limits of say \$18 and \$38 per horse-power year,—this rate-line also being shown in Fig. 4. With this way of charging there is a continual inducement held out to the consumer to increase his load-factor. The power company would probably also in-

crease its profits somewhat by the increase in load-factor, but only to a comparatively small extent.

In Fig 5, the two curves of load-factor and cost per kilowatt-hour are given, and they indicate more clearly than words the advantage of the system having as its basis the load-factor of the consumer. The dotted line represents the one cent per kilowatt hour rate with a guaranteed revenue equal to that from a 30-per-cent load-factor consumption; the full line or curve gives the equivalent cost per kilowatt-hour of the variable \$18 to \$38 per horse-power-per-year rate.

With such a system of charging established, the question immediately arising will be as to the manner in which the limiting values per horse-power per year are established, with power companies of different capacities to supply demands of all kinds and sizes.

Referring to the assumed case of a hydro-electric plant and transmission line wherein the wholesale cost is \$30 per horse-power per year, and further assuming that the rated

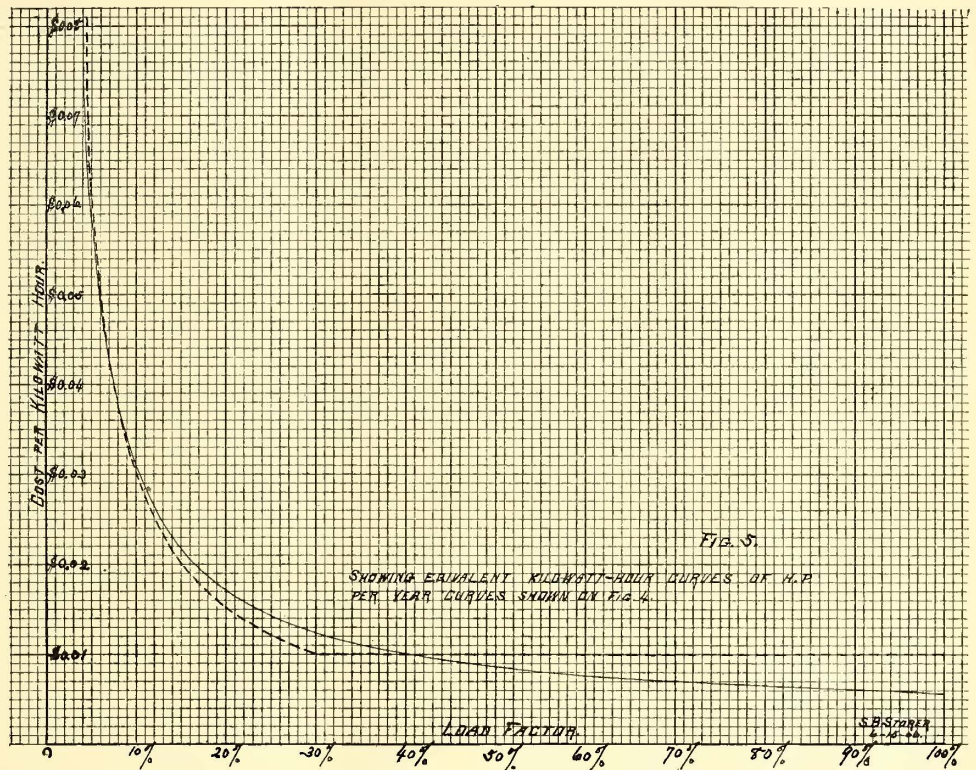


FIG. 5.—EQUIVALENT KW-HOUR CURVES OF HORSE-POWER PER YEAR CURVES SHOWN IN FIG. 4

capacity of the system as a whole is 10,000 horse-power, we then have a basis with which to start. In Fig. 6, a vertical line is drawn from the zero point at the middle of the lower line, and laid off in price per horse-power per year. On the lower line to the left is laid off the amounts of power that may be sold, up to the capacity of the plant. To the right is laid off the load-factors that may be obtained by the various consumers. From the \$30 point on the vertical line a horizontal line is drawn to the left that may be known as the "base-rate line."

If power is to be furnished to consumers having a load-factor of approximately 100 per cent and sold on a straight flat rate per horse-power per year, then the cost of retailing the power in small amounts will increase the cost as the amounts decrease, approximately in accordance with the curve starting from the base-rate line on the 4400-hp point, and increasing to \$43 on the zero horse-power line. If the consumer takes anything over 4400 hp, he may be considered as being entitled to the wholesale rate of \$30 per horse-power per year.

If, however, the consumers operate at a low load-factor,

the power company may "oversell" its plant to an extent directly dependent on the relation between the capacity of its plant and the amount of firm power sold to each one. The amount it may be oversold may be determined approximately from the equation of the "Law of Probability," or graphically from the "Probability Curve," both of which may be found in books on higher mathematics, but which will not be taken up here, as this is not intended to be a treatise on that subject.

It may be said, however, that if a large number of motors are operating in a city, performing all classes of work, starting and stopping, running part of the time at full load and part of the time at light loads, the ordinary amount of power required to supply them will be much less than the total rated capacity of the motors, and still every one of the motors may at some time during the day have been operating at full rated load. As a matter of actual practice the ratio is about three to one, the motors, of course, being mostly of from one-quarter horse-power to 20 or 30 hp. The 10,000-hp plant could therefore safely connect on its circuits small motors having

of the "probability curve," drawn with reference to the same line but on the lower side of the \$30 base-rate line.

The minimum rate or the zero load-factor rate for any amount of power may now be found by following the vertical line from the desired amount of power indicated by the figures at the bottom line of the diagram until it intersects the minimum rate line. From the point of intersection follow the horizontal line to the right of the vertical line at the middle of the sheet, thereby obtaining the amount in dollars per horse-power per year. In the same way, from the intersection of the vertical line indicating the horse-power with the maximum rate line, the amount of the maximum rate per horse-power per year is obtained.

Taking as an example a 400-hp consumer, the intersections are found to be at *a* and *b* on the minimum and maximum rate lines, corresponding to \$16 and \$43, respectively. Carrying a horizontal line to the right from *b* to *b'* on the 100 per cent vertical load factor line, and connecting *a'* and *b'*, we then have a variable rate line for 400-hp consumers.

The rate for consumers desiring to buy on a straight flat rate regardless of load-factor is obtained from the point *m* where the 400-hp line crosses the flat-rate line, or at the \$36 point.

In the same way a 3200-hp consumer's variable rate would be from \$24 to \$34, with a corresponding flat rate of \$30.40, and the variable rate line runs from point *c'* to *d'*.

Referring to the small consumers having a load-factor of approximately 15 per cent, and following the same method given above, ascertaining that the variable rate is from \$11 to \$52,—at 15 per cent load-factor the rate would be \$11. + .15 (\$52. — \$11.) = \$17.15.

In view of over-selling three times for this class of consumers, the gross income derived for each horse-power actually delivered from the plant would

be three times \$17.15, equaling \$51.45, or practically the maximum rate. This increased return per horse-power output of the station, over the corresponding straight flat-rate price of \$41 per horse-power year, is made necessary by the fact that three installations must be made to get the gross revenue of \$51.45, while only one is required for the \$41 revenue. The difference in revenue is therefore just about sufficient to make up for this additional expense.

In the same way, the 400-hp consumer with a load-factor of 25 per cent would pay at the rate of \$22.75 per horse-power per year, and over-selling twice would bring in a gross revenue of \$45.50 per horse-power per year.

The combination of these two rate-curves, both approaching the \$30 base rate line as the firm power increases, taken in conjunction with the method of charging that depends on the load-factor of the consumer, furnishes a system that affords absolute protection to the power company and at the same time gives all consumers every benefit of low price that can be done with safety to the vested interests of the

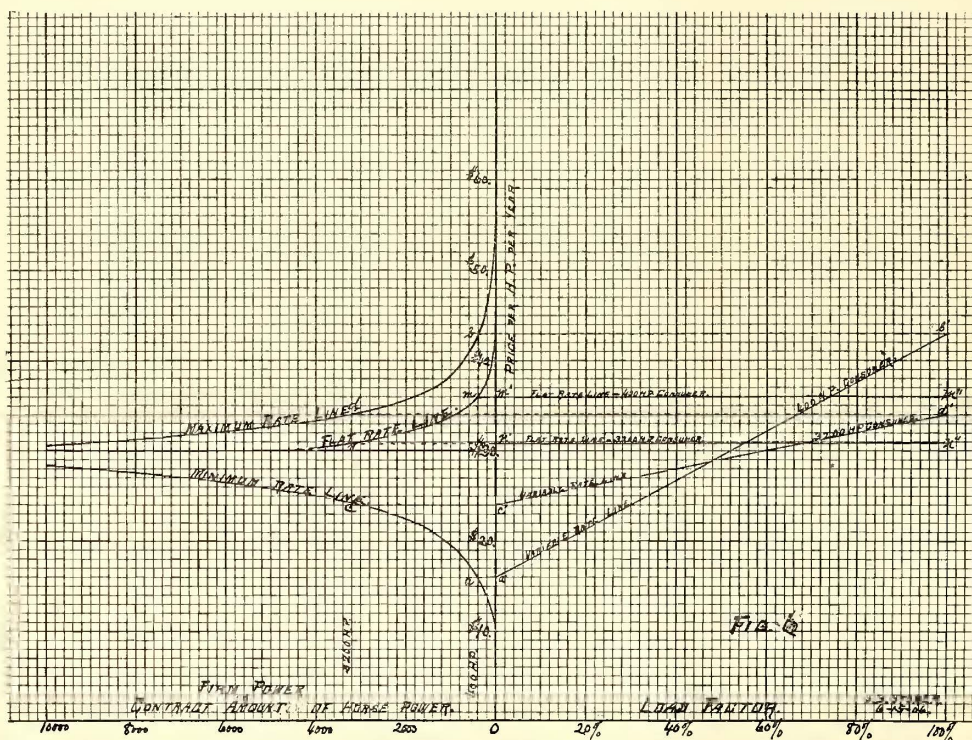


FIG. 6.—ILLUSTRATING RESULTS UNDER SUGGESTED PLAN FOR CHARGING FOR ELECTRIC POWER

a total rated capacity of 30,000 hp. The average load-factor of the different installations would not be much, if any, over 15 per cent, and where occasional large installations are operating somewhat more uniformly, the load-factor would reach perhaps 25 per cent, it being assumed, of course, that they are practically all ten-hour factories. To such factories, of say 400-hp capacity, the power house could not be oversold more than twice. If the entire output were sold to one, two, or even three large consumers, the plant could not be oversold at all, as the chance of both or all three of the consumers taking their maximum of power at the same time is so high as to become almost a certainty. With a single 10,000-hp consumer there is no "chance" about it, and such a customer must pay the full flat rate of \$30 per horse-power per year regardless of load-factor.

In Fig. 6, the curve marked "maximum rate line" is an approximation of the "probability curve," drawn with reference to the \$30 base-rate line and the central vertical line. The curve marked "minimum rate line" is also an approximation

power company. Each consumer would pay a rate per horsepower per year such as to give the power company a uniform percentage of profit on all its business, so there could be no question as to "preferential rates" and certain consumers having advantages over others.

It may be said that the maximum demand is hard to measure, but with a demand for that class of meters there will come an instrument capable of fulfilling the requirements. For the most part, in small installations, the maximum demand may be taken as the rated capacity of apparatus installed, and an ordinary integrating wattmeter giving the kilowatt-hour consumption per month, for use in determining the load-factor, is all that will be required. With large installations, where greater accuracy is required, more money may be spent on individual measuring instruments with no relative increase in cost of meters over that of the many small consumers, and the total error in records would probably be very much less than under present service.

In the sale of power on the maximum-demand basis, the question of the amount of firm power to be taken, and the permissible demands above that amount, are always the subject of much discussion. In this system, however, intermittent demands in excess of the firm power may be permitted in percentages approximately those obtained by following about the same curve as the maximum rate curve,—measurement being made from the \$30 base line up to the curve. For example, the small consumer may be permitted to take power 100 per cent above his firm amount; the 2000-hp consumer, allowing for probable maximums occurring at the same time, would be entitled to about 25 per cent intermittent demand. At the 10,000-hp limit, no intermittent demands could be permitted, as there is nothing with which to furnish them.

It must be understood, of course, that all permissible intermittent demands are paid for at the same rate per horsepower per year as the firm power, and are to be measured by the highest, daily, one-minute peaks, or average one-minute demands in excess of the firm power. The one-minute peak is taken for the reason that any load lasting for a full minute means a definite and corresponding opening of the gates controlling the water wheels, and therefore limits their output as much as if it lasted a much longer time.

It is not to be expected that this system of charging—based as it is on the "Law of Probability"—will apply where only one class of service is supplied, as, for example, incandescent lighting. There is very little "probability" about that service, for people want the light when it is dark and the demand consequently comes at that time. Where, however, lighting is only one of many other uses for power, the system indicated above applies with equal force and may be used for every consumer, regardless of size or of the use to which the electric energy is put, and also of the number of hours per day it is supplied.

The same system may also be applied to steam plants if consideration is given to the range in cost due to change in load-factor. The modification would appear in Fig. 6 by using two base-rate lines, one at about \$20 and the other one at about \$55. The minimum and maximum rate curves would then be drawn with reference to these two lines, leaving a considerable variation in price per horsepower per year between zero and 100 per cent load-factor even for the largest consumers. Greater leeway as to permissible intermittent demands could also be given, due to steam engines being capable of temporary overloads to a much greater extent than are water wheels. The general principles underlying all power plants of whatever type are, however, the same; and one system of sale and measurement of their output, giving due considerations to local conditions, would, if universally

used, do much to establish a better relationship between producer and consumer,—if, as in the one proposed, it is founded on equity.

SALE OF WATER-POWER FROM THE POWER COMPANY'S POINT OF VIEW

BY C. E. PARSONS,

Chief Engineer Hudson River Electric Company.

There are three important factors which have to be considered in determining the cost of hydroelectric power for a railway system: the first cost of the power plant and distributing system; the amount of power to be delivered, and the load-factor.

There is no reason to expect a railway manager to consider a proposition for power unless there is a saving over the cost of operation by steam, and the stumbling block in the way of a contract is usually the amount of this saving. The railway companies as a rule are not thoroughly conversant with the first cost of a plant and distributing system, and do not realize the magnitude of the interest and maintenance charges.

Before considering the sale of power from the power company's point of view, it may be of interest to describe the system of the Hudson River Electric Power Company, together with some of the more important work in connection with its high voltage transmission.

There are three water-power plants in operation, and the present plans provide for the construction of nine additional plants of capacities varying from 2000 hp to 40,000 hp. These plants will be built as the demands for power increase. The total amount of power developed and undeveloped, owned or controlled by the company, is over 150,000 hp. This figure is based on the average flow of the various streams.

An auxiliary steam plant has been built at Utica, and when all the apparatus has been installed it will have a capacity of 15,000 hp. Another auxiliary plant of equal size will be built near the eastern end of the transmission system, and the total amount of power then available in all plants, both steam and water, will be 165,000 hp.

The most important plant now in operation is at Spier Falls. The construction work was begun in June, 1900, and current was put on the lines in September, 1903. The dam is the fourth largest in the world, but will be the fifth when the Roosevelt dam in Arizona is completed. Its maximum height is 157 ft., and the total length is 1500 ft. The power house is 80 ft. wide and 400 ft. long, and is designed for ten units; six units are in operation, and the seventh will be delivering power in September.

The wheels were started in 1903 under a temporary building, and the permanent structure has been extended as fast as new units were installed. The entire building will be completed in August, and work is now progressing on the canal and penstocks, so that by October the plant will be entirely completed and the power house ready for ten units. The eighth generator is on order, and the plans are to operate the last two machines during the eight months of high water, sending the power into the Mohawk valley. Energy for this end of the system will be supplied during the remaining four months from the Utica steam plant.

The rated capacity of the generators is 2500 kw each, and the water wheels can develop 5300 hp, so that an overload of 50 per cent can be carried for short periods. Under emergency conditions the generators have been operated at 3400 kw on an eighteen-hour run without an unusual rise of tem-

perature. Experience, however, seems to indicate that it is not advisable to install wheels which will develop more than a 33 per cent overload on the generators, and all new plants will be so designed.

Under normal operating conditions the current from each generator is taken through a separate bank of transformers of the same capacity as the generator, delta connected on both the 2000-volt and the 30,000-volt sides, but in cases of necessity the low-tension bus may be used for paralleling or for running a generator on a spare bank of transformers.

The lines leading from the 30,000-volt side of the transformers are connected through motor-operated, remote-control oil break switches, and continue to the center clips of double-throw air break selector switches. By means of these latter switches a generator may be connected to either of the two high-tension buses. These buses are provided with sectionalizing air break switches between each of the generator connections by means of which the buses may be split up into as many sections as there are generators, thus making it possible to easily run several independent circuits. There are also in the upper bus two motor-connected oil switches for sectionalizing, by means of which the different sections of the bus may be paralleled or separated while supplying current. All the generators are paralleled on the high-tension side of the transformers.

The secondary lines from the high-tension current and potential transformers are grounded for safety; the cases are also grounded. These secondary lines and all other lines that lead to the switchboard are carried in ducts laid in a brick wall. For voltage regulation Tirrill automatic voltage regulators are used, one being connected to each of the exciters.

The station was designed for a maximum of 30,000 volts, but the oil and water-cooled transformers for number seven and number eight units will have a capacity of 5000 kw each, wound for either 2000-30,000 or 2000-60,000 volts. An addition will be built back of the present high-tension end of the building, in which will be installed the automatic 60,000-volt oil-break switches which will be connected with the Utica line.

The second plant in importance is located at Mechanicsville. This plant was built in 1897, and was acquired by the Hudson River Electric Company in 1902. Power from this plant was sent over the transmission lines to Spier Falls during 1902 and 1903, and used for construction work. This plant was a striking example of poor design from the hydraulic standpoint. The water wheels were in very poor condition, and on account of the contracted area for the head-water and tail-water it was impossible to get more than 75 per cent of the rated power from the generators. During 1903 and 1904 the entire water-wheel equipment was replaced by McCormick wheels, the head race was enlarged, and the area of discharge from the wheels was greatly increased. These changes were satisfactory, and it is now possible to run the machines at their full capacity.

The Hudson River at this point is divided by an island into two channels with a combined width of about 1200 ft. The western channel is used for the head and tail-race.

The power house extends into the river 257 ft., and is connected with the island by a concrete dam 26 ft. above the bed of the river. The main dam is built entirely of concrete; the up-stream face is vertical and the down-stream face has an ogee curve. The dam is 15 ft. in height above the river bed, 16 ft. thick at the base, and 30 ft. thick through the base and apron. The total length of the spillway between abutments is 850 ft. In the western abutment are twelve waste gates, each 4 ft. x 6 ft., motor operated.

The power house lies between the west bank and the island, and is practically a continuation of the dam.

The power house is divided into two parts by a head wall 6 ft. thick. The up-stream part contains wheel chambers for seven 1000-hp power lines of wheels for the main generators, and two sets of smaller wheels for the exciters.

The down-stream portion of the power house contains the governors and electrical apparatus. The total length of the power house is 257 ft. and the total width 66 ft.

The tail-race is 200 ft. wide, and joins the main stream 750 ft. below the power house.

The water-wheel plant consists of fourteen pairs of 51-in. McCormick turbines. Each unit has two pairs of wheels designed to operate at a speed of 114 r. p. m., and rated at 250 hp; the total power of each set of wheels is therefore 1000 hp. The normal head under which the wheels operate is 17 ft.

The total generator capacity is 7000 hp in seven generators of 750-kw capacity each. They are the General Electric type, 40-cycle three phase, with revolving fields and stationary armatures wound for 12,000 volts. The current is delivered to the line without the use of step-up transformers.

The switchboard along the north side of the generator room is of the latest design, and the circuits are so arranged that they can be split up and the various machines run on separate and distinct transmission lines.

An auxiliary steam plant of 1000-hp capacity was installed during the summer of 1901. This plant consists of two 505-hp Heine water-tube boilers and one Hamilton Corliss tandem compound engine of about 1000-hp capacity, which can be connected by means of a rope drive to one of the water-wheel driven 750-kw generators, the coupling being so arranged that the change can be made in a very few minutes.

The third water-power plant is located on the Schoharie Creek, seven miles south of Amsterdam. This plant was built in 1900 by the Empire State Power Company, and during the first three years had a checkered career. The first designs called for a masonry dam about 350 ft. long, a canal 3500 ft. long, with eight foot penstocks about 200 ft. long, connecting the end of the canal with the power house.

The plant was completed and put in operation, supplying power to the Helderberg Cement Company at Howes Cave in 1901. During a high flood in the spring of 1901 the water cut a channel 200 ft. wide around the end of the masonry dam, and also washed away several hundred feet of the canal, completely shutting down the plant. A temporary timber dam was built to close the opening between the masonry and the south shore, and the canal was repaired. The plant was again in operation early in 1903, but during an exceptionally high flood in October the water again cut a channel around the end of the timber dam, and for financial reasons the company did not make any effort to rebuild. Control of the Empire State Power Company was obtained by the Hudson River Electric Company in 1904. During that summer a heavy timber spillway about 300 ft. long, and a timber dike about 400 ft. long, were built, extending from the end of the masonry dam to a high rocky bank on the south side of the stream. Four heavy floods have passed over the structure without injury, and the plant has been in continuous operation since early in 1905.

The equipment in the power house consists of two 700-kw Stanley Indicator alternators, one 250-kw General Electric belted alternator, and three 500-kw, 2000 - 15,000 - 30,000-volt AB General Electric transformers. The machines were originally built for 60-cycle 11,000 volts, but have been re-wound for 40 cycle 2000 volts.

This plant is one of five which will eventually be built on the Schoharie, and when storage reservoirs have been completed the minimum flow will produce about 12,000 hp on an eighteen-hour basis.

During the past year an auxiliary steam turbine plant has

been built at Utica. The total capacity of this plant will be 8000 kw at normal load, with sufficient boiler capacity for 50 per cent. overload, giving a total output of 15,000 hp. Transformers will be installed for 2000-60,000 volts so that power can be taken from or delivered to the lines.

A change in the type of construction of the transmission lines of the company is being made. All new lines are to be of the steel-tower type, and the old lines will be rebuilt with towers as rapidly as the necessary arrangements can be made.

The change to the tower type was brought about primarily by the adoption of 60,000 volts for the line from Spier Falls to Utica. Another very strong reason for the change is the short life of the wooden poles and fixtures.

The experience of the company has been that the life of a wooden pole is from nine to twelve years, and the life of a cross-arm in many instances is even less. Within the past year cross-arms on twelve miles of pole line have been replaced at a cost of about \$500 per mile. The first cost of material and labor for poles and fixtures was about \$500 per mile, and the cost for repairs on cross-arms alone during eight years was equal to the first cost of poles and fixtures. This expense consisted almost entirely of labor, as the work was done at night, on Sundays, and at such other times as the current could be taken off of the line. The poles carried two circuits, and power could be off from only one circuit at a time. Some of the poles are beginning to show signs of weakness just below the surface of the ground, and are being replaced as rapidly as necessary. All of these poles were of sound chestnut and the cross-arms were of first quality Southern pine.

In order to maintain a wooden pole line in first-class condition the experience of this company has shown that maintenance and depreciation amount to 20 per cent, or that the amount of money expended in ten years is twice the first cost on the poles and cross-arms.

The cost of steel towers for two circuits and ground wire, including special construction for corners and transpositions, is about \$2,500 per mile. This includes first cost of towers, freight, concrete foundations, erection, and all work except labor of putting on insulators and stringing cables.

On a comparative basis the cost of steel tower construction is five times that of the pole line. Records show that galvanized towers for windmill purposes are in perfect condition after thirty years of service, and it is therefore evident that the tower line will be the cheaper type of construction.

The cost of insulators built for the same voltage is about equal in either type of construction, but the leakage must be greatly reduced on the towers.

The effect of lightning on a steel tower line in this climate is problematical, but with the towers well grounded and with copper ground wire of large capacity it would seem as though the conditions were more favorable with towers than with the pole line.

The line from Ballston to Utica, now under construction, is being built of galvanized steel angle towers designed for two circuits, with a ground wire placed in the center of the tower three feet above the top of the conductors. The towers are all of the same general type of construction, and there are three different arrangements of cross-arms and insulators.

The standard towers, which are used on tangents and where the deflection angle is less than 20 degs., weigh 4200 lbs. each, and have an ultimate breaking strength of 8000 lbs., the pull applied at a point 50 ft. above the ground and equally distributed over the four pins of the lower cross-arm. The towers will also have an ultimate strength of 8000 lbs in a direction normal to the pull of the main conductors. The transposition towers weigh 5600 lbs. each and stand the same

strain as the standard towers. These towers are placed $2\frac{1}{2}$ miles apart. The corner towers are of very much heavier construction, and weigh 10,000 lbs. each, having an ultimate breaking strength of 17,000 lbs. applied in either direction. These towers are only used where the deflection angle exceeds 20 deg. The same arrangement of pins is used on all angles between 20 deg. and 90 deg.

The usual spacing of the towers is 550 ft., but the distance depends largely on the contour of the ground, some of the towers being 750 ft. apart and others not more than 400 ft. The average number of towers per mile is about ten.

All towers are arranged for a separation between wires of 6 ft. at all parts of the span, which necessitates a greater spacing between the insulators at the corner towers. The steel angles forming the upright members are built in the form of "A" frames, as viewed from a point normal to the direction of the line.

The view in the direction of the transmission line shows the corner angles perpendicular, with diagonal angles from the apex at one side tied to the foundation at the opposite lower corner. These angles cross at a point 25 ft. above the ground and are tied to a common gusset plate. The four angles at the top of each side near the end of the lower cross-arm are notched and clamped together with a very heavy cast-iron clamp held with four $\frac{3}{4}$ -in. bolts. The main vertical and diagonal members are held with diagonal struts and tie-rods in all directions. The base of the tower is 17 ft. square.

The foundations for the standard and transposition towers are built of reinforced concrete buried five feet below the surface of the ground. The lower part of the foundation consists of a concrete slab 4 ft. square and 12 in. thick. The anchorage is a 3-in. x 3-in. x 5-16-in. angle with two cross-angles, 3 ins. x 3 ins. x $\frac{1}{4}$ in., riveted back to back across the bottom of the upright. The cross-angles are embedded in the concrete about four inches above the bottom, and $\frac{1}{4}$ -in. twisted steel bars, placed six inches apart, are laid in both directions immediately above these angles. A concrete column 10 in. square, reinforced with ordinary chicken wire, extends from the flat concrete base to a point 8 in. above the surface of the ground, completely surrounding the vertical 3-in. x 3-in. angle. The foundations for the corner towers are 5 ft. square, and the other dimensions are the same as for the standard towers. There are, however, two upright angles, 3 ins. x 3 ins. x 5-16 ins., at each corner of the tower, and these angles are tied together with a 2-in. x $\frac{1}{4}$ -in. strap about half way between the bottom of the concrete base and the surface of the ground. All the anchorages are set with a templet to grade, and the towers are then assembled on the ground and raised and bolted to the foundation angles.

Both upper and lower cross-arms are built of 3-in. x 3-in. x $\frac{1}{8}$ -in. angles, latticed, the upper arm being 11 ft. 9 ins. long and the lower arm 17 ft. 9 ins. long. For each conductor single pins are used on the standard towers, while three pins, so placed as to evenly distribute the load, are used on the corner towers.

On the transposition towers the conductor is dead-ended on two pins, thus requiring four pins in a straight line for each conductor in order to make the transpositions.

All inside pins are made of 3-in. standard pipe, and outside pins of 3-in. extra heavy pipe drawn down at the top end fitted with a $1\frac{1}{2}$ -in. bolt thread $2\frac{1}{2}$ in. long, which engages a metal bushing in the top of the insulator. All pins have been tested with a strain of 2000 lbs. applied at a point 18 inches above the cross-arm. The pins will stand a pull of 3000 lbs. at this point without permanent deflection.

The insulators are made with four petticoats, are $15\frac{1}{2}$ ins.

high, and the greatest diameter is 18 in. A metal bushing with $1\frac{1}{2}$ -in. thread is cemented in the top of the insulator. The head of the insulator is so arranged that the pull of the tie wires is applied directly in line with the metal bushing below the top of the pin. There are $2\frac{1}{4}$ ins. of porcelain between the top of the pin and the conductor. The various parts of the insulator are tested to 60,000 volts, and the insulator when assembled is tested wet to 140,000 volts. The insulators before the final test are turned bottom up, filled with water and allowed to stand twelve hours in order to be sure that all parts have been thoroughly fired and glazed. The weight of the insulator is about 45 lbs.

The conductors are six-strand, hemp-center copper cable, the equivalent of 000 solid wire; the outside diameter is $\frac{1}{2}$ in., and the breaking strength under test is about 6100 lbs.

A ground wire of the same size and material is strung the whole length of the line. Every fourth tower is grounded by means of a galvanized iron plate, 20 ins. x 30 ins., buried in moist ground and completely surrounded by six inches of crushed coke.

The conductors are tied to the insulators by means of copper cable, single 0 equivalent. There are two tie cables, one to take the strain in each direction on either side of the insulator. Each tie is wrapped around the head of the insulator, and the ends are brought back and fastened to the main conductor by a specially designed malleable-iron clamp with three grooves.

All of these towers were built by the Aermotor Company, of Chicago, and were erected by the construction department of the Hudson River Electric Company.

One of the largest items in the cost of a system for supplying power is the sub-station and apparatus. There are at the present time eleven sub-stations in operation, with capacities ranging from 1000 kw to 10,000 kw. The total cost of the distributing system, including transmission lines and sub-stations, is about equal to the cost of the generating stations.

The second item to be considered in determining the cost of hydroelectric power is the total number of kilowatt-hours required. It is self-evident that an average load of 2000 kw is more to be desired than a load of 500 kw, as the fixed charges and operating expenses of the distributing system in either case are practically the same. This is not exactly true in regard to the interest on copper and distributing apparatus, but this item is small compared with the operating expense and depreciation on lines, etc.

The load-factor is the third and most important item in determining the cost of power, load-factor being the ratio of average to maximum load. It is evident that when the load-factor is near 100 per cent all of the machinery is in operation on all parts of the system, and the transmission lines are carrying their full load; the entire investment will have an earning power, and the charges will be a minimum per kilowatt hour. This is an ideal condition, and one which cannot be realized. Nevertheless, it has to be used as a basis to work from in determining the cost with various load-factors. If a plant is built for supplying power for a railway only the cost per kilowatt-hour will be higher than where power is also supplied to factories and for lighting purposes. In a large mixed system consideration must be given to the loads which are on at a time when the railway demand is low and when the machines set aside for railway purposes can be used for partially carrying other loads. The value which is to be given to these separate loads must vary according to the character of the load and the time of year.

There are two methods which may be considered in making contracts for railway energy. One is the flat rate per

horse-power per year, based on the maximum demand, the other method is on the kilowatt-hour basis. In either case a fixed amount of power as the maximum load is agreed upon, and momentary overloads of 5 per cent or 10 per cent are allowed.

With the flat-rate method the power company is not interested in the load-factor, and the burden falls on the railway company. The only way for the railway company to take advantage of the cheaper hydroelectric power is by the use of storage batteries or by the operation of an auxiliary plant to carry peak loads.

With the second method of charging on the kilowatt-hour basis the power company must be protected by a minimum monthly payment. This minimum payment must be determined by the average load-factor. The load-factor, therefore, is the basis for determining the cost with the kilowatt-hour method.

The items to be considered in fixing the cost to the railway company per horse-power per year are the fixed charges, consisting of interest, depreciation, taxes, and insurance; the cost of manufacture, consisting of labor, repairs and supplies; the cost of distribution; and the cost of management. There should then be added a reasonable dividend on the stock. The sum of these items, less the dividend, divided by the average amount of power which can be supplied at the distributing stations throughout the year, determine the cost per horse-power per year to the power company. This cost with large customers determines the price which they are to pay for energy. If, now, the power company is to be subject to the loss of income due to apparatus being idle for a part of the time, on account of low load-factor, the railway company's cost per kilowatt-hour must be correspondingly increased.

The gist of the matter is that with the flat-rate method, in order to obtain the benefit of the cheaper power, the railway company must make an investment in either a storage battery or an auxiliary power plant and bear the interest and depreciation of the same; while with the kilowatt-hour method the rate to the railway company is higher but the power company bears the interest and depreciation of the apparatus which is idle part of the time, but which must be maintained in readiness to supply the maximum demand. In the kilowatt-hour method consideration should be given to the factory and lighting loads whose peaks do not overlap the railway load. In this manner the load-factor on each individual machine is increased and the railway company derives the benefit of this greater load-factor. In other words, the railway load-factor may be 45 per cent, but by means of the loads which can be carried on the plant the average load-factor on the machines supplying the railway company, which are usually running in parallel with some of the other machines, can be built up to say 70 per cent. This load-factor of 70 per cent is used instead of 45 per cent in determining the cost of the power for the railway company.

To analyze the methods of determining the cost, a concrete example will be given. The figures used are for comparison only and do not represent conditions of operations.

The maximum railway load is 3000 kw, or 4000 hp, and the load-factor is 45 per cent. Considering the fixed charges and cost of operation, it is determined that the value of the power at the railway company's sub-station is \$100 per horse-power per year. The cost to the railway company with the flat-rate method will, therefore, be \$400,000 per year, or, if the full amount of power could be taken for twenty-four hours per day every day in the year, the cost would be \$.0153 per kilowatt-hour. With a load-factor of 45 per cent the average power would be 1350 kw, or 1800 hp,

and the cost would therefore be, with no storage battery on the system, \$.0338 per kw-hour. The cost to the railway company is therefore \$100 per horse-power per year, based on the maximum amount of power used, and the cost based on the average of 1800 hp used is \$222 per horse-power per year. On account of the great cost per horse-power per year based on the energy actually used, the railway company is compelled to install a storage battery and decrease the maximum demand. The maximum demand will therefore be 1350 kw, the average load, plus a battery loss of approximately 350 kw, making the maximum demand on the power company 1700 kw, or 2260 hp. The cost to the railway company for the hydroelectric power will therefore be 2260 hp times \$100, or \$226,000 per year. To get the total cost for power there must be added the interest and depreciation of the storage batteries, which will amount approximately, on a comparative basis, to \$30,000 per year, making the total cost to the railway company \$256,000.

With the kilowatt-hour method the value of the power at the distributing station is the same, or \$100 per horse-power per year, or \$.0153 per kilowatt-hour. Instead of using the load factor of 45 per cent in determining the cost to the railway company, the railway company is given the benefit of the average combined load-factor of the generating plant. This load-factor is 70 per cent, and the cost to the railway company is \$142 per horse-power per year for power actually used, or \$.021 per kilowatt-hour. The total cost, therefore, to the railway company is 1800 hp times \$142, or \$255,600 per year.

The power company must have a minimum guaranteed monthly payment based on the maintenance of the load-factor by the railway company. The power company is also protected by the maximum demand which cannot be exceeded, and is assured of a stipulated income; so that if the railway company's load factor drops below whatever amount is stated in the contract, the railway company will be the loser by reason of paying for power which they have not used. Thus the railway company derives the benefit of the larger combined load-factor of the plant in determining the cost per kilowatt-hour, but is obligated, by reason of the minimum payment, to keep its load-factor within reasonable limits.

It is evident that the actual cost in either case is approximately the same, but with the flat-rate method the railway company has to make a larger investment in order to take advantage of the hydroelectric power.

REPORT OF COMMITTEE ON INTERCHANGEABLE COUPON TICKETS

The report of the committee of the Street Railway Association of the State of New York on interchangeable coupon tickets was as follows:

The committee appointed to consider an interchangeable coupon ticket begs to report as follows: An arrangement for the sale and use of such books will necessarily have to be a matter of individual and collective contract between the companies entering into such an arrangement, and attached we submit a form of such contract which we hereby recommend.

We also hereby recommend that the conditions to be printed on such books, and under which they are to be sold, be the same as attached. Respectfully submitted,

J. H. Pardee.

George G. Blakeslee.

R. P. Stevens.

Committee.

PROPOSED FORM OF CONTRACT COVERING INTERCHANGEABLE COUPON TICKETS

Whereas, certain of the electric railways of the State of New York, doing a general interurban business, are desirous of forming an association for the purpose of issuing interchangeable coupon books, and

Whereas, it is desired that said interchangeable coupon books shall be good for transportation upon all the lines that are parties to this agreement,

Therefore, it is hereby covenanted and agreed by and between the respective electric railways signing this agreement that the following rules and regulations be and are hereby adopted and agreed to as the rules and regulations governing said roads in issuing said interchangeable coupon books, and providing for the method of redeeming the same and the settlement of balances between said roads, to-wit:

In consideration of the adoption by all parties of this contract of the uniform interchangeable coupon book, we, as authorized representatives of our respective railways, do hereby agree to abide by the following rules for the regulation of the use of said interchangeable coupon books, and for the settlement of the revenue arising therefrom.

ARTICLE 1

The coupon books shall be uniform in every respect, differing only in the name or initials of the various railways by which they are issued, and shall be known as Form S. R. A. S. N. Y. No. 1.

ARTICLE 2

A committee of three, called the transportation committee, shall have charge of the details of the issuance of the interchangeable books provided for in this contract, and the settlement of all questions arising thereunder as may be hereinafter provided for. This committee shall be appointed by the parties to this agreement, and such committee shall elect a chairman. The members of this committee shall continue as such members until the expiration of one year from the date of their appointment, and until their successors shall be appointed.

ARTICLE 3

The Locks and necessary accounting forms shall be procured only from an official printer by requisition made upon the chairman of the transportation committee, who will order the shipment made and the bill rendered direct to the railway from which the requisition may have been received, which requisition shall not be honored by the chairman until the fifteenth of each month covering the following thirty days' supply, requisition to state numbers on books unsold, and number of books sold since previous requisition. The books will number consecutively for the entire association, that all books may bear different numbers without regard to the source of issue. Not more than three books per month per mile of single track or terminal mileage to be ordered by any one company.

ARTICLE 4

These coupon books, when regularly issued, shall be honored for passage over all the railways, parties to this contract, upon the conditions of the contract under which they are sold, and it is agreed that the contracts under which said respective roads sell said interchangeable coupon books, shall be identical in form, and the observance of this provision as to making said contract under which said books are sold, shall constitute a vital part of this contract.

ARTICLE 5

The settlements of the revenue derived from the sale of the coupon books shall be made as follows:

A. All foreign coupons collected by companies, party to this contract, shall be mailed to the company whose initials or numbers are stamped on each coupon, not later than the fifth of the calendar month following the month in which honored. A statement shall be rendered for the coupons so sent, on a basis of 83 1-3 per cent of their face value, and a remittance for such statement, if found correct, shall be made by the issuing railway not later than the tenth of the same month, provided settlement between two companies, each of which has mailed a statement to the other for the same month, shall be made by the payment of the balance.

B. The failure on the part of any company to make settlement with all other companies by the tenth day of each month, shall be made known at once to the chairman of the transportation committee by written notice, briefly stating the facts.

That the chairman of the transportation committee, on receipt of such a notice, shall promptly notify all other companies, party to this contract, of the facts by written notice served by registered mail, and that after the receipt of such notice from the chairman, the amount due each month from each company to said defaulting company or companies, shall be remitted to the chairman of the transportation committee instead of to the defaulting company or companies. Accompanying such remittance shall be rendered a copy of the bill or statement, together with the coupons collected, which statement shall show the amount due the sending company from the defaulting company, and the chairman shall be authorized to take such steps as are found necessary for the collection on behalf of the companies so sending him their accounts, the balances, if any, due them from the defaulting company.

C. When a company has once defaulted on its settlements, the chairman shall refuse to honor requisitions for said company for any more interchangeable coupon books, unless, at a meeting of the officials representing the roads parties to this contract, at which meeting not less than three-fourths of all the companies parties hereto are in attendance, action be taken on the affirmative vote of not less than three-fourths of the companies represented, authorizing the chairman of the transportation committee to supply the defaulting company or companies with coupon books at not to exceed the maximum rate per month provided for in said contract.

ARTICLE 6

Each company shall keep a daily record of the serial numbers of each company's coupons collected, which record shall be the basis of settlement in case of loss of coupons in transmission, provided copy of record is furnished by collecting railway, who shall, however, indemnify the issuing railway against the possibility of the lost coupons again being presented for payment.

ARTICLE 7

Expired or unused coupon books must be redeemed only by the railway by which issued, if presented within eighteen months of date of sale, but only on the following basis: Full fare or face value shall be computed for all the coupons which have been used, and the remainder of the original purchase cost shall be the proper redemption value.

Example.—A book is returned for redemption containing sixty coupons, showing that 180 coupons have been used; redemption value shall be computed as follows:

Original cost of book (240) coupons	\$10.00
Coupons used, 180 at 5 cents each	9.00

Redemption value of unused coupons.....	\$1.00

ARTICLE 8

Additional companies may become parties to the use of the interchangeable coupon book on approval of the transportation committee, and by subscribing to and complying with the terms of this contract. Such additions shall be bulletined by the chairman of the transportation committee.

ARTICLE 9

These rules and such regulations as may be adopted thereunder shall bind all companies, parties thereto, from the time they respectively become parties hereto as provided in Article 8 hercof. Any company may withdraw therefrom by giving sixty days' notice to the chairman of the transportation committee, provided it has adjusted all balances due or accruing to the companies, parties to this contract. Further, that notice of withdrawal shall begin with and run from the first day of the calendar month. The chairman of the transportation committee will bulletin in the name of the company desiring to withdraw from this agreement with the advice that the withdrawal shall be effective on a certain date, after which date the name of the company withdrawn must have been erased from all new books sold. The company withdrawing must return to the chairman of the transportation committee all unsold interchangeable coupon books, the numbers of which shall be shown on the above mentioned bulletin. The company withdrawing shall continue to honor for passage all books which may have been sold prior to the bulletined date of withdrawal, up to the date of the expiration of each coupon according to the contract date of sale.

ARTICLE 10

Any violation of this agreement shall be promptly reported to the chairman of the transportation committee, and by him brought

before a meeting of the committee, and will be acted upon by such committee or referred to the meeting of the parties of this agreement for further action, called for action thereunder.

ARTICLE 11

These articles and the rules of this contract may be amended only by a two-thirds vote of the companies subscribing, provided ten days' notice of the proposed changes has been given all members, through the office of the chairman of the transportation committee.

ARTICLE 12

The expense of the maintenance of this contract and the interchange of coupon books hereunder shall be adjusted and paid semi-annually by the constituent parties hereto, on the basis of the number of miles of main line of interurban railway operated by the respective companies outside of municipal limits. Each company shall pay such proportion of said expenses as the main line of such company operated outside of the municipal limits, shall bear to the total number of miles of main line of all the companies, parties hereto, operated hereunder, and the term "main line" shall be understood to mean a single track between given points, exclusive of side-tracks, turn-outs or sidings, said expense not to exceed \$25 per annum per company without the consent of the majority as provided in this contract.

ARTICLE 13

It is mutually agreed by the parties to this contract that the individuals signing this agreement as representatives of all respective railways, parties to this contract, shall each constitute a special trustee to hold, and as such trustee to become responsible for all monies held by their respective roads for the purpose of paying for the coupons redeemed for such companies, or other roads parties to this contract. That is, the said officials shall each respectively become the trustee for all funds received by their said road, under the terms and conditions of this agreement, and shall hold said monies as trust funds for the use of the said roads entitled to same under the terms of this contract.

ARTICLE 14.

Each copy of this contract shall be considered as an original, and when any company signs such copy, such signing shall be considered as the signing of the original contract jointly with all constituent companies, whether such companies are then, or thereafter become parties hereto.

ARTICLE 15

The transportation committee shall construe the articles and rules and issue such general bulletins to the companies, parties to this agreement, as occasion may demand. The decision of the transportation committee shall be final in all matters of dispute arising from the interchange of tickets.

This agreement, and the foregoing rules and regulations as they may exist, or as hereafter amended under Article 11 hereof, shall continue in full force and effect and be binding on each constituent company, parties hereto, from the date any such company becomes a party hereto as herein provided, to the time of withdrawal of such company herefrom as provided in Article 9 hereof, and it shall not be necessary at any time hereafter to renew this agreement between the parties hereto.

By the foregoing agreement, rules and regulations, and by the terms and conditions of the contract printed in the interchangeable coupon book, we as authorized representatives of our respective railways, agree to be bound.

.....

 Dated at
 this.....day of.....190...

CONDITIONS TO BE ATTACHED TO INTERCHANGEABLE COUPON TICKETS.

1. The holder of this interchangeable coupon book is entitled to receive an aggregate of \$12 worth of transportation over the several lines of electric railway named on the cover of this book, or which may be hereafter bulletined, which transportation will be given at rates of fare, and under the local regulations of the respective lines so named in bulletin and subject to all the terms and conditions of this contract.

2. In selling this interchangeable coupon book over the line of any other company, the selling company acts as agent only, and assumes no responsibility beyond its own line.

3. The coupons contained in this book shall not be honored for transportation if detached by any person other than the conduc-

tor, or if the serial number on left side of each coupon is altered, or in case of the number on outside cover of book not agreeing with contract number, which is the number on each coupon, and if for any reason the conductor demands the surrender of this book and the payment of full fare, then said book shall then be surrendered to the conductor, who shall issue his receipt therefor, and application for rebate on account of such surrender shall be made to the company from which the book was originally purchased. No attempt shall be made by the purchaser to adjust any such differences with the conductor.

4. The conductor will detach, in the presence of the passenger, a sufficient number of coupons at their face value to cover the local cash fare on his train, or the local one-way ticket fare if same is lower than local cash fare.

5. The interchangeable coupon book does not permit the checkings of baggage thereon under any terms or conditions differing from the rules of the road over which said book is being used, and under no circumstances shall the liability of any company permitting the checking of baggage on this book be greater than the sum of fifty dollars (\$50) in case of loss or damage to any such baggage.

6. This interchangeable coupon book expires one (1) year from the date of purchase. Expired or unused coupon books may be redeemed only by the railway by which it is issued, if presented within eighteen months of date of sale, but only on the following basis:

Full fare or face value shall be computed for all coupons which have been used, and the remainder of the original purchase cost shall be the proper redemption value.

7. It is understood and agreed that not less than two (2) five-cent (5c.) coupons will, under the contract conditions governing the use of this interchangeable coupon book, be accepted for any distance, no matter how short.

8. The further stipulations and conditions printed on the cover of this interchangeable coupon book constitute and form a part of this contract.

9. Any person using this ticket shall be bound by all the conditions and provisions of this contract, as fully as the original purchaser of same.

10. I have read all of the conditions of the above contract, and I hereby accept the same.

REPORT OF COMMITTEE ON STANDARD APPLICATION BLANKS AND FORMS

The report of the committee on standard application blanks and forms of the Street Railway Association of State of New York was as follows: The committee on standard application blanks and forms respectfully reports as follows: The committee held two meetings, on Jan. 11 and April 27, 1906, respectively, in Utica, and adopted the accompanying blanks, which are submitted for the consideration of the association as standard for application and surgical examination. These are the result of study of a large mass of blanks in use by the various railways, which were courteously furnished by the respective superintendents on request of the secretary. C. C. Coons was appointed a sub-committee to draft the application blank, and the thanks of the committee are hereby tendered him for his work.

We believe these blank forms, with slight modifications, will suit the individual requirements of various roads and will cover the necessities of all.

In the surgical examination blank we have submitted but one form to cover the requirements of city and interurban service, leaving it to the judgment of the respective surgeons to adopt a rating which shall show the grades of service for which the applicant is fitted. Thus an applicant rated "first class" would receive a mark of 9 to 10 and be recommended for the most responsible position; one rated "average" should be marked 7 to 9 and be assigned to less important service, while old employees receiving a rating of "average" with a mark of 6 to 8 could be retained in the less responsible positions.

We wish to tender our thanks to Secretary Fairchild for

Form 264-S-R-106-300.

Applicant's Signature at Superintendent's Office.....

SURGEON'S CERTIFICATE OF EXAMINATION.

Of..... Occupation..... Age (should be between 21 and 40).....

VISION: DISTANCE		NEAR	COLOR SENSE		HEARING	
Right eye.....	.....	.....	Green.....	.....	Right ear.....	.....
Left eye.....	.....	.....	Red.....	.....	Left ear.....	.....
Does he need glasses?.....		.....	Purple.....	.....	

What is the rate of Pulse..... of Respiration.....

What diseases has he suffered from?	NAME	DATE	RESULTS
.....

Has he hernia?..... What form?.....
 Its present condition.....
 Has he ever been injured?..... If so what and when?.....
 Is he the subject of any deformity, from injury or otherwise?..... If so, note here and locate on skeleton blank herewith.....

Has he any present source of disability in..... (Applicants should be stripped for this examination. Note with care varicose veins, enlarged joints and anything tending to produce or prolong disability.)	Heart.....
	Lungs.....
	Kidneys.....
	Joints.....
	Veins.....
	Feet and Legs.....
	Hands and Arms.....
	Spine.....
	Urinary Organs.....
	Nervous System.....

Does he use intoxicating liquors?..... Is his appearance that of a temperate man?.....
 Has he had small pox..... or been recently vaccinated?..... His height is..... feet..... inches; weight..... lbs.; color of eyes..... of hair.....

He is physically a { First-class
 Average subject for position as.....
 Defective

Mental characteristics { Alert
 Average
 Dull (Signature)..... Surgeon.

Examined.....
 Date..... 19.....
 Signature of applicant to be taken at Surgeon's office.....
 (Sign here)..... Applicant.

REMARKS:
 (Anything lacking in spaces above should be added here.)

REVERSE OF SURGEON'S CERTIFICATE PROPOSED BY THE STANDARD COMMITTEE

No.....

Application for Employment
 SURGEON'S CERTIFICATE

Name.....
 For position as.....
 Approved.....
 SIGNATURE.....

REMARKS:
 Sign.....

LOCATE ANY DEFORMITIES ON THE SKELETON.

REVERSE OF SURGEON'S CERTIFICATE PROPOSED BY THE STANDARD COMMITTEE

BODY OF APPLICATION BLANK FOR EMPLOYMENT, RECOMMENDED BY COMMITTEE

Penal Code.—Chapter 6, No. 570. A person who obtains employment or appointment to any office or place of trust by color or aid of any false or forged letter or certificate of recommendation, or of any false statement in writing, as to his name, residence, previous employment, or qualification, is guilty of a misdemeanor.

A person convicted of a crime declared to be a misdemeanor is punishable by imprisonment in a penitentiary or county jail, for not more than one year, or by a fine of not more than \$500.00, or by both.

Applicant must answer the following questions and sign this application in ink in his own handwriting:

Name in full. (No initials.)
Address in full.
Name and address of parents or relatives.
Age. Height. Weight
Single or Married, if latter give extent of family and their residence
Position desired. How long have you lived in Blank?
Where were you born?
If out of the United States, how long have you lived in this country?
Are you, or have you declared your intention to become a citizen of the United States?
Have you ever been in the employ of this Company before?
If so, in what capacity, on what division, and why did you leave the service?
Were you ever employed by a street or steam railway? If so, when, where, and in what capacity?
Why did you leave the service?
Have you ever been discharged or suspended from any situation? If so, state when, where, and for what reason?
What is your trade or occupation?
Where were you last employed and in what capacity?
When, and why did you leave?

State on the following blank your employment and employers during the last five years:

Table with 4 columns: FROM WHAT DATE, TO WHAT DATE, EMPLOYED AS, NAME AND ADDRESS OF EMPLOYERS

I agree to submit to a medical examination by the Company's Doctor and pay for same.

In part consideration for my employment, I agree to return upon demand or on severing my connection with the Company, all the Company's property then in my possession, and whenever requested, to make and verify an affidavit containing a full and truthful statement of any and all accidents, ejections, refusal of transfers, and assaults, of which I may have knowledge, (and I agree to deposit with the company as security for my performance of my agreements herein contained, which deposit is to be retained by the Company as liquidated damages in case of any breach thereof.

I agree to make application for a bond with such surety association as the company may designate, and in the event of their refusing to become my bondsmen, that I will, upon notification to that effect, resign from the service, and hereby agree to waive all claim for any damages resulting therefrom.)*

I agree to work under instruction on trial, without pay, at least days and such additional time in excess thereof as the Company may deem necessary.

I agree, as a punishment, in case of any infraction of the Company's rules, to serve time practicing or while under suspension without pay.

I understand that no compensation is paid to trainmen for time spent while engaged "on watch," (meaning waiting at any designated point for opportunity to work), but that Company's standard wages are allowed only for service rendered while actually employed on its cars.

I further agree that if I am discharged, or leave the Company's service voluntarily at any time during or after the trial period above referred to, I shall have no claim against the Company for services rendered, or expenses incurred by me during said trial period or while performing duty "on watch," as above explained.

I agree to at once provide myself with a standard uniform in accordance with the rules and regulations of the Company.

While in the Company's service, I agree to study carefully and comply faithfully with all its rules, regulations and orders.

I have read the foregoing, and clearly understand all conditions specified therein; and to the truth of all

statements made, and my willingness to abide by the conditions of this contract, I hereby make affidavit.

State of New York,
County of...
City of... } ss.

being duly sworn, deposes and says that the above statement is true to the best of his knowledge and belief.

Sworn to me this day of 190.

* Each company to retain or eliminate according to individual necessities. Retain or eliminate.

We, the undersigned, request the Blank Railway Company to employ

and do state that we have known him intimately for the past years, and that he is a man of good moral character, of sober, temperate and industrious habits; not addicted to the use of intoxicating drinks, and no violator of law and good order. And we further represent that he is a man of truth and integrity, good understanding, and of temper and manners fit to be employed on your system.

(Give Street No., City and State.)

Address
Address
Address

BLANK RAILWAY COMPANY

Station. Bond No. Badge No.
Employed as
Nationality. Age. Height. Weight
Married or Single. General Appearance
Introduced by. Turned in by.
Appointed by.

Superintendent.

*CASH DEPOSIT

Date 190

This is to certify that there has been deposited with the Treasurer the sum of \$ as a forfeit as provided for in this application.

Treasurer.

Received 190 of Blank Railway Company, the sum of \$ being refund of above deposit.

Note.—Each company to retain or eliminate the clauses inclosed in brackets about cash deposit, surety, etc., according to individual needs.

valuable assistance freely and repeatedly given, and to Mr. W. B. Brockway, president, and Mr. Elmer M. White, secretary, of the American Street and Interurban Railway Accountants' Association for loan of book of railway labor statistics. (Signed) F. H. Peck, Chairman.

REPORT OF COMMITTEE ON REVISION OF CONSTITUTION AND BY-LAWS

The report of the committee on revision of constitution and by-laws was as follows:

Article 11. It is suggested that the constitution be changed to form three classes of members, namely, active members, associate members and allied members.

(a) Active Members, to consist of railway or railroad companies whose properties are operated wholly or in part by electricity as the motive power, and located wholly or in part within the State of New York. Each active member shall be entitled to one vote, which shall be cast by the proper accredited delegate.

(b) Associate Members, to consist of individuals, copartnerships and corporations, who are actively identified with street and interurban railway interests, and other persons, who, in the opinion of the executive committee, have had experience of such a nature as to render desirable their connection with the association.

This class of membership is intended to include more particu-

larly engineering firms and financial institutions, independent engineers, bankers and brokers, power companies and electric railway companies situated adjacent to New York State, who may desire to have the privilege of attending the various meetings. The privileges of associate members shall be similar to those of the active members, except that they shall not be entitled to vote or hold office.

(c) Allied Members, to consist of individuals, copartnerships and corporations who are engaged in manufacturing, selling or dealing in electric railway supplies and materials.

Allied members shall have the privilege of sending representatives to the annual meetings, but shall not vote, hold office or have the privileges of the floor.

FEEES

Article 15. Associate Membership.—The dues of associate members shall be \$25 per year, which shall entitle the member to send delegates to the quarterly and annual meetings of the association

Allied Membership.—The dues of allied members shall be \$15 per year, payable as registration fee at the time of registration for the annual meeting. This fee shall entitle the member to send representatives to the annual meeting, and shall include one banquet ticket.

On motion the report was adopted as read.

REPORT OF COMMITTEE ON DETAILED OPERATING EXPENSE OF THE MECHANICAL DEPARTMENT

The committee on collection and compilation of mechanical tests made the following report:

At a special meeting of the association, held in Schenectady, June 10, 1906, for the discussion of cost of inspection and maintenance of cars and equipment, a committee was appointed to

Form 204-A-1000 6-06

DETAIL COST OF MAINTENANCE OF CARS AND EQUIPMENT

		RAILWAY CO. FOR		ENDING				
ACCOUNT 6		NO.	KIND	COST PER 1000			TOTAL VALUE	
				CAR MILES	WHEEL MILES	MOTOR MLS.		
A	AXLES		City					
			Interurban					
			Total					
B	BRAKE SHOES		City					
			Interurban					
			Total					

COLUMN HEADINGS OF BLANK FORMS SUBMITTED BY COMMITTEE ON COLLECTION AND COMPILATION OF MECHANICAL COSTS

prepare a standard system of records and blanks so that unit costs of inspection and maintenance of cars and equipment, in such detail as was found advisable, might be obtained in a uniform manner.

The committee begs to submit blanks presented herewith, which, under accounts 6, 7, 20 and 21, may be given unit costs of the more important items entering into these accounts for the purposes of comparison.

In the first column to the left will be noted letters a, b, c, etc., which may be used as sub-divisions of the account under which they appear.

In the second column, the names of the articles, and in the subsequent column, the kind, number and unit cost per thousand car-miles, wheel-miles or motor-miles, as may be required, and in the last column, the total cost of the items indicated. It is proposed that each item in the maintenance accounts shall include labor and material, and cost to prepare the article ready for use on the cars, but shall not include cost of installing on the car. For example: The cost of maintaining GE-800 motors shall include labor and material expended in repairing such motors, including the turning down of commutators, replacing coils, etc., but not the cost of removing and replacing such armatures in the motors. The total at the bottom of the page should show the total cost of the account, and not simply the total of the items given above.

From actual practice it is found that the records necessary to obtain the cost called for in these blanks may be obtained at a small expense by either dividing the accounts in the sub-heads, as indicated, and requiring that such sub-divisions shall be marked on the time slips and material requisitions, or the sub-division may be made in the general office, or in the office of the master mechanic directly from the time slips and requisitions, which of themselves indicate what kind of work was done, or what kind of material was used in each instance.

Your committee feel that in the items included in these blanks it has given those which may most profitably be compared on the requisition, and ask that an effort be made by all members to keep their records, commencing July 1, so as to obtain the information required for the purposes of this comparison.

The report of the committee was accepted, and the committee was continued with instructions to prepare suggestions as to the best method of keeping the records recommended.

The blanks prepared by the committee for collecting and compiling statistics on the cost of various detail items included in accounts 6, 7, 20 and 21 of the standard system of accounts are the result of much hard study and consideration, and it is believed the forms offered combine all the requirements in simple and convenient shape. There are three blanks, each 8½ ins. x 11 ins., arranged to be used with the loose-leaf filing system. The column headings are the same for each sheet and are shown in the engraving herewith.

In designating the particular items on which data should be collected, the committee did not attempt to include all the items that enter into the cost of maintaining cars and equipment, but in order to make a start and not complicate matters at the outset, it was decided to include merely the more important detail items that constitute the larger part of these amounts. The items finally selected are printed down the left-hand side of the forms as will be understood from the portion of the form reproduced in this connection. Space is left under each item to divide the data into "city," "interurban" and "total."

Of the three sheets submitted by the committee the first is devoted to account No. 6, and contains the following items:

- A—Axles.
- B—Brake-shoes.
- C—Journal Bearings.
- D—Painting.
- E—Car signs.
- F—Wheels—Cast.
- G—Grinding.
- H—Wheels—Steel.
- I—Turning.
- J—Damaged cars.
- K—Car body repairs, except items D and J.
- Total of account No. 6.

All of the second sheet and the top half of the third sheet are devoted to account No. 7. The second sheet comprises the following items:

- A—Armatures (with blank space left to enter data on several different types).
- B—Field coils (with blank spaces as above).
- C—Commutators.
- D—Brushes.
- E—Brush holders.
- F—Armature bearings.
- G—Motor axle bearings.

H—Total motor repairs (including all labor and material charged to repairs and installation).

The top half of the third sheet is a continuation of account No. 7 and contains the following items:

I—Controllers (with blank space left to enter data on several different types).

J—Gears.

K—Pinions.

L—Trolley wheels.

Total of account No. 7.

The lower half of the third sheet gives items from accounts 20 and 21 as follows (these items to include material and labor, except cost of installation):

Labor—Car cleaning.

Material—Car cleaning.

Car Inspection—Including minor repairs in car houses.

Lubrication.

The summary at the bottom of this sheet calls for the following information:

Total car-miles during period.

Total car-hours during period.

Average eighteen-hour cars.

Average maximum number cars in daily service.

Number cars ready for service.

Number defective cars "pulled in" during period.

EXHIBITS AT SARATOGA

There was no attempt to make a full line of exhibits. A few companies, however, had exhibits of light material on the veranda. The most important of these were as follows:

The Ohio Brass Company, of Mansfield, Ohio, displayed its single-phase overhead line material.

Dossert & Company, of New York, exhibited all of its various types of cable joints.

The National Lock Washer Company, Newark, N. J., had a neat exhibit of its curtain fixtures and sash locks.

The Crouse-Hinds Company, of Syracuse, N. Y., showed its Imperial Arc Headlight for suburban and interurban service.

The Rail-Joint Company, of New York, showed at Saratoga a full line of its various types of rail-joints.

The T. H. Symington Company, of Baltimore, Md., had an exhibit of its railway specialties.

The Franklin Car Heating Company, of Syracuse, N. Y., had a neat exhibit of its Western car heater.

The Gould Storage Battery Company, of New York, had a neatly arranged exhibit on the veranda of the Grand Union Hotel, of the Gould type of storage battery plates.

G. F. Taylor, of Randolph, Mass., exhibited an automatic fender, which applies the air brakes when it strikes an object.

HURRYING WORK ON THE WEST JERSEY AND SEA SHORE ELECTRIFICATION

The statement is made in Philadelphia that President Cassatt, of the Pennsylvania Railroad, has issued special instructions for hurrying work on the electrification of the company's line between Camden and Atlantic City, and that in accordance with his instructions the construction force has been increased. Just when the line will be ready for service it is impossible to predict, but the operation of trains will surely be begun early next month, so it is said. Already the cars on hand for use on the line are being run between Westville and Woodbury to acquaint the crews with their working. Power for this purpose is being taken from the Camden & Suburban Company's station. The sub-stations at Reega, Mizpah, Newfield, Clayville, Glassboro, South Camden and Atlantic City are all within a few days of completion, as is also the main station at Westville. The greatest amount of work to be accomplished is in Camden and in Atlantic City. In order to bring the electric line into Camden without interfering with the steam railroad, the structure of the proposed elevated roadway will be used. Where the stone sections are not connected, the railroad will erect frame structures upon which the rails of the electric line will be placed. Temporary stations will be used in Camden and Atlantic City.

THE SARATOGA CONVENTION

The twenty-fourth annual meeting of the Street Railway Association of the State of New York was held at the Grand Union Hotel, Saratoga, June 26 and 27. There were over 250 delegates in attendance.

The morning session on Tuesday was called to order at 10:30 with President Danforth in the chair. The annual address of the president follows:

PRESIDENT'S ADDRESS

The selection of a place at which to hold the twenty-fourth annual convention of this association was left to your executive committee, who, after careful consideration, determined upon Saratoga Springs as the best available place, and I hope that all the delegates to this convention will be pleased with their selection.

The past year has been fruitful of many events of importance to the electric railways of this State, chief among which, the change in policy regarding electric railways by the steam railroads, and the entrance of such railroads in the electric traction field.

While New York has been for years notably backward in the development of interurban lines, it undoubtedly leads to-day all other States in the newly established community of interest between steam and electric railways in the electrification of a heavy steam railroad terminal, and in the successful operation of electric cars over tracks in regular and frequent use by heavy trunk-line steam traffic. The extension of this latter class of service on the tracks of the West Shore Railroad, between Rome and Syracuse, by the operation of cars of the Utica & Mohawk Valley Railway Company, will be an established fact before the close of this year. The joint operation of steam and electric trains between the points named, will be closely studied by railroad officials of both classes of service throughout the country. It might be well to note at this time that a protected third rail is to be used, instead of the overhead trolley, to transmit current for the electric cars. Far-sighted railroad men see the necessity of offsetting the inroads into their freight and passenger earnings made by parallel electric lines, by furnishing equivalent service, on their own tracks, by the use of electric cars operated at high speed and frequent intervals. Plans have been prepared, and, I understand, some contracts have been let for the electrification of certain branches of a number of the steam trunk lines in this State. The successful operation of long interurban lines in direct competition with steam railroads has already impressed the steam railroads with the obvious advantages in the use of electric power for the operation of passenger, and of some classes of freight trains. For years there has been more or less open warfare between steam and electrical interests, and we note with pleasure the change in conditions as above outlined.

The business prosperity enjoyed by the country at large, continues to favorably affect the receipts of the steam railroads of this State, and will, apparently, continue during the entire year. The report of the Railroad Commissioners shows that the gross earnings of 106 street railways of the State of New York, for the year ending June 30, 1905, were \$70,730,085.66, an average of \$33,684.20 per mile of road, showing an increase over the preceding year of \$1,134.48 per mile. It is interesting to note that the steam surface railroads report for the same time shows gross earnings from operation, per mile of road operated, \$19,034.35.

The transmission of Niagara Falls power to Syracuse marks a new epoch, and brings more nearly an accomplished fact,—the operation of trains on all railroads by electricity.

Public sentiment regarding street railways is assuming varied forms; in some places, the tendency is toward municipal ownership; in others, to a liberal treatment of public service corporations, only requiring in return, a fair and honest service. Tendencies—almost anarchistic—are clearly shown by people of one city, while those in another advocate strongly, corporate ownership of public utilities, with a wise and just form of municipal supervision. The members of this association can best offset the growing demand for municipal ownership of public utilities by giving the public adequate service, and by pointing out the evils attending municipal ownership. The work of the Civic Federation in obtaining accurate information concerning the results of municipal ownership of public utilities in Europe will give us the ammunition necessary to overcome the forces now working against corporate interests.

During this winter your executive committee has called two

special conferences of the members for the informal discussion of various problems arising in the operation of street railways.

At the January conference, held in Schenectady, Jan. 10, subjects relating to the maintenance of cars and equipment were thoroughly discussed. This meeting was attended by the master mechanics and mechanical engineers of nearly all the railways in the State, and by a number of others from neighboring cities and Canada.

At the meeting held in Elmira in March, problems of the transportation department were discussed. Both meetings have satisfied your executive committee that an opportunity for various departmental officials to meet together for an informal heart-to-heart discussion of the problems which they have to overcome, is not only appreciated by such officials, but does much to increase their efficiency. It is not to be expected that the railways in Greater New York receive, directly, a great amount of material good through a discussion of various topics by this association; they do, however, gain in the fact, that through their work in the association, they are educating men whom they may, some time, find it advantageous to employ, and, in return, through their advice given at these meetings and through the exploitation of their system, greatly aid the other railroads in the State in improving their operating methods, and, incidentally, their earnings.

At the annual meeting last year, a resolution was adopted and referred to the executive committee for further consideration and report on the proposition of obtaining the appointment of a commission to revise Article 4 of the Railroad Law, authorizing the expenditure of such moneys as may be necessary for the expense of this commission, from the regular funds of the association, or from the proceeds of the special assessment heretofore authorized. Your executive committee advises deferring action of this character for at least another year.

Your executive committee would like to have, for the benefit of those whom you may elect for the ensuing year, an expression of your opinion, as an association, of the advisability of continuing these special meetings, and of having the annual meeting in June.

By consolidations and withdrawals of several roads, our membership has been reduced to thirty-six roads.

Your executive committee recommends a change in the constitution and by-laws which will permit electric railroads in adjoining States and Canada to become associate members, and also recommends a revision of the dues as now levied upon active members. By cutting out all unnecessary expense, the maximum dues may be materially reduced and the roads placed upon a more equitable basis. This association has been in existence for twenty-four years, and its policy has changed from time to time, with the change in conditions. We are all alive to the fact that we have reached another turning point and must decide at this meeting the future policy of the association.

Your respective committees have prepared careful reports on the subjects assigned them, and several important papers are to be read and discussed.

In closing, I desire to express my appreciation of the hearty co-operation I have received from the various members during the past year, and will ask all the members present to aid me in making this a most profitable convention.

The report of the treasurer for the year ending June 30, 1906, showed a balance of \$2,204 in the treasury.

After the general business of the convention had been completed the reports of the special committees on standard application blanks and forms, collection and compilation of mechanical costs, interchangeable coupon books, and revision of constitution and by-laws were read. These reports will be found elsewhere in this issue.

The convention session on Tuesday was devoted to a consideration of three papers on the sale of water power, viz: By S. B. Storer, general manager Niagara, Lockport & Ontario Power Company; Charles E. Parsons, chief engineer Hudson River Electric Power Company, and G. A. Harvey, electrical engineer International Railway Company, Buffalo. These papers are published in this issue, and the discussion will be published in detail in the issue of next week. An addition to Mr. Harvey's paper will also be published.

On Wednesday morning a paper on car inspection was presented by D. F. Carver, general superintendent of the Rochester Railway Company, and was discussed by those present. A

consideration of the question box followed. A report of this meeting will be published next week.

The officers elected for the ensuing year on June 27 were: President, J. N. Shannahan, general superintendent Fonda, Johnstown & Gloversville Railroad, Gloversville, N. Y.; first vice-president, T. W. Wilson, general manager International Railway Company, Buffalo, N. Y.; second vice-president, Edgar S. Fassett, superintendent United Traction Company, Albany, N. Y.; treasurer H. M. Beardsley, secretary and treasurer Elmira Water, Light & Railroad Company, Elmira, N. Y.; secretary, C. B. Fairchild, Jr., associate editor STREET RAILWAY JOURNAL, New York City; executive committee, the officers and W. H. Pouch, vice-president Orange County Traction Company, Newburgh, N. Y.; Oren Root, Jr., general manager New York City Railway Company; C. D. Beebe, general manager Rochester, Syracuse & Eastern Railway Company, Syracuse, N. Y., and C. Gordon Reel, vice-president Kingston Consolidated Railroad, Kingston, N. Y.

ENTERTAINMENTS AT THE SARATOGA CONVENTION

The entertainment committee of the Street Railway Association of the State of New York provided an excellent entertainment programme for the ladies who attended the convention in company with the delegates. The weather was excellent throughout the convention period, and all of the entertainments provided were carried through most successfully. The first outing was on Tuesday afternoon, June 26, when the ladies were taken in carriages for a drive in and near Saratoga.

Probably the most enjoyable feature of the convention was the banquet held on Tuesday night, not only on account of the excellent menu provided but also for the good music and speeches. The toastmaster was Hon. A. B. Colvin, who introduced the speakers of the evening, Hon. Edgar T. Brackett, Thomas R. Kneil and J. M. Wakeman. Senator Brackett's subject was entitled "A Lawyer's Paradise," and he characterized the meeting as "The twenty-fourth annual gathering of the New York State Negligence Case Defendants." Mr. Kneil extolled the glories of Saratoga and invited the association in the name of Saratoga's business men to come again. J. M. Wakeman, the last speaker of the evening, made a humorous address, entitled "The Third Rail," which created great merriment. Between the speeches violin and vocal solos were rendered.

Wednesday morning a large party made a trip to Lake George, where luncheon was taken before returning. On Wednesday afternoon the delegates visited the Spier Falls power plant of the Hudson River Electric Company, making the trip via trolley and teams. Those who remained after the regular convention work was over made a visit on Thursday to the works of the American Locomotive Company and the General Electric Company. An elaborate luncheon was served in the latter company's works.

ENTERTAINING THE CHILDREN MADE A PLEASURE RESORT FEATURE

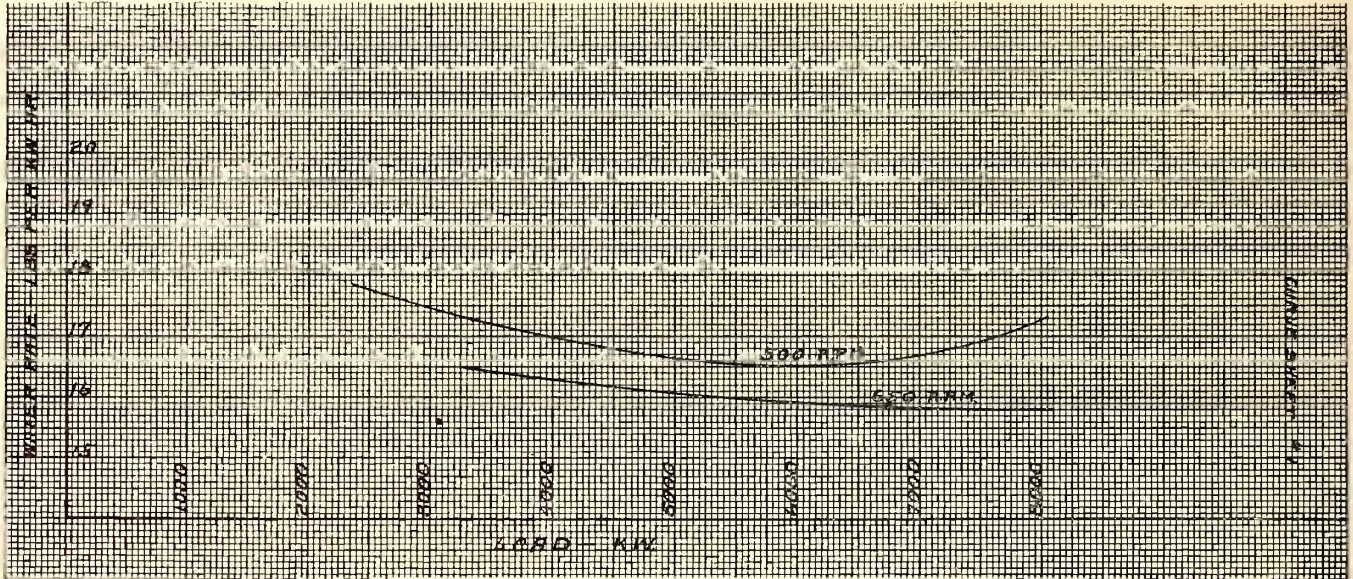
Manager Charles Ross of the Steubenville Traction & Light Company, of Steubenville, Ohio, adopted a rather novel plan in opening for the season Stanton Park, the pleasure resort owned by the company. He instituted a "Children's Day," and placed advertisements containing coupons in the daily papers. The coupons were good for free transportation to and from the park, and about 5400 of them were turned in. The big crowd of youngsters was handled without accident, although the majority of them were unaccompanied.

TEST OF A 5000-KW. CURTIS STEAM TURBINE

In March, 1906, a series of tests were made on one of the 500-kw Curtis steam turbines which has been in commercial service for about one year in the Fisk Street station of the Commonwealth Electric Company, Chicago, Ill. The turbine set is one of four installed in this station. The tests were conducted under the supervision of the representatives

All the tests, except those for speed, were made under regular commercial conditions. On account of the change in frequency during the speed tests, the load was absorbed by a water resistance, composed of plates in the Chicago River. It was found that the commercial load-water rate was identical with that obtained by use of a water rheostat, other conditions remaining the same.

In the commercial tests the load dispatcher maintained a



CURVE NO. 1

TABLE I.

Load K.W.	Steam Press (Gage).	Superheat Degrees Fahr.	Gross Flow Lbs. per Hour.	Condenser Leakage per Hour.	Back Press. Inches. Mercury.	R. P. M.	Water Rate—Lbs. per K.W. Hr.		Notes.
							Actual.	Reduced.*	
3,340	171	151	56,690	1,070	.89	500	16.66	17.29	Water Rheostat
5,940	169	180	98,370	950	1.72	"	16.40	15.55	Commercial
2,920	172	158	50,930	1,050	1.08	"	17.08	17.61	"
4,860	179	180	81,550	1,700	1.55	"	16.50	16.81	Water Rheostat
7,525	175	147	130,200	820	2.09	"	17.19	16.91	"
4,950	180	171	80,570	220	1.48	"	16.23	16.55	Commercial
0	178	150	3,520	220	1.40	"	.....	.....	Full Voltage

* Reduced to 150° F. superheat, 1½" back pressure, 175 lbs. (gage) steam pressure.

TABLE II.

Load K.W.	Steam Press (Gage).	Superheat Degrees Fahr.	Gross Flow Lbs. per Hour.	Condenser Leakage Lbs. Hour.	Back Press. Inches. Mercury.	R. P. M.	Water Rate—Lbs. K.W. Hr.		Notes.
							Actual.	Reduced.**	
†3,530	170	165	55,900	1,070	.85	650	15.55	16.40	Water Rheostat
5,140	180	179	81,930	1,700	1.50	640	15.67	16.03	"
8,090	177	141	131,160	820	2.03	640	16.11	15.80	"

** Reduced to 150° F. superheat, 1½" back pressure, 175 lbs. (gage) steam pressure, 650 r. p. m.
† Average of two points.

TABLE III. (Summary Table I.)

500 r. p. m.
150 F. superheat.
1½" back pressure.
175 lbs. (gage) steam pressure.

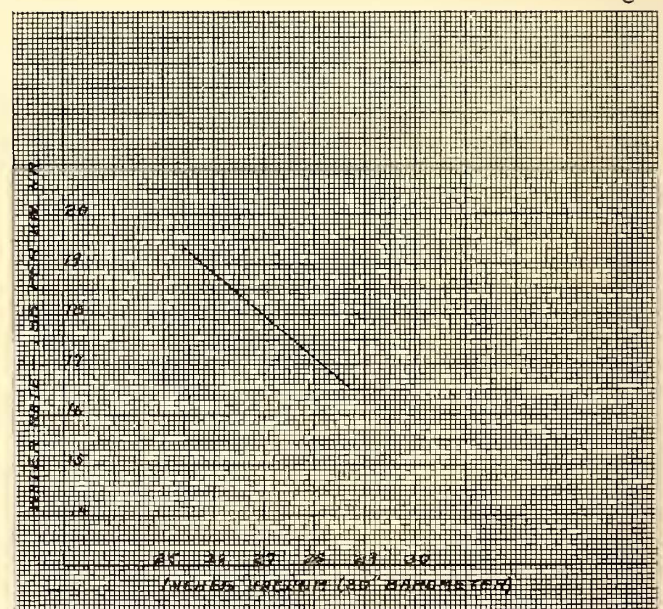
LOAD	WATER RATES
2500 kw. (½ load).....	17.74
3750 " (¾ ").....	17.08
5000 " (full ").....	16.62
6250 " (1¼ ").....	16.52
7500 " (1½ ").....	16.90

TABLE IV. (Summary Table II.)

650 r. p. m. load.
150 F. superheat.
1½" back pressure.
175 lbs. (gage) steam pressure.

LOAD	WATER RATES
3750 kw. (¾ load).....	16.35
5000 " (full ").....	16.07
6250 " (1¼ ").....	15.88
7500 " (1½ ").....	15.80

of the purchasers, Sargent & Lundy, and those of the General Electric Company. The generating unit consists of a 5000-kw turbine, direct connected to a six-pole, three-phase, 5000-kw, 900-volt, 500-r. p. m. revolving field generator.



CURVE NO. 2

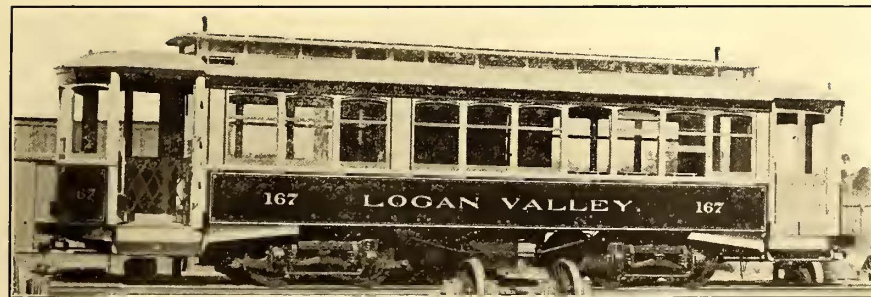
constant load on the turbine under test by varying the tension of the auxiliary governor spring, controlled from the switch-board by a motor. Steam pressure and superheat were kept as constant as possible by proper attention to the boilers. The load was measured by special indicating wattmeters, connected to independent potential and current transformers. All instruments were carefully calibrated at Schenectady and the calibration later verified in the laboratory of the Commonwealth Electric Company. As an additional precaution to insure accuracy, the readings taken were checked by readings obtained from a duplicate set of instruments, calibrated by the Electrical Testing Laboratories of New York. The load readings were recorded at intervals of two minutes.

All tests were made at about 150 deg. F. superheat, the temperature being read by calibrated mercury thermometers. The thermometers were placed in wells filled with mercury, proper correction was made for the exposed stem. Temperatures and pressures were recorded every five minutes. The amount of steam used was obtained by discharging the condensed steam into tanks, where it was weighed. After each run the condenser was tested for leaks, which, as shown by the tables, were of small amount.

The detailed results of the tests at 500 r. p. m. are shown in Table I. Table II. indicates the readings obtained at 650 r. p. m. To make the tests comparable, all results were reduced to 150 deg. superheat, 1½ in. back pressure and 175 lbs. (gage) steam pressure. The reduced water rates are given in the ninth column of Tables I. and II. Tables I. and II. are summarized in Tables III. and IV., respectively, and from these were obtained the curves in Figs. 1 and 2.

COMBINATION CARS FOR LOGAN VALLEY RAILWAY

The attractive-looking combination smoking and passenger car shown in the engraving is one of four recently put in service on the lines of the Altoona & Logan Valley Electric Railway Company, of Altoona, Pa., the road being controlled by the American Railways Company, of Philadelphia. The cars were built at the works of the John Stephenson Company, Elizabeth, under Brill patents, the grooveless-post, semi-convertible feature being utilized throughout the cars. The length of the car over the end panels is 29 ft. 6 ins., and over the crown pieces 41 ft. 6 ins.; width over the sills, including plates, 8 ft. 2 ins.; distance between the centers of the posts, 2 ft. 8 ins.; height from the floor to the ceiling, 7 ft. 10½ ins.; height from the track to the under side of the sills, 2 ft. 7½



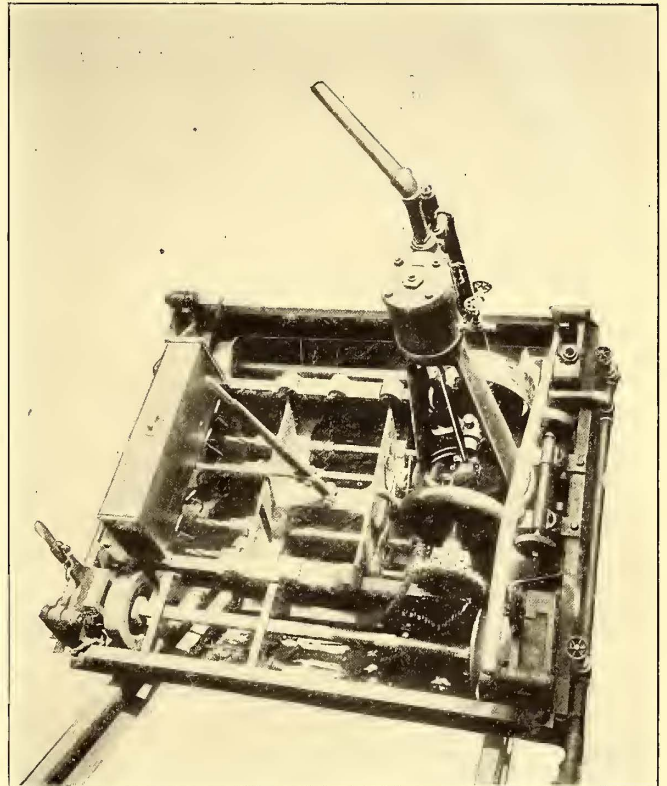
CAR FOR ALTOONA & LOGAN VALLEY ELECTRIC RAILWAY

ins.; height from the track to the platform step, 1 ft. 4½ ins.; size of the side sills, 8¾ ins. x 3¾ ins.; size of the end sills, 7¾ ins. x 4¾ ins.; thickness of the corner posts, 3¾ ins.; thickness of the side posts, 3¼ ins. The smoking compartment measures 9 ft. 5 ins., and is furnished with longitudinal seats; this compartment is separated from the passenger compartment by double sliding doors in-

stead of the usual single sliding door. At diagonal opposite corners of the car double folding doors and folding gates are used to protect the step openings. The adoption of the semi-convertible feature makes possible a seat measuring 36 ins. in length and an aisle space of 21 ins. The inside finish of the cars, including the ceilings, is of quartered oak. The type of truck is the No. 21-GE-1, having a wheel base of 4 ft. 6 ins. and a wheel diameter of 2 ft. 9 ins. Four motors of 40-hp capacity each are installed on each car.

QUADRUPLE TRACK DRILL

The track drill shown in the accompanying illustration is a power-driven machine furnished recently to the New York



QUADRUPLE TRACK DRILL

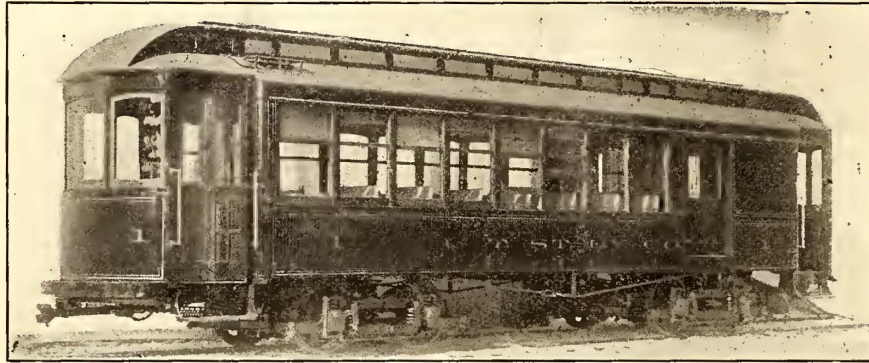
Central Railroad by the Columbia Machine Works & Malleable Iron Works, Brooklyn, N. Y. This particular drill has been operated by steam secured from the boiler of an adjacent locomotive, but it can be adapted for operation by electricity, gasoline or other power. It is furnished with four 1⅝-in. drills capable of drilling through a 90-lb. rail in 2¾ minutes. The drive is through a worm gearing.

When it is necessary to move the machine along the track to some other job, the drills are raised to 6 ins. above the rails to enable them to clear ties, frogs and switches. For this purpose a lever is placed at each corner so that four men can raise the drill frame in a very short time.

A glance at the right side of the illustration will show the grinding attachment. The power for running the grinder is secured by adjusting a few thumb-screws and throwing the friction wheel of the grinder against the revolving fly-wheel of the engine. Another feature is the water or oil tank for keeping the drills cool, as well as a tool-box.

PASSENGER AND BAGGAGE CARS FOR DU BOIS, PA.

The United Traction Street Railway Company of DuBois has added a number of combination passenger and baggage cars to its equipment, one of them being shown in the accompanying photograph. The cars were built by the J. G. Brill Company, and embody that company's grooveless post, semi-convertible feature (patented). The baggage compartment measures 9 ft. 2 ins., and has a sliding door on each side. The seats in this compartment are of the slat type, arranged to fold up when not in use. A hardwood partition having a single sliding door separates the baggage compartment from



NEW CAR FOR DU BOIS, PA.

the passenger compartment. At the step openings double folding doors are utilized. The cars are finished in cherry, natural, having ceilings of decorated birch veneer. The seats in the passenger compartment are 36 ins. wide, allowing an aisle space of 22 ins.; arm rests are provided for the comfort of the passengers. Numerous of the car builder's specialties are provided throughout the car, such as sand boxes, gongs, signal bells, and a channel iron draw-bar for hauling trailers. The truck wheel base measures 4 ft. 1 in.; wheel diameter is 33 ins. There are four motors of 40-hp capacity each.

The general dimensions of the car are: Length over the end panels, 31 ft. 8 ins.; over the crown-pieces and vestibules, 41 ft. 1 in.; width over the sills, including the sheathing, 8 ft. 2 ins., and the same measurement applies to width over posts; centers of posts, 2 ft. 8 ins.; size of the side sills, 5¼ ins. x 6⅞ ins.; size of the sill plates, ⅜ in. x 12 ins.; thickness of the corner posts, 3⅝ ins.; thickness of the side posts, 3¼ ins.

THE "THIRD-RAIL EYE" RECALLED BY DECISION IN BOSTON SUIT

A decision has just been handed down by the Supreme Court, sitting in Boston, in which a verdict of \$1,000 damages is returned in favor of John H. Woodhall for injuries received from particles of iron from the third rail on the Boston Elevated Railway, injuring his sight. The Superior Court, in the same case, returned a verdict of \$2,000. The jury found that the falling of the metal was due to the failure of the company to provide a receptacle for the metallic dust, and for the protection of travelers on the street.

The defendant contended, first, that there was nothing to show that what injured the plaintiff's eye came from the contact-shoe; and, second, that there was nothing to warrant the jury finding that the defendant was negligent in failing to apply to the Railroad Commission for approval of the pan.

After carefully reviewing the evidence and explaining in detail its ruling on each point, the court takes up the defendant's contention that the road was not liable, because the

Railroad Commissioners had approved its plans for building and operating the overhead structure, and says:

The Railroad Commissioners approved the plans for the railway as constructed, and gave the certificate required before it could be operated, and allowed it to be continued as before after investigating the subject of sparking. The defendant contends the action of the Commissioners is not reviewable by the court or jury; that the effect of it is to authorize the operation of the railway without a pan, and that therefore there could be no such thing as negligence on its part in failing to apply to them for approval.

Having quoted certain statutes the court further says:

The effect of these various provisions is to require the Commissioners to approve the plans before the railway can be constructed, and to require after the completion of the whole or a part of it, a certificate from them that it appears to be in a safe condition for operation before the corporation can operate it. In examining the plans, the Commissioners are required to consider the strength and safety of the proposed structure, the rolling stock, motive power and method of proposed operation, and the comfort and convenience of the public, and their judgment, in respect to these matters, as far as they enter into their approval of the plans, cannot be impeached or controlled.

It cannot be shown, for instance, that the railway is unlawfully maintained because the approval by the Commissioners of the plans was due to a mistake on their part if such was the fact, as to the strength and safety of the proposed structure, or the comfort and convenience of the public. Their approval is conclusive on the right and authority of the corporation to construct its railway as proposed, and has the same effect as an authority conferred by the Legislature to construct it in the manner proposed would have. Taken in connection with their certificate under section 18, chapter 548, that the railway appeared to have been constructed in accordance with the plans and appeared to be in a safe condition for operation, it established the structure as a lawful structure and as lawfully maintained and operated by the defendant.

But neither the approval of the plans nor their certificate of operation relieves the corporation from liability in case anyone who would otherwise have a cause of action by negligence on its part in the construction or operation of the railway. In the absence of anything to exonerate it, the corporation is still bound to exercise reasonable care and diligence in all matters relating to the construction and operation of its railway.

If the approval of the plans by the Commissioners and their certificate of operation are not conclusive on the question of the exercise of reasonable care and diligence by the defendant, manifestly the fact that the Commissioners had the matter of sparking under investigation and had made no recommendations and taken no action except to cause an investigation to be made, cannot held to be conclusive.

Moreover, it is to be noted that the trouble from sparking was not anticipated when the railway was constructed, and therefore the safety of the structure with reference to sparking could not have been included in the approval of the plans by the Commissioners. It is also to be noted that the certificate required before the corporation can operate the railway is a certificate that it appears to be in a safe condition for operation, not that it is safe, thus leaving open the question of safety with all the consequences involved.

If a pan was reasonably necessary, then it was either the duty of the defendant to apply to the Commissioners for their approval, or to proceed to put up one without such approval.

Interchangeable tickets are now being sold by the Norfolk & Portsmouth Traction Company. These tickets are good on the lines in Norfolk, Portsmouth and Berkley, on the lines now controlled by the traction company. Tickets marked by the individual companies and issued prior to the formation of the Norfolk & Portsmouth Traction Company are only good upon the lines designated upon the face of the tickets.

Two large consignments of trained wild animals sent from Europe to the Frank C. Bostock show at Coney Island several weeks ago were moved on to Paragon Park, at Nantasket Beach, Boston, and to Luna Park, Pittsburg, a few days ago. The animals were loaded on Brooklyn Rapid Transit express cars. This is the first time wild animals have been carried over the Brooklyn surface lines.

FINANCIAL INTELLIGENCE

WALL STREET, June 27, 1906.

The Money Market

There has been no appreciable change in the monetary situation during the past week. Despite the heavy liquidation in stocks the tone has ruled firm, and rates for maturities remain practically the same as those prevailing at the close of last week. The demand for money has been somewhat larger than heretofore, and there is nothing in the situation at the present time to warrant the expectation of easier conditions in the near future. This week preparations will be made for paying the July 1 interest and dividend, which will call for a considerable amount of money, and later on the banks will be obliged to pay into the National Treasury about \$10,000,000 of special deposits. It is not likely, therefore, that money for fixed periods will be offered freely by local institutions until these payments are made. A feature of the week has been the sharp decline in sterling exchange, bringing the rate down to near the gold import point, and while rumors of possible gold imports in the near future are current, nothing definite has as yet developed. Foreign bankers have been rather free sellers of finance bills, the proceeds of which are available for market purposes, but there is no disposition on their part to shade the quotations for time money now asked by local lenders. The bank statement, published on last Saturday, was extremely favorable, but had not the slightest influence upon rates for either call or time money. For the first time in several months there was a heavy contraction in loans. The decrease in this item amounted to \$2,318,000, and reflected the increased offerings of foreign capital. Deposits increased \$1,290,200, and consequently there was an increase in the reserve required of \$322,550. The increase in cash amounted to \$4,162,100, or nearly three times as much as was indicated by the preliminary estimates. The surplus reserve was increased \$3,839,550, and brings the total surplus up to \$10,912,925. This compares with \$15,094,675 in the corresponding week of last year, \$38,452,675 in 1904, \$12,923,850 in 1903, \$12,978,350 in 1902, \$8,428,200 in 1901, and \$15,526,850 in 1900. The European money markets have ruled easier, the feature being a reduction in the Bank of England discount rate of $\frac{1}{2}$ of 1 per cent to $3\frac{1}{2}$ per cent.

Money on call has been in plentiful supply at rates ranging from $3\frac{1}{2}$ to 2 per cent, the average for the week being about 3 per cent. Time money has ruled firm, with a fairly good demand for three and four months' maturities. Sixty-day money was obtainable at $4\frac{1}{2}$ per cent, ninety days at $4\frac{1}{2}$ and $4\frac{3}{4}$ per cent, four months at 5 per cent, five and six months at $5\frac{1}{4}$ per cent, and seven and eight months at $5\frac{3}{4}$ per cent. Mercantile paper has been quiet and unchanged at 5 and $5\frac{1}{2}$ per cent for the best names.

The Stock Market

The stock market during the past week has been somewhat abnormal, to the extent that it absolutely ignored favorable developments, which under ordinary speculative conditions would have caused a decided appreciation in values. The successful flotation of the \$50,000,000 Pennsylvania loan in Paris is one of the most important developments, as it implies the probability of the placing of similar loans abroad, and increasing our credit balances thereby, with resultant beneficial effects to our money market. The increase in the Baltimore & Ohio dividend from a 5 to a 6 per cent basis should have been sufficient to carry the price of that stock very much higher, and the declaration of an initial dividend on American Locomotive common reflected the prosperity of all industrial companies. In this connection there is a probability of increased dividends on Norfolk & Western and Chesapeake & Ohio, and the beginning of dividends on Southern Pacific in August, with the possibility, if not probability, of an increase in the Union Pacific dividend to a 7 per cent basis, together with some distribution of accumulated profits in the form of an extra dividend. The Anaconda dividend was increased 25 cents per share, while the declaration on Ontario & Western was $\frac{1}{2}$ of 1 per cent larger than the previous payments. These, with favorable crop reports and with generally satisfactory conditions in trade throughout the country,

and with call money in liberal supply, would naturally influence bullish opinion on stocks. The result, however, was just the contrary. Material and fundamental conditions were made secondary in importance to the announcement from Washington that the Department of Justice will undertake the prosecution of Standard Oil and Pennsylvania officials, and later by rumors that the Steel Corporation and other industrial corporations are under investigation. This decision of the Administration has not thus far had any disturbing influence on trade, but it has had a very unsettling effect upon the stock market. Prices for stocks have declined very materially during the past week, and the weaker stocks have been those in which the Standard Oil interests are dominant. The break in St. Paul and Amalgamated Copper indicated that insiders were not ready to support their stocks, while the selling of the steel stocks was due, in a measure, to the unfounded report of a proposed new combination of independent companies. The weakness in Reading and Pennsylvania may be ascribed to a report that the Interstate Commerce Commission will recommend Federal control of the anthracite coal lands, but taking the market as a whole the decline represents lack of confidence on the part of outsiders and the professional element, together with the operations of a rather aggressive bear party. Just now monetary conditions will play an important part in stock market affairs, and as we are at the end of the month and the July disbursements are due, temporarily higher rates for money will probably result in lower prices for stocks.

The local traction stocks have been a feature, the most noteworthy being a further sharp break in Interborough-Metropolitan to a new low record. Brooklyn Rapid Transit has experienced a substantial decline on the agitation for a 5-cent fare over all of its lines, but there does not appear to be any reason to expect any official action until after the heavy summer season traffic is over.

Philadelphia

Extreme dullness prevailed in the market for local traction issues during the past week, and although prices displayed more or less irregularity, the closing in most instances showed fractional net gains. About the only activity displayed was in Philadelphia Rapid Transit, of which 7500 shares were dealt in. In the early dealings the price rose from 25 to $27\frac{1}{4}$, on buying said to be for New York account, but toward the close there was a reaction of $2\frac{3}{4}$ points. Philadelphia Company common was steady, several hundred shares selling at $50\frac{3}{4}$ and 51, while the preferred stock sold at $49\frac{1}{2}$ and 50. Philadelphia Traction was strong at 99, and Union Traction held firm at 63 and $63\frac{3}{4}$. American Railways sold from 52 to $52\frac{1}{2}$ for odd lots. The United Traction Company, of Pittsburg, has declared a dividend of $2\frac{1}{2}$ per cent on its preferred stock, payable on July 20.

Chicago

Trading in the local traction stocks has been comparatively quiet, and apart from a sharp advance in Union Traction from $4\frac{3}{8}$ to 7, on purchases of about 600 shares, the market has been without noteworthy feature. Union Traction preferred advanced a point to 15, on the exchange of 450 shares. West Chicago sold at 30 for odd lots, and North Chicago brought 40 and 41 for small amounts. Chicago City Railway was dealt in for the first time in several weeks, a small lot changing hands at $167\frac{1}{2}$. Metropolitan Elevated common sold at $27\frac{1}{2}$, and South Side Elevated declined from $96\frac{1}{2}$ to 95.

Other Traction Securities

The Baltimore tractions have been unusually quiet, but prices generally displayed firmness. United Railway issues have been extremely dull, about \$50,000 of the incomes changing hands at from 74 to 73. Of the 4 per cent bonds, about \$25,000 sold at $92\frac{3}{8}$. The certificates representing stock deposited sold from 16 to $15\frac{1}{2}$ for about 1000 shares, showing a net loss for the week of $\frac{3}{4}$. Norfolk Railway & Light 5s advanced over a point to $100\frac{1}{2}$ early in the week, but later lost all the improvement, the final transaction taking place at $99\frac{1}{4}$. Knoxville Traction 5s sold at 107, and Baltimore Traction 5s at 114. The feature of the Boston market has been the sharp fluctuations in Boston & Worcester common; opening at 35 it advanced to 36, but subsequently reacted

to 32, which was the final figure. The preferred-stock sold at 85. Massachusetts Electric was extremely quiet, several hundred shares of the common changing from 20½ to 19½, while the preferred ran off from 71 to 69¾. Other transactions included Boston Elevated at 153, Boston & Suburban at 20, West End common at 97 and 96¾, the preferred at 112 and \$1,000 4 per cent bonds of 1932 at 102¾.

There was a little activity in traction stock in Cincinnati last week, but some of the issues made good gains. Toledo, Bowling Green & Southern Traction sold at 45, an advance of 5¼ points since the last sale. Cincinnati, Newport & Covington common advanced from 72¾ to 74, and the preferred sold at 98. Toledo Railways & Light sold at 33¼, and Cincinnati Street at 142½. Cleveland Electric had a rise during the week in anticipation of a settlement with the administration, but lost on a break in the negotiations. The last sale was at 77. Lake Shore Electric advanced in all its issues, the common selling at 167½, the old preferred at 68½ and the new preferred at 60. Northern Ohio Traction & Light sold at 30¾, a fractional decline. Cleveland & Southwestern common sold at 16. Toledo & Western declined from 15½ to 13¾, as the result of the announcement of the failure to sell the property.

Security Quotations

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

	June 20	June 27
American Railways	51½	52
Boston Elevated	152	153
Brooklyn Rapid Transit	81½	77½
Chicago City	167	165
Chicago Union Traction (common)	47½	43½
Chicago Union Traction (preferred).....	15¼	12¼
Cleveland Electric	80	81
Consolidated Traction of New Jersey.....	81	80
Detroit United	94½	93½
International Traction (common).....	59¼	58½
International Traction (preferred), 4s.....	80	82
Manhattan Railway	149	147¾
Massachusetts Electric Cos. (common).....	20	19¼
Massachusetts Elec. Cos. (preferred).....	70	68
Metropolitan Elevated, Chicago (common).....	26	26
Metropolitan Elevated, Chicago (preferred).....	66	66
Metropolitan Street	105½	*107
North American	96	95¾
North Jersey Street Railway	27	27
Philadelphia Company (common).....	51	50¼
Philadelphia Rapid Transit	24	24¾
Philadelphia Traction	99	99
Public Service Corporation 5 per cent notes.....	95	95½
Public Service Corporation certificates.....	69	68½
South Side Elevated (Chicago).....	96½	94
Third Avenue	128	128
Twin City, Minneapolis (common).....	112¾	111
Union Traction (Philadelphia)	63¾	63
West End (common).....	—	—
West End (preferred)	—	—

* Ex-dividend.

Metals

The scarcity of steel-making irons continues, and the indications are that there will be no appreciable increase in the supply for some time to come. Large inquiries and sales of pig iron are reported at Pittsburg. It is estimated that the volume of business of the steel mills for the month will be considerably larger than that of April. It is estimated that orders for steel rails this week will reach a total of 1,500,000 tons. Copper metal declined ⅛ of a cent a pound for all grades of refined, but the market rules steady at the new quotations. They are: Lake, 18½ and 18¾c.; electrolytic, 18¼ and 18½c.; castings, 18⅞ and 18¾c.

THE AMERICAN CITIES RAILWAY & LIGHT COMPANY

Isidore Newman & Son, bankers, of New Orleans and New York, have issued a prospectus outlining the organization and the capitalization of the American Cities Railway & Light Company, a new corporation which is to take over the properties of the Birmingham Railway, Light & Power Company, the Memphis Street Railway Company, the Nashville Railway & Light Company, the Little Rock Railway & Electric Company, the Knoxville Railway & Light Company and the Houston Lighting & Power Company.

The American Railways & Light Company was formed under the laws of the State of New Jersey, and has a capital of \$15,000,000. This capital is to be increased to \$27,500,000, of which \$12,500,000 are preferred stock and \$15,000,000 common stock. The preferred stock will be 6 per cent cumulative, with dividends payable quarterly, and is subject to redemption after three years from issue on any day when dividends are payable, at 107½, together with all cumulative dividends whether declared or not which are unpaid. It is proposed to issue immediately \$10,000,000 preferred stock and \$15,000,000 of common stock to secure the stock of the six local companies on the following basis, which are the terms offered to holders of the different companies:

	FOR EACH SHARE OF	
	New Preferred	New Common
Birmingham 6 per cent preferred.....	\$105.00	.....
Birmingham common	10.00	\$150.00
Memphis 5 per cent preferred.....	90.00	.....
Memphis common .....	.....	108.00
Nashville 5 per cent preferred	90.00	.....
Nashville common .....	.....	82.50
Little Rock 6 per cent preferred.....	105.00	.....
Little Rock common .....	.....	125.00
Knoxville 6 per cent preferred.....	102.50	.....
Knoxville common .....	.....	90
Houston 6 per cent preferred.....	102.50	.....
Houston common .....	.....	187.50

The distribution of capitalization will then be as follows:

	Present Preferred	Present Common	New Preferred	New Common
Birmingham Railway, Light & Power Company	\$3,500,000	.....	\$3,675,000	.....
The Memphis Street Railway Company	2,500,000	.....	2,250,000	.....
Nashville Railway & Light Company	2,000,000	.....	1,800,000	.....
Little Rock Railway & Electric Company	750,000	.....	787,500	.....
Knoxville Railway & Light Company	500,000	.....	512,500	.....
Houston Lighting & Power Company, 1905	500,000	.....	512,500	.....
	\$9,750,000	\$13,000,000	\$9,887,500	\$15,000,000
Preferred stock applicable to defraying expenses and other corporate purposes.....			112,500	.....
Total stock to be presently issuable.....			\$10,000,000	\$15,000,000

* Authorized issue, \$4,000,000; \$3,500,000 outstanding in hands of public; \$500,000 owned by Nashville Company.

† Authorized issue, \$2,500,000; \$1,995,500 outstanding in hands of the public; \$504,500 owned by Nashville Company.

‡ \$1,491,900 outstanding in hands of public.

Stockholders in these companies who may elect to accept the opportunity afforded them to accept the proposition, must deliver to the depository, the Commercial-Germania Trust & Savings Bank, at its office, Carondelet and Common Streets, New Orleans, La., or to the sub-depository, the Standard Trust Company of New York, at its office, No. 25 Broad Street, New York City, on or prior to Monday, July 16, 1906, their certificates of stock in such local company, duly assigned. Negotiable receipts, substantially in the form set forth in the proposition, will be issued therefor.

For the convenience of local holders of shares of the respective local companies, United States Trust Company, of Louisville, Ky.; Bank of Commerce & Trust Company, of Memphis, Tenn.; Nashville Trust Company, of Nashville, Tenn.; and American Trust & Savings Bank, of Birmingham, Ala., will receive delivery of certificates of shares of the local companies, and issue receipts therefor, exchangeable for the receipt of the depository required by this proposition, when the same shall be received.

An estimate by Messrs. Ford, Bacon & Davis of the gross earnings of the six properties involved is in excess of \$6,000,000 for 1906. The estimated net earnings applicable to the stocks show an earning capacity of more than twice the dividend on the preferred stock and a surplus equivalent to 5.04 per cent on the common stock.

J. K. Newman has consented to accept the presidency of the new company.

THE CHICAGO UNION TRACTION COMPANY TO BEGIN WORK OF ABANDONING ITS CABLE LINES—VALUES OF STREET RAILWAY PROPERTIES SUBMITTED

The Chicago Union Traction Company has filed with the City Clerk formal acceptances of the ordinances passed by the City Council for trolleyizing its lines. It is stated that the work of placing the wires and poles for all of the West Side lines will begin at once. The first work will be done on the Blue Island Avenue line. General Manager John M. Roach has said that he expected to be able to comply with the ordinances which demand that the West Side lines shall be equipped for electric operation in sixty days from the time authority was given, and that the work on the North Side lines shall be completed within ninety days. The Chicago City Railway Company has not yet accepted the ordinances, but it is said that the cable cars will be off the South Side lines by Jan. 1. The Union Traction Company intends to equip its present cars for electric operation by wiring them and mounting them on new trucks. The Chicago City Railway, it is said, will obtain new cars, and it has contracts for fall delivery of fifty-five cars of its latest type. It is further intended to change the present cable power houses to rotary converter sub-stations. Regarding the changes, President Mitten is quoted as having said:

"My idea is to put on practically new cars. We can utilize some of the present car bodies, but not a great many, and then only the best ones. The company must make its new service in Cottage Grove Avenue equal to that in Indiana Avenue and Wentworth Avenue. As things are now traffic is deserting Cottage Grove Avenue and going to Indiana Avenue, and we can put all the cars in the latter street the tracks will carry, and not be able to take care of the people. If, however, we had as good service in Cottage Grove then the traffic would distribute itself and there would not be the trouble."

The long expected figures of the values of the tangible property of the Union Traction Company and the Chicago City Railway have been presented to the City Council. The values fixed by the company are much in excess of the estimates made by Bion J. Arnold in 1902, which are as follows:

Values as submitted by railway companies:	
Union Traction	\$27,401,218
Chicago City Railway.....	20,103,936
Total	\$47,505,154
Values fixed in 1902 by Engineer Bion J. Arnold, based on the cost of reproducing lines:	
Union Traction	\$22,214,635
Chicago City Railway.....	17,172,424
Total	\$39,387,059
Fixed by Mr. Arnold in 1902 as value for electric railway purposes:	
Union Traction	\$14,937,088
Chicago City Railway.....	11,747,818
Total	\$26,684,906

W. W. Gurley, general counsel for the Chicago Union Traction Company, in presenting the figures for that corporation, said:

"This amount has been arrived at by determining the cost at current prices of reproducing the property in question and deducting therefrom the amount of money that would be required to place the present property in a condition as good as new, for the purposes of operation as a street car system, using the motive power which is now being used in the respective streets.

"The above amount does not include any estimate on work yet to be performed, either in the way of paving streets, reconstruction of tunnels, electrifying or equipping lines of railway or in procuring new or modified cars.

"We assume that all items expended hereafter in the improvement of the property will be taken into consideration as a part of the expense of the proposed rehabilitation or will be added to the value of our present tangible property.

"For lack of time we have not been able to determine the value of the unexpired franchises and rights of the various companies interested in the traction systems. If, as has been stated at previous meetings of your committee, the city is to appoint experts to verify these valuations, we stand ready to appear before those experts and inform them fully as to the separate items of property and the valuations thereof."

President Mitten, in his statement of the Chicago City Railway Company's estimates, said:

"The value of the tangible property of this company, as repre-

mented by our schedules, to be considered in the event of our arriving at a settlement with the city upon an indeterminate license plan, is \$20,103,935.89, and is based upon reproduction at current prices, less cost of bringing property at this date up to a condition operatively equal to new, and includes all of the new tracks constructed to date and the new cars now in service. The new paint shop and sub-stations now being constructed are omitted, but will necessarily be included as a part of the contemplated reconstruction, together with such additions as may be made prior to the actual transfer of the property.

"The valuation of unexpired franchises is not included, but will be submitted as soon as the work of preparing the same can be completed.

"If the city desires to appoint engineers to verify these values, the company's engineers will appear before them and supply the details upon which these values are based."

Mayor Dunne considers the estimates far in excess of what the lines are really worth. He says they are based on a wrong method of calculation, and that it is absurd to consider the actual value of the cable systems when they are so antiquated.

TRANSIT MATTERS IN NEW YORK

The New York, New Haven & Hartford Railroad Company has applied to the Rapid Transit Commission for a franchise for a four-track railroad to run from the terminus of its road at Woodlawn south to the tracks of the Harlem River & Portchester Railroad (owned by the New Haven line), thus affording an all-rail connection with Port Morris and doing away with the use of the New York Central's tracks. The application was referred to the board's committee on plan and scope.

The New York Central & Hudson River Railroad Company, in a letter to the Transit Commission, has signified its willingness to co-operate with the board in placing in a subway the present tracks on Tenth and Eleventh Avenues. Engineer Rice said that a plan was now under consideration for the placing of the tracks in a subway. He said that the chief engineer of the company and himself were in consultation already.

The New York Connecting Railroad Company has renewed its request for a franchise. The Board of Estimate had appointed a special committee to investigate the proposition, and its report was read. The committee wanted some light on the proposition as to route and to the amount of freight to be carried before passing judgment on the question. It was estimated that the cost of the road would be about \$1,000,000 a mile. Another conference of the Board of Estimate and the committee of the Rapid Transit Board was finally ordered.

Corporation Counsel Delaney has submitted his opinion that the Interborough Rapid Transit Company had no franchise to construct a third track on the Third Avenue elevated structure. Geo. L. Rives, counsel for the Rapid Transit Board, to whom was referred the Corporation Counsel's opinion on the third track proposition, said that a grant from the board was necessary before the company could build such a track. Controller Metz said that if the third track would help transit facilities the application should be granted. On the suggestion of President Orr it was decided to hold a public hearing on the matter on June 28.

IMPORTANT LEGAL DECISION AFFECTING ELEVATED IN NEW YORK

The Court of Appeals, a few days ago, in an action brought in 1901 by the owner of property on Sixth Avenue, along the line of the Manhattan Elevated Railway, reversed the decision of the lower courts, and held that abutting property owners are barred by the statute of limitations from bringing actions for damages to easements through the operation of the railroad after twenty years from the commencement of operations. Judge Vann wrote the opinion. "The elevated roads south of the Harlem River were constructed and put in operation between June, 1878, and August, 1880, the company claiming that under the statute abutting owners became barred twenty years later, viz.: between June, 1898, and August, 1900. The court held that the fact that the company had settled with many property owners similarly situated, and in various tax petitions had admitted its liability for damages to abutting property owners was irrelevant, maintaining that there was no privity between the plaintiff and other owners. The counsel for the company estimates that the number of such claims still outstanding or unsettled is about 7500, and their aggregate value, based on judgments and voluntary settlements already made, would be from \$6,000,000 to \$8,000,000."

MAYOR JOHNSON ANNOUNCES PLANS OF THREE-CENT FARE COMPANY—OTHER DEVELOPMENTS

Having overcome the long series of legal entanglements which have held up the building of the so-called 3-cent fare system in Cleveland, Mayor Johnson, of Cleveland, has announced the plans of the company. He states that a leasing company representing the city will take over and operate the property of the Forest City Street Railway Company, the name of the low-fare company. The Municipal Traction Company, the proposed holding company, was incorporated at Columbus, Ohio, last week, with nominal capitalization of \$10,000. The Forest City Street Railway Company at the same time increased its authorized capital stock from \$250,000 to \$2,000,000. Of this amount \$700,000 will be issued at once, and the proceeds will be used by the Municipal Traction Company in the completion of the lines already started by the Forest City Company, the purchase of power house equipment, rolling stock, etc. The names of the five directors who will operate the municipal company, as announced by Mayor Johnson, are: A. B. DuPont, of Detroit, Mich., who has been associated with Mayor Johnson in a number of his traction ventures; Frederick C. Howe, a traction expert; Edward Weibenson, a prominent banker who is secretary of an Ohio interurban road; C. W. Stage, county solicitor and an associate of Mayor Johnson, and William Breif, a prominent business man.

In his statement Mayor Johnson says that while the Municipal Traction Company will be nominally a corporation for profit, its purpose will be to act rather as an intermediary between the public and the street railway company. The lease under which it will operate will define the amount of profit which can be earned by the company and guarantee the payment back to the public of any residue above this guaranteed dividend. The repayment to the public may take either the form of betterment and extension of the service or the purchase of the property by the city. The statement says:

"The issue of stock by the Forest City Railway Company and the lease of the property by the Municipal Traction Company is to be upon the following conditions:

"(1) Neither preferred stock nor bonds shall be issued by the Forest City Railway Company, nor shall its property be encumbered by mortgage in any way.

"(2) The issue of \$700,000 of common stock shall be sold at 90 cents on the dollar, and shall be entitled to 6 per cent accumulative dividends at par.

"(3) All stock so sold and all stock already sold shall be subject to an option to purchase from the Municipal Traction Company by the city at \$1.10 and accumulated dividends.

"(4) All present stockholders of the Forest City Railway Company shall subscribe to these terms, and none shall have the slightest advantage or preference over another.

"(5) All proceeds of the sale of the stock of the Forest City Railway Company shall be expended by the Municipal Traction Company in the construction and operation of the street railway system, and the vouchers for all expenditures shall be open for inspection by the city authorities or by the public at large. This publicity shall attach to any work which shall be done in the future or which has been done in the past, since the formation of the company.

"(6) At any time the city may be empowered by law, and may desire to do so, it shall be permitted to enter under the lease in place of the Municipal Traction Company and assume and exercise the option to purchase, operate and maintain the system of the Forest City Railway Company.

"(7) The Municipal Traction Company shall pay all operating expenses of the Forest City Railway Company, a reasonable charge for depreciation, the accumulative dividend of 6 per cent on the outstanding capital stock, the expenses of the Municipal Traction Company, and shall devote all surplus earnings to the betterment of the service, to exercise the option to retire the capital stock of the Forest City Railway Company, or the reduction of fares."

The statement continues in part:

"The property which the Forest City Railway Company will turn over to the leasing company will consist of 5 miles of track already constructed, and 9 miles under construction. Work is being pushed in the laying of track and pavement; cars are being purchased, and part of the road should be in operation in the fall. Extensions to all parts of the city will be sought without delay, and new construction will be pushed with all speed.

"The remaining \$1,300,000 of the Forest City Company's stock

will be issued and sold from time to time, and the proceeds applied to new construction. By reason of the expiration of the grants of the 5-cent fare company on Central Avenue, and the nearness of the expiration of franchises on other streets, as well as the wide field in this rapidly growing city for more and better street railway service, the growth and extension of the low-fare system will be rapid as construction work will accommodate.

"Every franchise grant made to the Forest City Company by the city shall be safeguarded in every conceivable way against any abuse, and all future grants will pass under the lease of the Municipal Traction Company."

The Forest City Company is doing some rapid construction work. On the Denison Avenue line, work is being pushed to Lorain Street, and last Saturday and Sunday the company built more than a mile of track along Marcelline, to dodge injunction suits. This track lies in the southeasterly portion of the city, across the river from the Denison Avenue line, and is about 4 miles from the center of the city. It is said that the low-fare company proposes to build a line along the southerly border of the city, in which event the Marcelline Avenue line might be of some value. The line could also be used to form part of an entrance for an interurban line building to the south.

Last week Mayor Johnson and Horace Andrews, president of the Cleveland Electric, held a conference, relative to the leasing of the old company to a company representing the city. It will be remembered that this was proposed some months ago, and Mayor Johnson practically offered to accept \$85 per share for the property. At the meeting last week, Mayor Johnson said that in view of recent developments, he thought the value of Cleveland Electric had declined 10 points. This probably puts a quietus upon the acceptance by the company of any leasing plan, although the directors had expressed a willingness to consider such a plan, providing they received a fair proposition. The company received the report of Prof. Bemis, who was retained by the city to estimate the value of the company's property, while the city was given the report prepared by Secretary Davies upon the same subject. As has been intimated, the two reports are a long way apart by reason of the difference of opinion as to the values of existing franchises. Other meetings are to be held.

A new phase of the situation has been presented by the announcement that the Cleveland Electric Railway Company has received a proposition to lease the property to Eastern interests, who are represented in Cleveland by Henry Everett, formerly president of the company. President Andrews declines to disclose the identity of the new people, or to speak of their proposition, but he has denied that it is the so-called Widener-Elkins syndicate, which is securing numerous other traction properties in Ohio. It is also stated that the same syndicate is planning to acquire the Lake Shore Electric and other interurban lines radiating from Cleveland, with a view to making a huge system. The leasing of the property would carry with it the burden of concluding negotiations with the city for the final settlement of the franchise problem.

OUTING OF THE NEW ENGLAND STREET RAILWAY CLUB

The June outing of the New England Street Railway Club was planned for Thursday, June 28, at Salisbury Beach, and a most attractive itinerary had been arranged. The party was scheduled to leave Boston at 9:30 o'clock, in special cars over the Boston & Maine Railroad for Newburyport. Through the courtesy of the Haverhill & Ambsbury Street Railway Company, L. E. Lynde, superintendent, planned to take the party in special cars from Newburyport to Salisbury Beach; from there to Black Rocks, and on the return journey to Newburyport. A first-class shore dinner was arranged to be served at Hotel Cushing.

STRIKE IN PENNSYLVANIA

The employees of the Lehigh Valley Transit Company, operating in the slate and cement regions of Lehigh County, Pa., and part of Northampton, with lines from Allentown run to Bethlehem, Nazareth, Slatington, Slatedale, Emaus, Macungie, Hellertown, Catasauqua, Coplay, Egypt, Northampton Siegfried, Allentown and Philadelphia, are on strike, and conditions throughout the territory affected have assumed a serious aspect. The militia has been called out. The trouble is over a question of the recognition of the union.

A BILL TO PREVENT MERGERS IN MASSACHUSETTS NOW

A drastic bill, designed to prevent foreign railroad corporations from purchasing Massachusetts street railway companies and forcing foreign companies to relinquish any such railways which they may control, was before the committee on rules of the House, Saturday, June 23, on the question of the admission of the measure for consideration. The measure was received from Attorney-General Dana Malone, who had been requested, under an order of Representative Weeks, of Everett, to point out what form of legislation would be necessary to prevent the purchase of street railway properties by railroads organized under a foreign charter. Especial interest was attached to the Attorney-General's bill, because its provisions have the sanction of Gov. Guild, who, it is stated, is anxious to have the matter considered before the adjournment of this General Court. The suggested restriction of foreign railroad corporations follows a defeat of the so-called "merger bill," to which reference was made in the STREET RAILWAY JOURNAL last week. Gov. Guild congratulated the Legislature on the defeat of this measure. After a conference of various committee chairmen of the House, it was agreed that the Railroad bill and Governor's message should have a public hearing, and next Tuesday forenoon was assigned as the time for the opening of the hearing.

Chairman Cummings opened this hearing by reading the Governor's message. He said that the committee intended to hear everybody who had anything to offer. The committee wanted the advice of sound business men and sound lawyers, and would first hear those in favor of the enactment of such legislation. Representative Weeks, of Everett, called the attention of the committee to the bill, along these lines, that he had introduced House bill 1358. He also called attention to the fact that four-fifths of the members of the lower branch of the Legislature had gone on record that in their opinion such consolidation was adverse to good sound public policy. In response to a question by Committeeman Turtle, Mr. Weeks said the evil to which he referred was not so much a present one as the possibility of a future absolute control of all transportation lines in the State by one corporation. John C. Cobb, chairman of the legislative committee, Boston Merchants' Association, made a long speech, in which he said the board of directors of the Merchants' Association, at a meeting called for the purpose of considering the Governor's message, unanimously endorsed the position taken by the Governor, and instructed him, as their representative, to support the Governor's message. At the close of his speech, Mr. Cobb said he thought the question comes down to one of whether the State desires competition or monopoly. The Legislature has no authority to control the ownership of stock, but it has the right to say that no railroad shall have the right to control and operate both a railroad and a street railway in this State at the same time. If there was such a law the road would be very careful about owning street railway stock, even through New York parties.

Representative Luce, of Somerville, followed Mr. Cobb, and presented to the committee a bill which differs materially from that suggested by the Attorney-General. He said he did not present it with the idea that the bill suggested by the Attorney-General would not prove efficacious, but thought his own would give a better solution of the problem. He said he had heard many strictures on the bill suggested by the law officer of the Commonwealth, and upon investigation had found that his bill very closely follows the existing law, and if it is bad law then the codification bill recently enacted by the Legislature is also bad law.

The House adjourned to meet Wednesday afternoon at 4 o'clock, when it is expected that the committees on railroads and street railways will report an anti-merger bill. The bill will then be given its first reading and go into the orders of the day for Thursday.

Sealed proposals will be received at the office of W. W. Gurley, 914 Marquette Building, 204 Dearborn Street, Chicago, and be opened Thursday, July 5, 1906, by the receivers of the Chicago Union Traction Company, James H. Eckels and Marshall E. Sampson, for lowering and making changes in Van Buren Street tunnel, under the south branch of the Chicago River. Other work to the tunnels also is to be done, all in accordance with specifications on file with Engineer S. G. Artingstall, Postal Telegraph Building, Chicago.

OFFICIAL RETURNS CONFIRM DENVER ELECTION RESULTS

In the STREET RAILWAY JOURNAL of May 26, brief mention was made of the result of the municipal election held in Denver May 15, which resulted in the settlement of a number of questions of great importance to the Denver City Tramway Company and other interests. Quite recently the official returns of the election were formally announced, confirming the original result, but changing the figures somewhat. A complete statement of the questions voted upon by the tax-paying electors and the decisions recorded follows:

The Union Pacific Railway Company, to lay tracks for steam road on Blake Street. This was defeated.

The Denver Terminal Company, to lay tracks on certain streets of the city for alleged suburban lines. This was defeated.

The Municipal Traction Company, for a street railway on various streets of Denver, and covering much of the territory now covered by the Denver City Tramway Company. This was defeated by a heavy vote.

The Northwestern Terminal Company, for tracks on various streets to let "The Moffat Road" into Denver. This was carried by a substantial majority.

The Denver Gas & Electric Company, now operating in the city, to lay gas pipes and erect poles to supply electricity. This was carried by a small vote.

The Denver City Tramway Company, for a franchise for a period of twenty years, covering the present lines, some of which would expire in about fourteen years, and some 80 miles of extensions, to be built at the rate of at least 10 miles per annum. The payment into the city treasury of \$1,200,000, payable at the rate of \$5,000 per month on the first day of each month during the life of the franchise, and to be used only in the improvement of streets, boulevards and parks, and to be in lieu of all license tax on cars. The sales of half-fare tickets for children over six and under twelve years of age by conductors at the rate of ten for 25 cents. Providing for free transfers to connecting lines, but not to lines reaching the vicinity of end of line to which transfers are given. Also the extension of certain viaducts of the city at the cost of the company, and the paving between and for 2 ft. on each side of the tracks of the company at the company's expense and keeping same in repair. Litigation pending between the city and the company as to its present grants and rights of way, etc., not affected by the franchise voted. This was carried by a majority of 185 votes.

Of the four daily papers three opposed the franchises. In the case of "The Post," which was behind the application of the company known as the Municipal Traction Company, it supported this one and opposed all the others. The "Denver Republican," on the other hand, supported all of the applications except those of the Denver Terminal and the Municipal Traction Companies.

SAN FRANCISCO RAILWAY NOTES

The work of reconstructing the Sutter Street car line in San Francisco is proceeding very satisfactorily. The southerly track has been completed from Market Street to Fillmore, and work is now being rushed on the other track, so the United Railroads ought to be able to start running cars as far as Fillmore before July 1. The Sutter Street Railway Company, which operated the horse cars on lower Market Street from the ferry to Sutter, has petitioned the Board of Supervisors for permission to use the overhead trolley. The tracks will be used in conjunction with those of the United Railroads. The company also agrees to furnish light along its line. But this offer seems superfluous, as the United Railroads had previously agreed to light the same blocks.

The railway company has laid a standard girder-rail track on Post Street for the two blocks between Leavenworth and Larkin Streets, under a temporary permit, primarily, it is stated, for the hauling of debris. It will serve the important purpose of affording a connection between the company's Post Street line and the cross-town line on Larkin and Polk Streets, and from the manner in which the track has been laid the suggestion has gone forth that the company aims to use it as a permanent link in its system of overhead trolley lines. This will probably be done, should the people want the track to remain.

According to Superintendent Harris, of the California Street Railway Company, the cable system of the company will be in operation by Aug. 1. At the start cars will probably be run on California Street only between Kearny Street and Presidio

Avenue. "This part of the track," says Mr. Harris, "is in excellent shape, with the exception of two small stretches of track at the Larkin and Palk Street crossings. Below Kearny Street the roadbed will require considerable repair and rebuilding. The earthquake did considerable damage to the track below Sansone Street. The slot is closed in places and the track is very uneven. Most of the damage, however, was caused by the fire. This is particularly true of the track on O'Farrell, Jones and Hyde Streets, where the heat was so intense that it warped the track and slot rails out of shape. It will take longer to get this portion of the road in shape for operation; so we have decided, as a starter, to get the California Street line running.

"Unfortunately, we lost all of our cars. We had fifty-two cars, but operated normally about thirty-nine or forty. To meet the immediate needs of the company, we are having twenty-five cars built at the Hammond shops, at Seventh and Berry Streets, and these will be ready in six weeks."

Superintendent Harris says that new cables will have to be installed before cars can be run on the California and Hyde Street lines. The cable suffered considerable from the fire, notwithstanding the fact that it was 18 ins. below the surface of the street. One of the curiosities of the conflagration is to be seen in the north slot of the California Street line close to the Hyde Street crossing. Here the cable was subjected to such intense heat from the flames of the adjoining buildings that at one place the wire strands completely melted.

The Kearny Street line is now in operation from the Southern Pacific Depot, at Third and Townsend, to North Beach, by way of Third, Kearny, Broadway and Powell Streets.

The United Railroads has resumed the operation of its sight-seeing cars, three trips being made daily from the ferry. The route takes in the Cliff House, Affiliated Colleges and the Mission District.

The service on the Hayes Street line, commenced a few days ago, has been suspended temporarily until heavier rails can be laid to replace the light track that was found not to be sufficient to carry the heavy electric cars without derailment.

It is declared on reliable authority that the United Railroads have arranged to take over the Presidio & Ferries Railroad Company, more familiarly known as the Union Street line.

For the present the Union Street road will continue to be known as an independent line. It is seeking permits from the Supervisors on that basis. Before long, however, it is asserted that the road to the Presidio will become one of the proprietary lines of the United Railroads, or at least a friendly connection. The United Railroads will soon be found supplying the Union Street road with power, cars and transfer facilities, if it does not take the road over into its system.

The Union Street line has asked the Supervisors for permission to convert its road into an electric line and to erect poles and wires for the operation of electric cars. Its application has already been passed upon favorably by the street committee of the Board.

BOARD OF ESTIMATE OF NEW YORK ASKS FOR NEW SUBWAY PLANS

The Board of Estimate held a long session and disposed of a large amount of routine business Friday, June 22. On motion of President Coler, of Brooklyn, the board passed by unanimous vote a resolution asking the Rapid Transit Commission to proceed forthwith to prepare plans for an elaborate extension of the subway system to connect all boroughs. The resolution in full follows:

"Resolved, That, in accordance with Section 4 of the Rapid Transit law, as amended, the Board of Estimate and Apportionment, as the local authorities of the city of New York, hereby requests the Board of Rapid Transit Commissioners of said city to proceed forthwith to the consideration of a rapid transit subway system to serve the transportation needs of the city by a continuous system of connected routes in the boroughs of the Bronx, Manhattan, Brooklyn and Queens, with provision for a future extension line into the borough of Richmond; said rapid transit line to begin at a point in the borough of the Bronx, to be recommended by the president of said borough, to proceed thence to the borough of Manhattan, and along certain streets in said borough, to be recommended by the president of said borough, to connect with the Williamsburg Bridge, and crossing said bridge to proceed in the borough of Brooklyn through Broadway to Jamaica Avenue, and to connect also with the Manhattan Bridge, and crossing said bridge to proceed in the borough of Brooklyn by way of Flatbush Avenue, as extended, and Flatbush Avenue and Fourth Avenue to Fort Hamilton, with a spur con-

nection at Fortieth Street for extension to Coney Island; and,

"Resolved, That the Board of Estimate and Apportionment recommends to the Rapid Transit Commission that the said rapid transit system be provided for in a contract or contracts which shall insure the operation of the entire system, as recommended, by one corporation, whether said corporation be a private corporation or the corporation of the city of New York."

THE CLAIM AGENTS' QUESTION BOX

The American Street and Interurban Claim Agents' Association is making this year its first attempt at a question box, and a call has been issued by Secretary B. B. Davis, of the association, with headquarters at 14 North High Street, Columbus, Ohio, for replies to a series of twenty-four questions, appended hereto. Answers are requested by Aug. 1, so that the classification and preparation for publication and distribution before the annual convention on Oct. 15, can be carried out so as to insure the best results. In replying to questions it is only necessary to answer by number, and not to repeat the question. Replies should all be signed. The queries for the box follow:

1. Is it good policy to settle personal-injury claims in which there is, according to the investigation, no liability, when it can be done along close lines, or shall we stand on these cases and settle only those which are close or for which we are clearly liable?
2. What steps are taken, and by whom, to collect damages for injury to cars on the street by vehicles, etc., owing to neglect or recklessness of drivers, or the breaking of glass by persons outside or inside of cars through no fault of the company?
3. What is the law in your particular State in a case where a pedestrian or teamster is struck by a car while crossing electric tracks; who testifies that he looked and listened and failed to see the car; where the conditions are such that he could not help seeing it, if he had looked, and where it would be self-evident from the surrounding circumstances that the man was committing perjury. Could he be convicted of perjury in your State if the jury find for the defendant in a damage case?
4. What is the best way to break up ambulance chasing?
5. What is the custom or practice in regard to calling upon injured persons, especially when there is no liability?
6. How can conductors and motormen be made to render reports of accidents seemingly trivial?
7. What qualifications should a claim agent possess to be successful?
8. Is it advisable to declare your identity to possible claimants in every accident which occurs, or not? If so, why? If not, why?
9. Is it advisable or a good policy to obtain medical examinations in all cases of injuries, and how soon after the accident?
10. What is the best method to adopt in the investigation and disposition of "blind or unreported cases?"
11. What is the best method of settling claims; by cash, check, or order on the treasurer?
12. Is it a good plan to discuss cases with attorneys after case has been placed in their hands?
13. What is the best plan to adopt when prominent physicians, who are inclined to be friendly, present a bill for double the amount charged in ordinary cases?
14. Is it better to interview an injured person before the investigation is made in order to get his or her statement first?
15. Should surface railway companies have a regularly employed physician?
16. Does sending a physician in minor cases aggravate the case and make it more difficult for settlement and more expensive?
17. Which is the better qualified, the operating, or claim department, for instructing train men in their duty in relation to accidents?
18. What is the best form of blank release to be used in settlement of cases, to safeguard it against future attacks?
19. What statistics relating to accidents should a claim department have, and of what value are they?
20. Of what value are photographs in the disposition of claims?
21. What is the best way to maintain harmonious relations between the claim and operating department?
22. What has been your experience in following up so-called permanently injured persons after their claims have been disposed of? Wouldn't it pay to keep them under observation?
23. What is the best plan in securing full details and protecting company's interests in accidents resulting in death?
24. What instruction should be given conductors and motormen regarding accidents when they first enter service? In what manner should instruction be given?

The Indianapolis, Crawfordsville & Western Traction Company has increased its capital stock from \$2,000,000 to \$3,000,000. The road is expected to be under construction, 45 miles, extending from the Industrial School for Girls, a State institution, west of Indianapolis, via Clearmont, Brownsburg, Pittsboro, Raintown, Lizton, Jamestown, New Ross, Mace to Crawfordsville. Track laying to begin July 1. The Marion Trust Company, of Indianapolis, is said to be handling the financial end of the operations. Edward Hawkins is president of the traction company. A mortgage for \$3,000,000 was recently filed.

SCHOEPF SYNDICATE FORMS BIG COMPANY—AFTER DAYTON & TROY

The Indiana, Columbus & Eastern Railway Company, recently incorporated by the Schoepf syndicate to take over and operate a number of the properties of the syndicate, has filed papers with the Secretary of State of Ohio increasing its capital stock from \$1,000,000 to \$12,000,000. Of this amount 100,000 shares are common stock and 10,000 shares 5 per cent preferred. At the same time the Columbus, Newark & Zanesville Traction Company reduced its capital from \$1,500,000 to \$850,000, retiring its preferred stock. The capital stock of this company was then increased to \$6,250,000, of which 49,000 shares are common and 5000 preferred. The explanation of these changes is that the Columbus, Newark & Zanesville Traction Company has absorbed the Columbus, Buckeye Lake & Newark Traction Company and the Zanesville Railway Light & Power Company, and their securities are retired by the new issues.

The Indiana, Columbus & Eastern will buy or lease and operate nearly all the Ohio lines of the Schoepf syndicate, including the lines above mentioned, which were acquired from Tucker-Anthony, the lines acquired from the Appleyard syndicate, the Dayton & Western, the Dayton & Northern, and that part of the Dayton & Muncie from Greenville to Union City, the Columbus & Lake Michigan Railway, the steam road operating from Lima to Defiance, and the lines under construction from Lima to Bellefontaine and from Lima to Toledo. The new capital will provide money to install additional power where needed, and to place the various properties in first-class shape for fast long-distance service.

Much interest attaches to the report that the syndicate is again seeking to acquire the Dayton & Troy Electric Railway. The syndicate tried some time ago to get this road, but the Clegg family, of Dayton, who own it, declined to sell except at a price which was deemed unsatisfactory to the Cincinnati syndicate. The Dayton & Western, owned by the Winters family, which was closely allied with the Clegg family, occupied a similar position with regard to that road, but the property was turned over to the big syndicate on a leasing arrangement. The report is that the Dayton & Troy may be acquired under a similar arrangement, which will leave the ownership as heretofore, but with the operation in connection with the big system. The peculiar importance attached to this particular situation is that the Dayton & Troy is in an alliance with the Western Ohio and the Toledo Urban & Interurban for handling through business between Dayton and Toledo. The syndicate tried some time ago to secure the last two roads, and upon failure to get them they decided to build a line from Lima to Toledo. This is now well under construction, so that for the through business between the two large cities it now has no need of the Toledo Urban & Interurban or the northern section of the Western Ohio between Lima and Findlay. To secure a direct connection for its new Lima-Toledo line it does need the Dayton & Troy. The syndicate owns the Dayton, Springfield & Urbana and the Urbana, Bellefontaine & Northern, and these in connection with a line which it is building from Lima to Bellefontaine will make a through line from Dayton to Lima and Toledo, but it is so indirect that well-informed traction people do not believe that the syndicate could, or would, attempt to compete for time with the more direct lines, hence the desire of the syndicate to secure these lines and the great interest which attaches to the outcome of the new negotiations for the Dayton & Troy.

THE NEW BRITAIN THIRD-RAIL LINE TO BE DISCONTINUED

In the Superior Court at Hartford, Conn., Corporation Counsel Hungerford, of New Britain, and Attorney Lucius F. Robinson, representing the New York, New Haven & Hartford Railroad Company, appeared before Judge Silas A. Robinson and submitted a form of judgment agreed upon in the suit to restrain the company from continuing to operate the New Britain third-rail line. By this judgment the third rail will be discontinued Aug. 1 of this year. The judgment is as follows:

"This action by complainant claiming an injunction against the operation by defendant of its railroad within the city of New Britain by means of a third rail charged with electricity and claiming other relief, came to this court on the first Tuesday of September, A. D. 1905, and thence to the present time. The defendant on the 2d day of November, 1905, filed its demurrer to the

complaint. Upon the 28th day of March, 1906, upon motion of the plaintiff, the city of New Britain, the State of Connecticut was made a party plaintiff in this action, and upon motion of said plaintiff, the city of New Britain, allowed on the 28th day of March, 1906, the complaint was amended as appears by the amendment on file. Upon the 25th day of April, 1906, the defendant withdrew its demurrer to the complaint and filed notice of its intention to refuse to plead further in said action. The court thereupon having heard the plaintiff finds that the allegations of paragraphs one, two, three, four, five, six and eight of the complaint as amended are true, and the court further finds that the plaintiff's third prayer for relief ought to be granted, and that a permanent injunction should issue against the operation of the defendant's railroad within the limits of the city of New Britain in the manner set forth in the complaint.

"Whereupon it is adjudged that the defendant and its servants, agents and lessees be, and they are hereby, enjoined each under a penalty of \$10,000 against the operation of the defendant's railroad within the limits of the city of New Britain on and after the 1st day of August, 1906, by means of the system of operation known as the third-rail system, that is, by means of a third rail charged with electricity, and it is adjudged that no party to this action recover any costs from any other party."

G. A. R. CAUSES HEAVY TRAFFIC IN OHIO

Traction lines in the vicinity of Dayton reaped a big harvest from the annual encampment of the Ohio Grand Army of the Republic, held in that city a few days ago. The steam roads declined to give the veterans the usual rate of 1 cent per mile, and would make no reduction from the 2 cents a mile rate now in force. As a result, the soldiers took the traction lines as far as possible, for they gave reduced rates and ran special cars from all points in the district. The Columbus, London & Springfield Railway had nearly 500 out of Columbus, and the Dayton, Springfield & Urbana, 300 out of Springfield. The Dayton & Troy—Western Ohio—Toledo Urban & Interurban limited service from Toledo to Dayton was taxed to its uttermost carrying capacity for two days. Double headers, and in some cases three sections, were run on each train. In addition there were several specials out of Toledo, five specials out of Findlay, six out of Lima, and so on all down the line. There were few delays and no accidents reported, and the tractions not only gathered in a fine lot of extra business, but secured an immense amount of advertising, as the newspapers all over the district commented upon the excellent service given by the electric lines.

TRAINS FROM LOS ANGELES TO THE COAST

Officials of the Pacific Electric Railway Company are planning to run trains of three coaches between Los Angeles, the seashore and other important interurban points. According to officials of the company the improvement is absolutely necessary. The trains will be made up of two motor coaches and a trailer. Each train will have a seating capacity of 150 persons. The trains will be through ones entirely. The company will provide individual coaches to take care of local demand. A test of the new train is now being made by Chief Electrician S. H. Anderson, and Mr. Huntington will be one of the party to make the trial trip. J. McMillan, general manager of the Pacific Electric, has been working on the scheme for months, and if a test proves successful, interurban electric trains will become important factors in Southern California transportation.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED JUNE 19, 1906

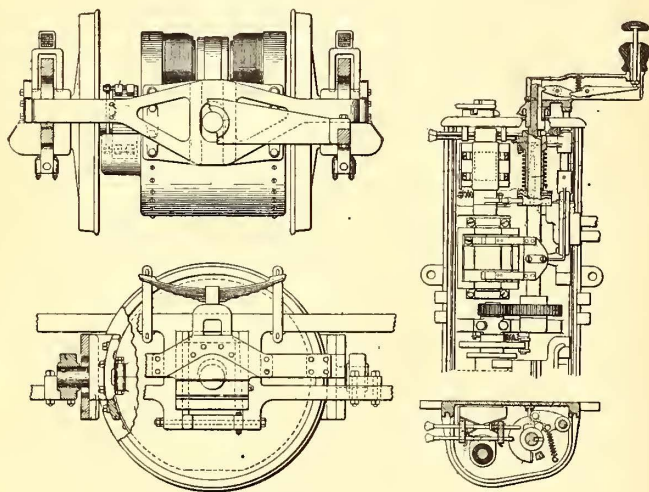
823,513. Safety System for Operating Railroads; William H. Dammond, Detroit, Mich. App. filed Feb. 17, 1905. Insulated sections incorporated in the track, which constitute receiving stations by which the messages are transmitted to the train from points along the road. Also actuates danger and caution signals in front of the train.

823,646. Signaling System; Jacob B. Struble, Wilkinsburg, Pa.

App. filed April 11, 1905. A signaling system for railways employing an alternating current as a motive power, and a rail of the track as a return for the alternating current in which a closed track circuit is employed, the usual current in which effects a suitable form of translating device, which device responds to the usual current in the track circuit in its normal operation. The translating device in turn may control a circuit including an operating mechanism for a signal device comprised in a railway signal, or the translating device may directly operate the signal.

823,648. Railway Signaling; Louis H. Thullen, Edgewood, Pa. App. filed Feb. 5, 1904. A signal system for electric railways in which the motive power for the motors is alternating current with a return for the propulsion current through the rails. Had a source of direct current for energizing the rails of the block sections.

823,732. Safety Railway Switch Structure; Henry R. Luther, Newton, Mass. App. filed Sept. 1, 1905. Details of construction of a lock for the switch point, preventing the same from being jarred out of place by the wheel flanges passing over the heel of the switch point.



PATENTS NOS. 823,969 AND 823,992

823,992. Emergency Brake; Fred. B. Corey, Schenectady, N. Y. App. filed March 21, 1903. Mounted within the controller casing and operatively connected in the car-brake system is an emergency valve, which is adapted to apply the brakes in case the controller handle is released in any of its operative positions.

823,966. Brake Actuating Device; John Post, Philadelphia, Pa. App. filed Feb. 12, 1906. The brake-shoes are secured to the piston rods of steam cylinders, and a steam circulating system connects the cylinders with controller valves at each end of the car, which valves are in turn connected with a steam boiler.

823,968. Electric Locomotive; Edward D. Priest, Schenectady, N. Y. App. filed Jan. 28, 1905. Four pairs of wheels are provided on each of which is a direct-connected motor. The invention relates particularly to a form of suspension by which the weight is evenly distributed to all of the wheels.

823,969. Electric Locomotive; Edward D. Priest, Schenectady, N. Y. App. filed Jan. 28, 1905. Modification of the above, and relates particularly to a transverse suspension system for keeping the pole faces of the motor in parallel with the armature.

WARNING AGAINST ACCIDENT FAKIRS

Edward Fitzgerald, claim adjuster for the Cincinnati, Newport & Covington Traction & Light Company, has sent out a circular letter warning street railway companies against a party of accident fakirs that recently attempted to operate against his company. A woman with a child in her arms boarded a car late at night, and as she was slow in taking her seat the car started, and she was thrown against the seat and the child dashed to the floor. The woman's husband and a couple of friends were on the car when the "accident" took place. It appears that she was suffering from an old injury, and a doctor who was attending her was in the deal. Three suits were filed—one for injuries to the woman, one for injuries to the child, and one by the husband for loss of services of wife and child.

PERSONAL MENTION

MR. W. R. COOPER has been appointed editor of the "Electrician" (London) in place of Mr. F. C. Raphael, who retires June 30.

MR. A. M. HEWES, of Chicago, was elected a director of the Indianapolis, Crawfordsville & Western Traction Company at the special meeting of the board of directors June 19.

MR. NICOLAS LE GRAND has resigned as manager of the supply department of the St. Louis Car Company, and will engage in the general railway supply business in St. Louis.

MR. D. A. MUNGER has been appointed general traffic agent of the Pacific Electric Railway Company, and has entered upon his new duties. He is an Eastern man. The management of Alpine Tavern and of the Pacific Electric's traffic business at that end of the line is again in the hands of Mr. J. H. McGuire.

MR. W. H. WHITESIDE, president of the Allis-Chalmers Company, accompanied by his wife and daughter, sailed from New York for Liverpool, June 19, on the "Caronia." Mr. Whiteside and his family will visit various points of interest in England, Germany, Switzerland and France, spending most of their time on the Continent.

MR. R. W. KING, formerly manager of the Rapid Transit Company of Chattanooga, Tenn., has been elected manager of the Lookout Railway Company, of Chattanooga, which embraces the incline and the railway to top of the mountain, known as the Lookout Mountain & Lula Lake Railway. Mr. King is planning now completely to remodel and rebuild the line.

MR. A. D. SCHINDLER, formerly general manager of the Pacific Electric Railway Company, has opened a railway construction office in San Francisco. Associated with him are Mr. R. S. Masson, who, until June 1, was consulting electrical engineer of the Pacific Electric Railway Company, and Mr. Melville Dozier, once engineer of maintenance of way for the same corporation.

MR. HENRY E. HUNTINGTON has returned to Los Angeles from a six weeks' trip in the East, where he devoted most of his time to affairs of the Newport News Shipyard, in which he is interested. Mr. Huntington says that rails have been ordered for 125 miles of track for the Pacific Electric lines in Southern California, and the construction of these lines will begin in the fall. The first new construction work will be the line between Lake Avenue and Monrovia. The work of double-tracking the Redondo line will be continued until completed.

MR. GEORGE U. G. HOLMAN, of New York, who promoted and built the Levis County Railway, Quebec, Canada, is now associated with Mr. L. Knowles Perot, of Philadelphia, as electrical engineer of the Valley Forge system of railroads and railways. This syndicate will build and operate a third-rail private right-of-way-line between Philadelphia and Phoenixville, Pa., and has offices in the Land Title Building. Mr. Holman is also vice-president of the Public Service Investment Company, which is the holding company for eleven Pennsylvania corporations. He retains his New York office.

MR. D. H. LAVENBURG, of Toledo, has been appointed general manager of the Ohio Central Traction Company, with headquarters at Galion, Ohio, succeeding Mr. T. C. Cherry, resigned. Mr. Lavenburg has had a long and varied experience in steam and interurban railway work. For a number of years he was train despatcher on the Wheeling & Lake Erie Railway (steam). He became chief train despatcher of the Toledo, Fremont & Norwalk, now a part of the Lake Shore Electric Railway, and later was division superintendent of that line. Three years ago he went to Texas as superintendent of the Northern Texas Traction Company, and a year later he resigned to become general manager of the Toledo & Indiana, which position he held up to a few months ago, when the road changed hands.

MR. P. NEY WILSON has resigned his position as supervisor of the South Jersey division of the Public Service Corporation of New Jersey, and has accepted the position of engineer of permanent way and associate engineer of construction of the Para Tramways Company, of Para, Brazil. This is one of the lines now being constructed by the J. G. White Company, of New York, and Mr. Wilson will sail for London about July 20 to go over the plans of the Para road, and will soon after leave England for Brazil. Mr. Wilson has been supervisor of the Camden & Suburban Railway Company and its successor, the South Jersey division of the Public Service Corporation, for a period of nine years. In this capacity he has had charge of the track construction of the Camden lines and has made an excellent record.

