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Caring for the Peak of the Load

Every time that a new electric lighting or railway power plant is designed one of the foremost and most difficult of the problems to be solved is "How shall we cope with the peak of the load." Many methods to solve this question have been proposed, and a number of them are in use, the most usual being an installation of storage batteries. There is no doubt that in many ways this is the most satisfactory means of accomplishing the desired result, with the exception that a considerable investment is required and the rate of deterioration is excessive. Where the interest on the investment, depreciation in value, and cost of maintenance is considered, it becomes a question whether or not a storage battery installation is more economical than using one or more extra engines and batteries of boilers, keeping the fires banked and the engines idle during the slack hours, especially as these engines being in use for only a few hours a day may be of simple design and need not have all the economies imperative when all-day running is necessary.

In connection with the latter plan it may be added that a great increase in the boiler capacity is not needed if the plant is equipped with economizers, rapid steaming water boilers and forced draft. The possibilities of this combination has not been as fully appreciated as they deserve by many designing engineers and officials. Apart from considering the combination merely as a means of meeting the heavy demand of rush hours, each equipment has its advantages in regard to the economical generation of steam, which alone often warrants its use, besides offering a solution of the problem in question, that of providing a large reserve steam generating capacity, which can be utilized in a comparatively short space of time. The function of the economizer in this combination is that of providing a large mass of water which, when forced draft is used, can be heated up far above the boiling point by the flue gases, which are much above their temperature created with natural draft. By forced draft, also, the boilers, if properly constructed, can be forced to almost any degree desired in a very short time.

Financially considered, it may be said that the investment in such a plant is as great as that in a storage battery, but when operating expenses are taken into account it at once appears that while in the case of the storage battery the energy must be first stored in the battery and then discharged, the efficiency of the system must be considerably below unity. In the second system, however, there is no double conversion, and under certain conditions it may show a gain over the battery method.

Turnstiles in Boston

At a hearing held last week before the Massachusetts Railroad Commissioners, in Boston, a number of remonstrants against the use of turnstiles at the exits of elevated and subway stations presented their objections. The arguments advanced were on the ground that the turnstiles formed an obstruction in a public highway, and were dangerous to patrons of the road. Several persons testified that they had received injuries in passing through the gates, and claimed that the company ought to supplant the devices by men stationed at the exit points.

On the Boston Elevated Railway 87,000,000 people have passed from the trains since the elevated structure was opened for business, and thus far only seven complaints of injuries received at turnstiles have been received at the company's offices. Under the present system of train operation it has been found necessary to collect fares before allowing passengers to enter on the platforms, as cars would have to be run very slowly between stations if conductors were required to collect fares after the passengers had boarded the cars. This makes it necessary to prevent people from approaching train platforms by the exit stairways, and if a man were placed there, instead of a turnstile, people might climb to the platform only to be told to go down and come up another way. It is also necessary to insure the safety of people present on the train platforms in the subway by shuttting out loafers and others who do not intend to ride. Some dissatisfaction was found with the stiles first used, so they have been modified. The present turnstile is so planned that every passenger has to push it until a ratchet slides up a short incline in the rotary mechanism. The arm may swing back if someone leaves the stile with the ratchet half-way up the incline, but injuries received in this way are almost unknown. If the company should follow the suggestion of placing a man at each point where there is now a turnstile, the exit man could not be made a fare taker without destroying

the system of separating people coming in and those going out. There are thirty-three places where a man would be required to replace an exit turnstile, and this would require sixty-six additional men each year, or an expense of over $42,000, not including entrance turnstiles.

In regard to the so-called public highway obstruction we cannot see why any railway company which leases property for business purposes and pays a rental, should not be allowed to charge for admission to that property. It would be poor policy to throw open the stations to the general public without payment of fare, not only on account of the increased liability to accident from the third rail and swiftly moving trains, but because a fare must be paid somewhere, and it is better to have the fare paid at the entrance than either on the cars or at an exit. Passengers are in a hurry at an entrance only when they see their particular train or car coming, but they are always in a hurry at the exits. Then, again, the platforms are so small that it would be dangerous to allow peddlars and idlers there.

The claim advanced by the objectors to turnstiles, that any person has a right to cancel the contract to ride at any time before actually stepping on the cars is little short of infantile. We cannot see how any person of sanity and intelligence, who deliberately buys a ticket of the railway company and enters its station, with the privilege of riding, after the ticket has been macerated in the ticket chopper, deserves to get his money back, in case a sudden fancy that, after all, he does not wish to ride, enters his head. In regard to the actual turnstile accidents we can only say that practically no form of modern machinery or mechanism, from a needle to a railway train, is free from the possibilities of accident under some conditions, and the price of our highly engineered civilization is of necessity paid in part by the assumption of this risk. When one considers, however, the millions of passengers carried without injury by our elevated roads and reflects upon the marvellous safety of rapid transit in cities in consideration of the traffic handled, and follows month by month the ever-increasing use of safety appliances by progressive managers, the arguments of the fault-finders, as exhibited in the Boston instance, appear little short of inane.

Steam Road and Trolley

A report comes from Maine of proposed legislation to permit steam roads to buy, build and operate trolley systems. This is already permitted in some States but forbidden in others, so that there is nothing of novelty in the proposition from 'way down East. It emphasizes, however, a strong tendency of somewhat uncertain purpose and effect. Whatever steam railroads may do or fail to do we believe first, last and always in the future of electric railways, the lines that stop at "every man's corner" instead of every 5 miles or 10 miles. The urban dweller, much as he depends on the trolley, can hardly realize what an interurban road means to the region it traverses. The world wagged comfortably along for many a century without the telephone, but now that we have it we can hardly do business without it. Just so with the trolley; it has made itself indispensable in every place that it has touched. The best proof of this is the rapidity with which fervid denunciation has been transformed into enthusiastic endorsement when the projected road has become a reality. Even exclusive summer colonists who have damned most earnestly when a trolley line has threatened to invade the sanctity of their domain have been converted by the light of experience. Now, in so far as the Maine proposition or its equivalent will tend to the building of more and better electric roads, it is excellent and worthy of support; in so far as it will hinder such developments it is bad and reprehensible. That steam railroads have built and operated electric roads of the most useful and efficient sort admits of no dispute. The Nantasket line, the New Britain line and the fine line between Manchester and Concord, N. H., which we have recently described, are cases in points.

On the other hand there are plenty of cases in which steam roads have throttled franchises or have acquired them for purely obstructive purposes. Competition is never grateful to any line of business, and the deadly effect of a well administered trolley line needs no sort of demonstration. There is little doubt that an interurban line is a dangerous competitor even when it is short and without through connections, while with them it takes on a still more serious phase of development. There is at present a strong tendency to build long lines, and we have many times pointed out the advantages of at least a working form of consolidation in the case of connecting electric roads. This is a form of combination which results in nothing but good to the community. The immediate result in almost every case is better service and the reduction of fares, while the roads themselves can gain by important economies. In particular we have often pointed out the advantage of through cars, welding connecting roads into a coherent system. The steam roads themselves have long since passed through the stage of independent or conflicting operation and have emerged into a state of aggregation that gives the public long through routes all over the country. Now, what is going to be the effect of ownership by steam roads on the relations between contiguous electric roads? When a railroad acquires one link in a chain what relation will that link afterwards bear to the others? Will it be possible to unite it so as to form part of a through route? These are most vital questions bearing on the matter in hand. In other words, will the proposed measure advance or obstruct the general cause of electric traction in its larger and more important developments? That roads built and operated in the light of extensive railway experience will be in themselves well built and well operated is altogether probable, but will they, upon the whole, tend to enlarge or to restrict the sphere of electric railroads?

On the answers to such questions as these depend the propriety of a general provision such as has been proposed. The answers may often be predicted in particular cases, but in general they are indeterminate. A statute cannot readily be made to fit every case or to provide for future changes of railway policy. It is hard to foresee all the possible contingencies or to find a touchstone to discriminate between permissive and obstructive purposes. But what would be the result of a provision to the effect that any line built or purchased under such an act as that which is here in question should grant connection and right of way over its tracks to present or future contiguous lines on terms to be fixed by the courts? Would the steam railroads want rights thus guaranteed against obstructive use? If they would, by all means let them be granted, for every well-run road is a public benefit by whomsoever built and owned. In the case of most ordinary lines there is little need of such a provision, for the advantages of united action are too apparent to need legislative enforcement. There are sometimes temporary misunderstandings between connecting lines, but they are generally overcome by obvious common

interests. Where compensation with steam roads is concerned these common interests are replaced by a mutual distrust and rivalry that is not easy to dissipate. It looks to us very much as if some such rider should be attached to any act which should give railroads the right to occupy in their own behalf ground which otherwise might be used for greater public good. The strength of electric traction lies in the benefits it confers on its patrons. They are sometimes prone to grumble, to find fault with the accommodations, and to demand all sorts of unreasonable concessions, but we have yet to see the case in which the worst electric line ever built, operated in the most shiftless way on record, would be willingly dispensed with by the community it inefficiently serves. Electric traction is going ahead, it is giving and will give to this country the best system of transportation that the world has ever seen, and its way must not be blocked. Its growth may legitimately be regulated and guided, but in the interests of the whole people it must not be checked.

The Passenger Traffic Problem of Greater New York

The articles by Mr. Wheatly on this subject, commencing with the issue of Jan. 10, are concluded in this issue. The first article was an attempt to show the present traffic conditions in Manhattan and to indicate what the problem for solution was conceived to be. The article in the issue of Jan. 17 gave an outline of the additional traffic facilities authorized or proposed and pointed out, wherein these facilities appeared to fall short of providing an adequate and comprehensive rapid transit system for Manhattan. This article also indicated the relation of the additional facilities to one another and to the present lines of traffic. The concluding article in this series, which is published in this issue, deals with the present traffic conditions in Brooklyn and Queens, and the probable effect of the completion of the new bridges and tunnels upon the entire transportation situation of Greater New York, and especially of Brooklyn and the Long Island suburbs.

One of the points brought out early in the discussion was that the existing lines of traffic in Manhattan are already being worked almost to the utmost limit of their capacity. The addition of a third track on the elevated structure here and there, the amplification of its terminals at City Hall, the Battery and other congested points, the removal, in so far as is possible, of the existing limitations to train movement at Ninth Avenue and Fifty-Third Street and other similar junction points, the completion of the electrical equipment of all of its lines, making possible an increased number of cars per train, and the lengthening of its station platforms is about all that can be done to increase the passenger-carrying capacity of the Manhattan Elevated road. When all of these things have been done the increase in hourly traffic capacity will amount to only a small percentage of the maximum traffic now being carried in one direction. It has recently happened repeatedly that over 100,000 people have been carried in one hour, of which, perhaps, 90 per cent were in one direction. It may be possible, however, by making a more evenly balanced traffic to increase considerably the number carried in one hour in both directions. Mr. Vreeland is authority for the statement that the adoption and enforcement of a proper code of rules of the road and the consequent removal of the vehicle interference, will enable the surface lines to increase their carrying capacity 25 per cent in one direction. Here, too, there is an opportunity, by creating a more evenly balanced traffic, to carry more people in one hour in both directions. With the co-operation of the city authorities all of these improvements on the elevated and surface lines are made possible, but without their active assistance little can be accomplished.

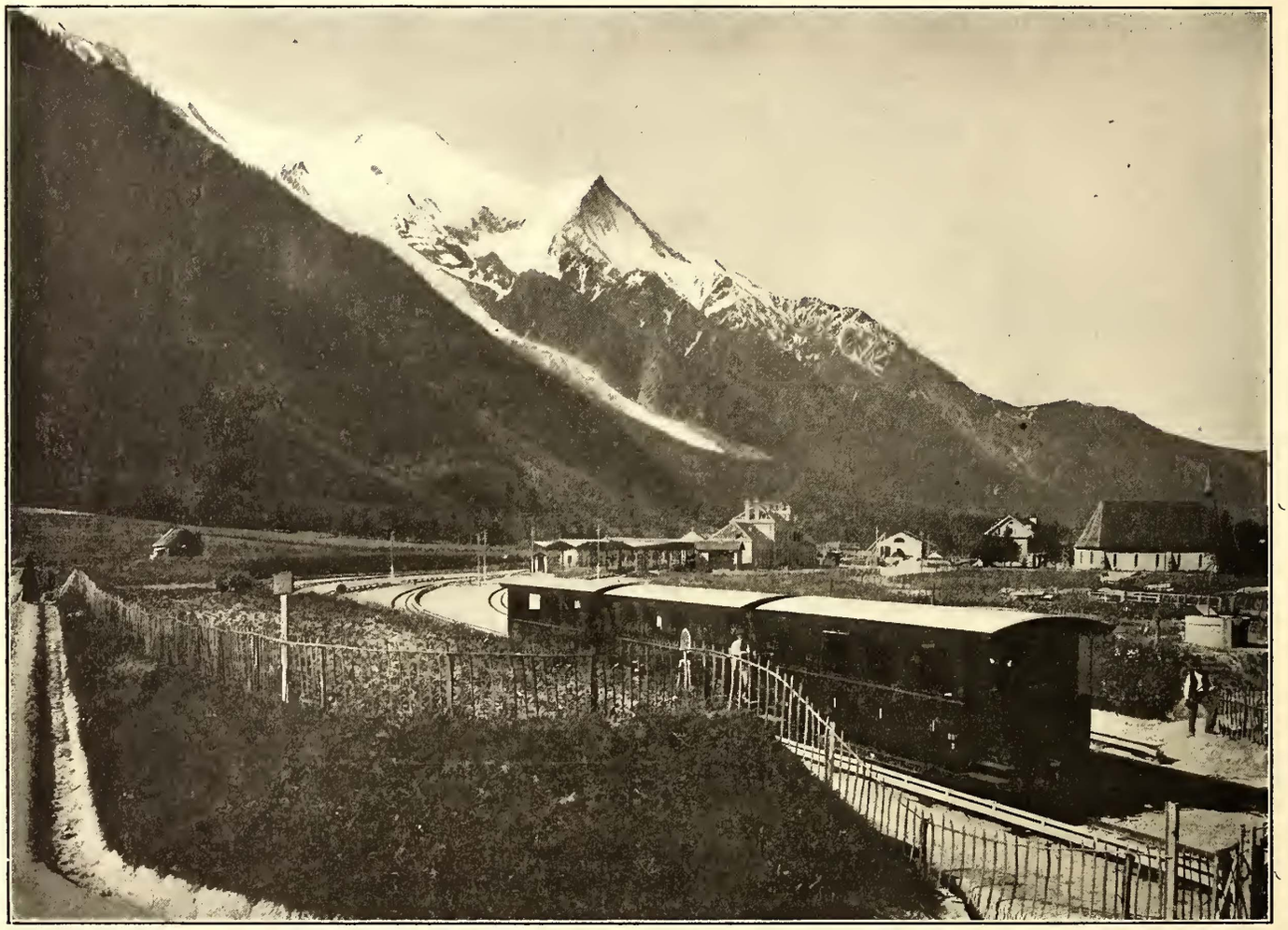
The significant fact is strongly brought out by Mr. Wheatly that the north and south traffic leaving the business district in New York now averages about 142,000 passengers in the maximum hour, and that this number is 56 per cent of the total. The existing conditions of overcrowding on the north and south lines are well known, and the proportion of passengers who do not obtain seats may be estimated by any one who rides in the rush hours. It has been variously estimated that 50 per cent to 60 per cent obtain seats while 40 per cent to 50 per cent stand. How near this estimate is to the truth can be shown only by actual figures. But the fact remains that the present volume of north and south traffic most urgently demands radical action looking towards permanent and adequate relief. Unless this is done the future growth of the northern part of the city and its suburbs is bound to be retarded. The additional facilities outlined at present do not furnish adequate and permanent relief to the north and south traffic.

Mr. Wheatly calls attention to the fact that the greater part of the additional facilities will not be completed until 1907 or 1908, and not until then may it be expected that there will be an adequate outlet for the growth of population. Furthermore, the additional facilities, as at present outlined, point toward Brooklyn, Queens and suburban Long Island as the territory to which the overflow of population will be forced to go. Heretofore the growth has been principally toward the north, because only in that direction was there direct land communication with the suburban districts, with the single exception of the Brooklyn Bridge, which afforded a most inadequate means of communication with Long Island as a whole and with Brooklyn in particular. The difficulty in the way of the population spreading west is shown by the fact that with the present ferryboat service across the Hudson River the first mile is made at the average rate of only 4 miles per hour. The completion of the subway, with its ability to handle only about 28,000 seated passengers per hour in one direction, will give only temporary relief to the north and south traffic. Within a short time after its completion this rapid transit highway is apparently destined to be overcrowded quite as badly as the existing lines. Before additional subways can be authorized and completed the traffic will have greatly increased, and the congestion is expected to be as great, if not greater, than at present.

But most remarkable of all is the statement that the additional bridges and tunnels leading toward Long Island will have a maximum carrying capacity per hour in excess of the entire number of people who now come from Long Island to Manhattan in one full day. This maximum traffic capacity of the bridges and tunnels will not, however, be reached until there is a great increase in the population across the river, and not until the railroads serving Brooklyn, Queens and suburban Long Island have made adequate increase in their facilities for handling the vastly increased passenger traffic. The railway officials are fully alive to the fact that to attract increased population the traveling facilities must be kept considerably in advance of the demand for transportation. There seems to be little reason to doubt that the wisdom of the municipal authorities in providing upon such a broad and comprehensive basis for the future growth of the territory across the East River, will result in drawing to that territory the overflow of population which is now waiting to leave Manhattan upon the line of least resistance, as well as the increase of population for many years to come.

ELECTRIC ROAD FROM FAYET TO CHAMONIX

Chamonix, the French village which lies nearest to the foot of Mont Blanc, is the most popular tourist resort and center for excursions in the entire Mont Blanc region. Up to within a year, however, there was no means of reaching the town except by a diligence ride for several hours after leaving the nearest steam railroad station to Fayet-St.-Gervais, or by the even longer passage, by diligence or on foot, across the Téte Noire pass from the Swiss village of Martigny. The new electric road which now connects Fayet and Chamonix has been built by the Paris-Lyons-Mediterranean Railroad Company, one of the large trunk railroads of France, and connects at Fayet with a steam line of the Paris-Lyons-Mediterranean Railroad Company. There are no special features worthy of notice on the steam-operated part of the line as far as Fayet-St.-Gervais, but from this point the new electric railway offers a great number of interesting points which will be noticed hereafter.



GENERAL VIEW OF ELECTRIC TRAIN, STATION AT CHAMONIX AND MOUNT BLANC

The road is being extended from Chamonix on to Switzerland, and this work is now under construction by the Paris-Lyons-Mediterranean Company, but the present article will deal in detail with only that portion now open for traffic.

The traffic on the line is, of course, very irregular, consisting principally of tourists, and no traffic was expected during the winter months. The company was, in fact, authorized by its concession to suspend the service during the winter, that is, six months every year, and to charge the fares double those obtaining on the main trunk lines of the Paris-Lyons-Mediterranean system. It appears, however, that the results of the first year's working, that is, during 1902, have been so encouraging that the company expects to maintain the service throughout the year, except when heavy falls of snow actually prevent.

The length of line from Fayet to Chamonix is about 19 km or 12 miles, in which distance there are twelve stopping points. The maximum grade is one of 9 per cent for a distance of 2.155 km (about 1½ miles), the other of 8 per cent for a length of 1.386 km (about 0.85 miles). The remainder of the road presents no grades exceeding 2 per cent.

Experiments were first made with a mountain locomotive, which could be run with or without using the cogwheel, but this was replaced by a special system of train control, which is very similar to some of the American multiple unit systems. It was devised by Mr. Auvert, one of the engineers of the Paris-Lyons-Mediterranean Railroad, and has proved very satisfactory. The question could have been solved, of course, by the use of single motor cars instead of trains, but this was not considered practicable in this case for reason that the company wished to keep the rolling stock the same as that employed on the steam divisions of its system.

TRACK AND THIRD-RAIL SYSTEM

The track is laid with 35 kg (70 lbs.) T-rails in 39.36 ft. (12 m) lengths, and with a 1 m gage. A central rail is fixed between these rails on the steep inclines above referred to. The track rails are mounted on ties spaced as shown in Fig. 1, and are held to the ties by tie-plates with lag screws, except at certain portions of the heavy grades, where they are solidly anchored at intervals to prevent creeping. Fig. 2 shows clearly the systems of track construction as well as the central rail, above referred to, which has been installed on the heavy grades for emergency braking purposes. The rail is gripped by the brake fixed on the cars. It is of the ordinary track-rail section, and is fixed at a height of some 60 mm (2½ ins.) above the outer track rails, as shown. The ordinary angle-plates are used with this rail, and the anchoring chairs are fixed to heavy wooden supports, the latter being placed alternately, one each side of the track.

The third rail is also of the same section and type as the track rails. It is placed outside the track and is supported by paraffined wood insulators, which are mounted on the ties, as will be seen in Fig. 3. In the stations the third rail is carried between tracks for the convenience and safety of passengers. Moreover, wooden guards are used, very similar to those employed on the Paris-Orleans Railway, as described in a recent number. The top of the third rail is some 23 mm (15-16 in.)

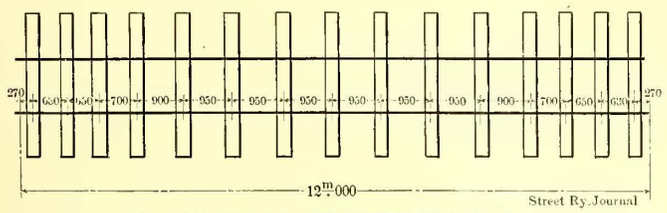


FIG. 1.—PLAN OF TRACK, SHOWING SPACING OF TIES

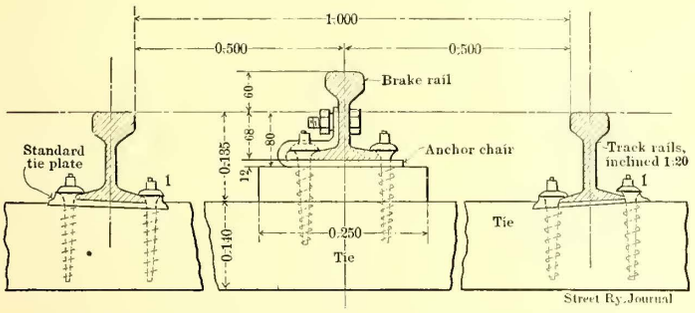


FIG. 2.—SECTION OF TRACK SHOWING BRAKE RAIL

higher than the track level, and is 108 cm (3 ft. 6 ins.) from the center of the track. For bonding the company has adopted the Brown plastic bond, which has given very satisfactory results. The resistance of the third rail has been found to be about 0.000049 ohms per meter length. The Paris-Lyons-Mediterranean Railway Company, however, now favors the use of special composition rails, already adopted by the Paris Metropolitan Railway Company for its recent work and which will be used on future work.

At crossings and elsewhere where the third rail is interrupted the ends are connected in the manner represented in Fig. 4. The bare copper wires joining the ends of the third rail at these

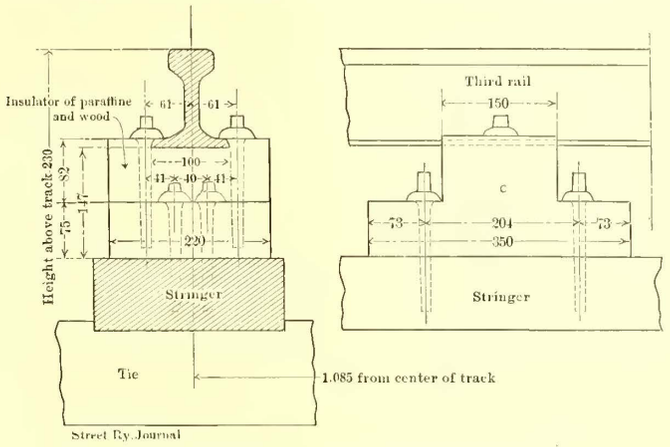


FIG. 3.—METHOD OF INSULATING THIRD RAIL

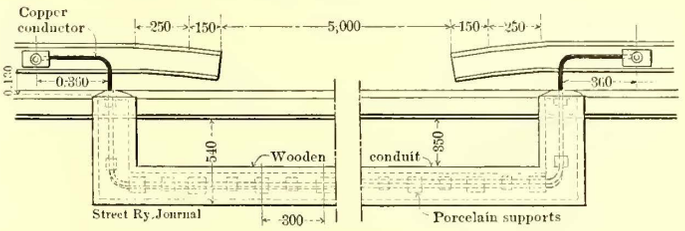
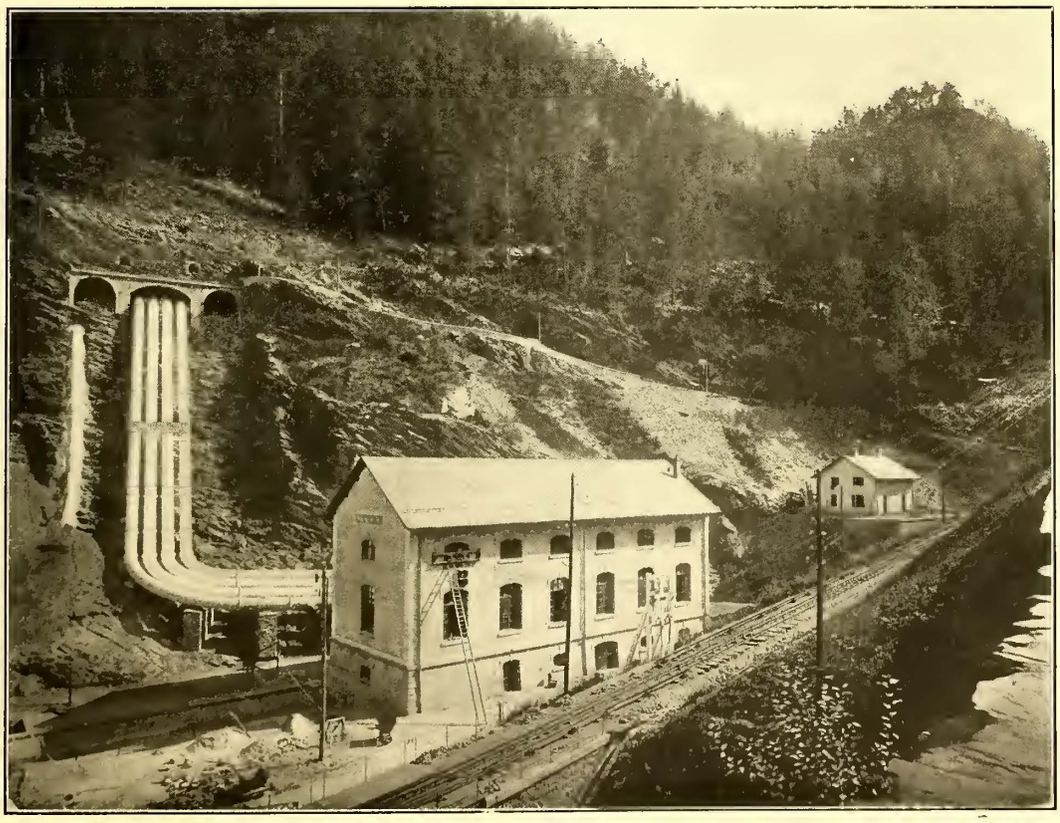


FIG. 4.—METHOD OF ELECTRICALLY CONNECTING THIRD RAIL AT CROSSINGS

places are simply laid in wooden troughs, which are filled with asphalt. The same wooden trenches are used for the connecting feeders of the third rail.

GENERATING STATIONS

There are two generating stations, situated respectively at Servoz and Chavants, as shown on the map, Fig. 5. Distribution is by direct current, but high-tension distribution with sub-stations will probably be used for feeding the extension of the line now under construction.



VIEW OF POWER STATION AND GRADE AT SERVOZ

Both stations are hydraulic and derive their power from the River Arve, the valley of which is followed by the line for some considerable distance. The water of the Arve River is turbid and muddy, and special care had to be taken on this account to pass the water through a special depositing chamber before admitting it to the turbines. These chambers are cleaned out from time to time.

The fall of water utilized by the Servoz station is afterwards employed by the electrochemical works at Chedde, for which purpose the fall was at first constructed by the Société des Forces Motrices de l'Arve. The total height of the fall is 178 m (584 ft.). The first 39 m (126 ft.) is used by the Servoz station of the Paris-Lyons-Mediterranean Company, while the remaining 139 m (458 ft.) is employed by the Chedde electrochemical works, as above stated. The normal

flow is 12 cu. m (423 cu. ft.) per second, while the minimum flow is 6 cu. m (212 cu. ft.) per second. The normal horsepower available for the Servoz station is 4560 on turbine blades, and the minimum power available on the turbine blades of the Servoz station is 2280 hp.

The low water season exactly coincides with the stoppage of the operation of the railway, so that there is no shortage of power, although now that the service is proposed for the whole year there may be trouble from this cause. The Chavants station, however, is well supplied with water and can make up the deficiency at Servoz.

PASSENGER STATION AT CHAMONIX

The waterfall supplying the Chavants station has been installed in its entirety by the Paris-Lyons-Mediterranean Company. The figures corresponding to those given for the Servoz station above are as follows: Height of fall, 94 m (288 ft.); maximum flow of water, 11½ cu. m (406 cu. ft.) in summer; minimum flow, 5 cu. m to 6 cu. m in winter.

The same system of hydraulic construction has been followed in both stations, and one description will serve for both. The dams were at first built with wooden beams, but they were carried away, and solid masonry dams have been substituted.

The depositing chambers rendered necessary by the muddy character of the water are 230 m (754 ft.) in length for the Servoz station, and are subterranean. They allow an output of 8 cu. m (282.4 cu. ft.) per second, and the speed of the water is reduced between the intake and the outlet to 0.47 m (1.54 ft.) per second. The sand and other matter in suspension are thus deposited. There are also by-passes, allowing the water to be diverted directly into the Arve when necessary to clean the depositing chambers.

The main turbines have no regulators and the voltage is kept constant by electric means only. The methods vary somewhat in the Servoz and Chavants stations. The reason of this is that the Servoz station feeds directly into the line, whereas the Chavants station supplies its current to the line through a feeder of considerable length, so that over-compounding is necessary. This fact makes the question of close regulation less important than in the case of direct feeding. In both stations the turbine constructors had the following limitations imposed upon them: The full-load speed was to be 450 r. p. m.; the no-load speed was specified not to exceed 600 r. p. m., a variation which will seem very low if one remembers that the ordinary turbines built for a normal speed of 450 r. p. m. have a no-load speed of 1000 r. p. m. to 1100 r. p. m. This variation of speed has been obtained by special construction of the blades in the revolving part of the turbine.

THE SERVOZ STATION

This station contains four main generating groups and two excitation groups. All are horizontally placed and the generators and turbines are direct coupled by means of a Raffard strap coupling. The ratings of the main generators are as follows: Normal output (continuous) 370 amps.; overload for one-half hour, 450 amps, with rise of temperature not exceeding 45 degs. C.; momentary overload without dangerous sparking 600 amps.

This latter figure is interesting, inasmuch as the machines have to take care of heavy overloads, no accumulator batteries being provided.

The four main generators are separately excited and are of 200 kw rating each with six poles and are connected to reaction centripetal turbines. The two auxiliary dynamos are of 40 kw, four poles each, and are connected to centrifugal turbines. They serve as exciters to the large machines and also fulfil the lighting service of the stations. The auxiliary turbines for the exciters are regulated by a special and very exact regulator, designed by the Société de Construction de Vevey. As this regulator is of a well-known type attention will be given to the main generator regulation, which, as above stated, is made by compounding, the turbines running at no-load speed of 615 r. p. m. and a full-load speed of 450 r. p. m.

STE. MARIE VIADUCT ON CHAMONIX ELECTRIC RAILWAY

The variations in speed and power are given in the following table:

Mechanical hp on turbine shaft	Speed in r. p. m.	Voltage at generator terminals	Load in amperes	Effective load in kw
0	615	550	0	0
62	595	577	72	42
107	575	578	124	72
162	550	578	188	109
214	522	568	252	143
260	500	558	312	175
308	470	542	380	206
342	478	522	440	230

The regulation, as will be seen from the tables, is very good and is obtained as follows:

The main generators have two field windings, one of which receives constant excitation from the auxiliary dynamos, and the second field winding is connected in series with the station, and is therefore excited by the current on the machines. Any increase in load naturally decreases the speed of the turbines, as per the first two columns in the table above. The increased load, however, increases the series excitation of the generator, and therefore compensates for the decrease in speed by raising the ampere turns of excitation. The variation in voltage is not considerable, as will be seen from the third column in the table.

The switchboard is of the panel type, the panels being distributed from left to right-hand side as follows: Generating panels, 1 and 2; line panel; generator panels, 3 and 4; exciter panels, 1 and 2. The measuring instruments are of Chauvin and Arnoux type, and Thomson-Houston circuit breakers are used, being set at 1750 amps.

CHAVANTS STATION

By reference to the profile map this will be seen to be situated near kilometer 9. This station feeds the line by means of a feeder running as far as kilometer 12, and over-compounding is therefore used. This over-compounding is made on the same principle as that at the Servoz station. A special device has been provided in order not to run the Chavants machines as motors when the load on the line is light. One possible danger which might result from over-compound is that the series field might be reversed at Servoz station and the constant excitation might be such as to result in a serious loss in current and even accident. An automatic apparatus has, therefore, been provided for braking the Chavants station under light load by resistance in series. This resistance is short circuited as soon as the load in the Chavants station exceeds 50 amps. The general arrangement of this device is shown in Fig. 7. It consists essentially of a motor M, the fields of which are in series with the line, and the armature of which is connected to a constant voltage through the lighting bus-bars. When the load passing through the fields of the motor is small it does not create a sufficient torque for running the motor. When it is high enough to overcome the resistance of the spring R the motor draws down the plunger A, which short circuits the resistance B by means of the bridge C. The resistance is made of a type PR Thomson-Houston resistance, carrying 70 amps., and having a resistance of 0.8 ohms.

The bus-bar voltage at the Chavants station is, therefore, in-

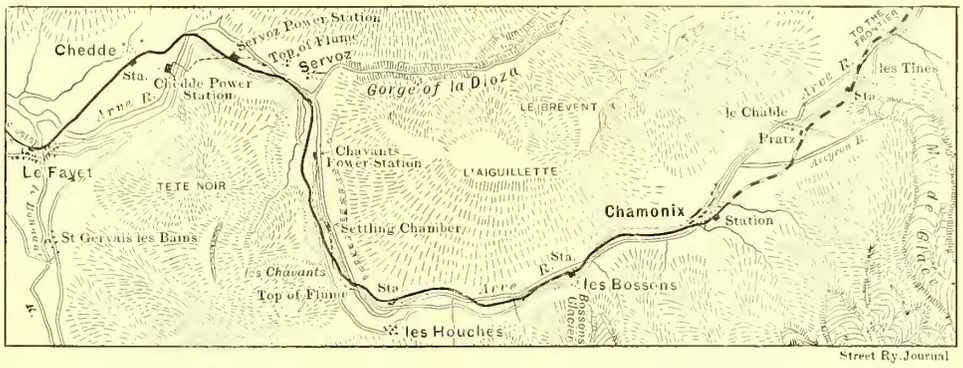


FIG. 5.—MAP SHOWING ROUTE OF CHAMONIX ELECTRIC RAILWAY

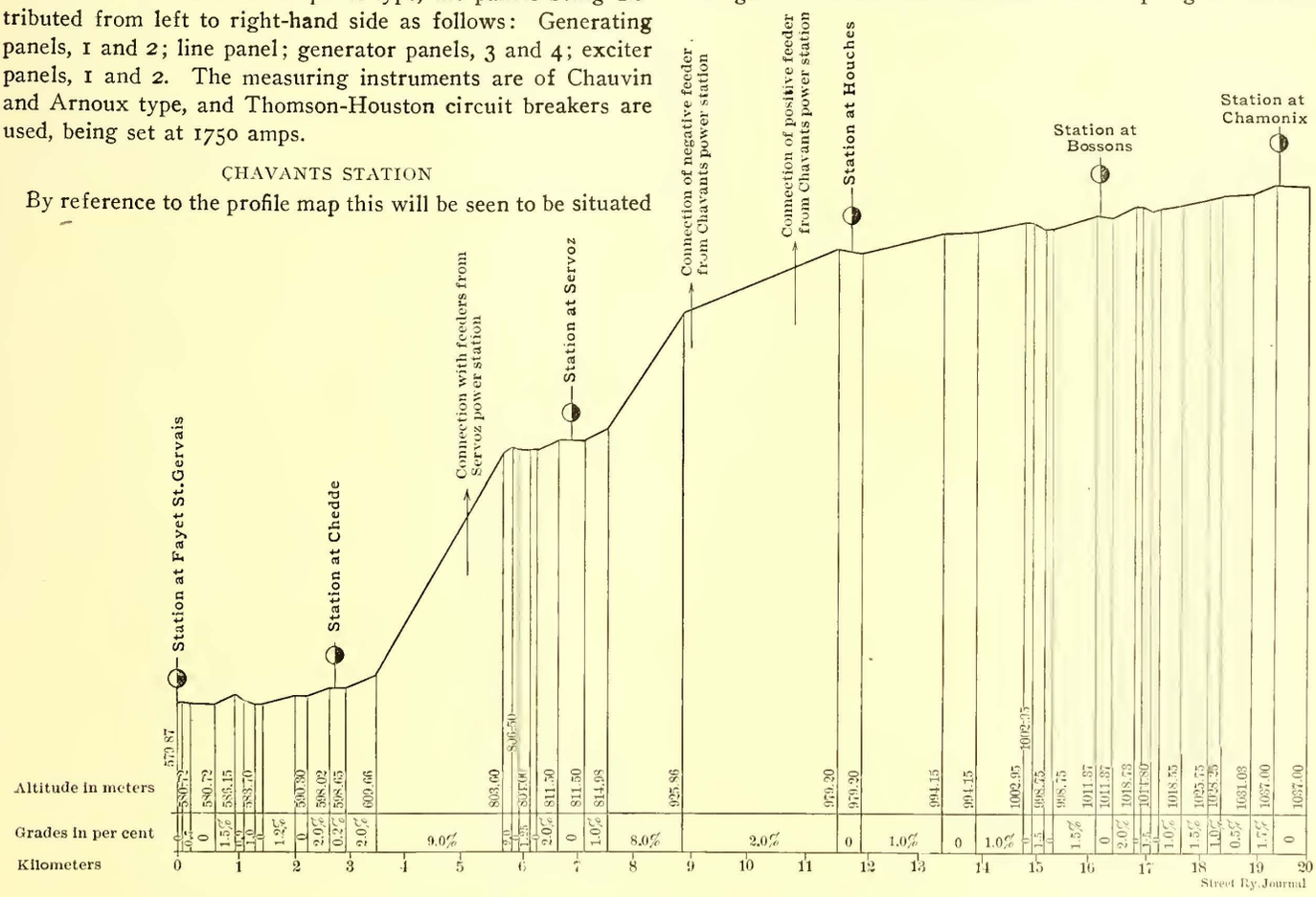


FIG. 6.—PROFILE OF CHAMONIX ELECTRIC RAILWAY

creased as follows: At no-load speed of 600 r. p. m. the no-load tension at the terminals of the generator is 550 volts. At the speed of 450 r. p. m., corresponding to full load of 290 amps., the terminal voltage is 680 volts. This increase in voltage is about exactly absorbed by the loss in the feeders on the positive and negative side.

HYDRAULIC POWER STATION AT SERVOZ

ROLLING STOCK

As was stated in the earlier part of the article the rack system was tried and discarded, and the locomotive used therewith was replaced by a multiple unit system of train control, designed by M. Auvert, engineer of the Paris-Lyons-Mediterranean Railway Company, and which has been in successful service for the past six months. It is not the purpose here to discuss the many interesting points involved in the pneumatic system of train control in operation on the line, which will form the subject of another article at a future date. A brief description will be given, however, of the trains, motors and rolling stock which present special features of interest.

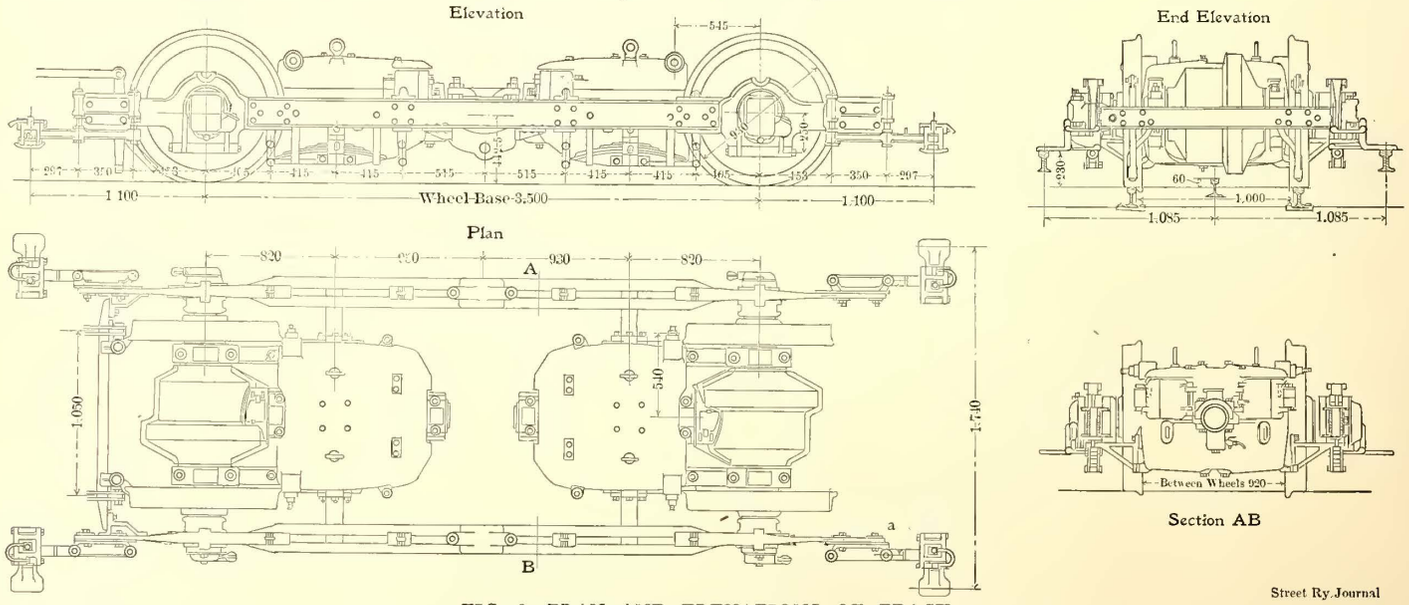


FIG. 8.—PLAN AND ELEVATIONS OF TRACK

The following table gives the schedule of regular trains in service, to which are added extra trains whenever needed.

From this table we see that at least two kinds of cars have been used, one for passenger traffic and the other for freight:

TIME TABLE OF TRAINS AND REGULAR SERVICE

April 1 to June 1.....	3	passenger	trains,	1	freight train each way.
June 1 to July 1.....	5	"	"	2 "	trains "
July 1 to July 15.....	8	"	"	2 "	" "
Sept. 15 to Nov. 1....	5	"	"	2 "	" "
Nov. 1 to Dec. 15....	3	"	"	1 goods "	"

The passenger cars are of two classes as on the Paris-Lyons-Mediterranean main line divisions, and the freight cars are of several types. Both passenger and freight cars are used as motor cars; a train always includes a large proportion of motor cars, in view of the high grades to be surmounted. For instance, a seven-car train is composed of five motor cars and two trail cars. Lighter trains are made of five motor cars and one trailer, four motor cars and one trailer, or three motor cars and one trailer. The motor cars weigh about 20 tons each.

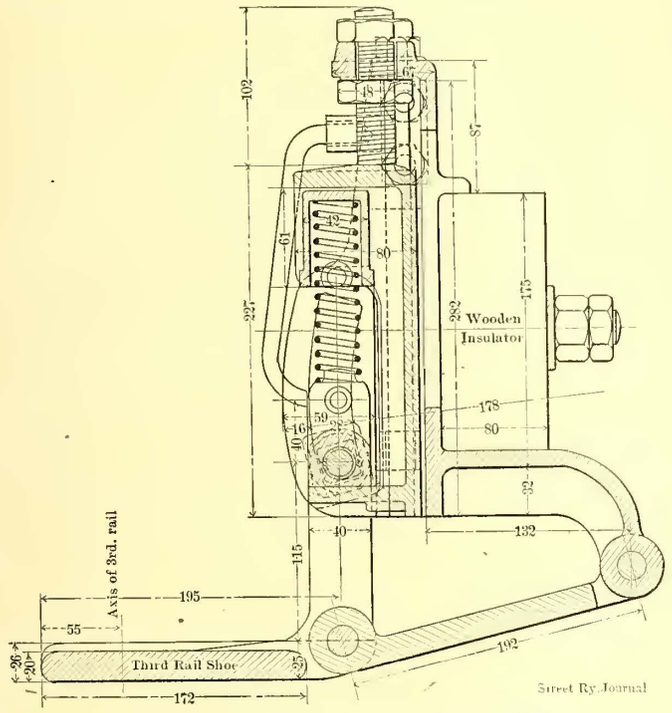


FIG. 11.—SECTION OF THIRD-RAIL SHOE

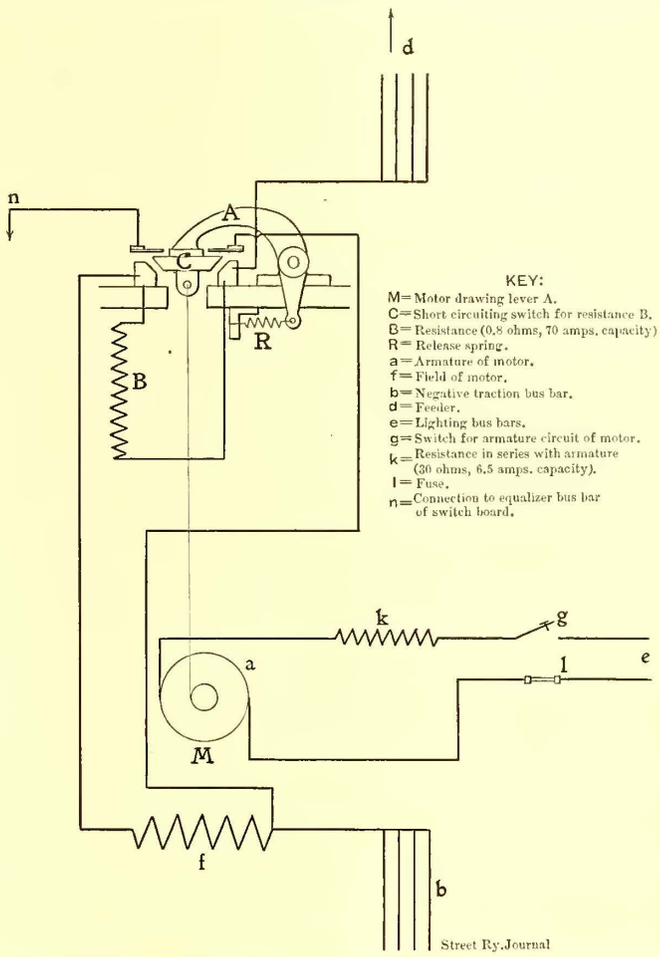


FIG. 7.—DIAGRAM OF REGULATING DEVICE AT POWER STATION

frames rest on the axle boxes without the interposition of springs. This disposition was adopted to avoid the difficulties which would have been experienced from the use of springs in this case. Their play would have changed the relative positions of the central brake and the rail on which it acts, as will be described, and which is a special feature of these cars.

The motors are mounted with their shafts parallel to the

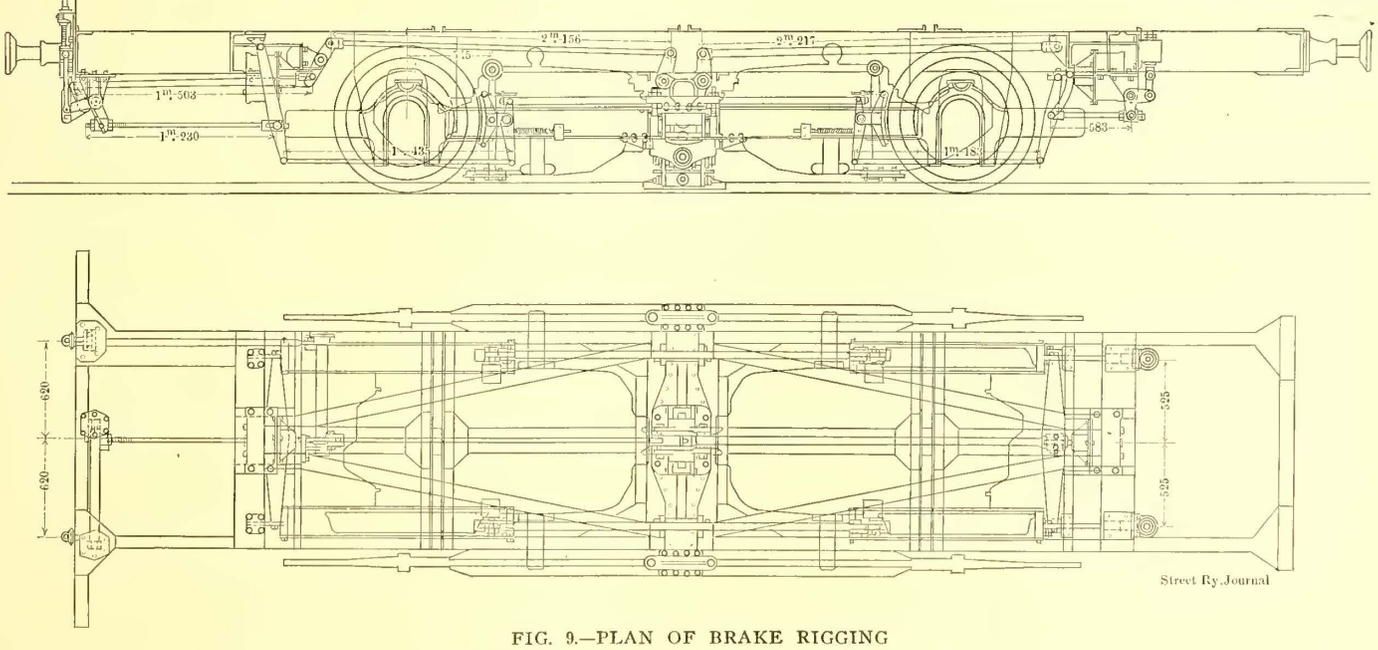


FIG. 9.—PLAN OF BRAKE RIGGING

All of the cars are mounted on two axles, and are equipped with two-series motors of 65 hp each. The assembly of the truck parts is not made according to the principles of ordinary track, and the end of the shaft opposite to the commutator carries a bevel pinion, which meshes with a bevel gear. The motor is suspended from each side by means of long, flat elliptical

springs, each system of springs supporting the motor on its own center of gravity.

A double system of brakes is used, as shown in Figs. 9 and 10. One system acts on the wheels, and is suspended from the motor frame. The other acts on the center rail and is suspended from a cross bar of the truck. The suspension of wheel brakes from the motor frames is intended to avoid the inconvenience to passengers of shocks by braking, as these shocks are thus reduced to a minimum.

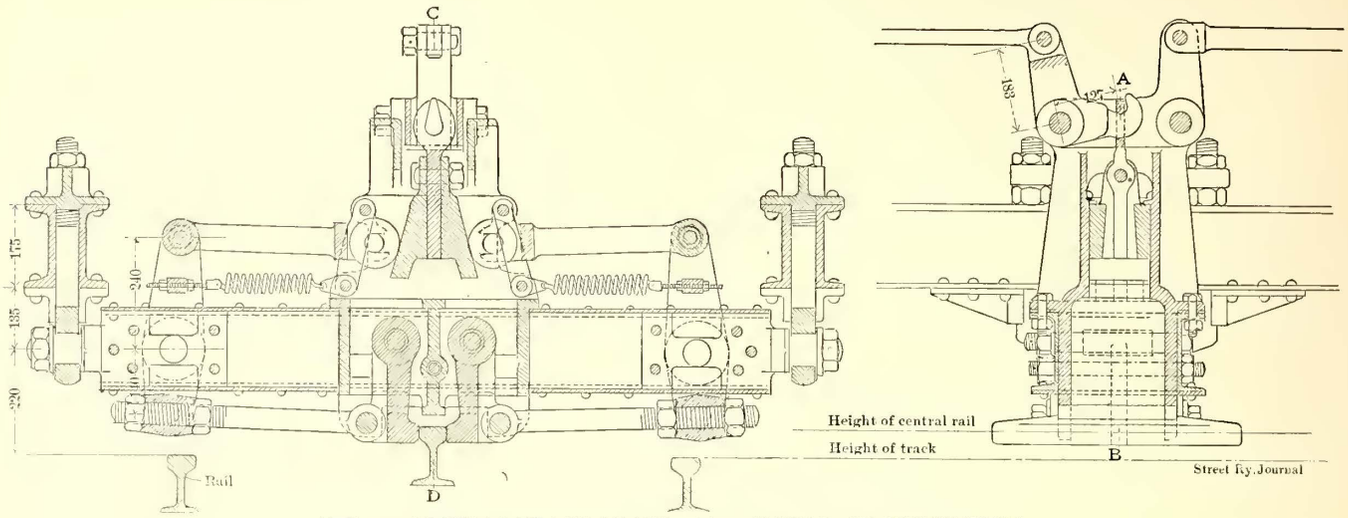
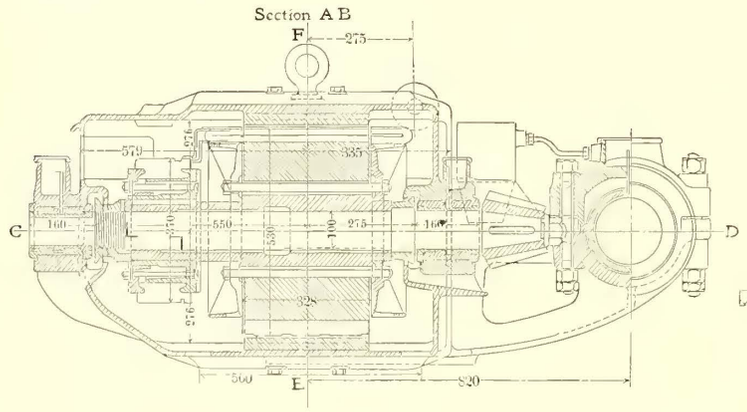
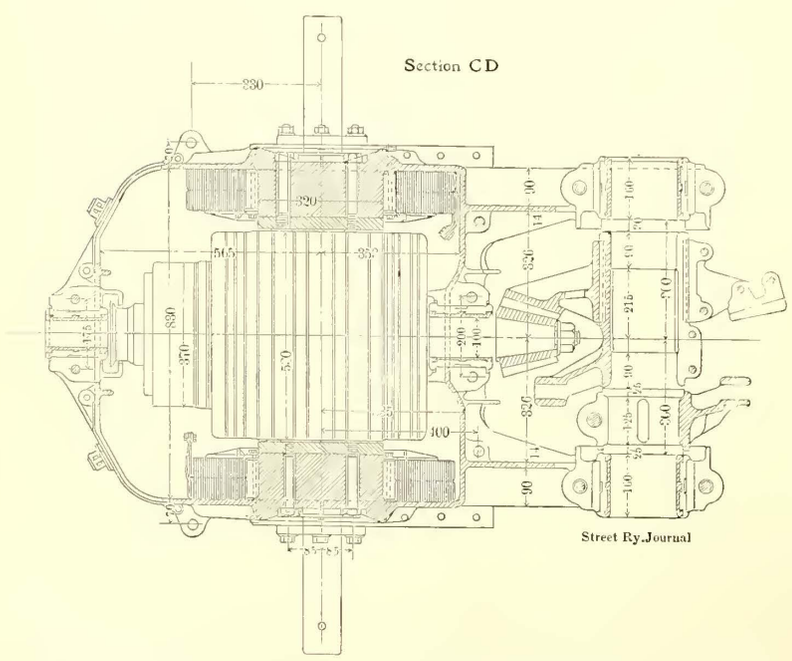


FIG. 10.—CENTRAL-TRACK BRAKE AND METHOD OF SUSPENSION





It must not be forgotten that the brake generally employed is the wheel brake, the central track brake being only used for emergencies.

The third-rail shoe is supported by means of a rather solid iron bar at the ends of the side-bars, as shown in Fig. 8. Its construction differs somewhat from the American third-rail shoe, as will be seen in further detail in Fig. 11. The frame of the shoe support is now carried by a wooden bar of a section of 80 mm x 175 mm (3 ins. x 7 ins.). This wooden beam is also used for electrically insulating the third-rail shoe, in addition to a "stabilite plate," which was formerly used alone. Stabilite is a material somewhat similar to vulcanized fibre but harder.

According to American practice the motors should have their

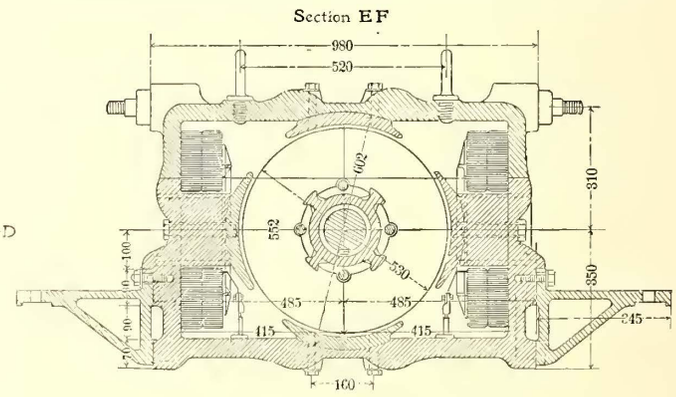


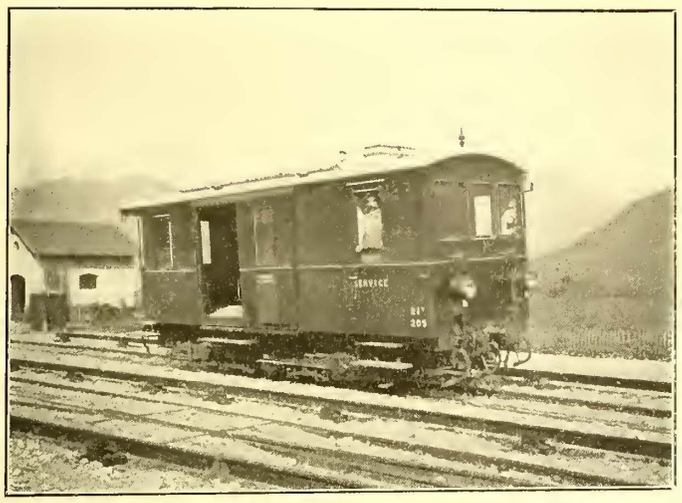
FIG. 12—SECTIONS OF MOTOR

shafts parallel to the axles of the truck, but some difficulties would have been experienced a few years ago in the construction of heavy motors of this kind for a gage of 1 m, especially with the elastic coupling, which is very much in favor in France; and as such a coupling takes a certain space on the available length of axle it increases the space necessary for motor suspension. The motor had, therefore, to be placed longitudinally.

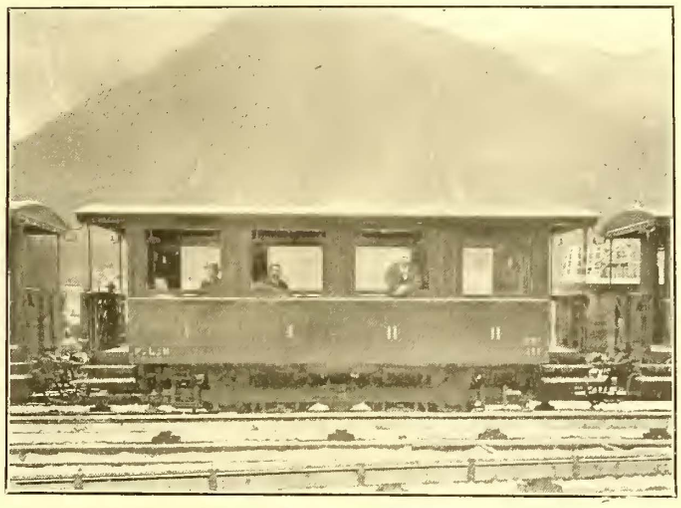
This arrangement is very clearly shown in Figs. 8 and 12, especially the latter. Referring to this figure we see that the end pinion on the motor armatures meshes with a large bevel gear, which transmits the rotation from the motor to the elastic coupling, the bevel gear, as shown, being keyed not to the shaft but onto the sleeve of the elastic coupling, represented in detail in Fig. 13. From inspection of these figures it will be seen that the power is transmitted from one sleeve to the other through springs which rest on the ends of pieces on the two sleeves. The pinion, gear and coupling are enveloped in a gear case filled with special lubricating material. Incidentally it may be stated that the grease usually employed in these cases has been discarded, as the centrifugal force threw it out of the gears along the sides of the gear case, so that good lubrication

was an impossibility. The material now used is called "mineral tallow." The gears used were cut in the shops of the Paris-Lyons-Mediterranean Railroad for the La Fayet Chamonix road, and are of cast-steel of a very hard constitution, the pinions being made of mild forged steel.

The oiling of journal boxes of the truck is accomplished by means of felt oilers and the motor axle bearings by means of a wick. The bearings themselves are of Babbitt bronze.



BAGGAGE MOTOR CAR



PASSENGER MOTOR CAR

Each of the two motors of the motor cars is rated 65 hp at 550 volts, with a temperature rise of 60 degs. C. over the air temperature. The overload rating is 200 amps. per motor during ten minutes without undue sparking. A speed of 275 r. p. m. is obtained with a gear ratio of 4:1. The motors are direct-current series motors, as per ordinary practice. They have four poles, and the non-laminated pole pieces are placed horizontally and vertically, the latter having no windings, the horizontal pole pieces having each two field coils. The outside appearance of the motors is similar to American construction, the electrical parts being protected by two shells, completely enclosing them, the joint being horizontal and secured by bolts. The lower shell of the motor carries the armature bearing and the lower part of the axle bearings. The commutator has 113 segments. The motors were supplied by the Alioth Company.

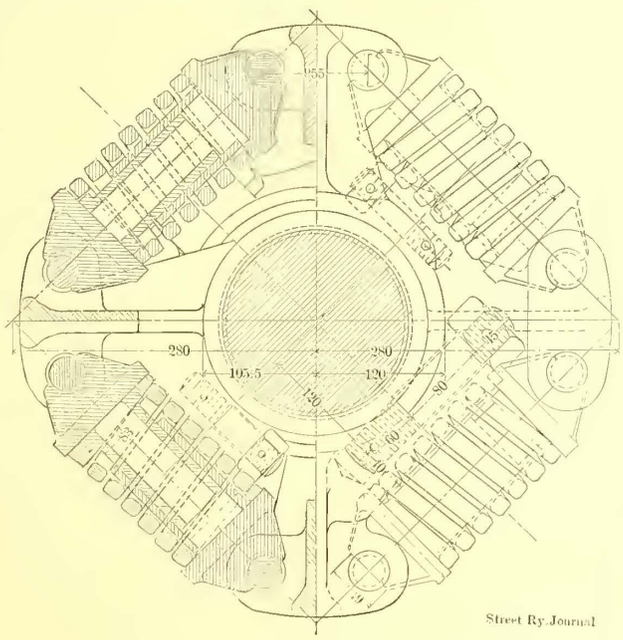
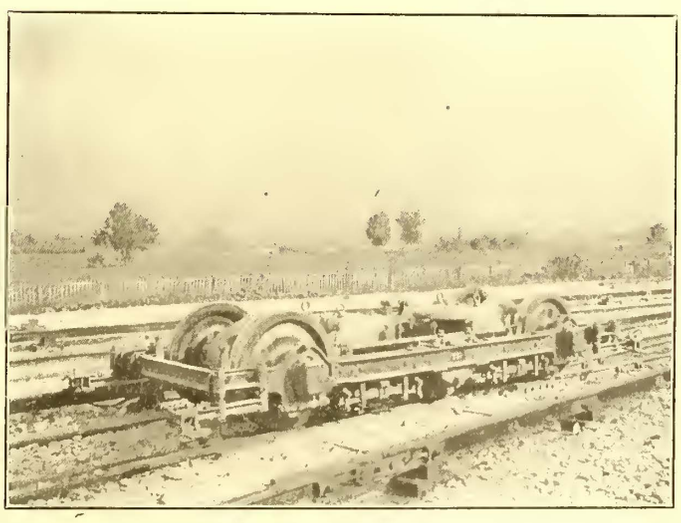


FIG. 13.—FLEXIBLE COUPLING USED BETWEEN MOTOR SLEEVE AND AXLE

Both motors of the same motor car are permanently in multiple, and this has been done for avoiding the possibility experienced with series coupling of motors of slipping. Five positions are employed on the controllers, which are operated, as before stated, by pneumatic means. Three positions use rheostatic control of the armature only, and in the last step the field coils are shunted. This plan was adopted by the Paris-Lyons-Mediterranean Railroad Company so as not to be limited to one running speed only. It has been found, however, that the use of the accelerated-service speed point is the one with no resistance in the armature circuit, and with shunted field is inadvisable in practice, and it is very seldom employed. The reversal of motors is obtained by simply reversing the armature in the ordinary way. The resistances used for control were first made with wire coils, but were replaced later by packed-card resistances, similar to the American types. These resistances are not used for braking, as in some mountain installations in Switzerland.

The Paris-Lyons-Mediterranean Railroad system of pneumatic control itself would offer a very interesting study, but it deserves to be treated in more detail than is possible in this article. Briefly, it consists of moving the several controllers by pneumatic impulses from a train pipe operated from the motorman's cab.

As in most installations of this character the brakes may be operated by compressed air or by hand. Each is independent. Compressed air is normally employed with the wheel brakes, and exceptionally with the central rail brake. The regulations provide that this brake is to be used only on down grades exceeding 8 per cent.



TRUCK OF MOTOR CAR

The cars are heated electrically by means of de Guise electric

heaters, which are somewhat similar to the American Gold heaters. The electric lamps are supplied with current at 330 volts. This tension is held fairly constant by resistances, which are regulated by means of a small motor arranged in a similar manner to the current checking device in the Chavants station, described above. Ten incandescent lamps of 16 c. p. each are used on each car. Each head motor car carries an electrically-driven compressor, which furnishes air for the train, for the brakes and also for the pneumatic control. It is of the Christensen type.

The accelerating current during maxium load amounts to about 180 amps. per car. The speeds secured are about 40 km (25 miles) per hour on the level and 12 km (7½ miles) on the grades.

Electrical appliances have been extensively used in the depots, shops, etc., including several 6-ton cranes, one 20-ton crane and several winches, all running under 550-volt circuit. There are also elevators running on the 110-volt lighting circuit, and a special electric crane of 20 tons spanning the tracks, both the normal and 1-m gage at the terminal station of La Fayet. This crane is used for transferring freight from the standard to the narrow-gage cars.

The station's lighting is arranged from the third-rail circuit of 550 volts.

The line has developed a traffic of about 120,000 passengers during the first year. The operation expenses, including repairs, amounted during the same time to about frs. 1.80 per car km (57 cents per car mile).

PROPOSED EXTENSIONS

The following plans of extension have been made and are now being carried out by the Paris-Lyons-Mediterranean Railroad Company, to whom this paper is indebted for the preceding and following information:

All arrangements have been made for extending the line as far as the Swiss frontier, a distance of some 20 km (13 miles). The first portion of this extension has already been commenced, i. e., as far as Argentiere, but the date of starting on the second portion will depend upon the rapidity with which the Swiss end of the line, which will terminate at Martigny, is built.

The same rolling stock will be utilized. The line will be third rail, 500 volts and of similar construction to that now in operation.

The Chavants station, which is of sufficient capacity to supply 12,000 hp, eventually will supply the total power required for the extension. Alternating current will be used at from 10,000 volts to 12,000 volts and 25 cycles. The generators will be of 1200 hp each.

Each transformer sub-station, of which there will be two, will be provided with two converter sets, each of which will suffice for the service, the other being installed as reserve. There will be a battery of 306 accumulators of 1200 amp.-hours at one-hour discharge rate. There will also be one automatic booster of special construction, somewhat similar to the Pirani booster. It will have a separate shunt excitation and two opposite series excitations, one fed by the current direct from the machine, the other by the current furnished to the line.

The arrangement of the turbines will differ a deal from those now installed because they are to generate alternating current at constant frequency. They will be furnished with a regulator, the type of which is not yet determined.

As regards the Swiss extension the Swiss company is now in formation, with a capital of 10,000,000 francs.

St. Thomas, Ont., which recently took over the local street railway property, is now booming the road by having canvassers sell special tickets, offering inducements in the way of reduced fares. The plan is to educate the people to the use of the cars.

FREIGHT AND EXPRESS ON ELECTRIC RAILWAYS—I.

BY H. S. COOPER

While electric railways were actually "street" railways and all their business was purely a passenger one, it was possible for each one to be a law unto itself without special inconvenience or injury to itself or to others. Even when they strayed beyond the corporate limits of their own towns or cities and became suburbans the same course could be continued with like absence of evil results. But when they went farther afield and grew into interurbans—electric paths between cities—they found, even in their then single business of carrying passengers, cases without electric carriage precedent and conditions utterly unprovided for. In such cases the wise managers took a stealthy peep at the methods of their elder brothers, the nearest steam railroads, borrowed some of their ideas, fitted them to their own conditions and all went well.

Presently some of the suburban and interurban passengers wanted to take something or other with them on the car, something too bulky or too heavy to "carry on the lap," so it was dumped on one or the other of the platforms and an extra fare or two charged for it and rung up on the fare register. Presently also, the local storekeepers found the cars handy things by which to send out packages and bundles to their customers directly on the line of the road, and these customers found it equally as handy to send back butter and milk and eggs to the storekeepers and their friends and customers in town. By this time the platforms were getting too full of "truck" for comfort or safety, so a small portion of the car was partitioned off as an express and smoking compartment, and the smokers sat around on the egg crates and milk cans. The conductor, having no other pressing duties to perform, was made receiving and shipping clerk, freight and express agent, and was also expected to perform the duties of rate and claim agent and to act as gager and weighmaster, himself being the scales. The charges for the service still followed the extra fare principle, were 5 cents or multiples of it, and were rung up on the fare register, some roads providing a special one for this purpose.

But soon the business increased by leaps and bounds, and it was found that the little express compartment—with Pooh-Bah to run it—and the system of extra fares, were all too inadequate for the business, so special cars, devoted entirely to express and freight, were started out, and a special rate sheet of charges was promulgated, whereby the cost of sending pumpkins, eggs, apple-sass, groceries, etc., to and from town was fully itemized and explained. In getting out this rate sheet the manager studied a "standard classification" and a "local distance tariff" which he had borrowed from a friend who worked in the local steam railroad freight depot, but it was considerable of a puzzle. The abbreviations were Greek and the figures, in their little square compartments, confused him, so he figured out a rate on each one of the local products, basing it on the old extra fare principle, and let it go at that. It was true that it was arbitrary and inconsequent to a degree, and Tom, Dick and Harry came in and kicked until it was changed to suit their shipments and their ideas, but all the time the business increased, as did the profits, and the roads multiplied and extended.

But now, when these electric roads extend over States, when they begin to link cities together like beads on a string, when they meet and cross and join and interchange traffic, when they parallel and compete with steam roads in their own special territory, then it behooves them to pause and consider the subject of freight and express rates and classification, and once more turn to the steam roads and old express companies for ideas. Not that there are as yet many electric roads that are of size or have business enough to warrant the adoption of full steam railroad freight and express practice, but, as all electric railways have

learned, there are many principles in steam railroad practice that have been evolved from long and dear-bought experience, and it is a wise manager who profits from the experience of others.

Moreover, with the present extending of electric railways on their own account, and with their junction with others, it will be only a short time before nearly every interurban road will have to interchange traffic with other electric roads or with steam-railroads. In the latter case they will find that this can only be done in the manner and on the terms of the present intertraffic arrangement of the steam railroads themselves. In the former case, while it may not be necessary or wise to use the same steam road arrangement, it will be both wise and necessary to have some standard traffic agreement and rates for general use between connecting electric roads, similar in effect to that used between steam roads. While it may be possible for the electric roads for a long time to keep their own rates separate and distinct from those of the steam roads with which they interchange, it is certain that, in the end, both will be forced to unite on a common classification and tariff. "It is not wise to cross a bridge until you come to it" is a true saying, but if there is a stream to be crossed it is wise to be certain of the means of crossing it when it is reached, and in the case of traffic interchange, classification and tariffs it will be wise to look a long way ahead, and as fast as possible adjust them with an eye to the future as well as the present. Of course, for traffic originating and ending entirely within its own territory and free from the competition of common carriers, an electric road may continue for a time to be a law unto itself in the matter of rates, for in such cases local conditions will govern until a standard basis is established as is done in similar steam road territory; the only caution to be observed is to take negative example from the steam roads and not kill the goose that lays the golden egg.

Except in very rare cases it will be unwise for the electric roads to cut the steam road or express company rates between competing points, as the infinitely quicker and more frequent and regular service of the electric roads will, of itself, turn the short-haul freight business towards them. In addition to this advantage lies the farther one that, in nearly all towns and cities the electric line and its stations or depots are more accessible than those of the steam roads, which, from the nature of their freight cars and locomotives and the room they occupy, etc., are compelled to locate their freight yards and stations at points where land is cheap or their business is unobjectionable, and these locations are often inconvenient or distant from the business centers. In the country districts, also, the depots of the electric roads, or, at any rate, the loading places or spurs or sidings, can be, and generally are, much more frequent and closer together than is possible on the steam road. This is, in the beginning of the electric freight business, an important point to shippers and receivers of broken bulk or package freight, especially when such freight is perishable or semi-perishable, or when it is a rush order. Even where the electric road is compelled to use a freight or express depot of its own within a city or town its cars are so unobtrusive as compared with the locomotives and cars of the steam road that it can, without local opposition, generally maintain such a depot at a much more central and convenient point for shippers than can the steam road. This point of immediate accessibility, when coupled with prompt and quick carriage, will always give an advantage to the electric roads that will bring them the short-haul freight even at the same rates as the steam road. This is an advantage that will not only always adhere to the electric road but it is one that will grow greater in proportion as their business increases. In the first place the inflexibility of the long steam road freights, their necessarily irregular and comparatively infrequent service, is a natural handicap that they cannot remove as long as they remain steam roads.. In the next place this condition will also increase with them, as it will follow the same lines as the passenger business has, i. e., the electric roads will get the short-haul, broken bulk and package freight, and the steam roads will turn their entire attention, energies and service to the longer-haul and car-load business.

At the same time the local express and parcel business will naturally gravitate towards the electric roads for the same reasons as the short-haul freight. The local business of the old-line express companies is absolutely dependent on the often very irregular and infrequent passenger trains, and here again the regularity and frequency of the electric service cuts the ground from under their feet. Not only does it do so during normal times, but at rush periods, such as the Christmas holidays, the frequent service of the electric roads enable them to keep the goods in transit and delivery, while the regular express companies are snowed under with offices full of congested and delayed goods.

That this point is fully appreciated by the existing express companies is shown by the fact that they have, in several instances, made arrangements with electric roads by which they handle all the express and parcel business on these roads, and it is further shown by the fact that overtures have been made on the same lines to several other roads which are now operating their own express lines, and if final proofs are desired they are furnished by the fact that propositions have been made to both uncompleted and projected electric roads looking to the operating of their express business by some of the established express companies.

Whether such an arrangement, if general, would be a satisfactory or remunerative one to both parties would be hard to predict until greater and longer experience is had of the arrangement. The fewness of the roads so operating their express business, and the short time during which it has been done, prevent any generally reliable results from having been arrived at. As a whole, the roads so operating appear to be pleased with the arrangement; they state that it gives them a known fixed or certain return with a fair profit in it, that it eliminates a great many chances for risk and loss and damages, and that it greatly lessens their accounting—already becoming somewhat of a burden. On the other hand, under some of the agreements, the roads are actually losing a very large part of a profitable income and are putting themselves in a position where it will be difficult for them to recover it without intervening loss. Where the electric road is a short-cut or a connecting road between two cities or two steam roads, and where the through business is the preponderating one, it is probable that an equitable arrangement by which an independent express company operates the express business would be mutually profitable. But that it is a wise movement generally to tie up its local express business with one of the large express companies, and especially to do so for any term of years, is somewhat to be doubted, and it would be wisdom on the part of any electric road management that considers making such an arrangement to view the matter carefully, and, if it is to be tried, to do so tentatively.

This is all the more true where the electric road proposed to retain and operate the freight business. The dividing line between freight and express is sometimes dim even on steam roads, and has been, and still is somewhat, a source of dispute between the steam roads and their carrying express companies.

In the case of the electric roads this line is still more hazy, and several roads have had, in self-defense, to make an arbitrary distinction of weight, bulk or character of goods in order to preserve the difference between the two departments. With one car or set of cars handling both classes of goods, delivering each without change or rehandling, in approximately the same time between termini or destination, and with little apparent difference in cost of handling, it has seemed strange to many express customers that they should pay from two to ten times the rate that freight customers were paying for similar goods

and almost identical service, excepting, perhaps, delivery. This condition has been aggravated by the practice of many of the electric roads in counting nearly everything that was not in car-load lots as express, and putting a special rate on it. The express charge sheet of one electric road contains such items as buggies, two-horse surrey, square and grand pianos, cook stoves and ranges; that of another has cement, lime, etc., in barrels, crockery in crates, calves, pigs or lambs, boxed or crated; in fact anything in compact form, boxed, barreled, bagged, crated, baled, banded or roped seems to be acceptable as express or parcels to some electric roads, and the wonder is, where does freight come in.

Now there is little doubt that on purely local business an electric road can handle much heavier and bulkier goods than is ordinarily carried by the regular express companies, and can do such business profitably at a rate that the express companies cannot approach. But these facts are no reason for their actually doing so. Any unnecessarily low rate of service is always a boomerang, both to the parties who do it and to any and all others in the same line of business. The dear public being only a collection of individuals is as little grateful for charity as any single person, and unnecessarily low rates of service are a gratuity that will always cause ingratitude.

Express matter can be roughly divided into five classes:

1. Packages so small as to need individual attention in transit.

2. Goods so fragile as to necessitate much more careful handling in transportation than is given in freight service.

3. Matter so perishable as to need quick transportation, full protection or personal care and attention while in transit.

4. Goods so intrinsically valuable as to need special watchfulness and care until delivery.

5. Goods so greatly needed as to require the very quickest possible transportation and delivery.

For such extra care, responsibility and speed of delivery the carrier demands and the shipper expects to pay a much higher rate than is asked for the slower and less careful transportation of freight, and while many electric roads can and do transport their freight almost as rapidly and carefully as they do their so-called express matter, it is unwise, for that reason, to dump into the express list everything that comes to them.

A further matter that has hitherto differentiated express from freight has been the doorstep collection and delivery of the former by the carrier for the ostensible carriage rate, but even this distinction has lately been wiped out in some recent cases, as a few electric roads now deliver all freight within a certain distance for the same or less rates than are charged by the competing steam road for transportation only. In some other cases a small additional percentage, up to 10 per cent, is added for "wagon delivery," the shipper having to deliver the goods to the car or station of the electric road.

Taking all the foregoing facts into consideration it would seem to be a good thing for a good many of the electric roads to take a little time for considering this matter of express and freight classification and tariff before they get into such a general state of confusion that it will take drastic methods to bring them out of it and standardize them. "Make haste slowly" is a wise maxim in things that are intended to endure, and "experience is a wise teacher" is another one, and the moral thereof is, that in this part of their business the electric roads, at any rate those that either do or will compete with the steam roads or express companies, can afford to copy their practice until they are able to inaugurate a universal standard of their own.

Quite a number of electric roads have done this absolutely, and as many more have based and moulded their classification and rates approximately on those of their competing steam road and express company, and the reports from these roads, and personal observation of the results attained, all show that this is a wise way to begin. It gives an immediate and ready-made system which can be modified with ease at any time, a system that is understood by all shippers. It antagonizes the competitors the least and gives them no ground for attempted opposition and reprisals, it furnishes no bad precedent of slaughtered rates, it gives a standard for mutual comparison, it enables and facilitates interchange of traffic, and finally, from all reports received and observations made, it gets the cream of the business and pays a fair profit, if properly managed and handled.

Should the adoption of such classification and rates prove wrong in certain cases, and it will be only in a few cases among electric roads which compete with steam roads, it will be found to be, at least, as easy to change from as from an arbitrary rate sheet, and in most cases it will be easier, as in nearly every case the change will be a decrease in rates or a change in classification that will generally amount to the same thing. It is always easy either actually or apparently to lower rates or cheapen a service, but almost every one has had experience of the uneasiness of raising fares or rates, and from all appearances some electric roads are laying the foundations for such an experience by ignoring the experience of their older brothers and slaughtering rates.

Besides the natural advantages of frequent and regular service and quick transit and delivery there is, in nearly every case, another advantage with which electric roads start, and it is an advantage that entails some risk unless it is used with good judgment. This is the feeling—call it animosity, prejudice or what you will—that is generally held against the steam railroads and express companies and which manifests itself instantly on the commencement of operation of a rivaling electric road by a transference of all possible patronage to it even at equal or slightly greater cost or at less personal convenience of the shippers. It is seldom that an electric freight and express service is not welcomed, and while it is both wrong policy, bad business and poor taste for the electric road in any way to encourage or increase the feeling of antagonism against its competitor, it is both good business and good policy to retain and increase the good feeling manifested towards itself, and there is no surer way of doing this than by avoiding the conduct which created the antagonism that is so general against steam roads. To any one who has had to stand the insolence of office of the ordinary minor employees of steam roads; who has had to endure the stand-and-deliver practice of the ordinary freight and express service; who has had goods delayed, lost, injured or ruined without reparation except at the will and within the good time of the offending party; who has had to endure the exactions, discriminations and the arbitrary and one-sided rules and regulations of the generality of the steam roads and express companies—to such a one the advent of a competitor not controllable by them is most gladly welcomed, and that welcome can be made permanent if any sort of tact or management is manifested by the electric road. The advent in a community of a common carrier that will not only give better service, but will also give better treatment, is always hailed with a welcome which is an immense initial advantage to the newcomer, and one that is worth conserving at considerable trouble and even at some decrease of possible profit.

Both of these points seem to be forgotten or neglected by some of the electric roads, especially by some of the newer ones. Appeals are made to the prejudice of shippers, rates are unnecessarily cut with this end in view, and uncalled for concessions are made at the beginning that cannot be continued without loss of profit and of which the necessitated final abridgement or abrogation will lose customers and traffic and leave hard feelings. At the same time a few electric roads, and it is pleasant to state that it is only a few, have adopted with their classification and rates some steam road manners and methods, and are perhaps unconsciously placing themselves in the steam road category, to their own manifest disadvantage. Such a tendency should be repressed as soon as it becomes apparent.

THE PASSENGER TRAFFIC PROBLEM OF GREATER NEW YORK—III, BROOKLYN

BY W. W. WHEATLY

In their transportation characteristics the Boroughs of Brooklyn and Queens are quite different from Manhattan. In the admirable and comprehensive report on the engineering and operating features of the Chicago transportation problem recently submitted to the Chicago City Council, Bion J. Arnold, in the chapter devoted to a general discussion of street railway systems and the conditions governing them, said:

Nearly all the large cities of the United States are laid out and developed on one of three distinctive plans, each plan requiring a different general system of transportation routes to serve its population.

First—The peninsula plan, with water-front on both sides, such as that of New York City and San Francisco.

Second—The valley plan, with a river running through the center, population and business districts on both sides of the river, such as Pittsburg.

Third—The radiating plan, with territory on one side of the water front, such as St. Louis, Boston, Brooklyn and many other cities. To the third plan Chicago belongs.

The peninsula and valley plans usually call for comparatively small street railway track mileage, and great traffic density is found on that mileage, together with large gross earnings per capita served per mile of track and per car mile.

The radiating plan means greater street railway mileage for the population served, with much smaller gross receipts per capita. It can be easily seen how different is the problem in a peninsula and valley city from that of a radiating city. In the former there may be a few long through lines with heavy traffic with many short crosstown feeder lines. In a radiating city, on the contrary, there is a large number of through trunk lines of great length and many crosstown lines, increasing in length as they are farther removed from the point of radiation.

Population and population density have an enormous influence on street railway earnings and profits. A knowledge of these differences in city plans and their bearings on the earnings of transportation companies is absolutely essential to the proper understanding of the theory of conducting transportation. As is the case in all cities laid out on the radiating plan, Chicago has a common point where all lines of traffic concentrate and which is the objective point of its population, commonly designated as its business center.

This description of the distinctive transportation features of cities like Brooklyn, which are laid out on the radiating plan, fits so accurately the problem under discussion that it is worth giving in Mr. Arnold's own language. The transportation system of Brooklyn, as it exists to-day, is not a growth based upon a general plan carefully conceived and carried out. It has been a haphazard growth participated in by many corporations working independently of one another for a great many years, with practically all of their heavy traffic lines pointed toward the East River. In addition to belonging to cities of the radiating class Brooklyn's transportation system has another distinctive feature. It has grown into somewhat of a fan-like shape, with its long, main lines trending toward and converging at a few strategic points along its water front, where the business districts are located or where there are outlets by bridge or ferries to Manhattan. Like other cities Brooklyn has its chief problem and its subsidiary problems. Its chief transportation problem is not merely to move its population to its own business district, but to move a considerable proportion of the population through its own business district and across the East River to Manhattan. If the movement to Manhattan could be accomplished without passing through the streets in the business districts of Brooklyn, already congested with the local Brooklyn traffic, the chief difficulty, so far as it relates to Brooklyn, would be removed. The subsidiary problems relate almost entirely to the unfortunate condition which brings the long and the short-haul traffic together at congested points and retards the movement of both.

A not uncommon feature of the traffic movement of many cities of the radiating class, but which is more marked in Brooklyn than in any other large city in this country, is the remarkable concentration in the rush hours when the people are going to and returning from business, and the equally light traffic movement during the intermediate daylight hours and after 7 p. m. Brooklyn is rightly known as a large manufacturing city and the majority of its manufacturing plants are located on or near to its water front along the East River and the lower bay. Its shore front is a bee-hive of industry. Its shopping, office and financial center is also located in close proximity to the East River. All of these workers, and in addition those who go to Manhattan, seek the routes leading to the same district about the same hour every morning, and return homeward about the same hour every evening. After all of these workers have reached their places of business in the morning there is no considerable floating or visiting population, as in Manhattan or other large cities, to furnish a respectable mid-day or evening traffic. It is a circumstance worthy of mention that the mid-day traffic consists largely of Brooklyn women going shopping or visiting. A bright day and an attractive display on the bargain counters will bring them out in full force, but a disagreeable day and no attractive bargains will keep them at home. Manhattan being the objective point to which the floating or transient population is attracted, Brooklyn on account of its proximity to Manhattan is completely overshadowed, and is singularly lacking for a city of its size and importance in those elements which contribute to a steady all-day traffic.

Except in the summer season when the beaches and shore resorts along the Sound and the Atlantic Ocean attract large crowds, the traffic after 7 p. m. is exceedingly light. In addition to being known as the dormitory for Manhattan Brooklyn is also distinguished as the city of churches and the city of homes. It may also be said to be the city of cemeteries, for it has all but one or two of the pretentious burying grounds of Greater New York. These several distinguishing features are mentioned because they assist in explaining the peculiarities of its traffic. Its people are known as a home-loving people, and at the close of the day's work prefer the sanctity and quiet of their own homes to the less agreeable recreation of traveling and swelling the receipts of the transportation companies. There are traditions in certain quarters that wicked Manhattan never sleeps or rests, and, therefore, its traffic is continuous, but not so with Brooklyn.

It is not necessary to dwell upon the transportation problem of Long Island City and the Borough of Queens. The traffic has not yet reached that magnitude which makes its problem complicated or difficult. The problem here is to provide for the future rather than for the present. The traffic partakes of the same general character as in all cities of the radiating class. Figures were given in the issue of Jan. 10, 1903, showing the passengers carried on the lines in Brooklyn and Queens, and may be referred to in connection with this article.

In May, 1883, the Brooklyn Bridge was completed and opened to traffic. Since that time not another avenue of direct communication with Manhattan has been opened. All the ferry routes which now cross the East River (with the exception of one) existed twenty years ago. In Feb. 1898, after fighting many years for the privilege, the railroad companies were permitted to send the surface trolley cars across the bridge. The elevated lines commenced the free transfer of passengers to the local bridge cars in June of the same year. The simple statement of these facts when placed alongside the figures showing the growth within twenty years of Brooklyn and its suburbs is convincing testimony that the transportation facilities between Brooklyn and Manhattan have practically stood still, while the population and the passenger traffic outstripped them. Table No. XI shows the population by de-

cades of the counties of Kings, Queens and Nassau from 1860 to 1900 inclusive:

TABLE NO. XI.

Population Kings, Queens and Nassau Counties—

	1860	1870	1880	1890	1900
Kings.	279,122	419,921	599,495	838,547	1,166.582
Queens.	57,391	73,803	90,574	128,059	152,999
*Nassau. ...	.....	.....	.....	.....	55,448
Total.	336,513	493,724	690,069	966,606	1,375,029

* Nassau organized from part of Queens in 1899.

It will be noted that within twenty years the population of Kings County increased 94 per cent, and that of Queens (with Nassau added for comparison) increased 130 per cent. This tremendous growth did not seem to impress the municipal and State authorities as calling for any action on their part to increase the facility of communication with Manhattan until a few years ago. To their lack of foresight and enterprise may fairly be attributed the present congested condition of passenger travel.

The number of operating companies and the mileage of lines owned and leased in the Boroughs of Brooklyn and Queens is as follows:

Brooklyn—	Track Mileage
Brooklyn Heights R. R. Co. (surface lines)	454 miles
Brooklyn Heights R. R. Co. (elevated lines)	68 "
Coney Island & Brooklyn R. R. Co. (surface lines)	47 "
Van Brunt St. & Erie Basin R. R. Co. (surface lines)	3 "
Total.	572 miles

Queens—	Track mileage
New York & Queens Co. Ry. Co. / New York & North Shore Ry. Co.	102 miles

When the fact is understood that the chief transportation problem of Brooklyn relates to the question of carrying the population to and from Manhattan without coming into contact with the local Brooklyn traffic it is not difficult to determine the cause of the present conditions. There are two principal reasons why the transportation companies of Brooklyn have been unable of their own accord to furnish relief from the present congested conditions of travel:

First. The converging of the several long lines of heavy traffic into a few narrow lanes leading to the bridge and the ferries, and the failure of the city authorities to provide more and wider avenues of approach.

Second. The physical limitations of the present bridge and its Manhattan terminus and the steady refusal of the people to make greater use of the ferries.

It became apparent long ago to the citizens of Brooklyn, who had the time and inclination to acquaint themselves with the governing conditions, that no considerable amount of relief could be expected until there was a radical improvement in the means of communication with Manhattan. Under the wise leadership of President Greatsinger, who immediately after coming to Brooklyn discovered the root of the trouble, the transportation companies have been pressing the municipal authorities for an immediate amelioration of the situation by the adoption of well-considered plans for which the transportation companies proposed to pay. All of these plans related in one way or another to increasing the carrying capacity of the present bridge and affording immediate temporary relief. The plan known as the Martin plan for expanding the Manhattan terminals, and connecting the present bridge with the new bridges under construction, failed to receive the approval of the municipal authorities, although it had already been approved by the board of expert engineers appointed by the city and by the chief engineer of the bridge department, by the engineers of the transportation companies, and had been accepted by the management of the railroads. In his recent annual message to the Board of Aldermen the Mayor, Mr. Low, said: "Two plans have been suggested for the purpose, both of which have some merit, but neither of which is free from serious objection. A third plan is now under consideration which may solve the problem better than either of the others. The choice between these three plans must be made at an early date." It is quite clear that the delay rests with the municipal authorities and that the railroads are simply awaiting their convenience.

The construction of four additional loops for the surface lines at the Manhattan terminal will not increase the carrying capacity of the bridge, although it will assist in scattering the concentration of people in the terminal over a wider area. President Greatsinger's second plan was intended for the relief of the congestion of cars and vehicles at Sands Street and Washington Street, Brooklyn. It was a proposal that the railroad companies construct an incline and elevated structure over Sands Street, leading from Washington Street, near Concord, and passing on a level with the bridge floor to a point on the bridge roadways, where a connection could be made with the present surface tracks. Under this plan the greater number of the surface cars bound for Manhattan would avoid crossing the traffic on Sands Street returning from Manhattan. This plan, it is understood, is also awaiting the approval of the municipal authorities. A proposal, made many times within recent years by the citizens of Brooklyn for the widening of Livingston Street and its devotion to the necessities of the surface lines, appears also to be languishing, while the railroad companies are anxious to have the improvement made. President Greatsinger had other plans of equal importance for the giving of immediate relief which he would be glad to carry into effect, but has been deterred from pressing them owing to the evident lack of sympathetic co-operation on the part of the municipal authorities. The outlook seems to be that no plans for immediate relief will be authorized, and that the first relief experienced will be upon the completion of the new Williamsburg Bridge next January or soon after.

The problem for solution, as it relates to permanent future relief, may be stated under three headings:

First. To widen existing streets or open new avenues leading toward the present bridge and the new bridges now under construction; and for the city to co-operate with the railroads in making these avenues of approach toward Manhattan available for the uninterrupted use of surface and elevated rapid transit routes.

Second. Such additions of tracks, inclines and other connections as will enable the companies to furnish rapid movement not only to the present population but to the greatly increased population and passenger traffic which is certain to come. The construction of additional tracks on existing franchises should take such form as will enable fast express service to be operated for the long-distance riders, with an entire separation, if possible, of the long and short-haul traffic.

Third. To provide a means (by subway or elevated structure) of distributing and collecting in the business district of Manhattan the traffic from Brooklyn and suburban Long Island without throwing the greater part of it upon the local Manhattan lines. There should be not merely a local terminal for each bridge and tunnel in Manhattan, but a means of intercourse between these terminals, so that a circulating system of train and car service may act as an agency for distributing and collecting the traffic.

The vastly increased means of communication with Manhattan which the Boroughs of Brooklyn and Queens are to enjoy within a few years is destined to have almost a revolutionary effect upon the routing and volume of traffic. The creation of new rapid transit routes will not only create new traffic but will also break up and change the flow of traffic in existing channels. What the new alignment will be can only be conjectured. It will depend to a certain extent upon the capacity of the bridges and tunnels, but to a greater extent upon the arrangement and combination of the lines operating

over and through them, and to a still greater extent upon the convenience of these lines to the business district of Manhattan. In this connection some of the details of the new bridges will be of interest. There are presented herewith diagrams showing in cross-section the trackage and other transportation arrangements of the three new bridges over the East River, also for comparison a cross-section of the present Brooklyn Bridge.

Various statistics of travel over the present bridge have been published from time to time, but the latest record taken is shown below.

On Nov. 10 an accurate count was taken by the Brooklyn Heights Railroad Company of the number of passengers carried by surface, elevated and bridge cars over the bridge during twenty-four hours. On the same day a count was taken by bridge employees of the number of people that walked over the bridge, also the number in vehicles on the carriageways. Table No. XII gives the totals of the respective classes of traffic in each direction for the twenty-four hours:

TABLE NO. XII.

STATEMENT OF PASSENGERS PASSING OVER BROOKLYN BRIDGE NOV. 10, 1902

	To Manhattan	To Brooklyn	Total
In surface cars	74,852	72,808	147,660
In bridge cars	65,934	49,169	115,103
In elevated cars	8,716	10,125	18,841
Local pass's (bridge only)	13,780	11,913	25,693
Totals	163,282	144,015	307,297
Promenade	6,952	7,496	14,448
In vehicles (estimated)	4,100	3,800	7,900
Grand totals	174,334	155,311	329,645

Of the 133,944 elevated railway passengers carried on the bridge railway tracks only about 13 per cent were carried in through trains, and 87 per cent were compelled to transfer to or from bridge trains.

Of the total passenger traffic on the bridge 45 7-10 per cent was carried in trolley cars, 48 2-10 per cent in bridge trains, and only 6 1-10 per cent in elevated railway trains.

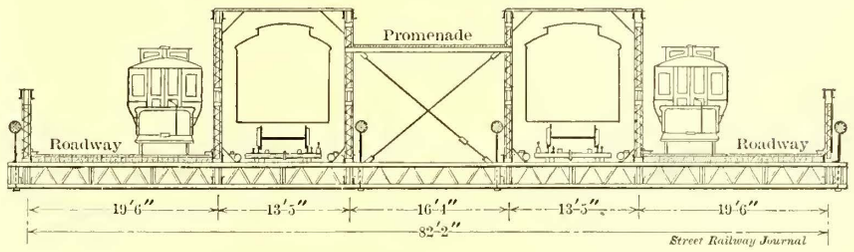
During the morning and evening rush hours the heaviest traffic for one hour was shown to be as follows:

7:30 A. M. TO 8:30 A. M.

In surface cars to Manhattan	15,251
Bridge railway to Manhattan	25,277
Promenade, to Manhattan	869
In vehicles (estimated)	480
Total for one hour	41,877

5:30 P. M. TO 6:30 P. M.

In surface cars to Brooklyn	13,700
Bridge railway to Brooklyn	26,926
Promenade, to Brooklyn	1,526
In vehicles (estimated)	550
Total for one hour	42,702



CROSS-SECTION OF PRESENT BROOKLYN BRIDGE STRUCTURE

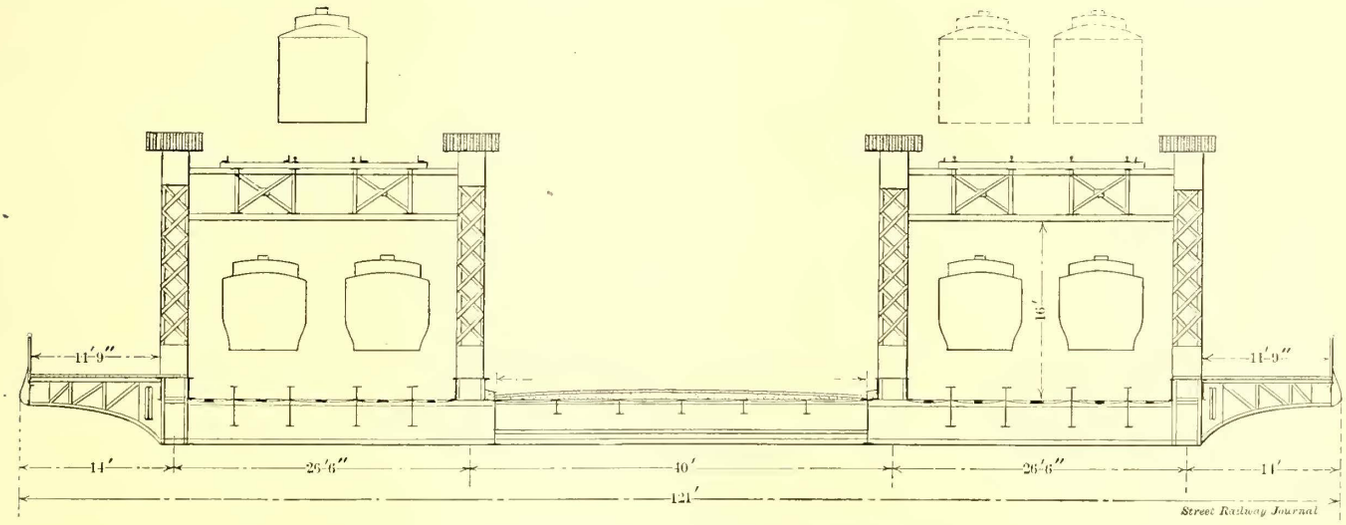
The vehicle traffic on the roadways for the month of November, 1902, was as follows:

Single horses	2,384
Single-horse vehicles	64,133
Double-horse vehicles	31,200
Total	97,717
Average for Sundays	500
Average for week days	3,190

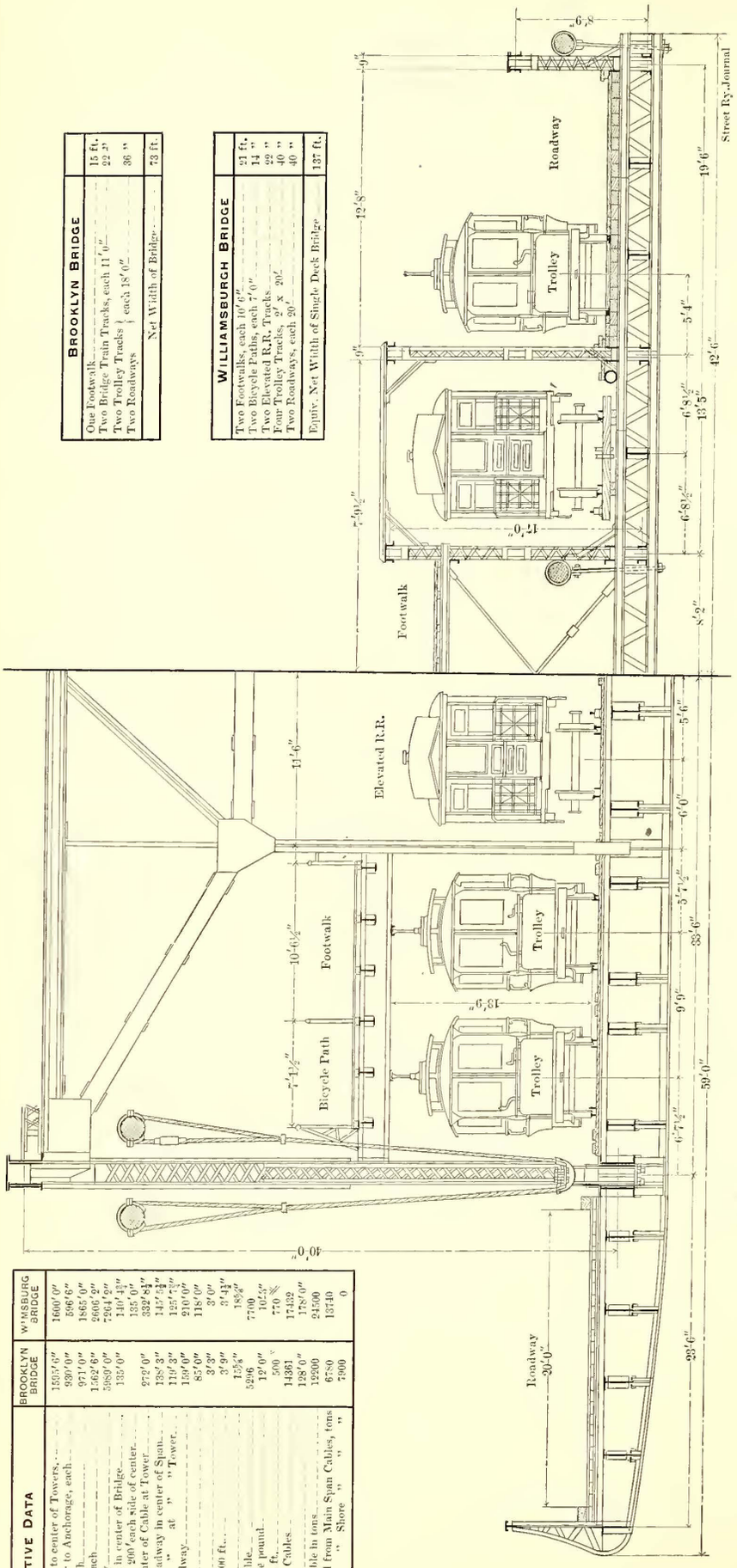
The greater proportion of the weekday vehicle traffic crosses the bridge toward Manhattan from 6 a. m. to 9 a. m., and toward Brooklyn from 4:30 p. m. to 6:30 p. m.

The completion of the Williamsburg Bridge is promised in the early part of 1904, but it is almost certain that it will be some months or a year later when the approaches and terminal arrangements in Manhattan will be completed. The municipal authorities have not yet decided upon the plans for street widening and the opening of new avenues of approach, nor upon the plans for the necessary terminal arrangements for the surface and elevated lines and the connection by elevated or subway with the other bridges and tunnels. Public policy would seem to demand that no further time be lost in agreeing upon the plans and having them promptly executed. Any delay in the completion of the necessary terminal arrangements will amount practically to a delay in the completion of the main span. The Brooklyn people, for whose benefit the bridge is intended, will not care to use it if they are to be dumped out in a local or temporary terminal on the Manhattan end, 1½ miles from the Wall Street-City Hall district, without suitable means of reaching their destination.

It will be seen from the diagram that this bridge is to have



CROSS SECTION OF MANHATTAN BRIDGE



COMPARATIVE SECTIONS OF BROOKLYN AND WILLIAMSBURG BRIDGES

Brooklyn Bridge	
One Footwalk	15 ft.
Two Bridge Train Tracks, each 11′ 0″	22 ″
Two Trolley Tracks } each 18′ 0″ Two Roadways }	36 ″
Net Width of Bridge	73 ft.

Williamsburgh Bridge	
Two Footwalks, each 10′ 6″	21 ft.
Two Bicycle Paths, each 7′ 0″	14 ″
Two Elevated R.R. Tracks	22 ″
Four Trolley Tracks, 9′ 8″	40 ″
Two Roadways, each 20′	40 ″
Entire Net Width of Single Deck Bridge	137 ft.

Comparative Data	Brooklyn Bridge	Williamsburg Bridge
Length of Main Span, center to center of Towers	1595′ 6″	1600′ 0″
Length of Land Span, Tower to Anchorage, each	930′ 0″	596′ 6″
Length of Brooklyn Approach	971′ 0″	1865′ 0″
Length of Manhattan Approach	1562′ 6″	960′ 0″
Total length of Carriage-way	5989′ 0″	7261′ 6″
Clear Height above M.H.W. in center of Bridge	135′ 0″	140′ 4″
″ ″ ″ 900′ each side of center		135′ 0″
Height above M.H.W. to center of Cable at Tower	272′ 0″	332′ 8½″
″ ″ ″ ″ Roadway in center of Span	138′ 3″	147′ 7½″
″ ″ ″ at ″ Tower	119′ 3″	125′ 7½″
″ of Tower above Roadway	159′ 0″	210′ 0″
Width of Bridge	85′ 0″	118′ 0″
Grade of Roadway in 100 ft.	3′ 3″	3′ 0″
Max. grade of Roadway in 100 ft.	3′ 9″	3′ 43″
Diameter of Cables	15⅝″	18¾″
Number of Wires in each Cable	5296	7500
Length of Wire weighing one pound	19′ 0″	10′ 5″
Weight of one Cable per lin. ft.	500 ℔	770 ℔
Total Miles of Wire in Four Cables	14361 ″	17432 ″
Versine at Mean Temp.	128′ 0″	178′ 0″
Ultimate strength of each cable in tons	12200	24500
Permanent weight suspended from Main Span Cables, tons	6780	13740
″ ″ ″ Shore ″ ″	7900	0

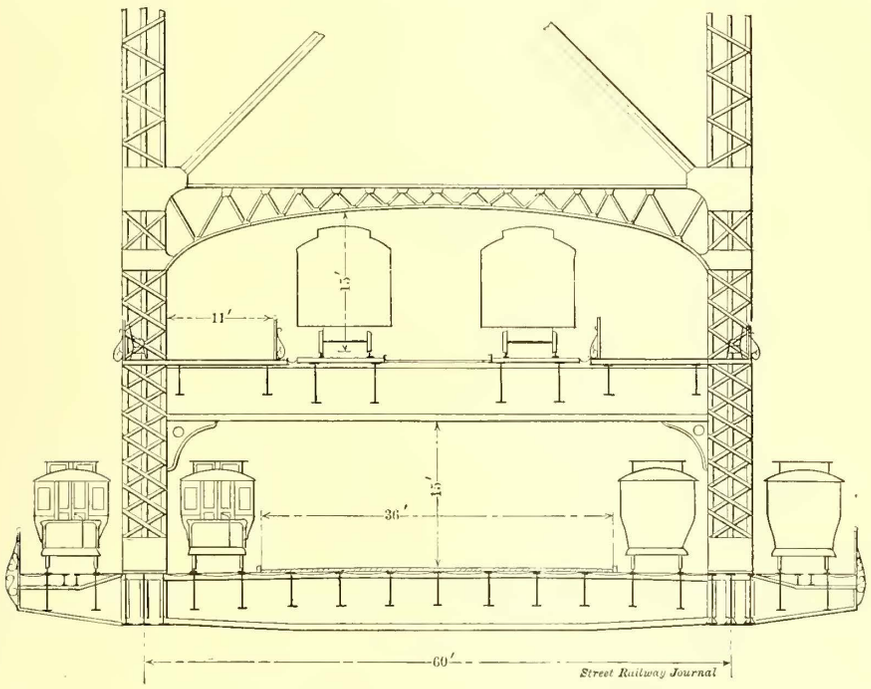
two tracks for elevated trains and four tracks for the surface trolley cars. By this arrangement it is plainly evident that the bridge is to be devoted mainly to such traffic as can be handled by the Brooklyn surface lines. There are a very large number of surface lines converging near the Brooklyn terminal of this bridge. Many of these lines are crosstown lines serving the thickly-populated central section of the city, but their traffic at present is light because of the inconvenience of reaching the business district of Manhattan by the ferry routes. There are also several long lines reaching eastward to the suburban districts, and other lines reaching northward toward Greenpoint and Long Island City, which serve thickly populated regions.

The Broadway elevated line is the only elevated road tributary to this bridge. It furnishes a direct route to East New York, and with the incline now building at Cypress Hills the trains may pass to the surface and run through to Richmond Hill and Jamaica. With a 5-cent fare and through train service to Manhattan this elevated line will certainly command a traffic which will render necessary a third track from the bridge to East New York for its fast express train service.

The traffic capacity of this bridge, when worked to the maximum, may be closely estimated. Based upon the experience with the present bridge there would seem to be no reason why the two trolley tracks, free from the interruption of team traffic, cannot comfortably handle toward Manhattan 700 surface cars per hour, 350 on each track. Figuring a maximum of fifty passengers per car would give 35,000 passengers per hour on the surface lines. If the elevated trains are to maintain a good average speed on the bridge it will not be safe to operate more than sixty per hour, or one minute apart. Figuring six cars per train and a maximum average of eighty passengers per car we have 28,800 passengers per hour, making a grand total of 63,800 passengers per hour in one direction. It is hardly possible that this maximum passenger movement will be realized at the outset, and certainly not until the plans for delivering the people near the business district in Manhattan are completed.

Bridge No. 3, known as the Manhattan Bridge, will probably not be completed before 1907. Its Manhattan terminal is to be near Canal Street and Forsythe Street, about two blocks east of the Bowery. Its Brooklyn terminal has not yet been definitely announced. The diagram indicates that this bridge is to have four tracks for the surface trolley cars and four tracks for elevated trains. Its passenger carrying capacity will, therefore, be considerably greater than any of the other bridges. Figured upon the same basis as the Williamsburg Bridge, its maximum capacity should be 92,600 passengers per hour in one direction. This bridge will serve all of the lines that are served by the present bridge, and will be capable of serving others that are not now able to run over the present bridge. It will make possible a division of lines and probably a division of territory with the present bridge that will greatly simplify the operation of both. The present bridge will have to pass through a period of reconstruction within a few years, which may make considerable interruption

if not a temporary suspension of its traffic. The Manhattan Bridge during the period of reconstruction will have to carry its full quota of the traffic. The striking feature of the Manhattan Bridge is the adaptability of its location for handling practically all the train service of the elevated railway system of Brooklyn, except the Broadway line, should it be required to do so. With the building of a small amount of connecting elevated structure this bridge will be able to serve the Myrtle Avenue, the Lexington Avenue, the Fulton Street and the Fifth Avenue elevated lines with their several suburban connections. Its completion will mark the time of the first real relief to the congestion of traffic on the present bridge. If the municipal authorities build wisely upon the knowledge that this bridge is destined to become the greatest single artery of travel between Brooklyn and Manhattan there will be ample provision made on both sides of the river for wide avenues of approach and their devotion, not to the setting out of flower beds and grass plots, but to the single purpose of facilitating interborough communication by trolley car and elevated train. At the Manhattan terminal there should be a most comprehensive plan for the distribution and collection of the traffic by means of subways or elevated structures. There should be, as one of the connections of this bridge, a crosstown line over or under Canal Street to West Street, connecting with all the north and south lines, and these connections should be made one of the important features of the operation. But the principal distributing agency of this bridge should be a subway which will be sufficiently commodious to take the passengers by trolley car and elevated train direct to the Wall Street district. When the people of Brooklyn awake to the fact that this bridge means more to their city from a rapid transit standpoint than any other single factor there will be a demand that no narrow or niggardly policy be pursued in enabling the transportation lines to use it to the full capacity.



CROSS-SECTION OF BLACKWELL'S ISLAND BRIDGE

Bridge No. 4, known as the Blackwell's Island Bridge, although different in construction, is similar to the Williamsburg Bridge in its traffic capacity. It has four tracks for trolley cars and two tracks for elevated trains. The Manhattan terminal is to be at Fifty-Ninth Street and Second Avenue, and the Long Island City terminal near Ravenswood Park. There are no elevated roads at present in Long Island City, and the provision for running elevated trains over this bridge is therefore a little obscure, unless it was intended that the Manhattan Elevated road should send a portion of its Second Avenue train service to Long Island City. It should be borne in mind that here the conditions are entirely different from those surrounding the other bridges which propose to deliver their traffic to the business district without transferring it to the local lines. The passengers coming by the Blackwell's Island Bridge must necessarily change to the local Manhattan lines and pay another fare to reach the shopping or business districts. This being the case the plan to run the Second Avenue trains to Long Island City appears to be a practicable and a reasonable arrangement.

The operation of the trolley cars of the surface lines from Long Island City to Manhattan will be a wonderful stimulus to the growth of traffic in the Borough of Queens. It is probable that the traffic capacity of this bridge is several years in advance of the actual requirements. A great many of the vacant lots in Queens must be built upon before there will be a traffic of 63,800 people coming to Manhattan in one hour. But this ample provision for the future is an invitation for an increase of population which will be certain to follow.

THE LONG ISLAND (STEAM) RAILROAD

The fact that certain of this company's lines are to be equipped for electric operation, and that the trains are to go through the new tunnels to Manhattan makes it a subject of interest. A map of the western half of its lines is shown herewith, upon which the lines to be operated electrically are indicated. This map covers all the points within a distance of 50 miles to 60 miles of the East River, which may be said to be directly tributary in passenger traffic to Manhattan, Brooklyn and Queens. As a basis for a proper understanding of the existing conditions it should be remarked that this railroad has not heretofore been a factor of great consequence in the local transportation problem of Greater New York. This has been true, because of its inability to deliver passengers direct to the business district of Manhattan within a reasonable time. On account of its terminals at Flatbush Avenue (Brooklyn) and at Long Island City being twenty minutes to thirty-five minutes away from the lower end of Manhattan, and the inconvenience of one or more transfers, it could not attract any considerable number of permanent residents doing business in Manhattan. Its passenger traffic has, therefore, been largely local. In the development of the territory of Long Island outside of Brooklyn and Queens it has done the work of a pioneer, and still remains the factor of primary importance. The fact that about 50 per cent of its gross earnings is made in the four summer months indicates better than anything that can be said of the character of its business. A glance at the map will show that its lines are located with reference to serving the territory along the Atlantic Coast and Long Island Sound, as well as Central Long Island.

Table No. XIII shows the number of passengers carried by years from 1893 to 1902 inclusive. It will be noticed that there was a decline in the passenger traffic from 1893 to 1898, since which time it has gradually increased.

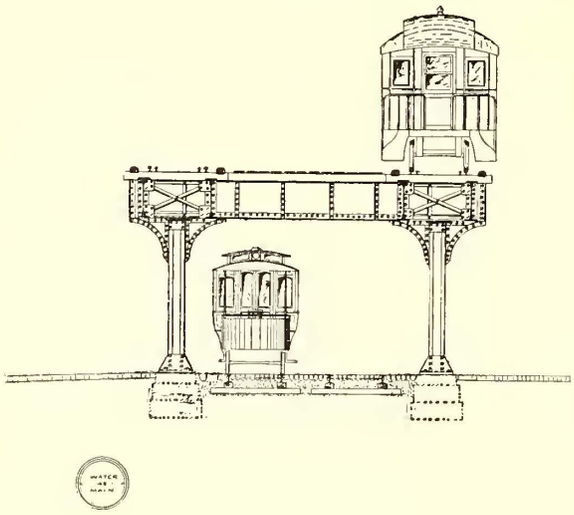
Prior to 1893 the Long Island Railroad had a practical monopoly of the available routes to the shores of Long Island, and carried almost all of the excursion travel to the South Shore resorts within an hour's ride of the East River. The development of the Brooklyn electric roads, which commenced at about that time, was continued for many years, and reached

its maximum in 1898, since which time practically no additional electric lines have been built. The enormous excursion traffic developed by the surface electric roads to the nearby shore resorts resulted in diverting passengers from the Long Island Railroad and the resorts served by it. Furthermore the surface lines started new resorts at their terminals, and succeeded in drawing to them the natural increase that otherwise would naturally have gone to the Long Island Railroad.

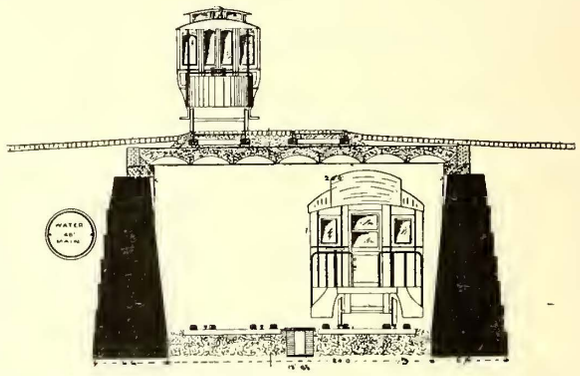
TABLE NO. XIII.

STATEMENT OF NUMBER OF PASSENGERS CARRIED—FISCAL YEARS ENDING JUNE 30, 1893 TO 1902, INCLUSIVE

1902	16,611,102
1901	14,520,218
1900	12,387,649
1899	11,777,205
1898	11,386,772
1897	No figures
1896	13,934,534
1895	13,768,163
1894	13,919,249
1893	14,498,762

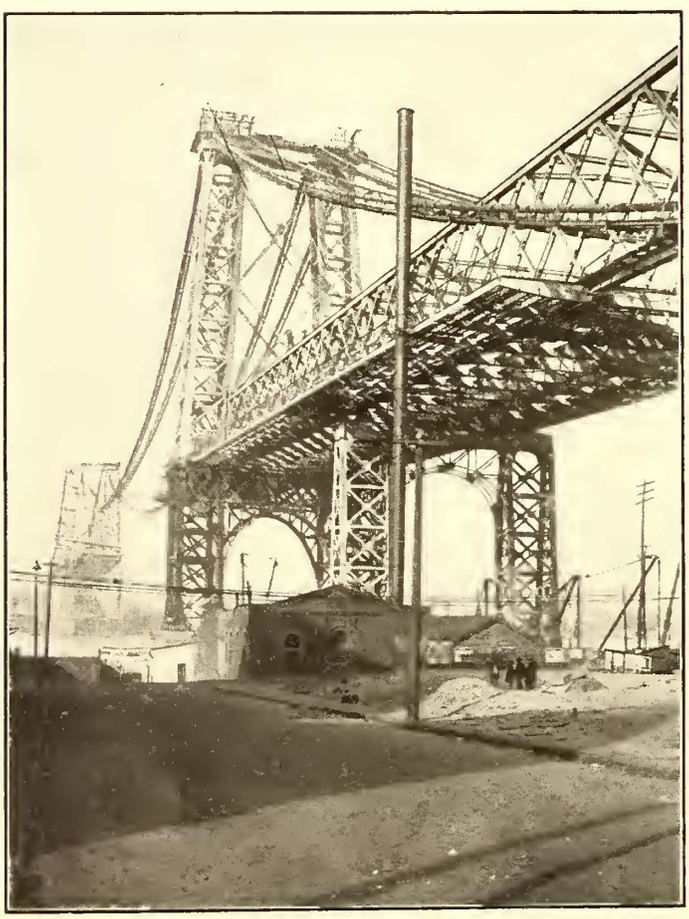


Cross Section of Elevated Railway.



Cross Section of Subway.

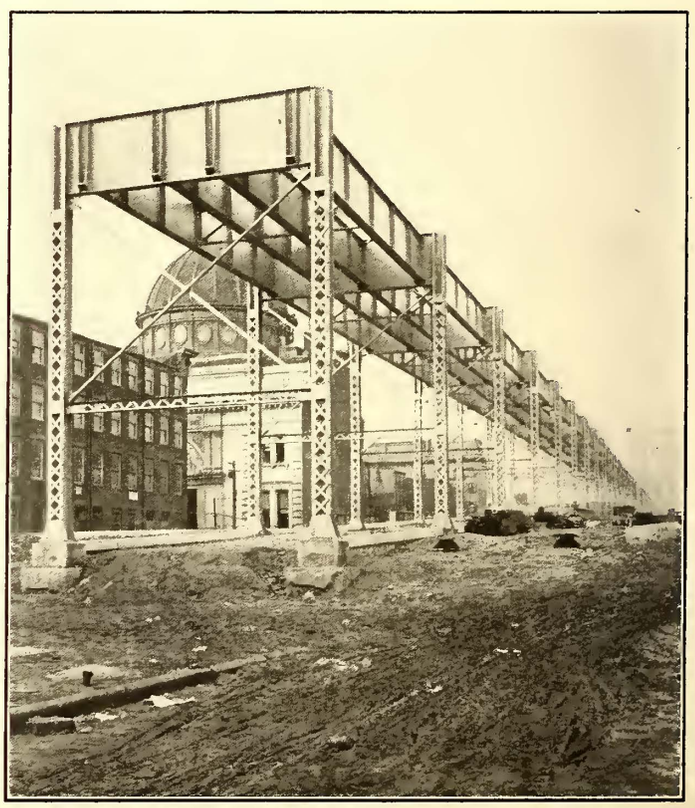
ATLANTIC AVENUE IMPROVEMENT



WILLIAMSBURG BRIDGE, FROM BROOKLYN

In 1898 the management of the Long Island Railroad inaugurated the policy of providing a train and car service considerably in excess of the actual traffic requirements for the purpose of inviting an increased passenger business. This policy has been carried out in a generous spirit during the succeeding years, and the results are reflected in a steady gain in passenger traffic.

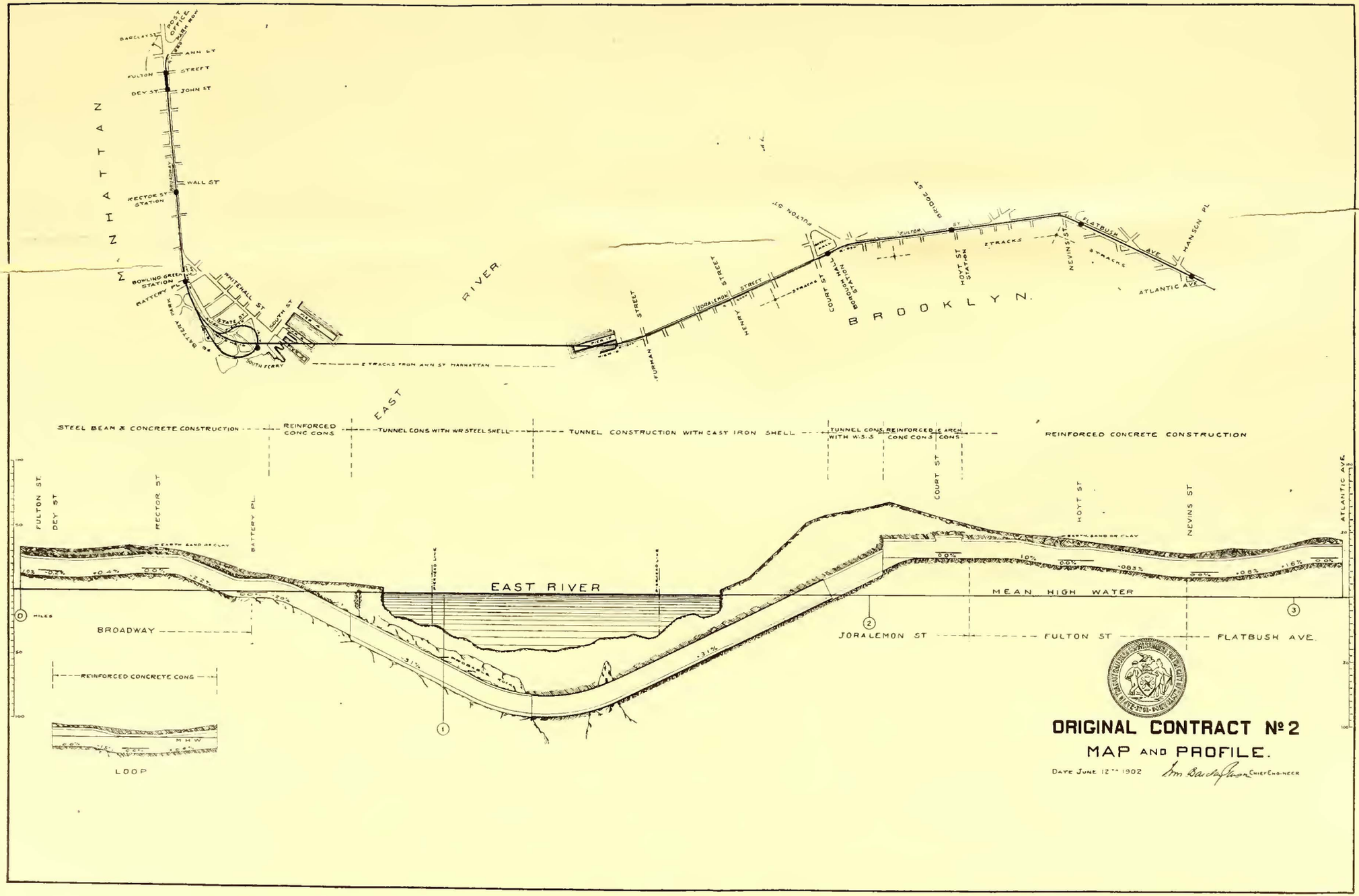
In 1899, by virtue of an arrangement with the Brooklyn Rapid Transit Company, the Long Island Railroad commenced to operate its Jamaica express trains over the Brooklyn Elevated structure from the incline at Flatbush Avenue and Atlantic Avenue to the Brooklyn Bridge, thus making



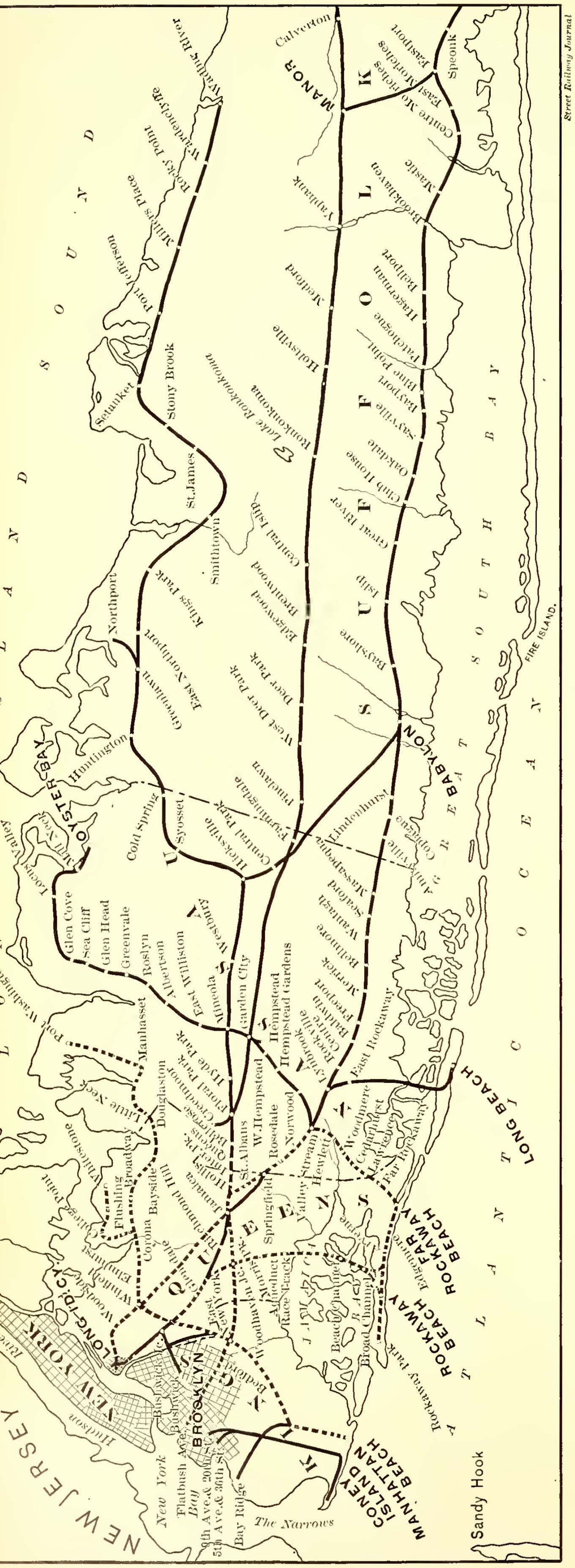
ELEVATED RAILWAY STRUCTURE—APPROACH TO WILLIAMSBURG BRIDGE, BROOKLYN SIDE

direct through service between Jamaica and the Brooklyn Bridge.

As tending still further to illustrate the existing conditions of passenger traffic Table No. XIV is presented. It shows, among other things, that each passenger was carried an average distance in 1902 of 14.49 miles, and that the average amount received from each passenger was 20.5 cents.



TUNNEL UNDER EAST RIVER FOR BROOKLYN EXTENSION OF THE RAPID TRANSIT SUBWAY, CONNECTING WITH LONG ISLAND RAILROAD AT FLATBUSH AND ATLANTIC AVENUES



THE LONG ISLAND RAILROAD LINES LEADING FROM NEW YORK. DOTTED LINES SHOW THAT PORTION OF THE ROAD TO BE OPERATED ELECTRICALLY

TABLE NO. XIV.

PASSENGER TRAFFIC STATISTICS LONG ISLAND RAILROAD.

	1898	1899	1900	1901	1902
Miles of road	375.29	379.48	379.48	380.27	395.98
Average miles each passenger was carried	13.54	14.20	13.78	13.69	14.49
Average earnings from each passenger (cents)	20.74	21.17	20.18	18.2	20.5
Average earnings per passenger per mile (cents)	1.53	1.49	1.46	1.329	1.413
Average number of passengers per train	50.93	54.45	54.25	64.52	67.06
Average number of passengers in each car	15.17	16.01	16	----	----
Passenger train mileage	3,027,461	3,071,841	3,145,658	3,081,332	3,589,109

Several years ago Mr. Theodore Cooper made a study of the traffic on the Manhattan Elevated road and discovered that the average haul per passenger was 3.4 miles, which for the 5-cent fare makes about the same rate per passenger per mile as the Long Island Railroad received in 1902, viz.: 1.4 cents. The average number of passengers per train and per car indicate that there is still opportunity for increased density of traffic without approaching the limit of crowding, with which the average New Yorker is, unfortunately, too familiar.

Table No. XV, which follows, shows the traffic by months for the calendar year 1902, and indicates the wide variation between the winter and summer traffic:

TABLE NO. XV.

STATEMENT OF NUMBER OF PASSENGERS CARRIED, BY MONTHS, FOR 1902

January	870,209
February	800,277
March	974,927
April	1,168,665
May	1,379,819
June	1,827,262
July	2,522,258
August	2,571,369
September	1,641,150
October	1,141,190
November	1,081,005
December (1901)	898,017

At the present time the average number of passengers coming from points on the Long Island Railroad and going to Manhattan in the maximum hour of the morning is estimated at 15,000. One-third of these reach Manhattan by way of Flatbush Avenue (Brooklyn), and two-thirds by way of Long Island City (Thirty-Fourth Street Ferry). The daily passenger train service in and out of Long Island City is 425 trains, with 2500 cars, and in and out of Flatbush Avenue (Brooklyn) it is 266 trains, with 1050 cars.

The average daily distribution of travel on the Thirty-Fourth Street Ferry is shown graphically by the following diagram, made up from the record of five week days in October, 1900. A considerable proportion of the passengers using this ferry is brought to it by the surface trolley lines of the Borough of Queens.

As previously stated the map presented herewith of the Long Island Railroad shows what portion of the lines tributary to Manhattan it is proposed to operate by electricity. The names and mileage of these lines is as follows:

Long Island City to Manhattan Beach	16.10 miles
Glendale Junction to Rockaway Park	10.31 "
Hammels to Valley Stream	8.37 "
Long Island City to Port Washington	18.18 "
Whitestone Junction to Whitestone Landing	4.78 "
Glendale Junction t Rockaway Junction	4.34 "
Flatbush Avenue (B ooklyn) to Jamaica	9.63 "
Total	71.71 miles

The present pla is that all the trains from these lines will be operated by th multiple unit system, with the third-rail conductor. The tr ns from the six lines first named will probably run to Manh tan by way of Long Island City and the

Thirty-Fourth Street tunnel. The trains from Jamaica by way of Flatbush Avenue will probably run to the Battery or the City Hall, in Manhattan, by way of the Interborough Rapid Transit Company tunnel. A map and profile of the Brooklyn extension of the Rapid Transit subway, including the tunnel under the East River, is shown herewith. The present amount of train service local to the lines affected by the proposed electrical development is as follows:

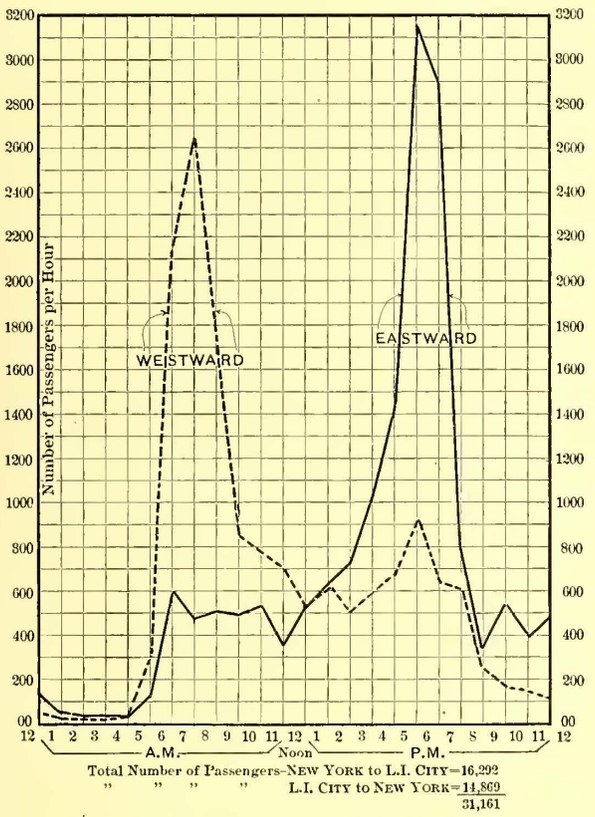
West-bound to Long Island City, daily, 150 trains, 660 cars.

East-bound from Long Island City, daily, 150 trains, 660 cars.

Maximum train movement one way, one hour, twenty trains, 135 cars.

Maximum train movement one way, one hour, to Flatbush Avenue (Brooklyn), ten trains, thirty cars.

It will be seen that the proposed electrical development will cover practically all the lines within a radius of 20 miles of the



DISTRIBUTION OF TRAVEL ON THIRTY-FOURTH STREET FERRY OF LONG ISLAND RAILOAD—AVERAGE OF FIVE DAYS IN OCTOBER, 1900

East River. Beyond that the lines to the eastward will continue to be operated by steam power as at present, or until other and more comprehensive plans are formulated. Although it has not been definitely announced, it is believed that when the steam trains from the east reach the zone of electric operation they will be taken by electric locomotives and run through to Manhattan by one or the other of the tunnels, thus affording through rapid transit to the long distance as well as to the short-haul passengers.

Taking Jamaica as a common point to illustrate the proposed saving of time under electric operation, we find that the present running time, Jamaica to Manhattan, via Flatbush Avenue, is fifty-five minutes. Under electric operation it is proposed to deliver the passenger by this route in Manhattan in thirty-five minutes, a saving of twenty minutes. The present running time, Jamaica to Manhattan, via Thirty-Fourth Street Ferry, is thirty minutes. It is proposed under electric operation to deliver the passenger by this route in Manhattan in twenty minutes, making a saving of ten minutes.

Being the most gigantic work of its kind ever undertaken in this country, the Pennsylvania-Long Island Railroad tunnel, from New Jersey to Long Island, with its great passenger terminal underground at Thirty-Third Street and Seventh Avenue, Manhattan, is naturally a subject of much interest to railroad men of all classes. While the tunnel itself is of interest the chief interest centers around matters of equipment and operation. Its completion is so many years hence that at this time many of the plans, while carefully studied out, are still too incomplete and indefinite to warrant publication. A most interesting contribution to our present study of this stupendous undertaking is shown in Table XVI, which gives figures concerning the track, car, train and traffic capacity of the proposed underground Manhattan passenger station, also the same figures for other large passenger terminals to be used in comparison:

TABLE XVI.

STATEMENT OF TRAFFIC CAPACITY OF PROPOSED PENNSYLVANIA-LONG ISLAND RAILROAD TERMINAL PASSENGER STATION AT THIRTY-THIRD STREET AND SEVENTH AVENUE, MANHATTAN, AS COMPARED WITH THE KNOWN TRAFFIC CAPACITY OF OTHER LARGE PASSENGER TERMINALS.

Station.	Number Stub Tracks Under Shed.	Number Through Tracks Under Shed.	Approximate Car Capacity.	Length Lin'l Feet Track, Clear Standing Room.	Total Trains Operated Within 24 Hours.	Greatest Number of Trains Within One Hour.
Manhattan (proposed new station)	6	19	377	26,490	*960	§120
Jersey City	12	--	160	10,860	246	22
Philadelphia	16	--	159	10,750	499	45
Pittsburg	14	2	216	14,695	288	40
Camden	12	--	144	9,760	172	28
Long Island City	15	--	110	7,420	423	35
South Boston	28	--	283	19,240	737	--
North Boston	23	--	196	14,385	700	--
St. Paul (proposed new station)	8	6	195	13,690	202	96

* 960 is about 43 per cent over the Jersey City and Long Island City stations combined.

§ 120 is about 111 per cent over the Jersey City and Long Island City stations combined.

NOTE.—It is understood there are to be two tunnels to Long Island City with four tracks, and one tunnel from Manhattan to New Jersey, with two tracks. The maximum capacity of the Long Island City tunnels, with trains two minutes apart, will be sixty trains per hour in one direction, or 120 trains per hour in both direction. The maximum capacity of the New Jersey tunnel on the same basis will be thirty trains per hour in one direction, or sixty trains per hour in both directions.

Figuring eight cars per train and a maximum of eighty passengers per car it appears that the maximum hourly carrying capacity of the Long Island City tunnel in one direction is 38,400 passengers, and the New Jersey tunnel 19,200 passengers.

Notwithstanding it is to be underground it will be seen that this passenger terminal is to have a greater number of feet of clear standing room on its tracks and a greater car and train capacity than any other large terminal in this country. Having been planned upon a most liberal scale it remains to be determined how soon there will be sufficient traffic to utilize its facilities to their maximum limit.

It is understood that practically all of the through trains and a fair proportion of the suburban trains of the Pennsylvania and Lehigh Valley roads will run to Manhattan through this tunnel. As with the Long Island road, it is believed that the through trains coming from beyond the zone of multiple unit electric operation will be drawn by electric locomotives. Information is not available at this time as to what extent the Pennsylvania Railroad intends to equip its lines for suburban electric operation. Many of the suburban trains will continue running to Jersey City for the accommodation of those whose business is convenient to the downtown ferries. An interesting detail of the tunnel operation is that it is proposed to send all the trains coming from New Jersey (except those that are to immediately return to New Jersey) under the East River to

Long Island City, stopping just long enough in the Manhattan terminal to discharge passengers, baggage, etc. In the yard at Long Island City the ordinary functions of tearing apart and making up trains, cleaning, inspecting and repairing cars will be performed. The terminal yard at Long Island City is to be another mammoth affair, and will probably rank as the largest terminal passenger yard in the world. It is planned to have a car storage capacity of 1000 cars, and will have facilities for handling over 1000 trains per day. All of the trains of the Long Island road which go to the Manhattan passenger terminal will, after a reasonable time for unloading and reloading, return to Long Island City and thence eastward. It is not at present contemplated that any trains will be run through from points on Long Island to points in New Jersey or beyond, or vice versa, although it will be possible to do so with special trains when desirable.

That portion of the Long Island Railroad, between Flatbush Avenue (Brooklyn) and Jamaica, a distance of about 10 miles, operates on the surface of Atlantic Avenue, and crosses at grade a great many busy streets. There are eight grade crossings with trolley lines between Flatbush Avenue terminal and East New York. The work of eliminating these grade crossings by the construction of a combined subway and elevated structure is now under way, and is known as the Atlantic Avenue Improvement. At present the tracks of the Long Island Railroad follow the undulating contour of the street surface. The completion of the improvement now under way will make practically a level grade for the railroad, passing underground at some points and overhead at others.

Cross-section diagrams are herewith presented, showing the subway and elevated construction. It will be noticed that when the railway is taken off the street surface a trolley line is to run over the subway and under the elevated structure. The street will then be restored to the purpose for which it was originally intended, and will become one of the principal avenues for east and west street traffic.

By means of this improvement the Long Island Railroad will have, by its connection with the Brooklyn end of the tunnel of the Municipal Rapid Transit Subway, a continuation or extension of that rapid transit route as far as Jamaica. This will render possible the operation of through train service from the business district of Manhattan to Jamaica, where connection will be made with the train service of the entire Long Island system. The maximum traffic capacity of this new rapid transit route may be figured approximately upon the basis of thirty trains per hour, two minutes apart.

The completion of the two tunnels to Long Island and the accompanying electric installation, by which this road will have direct communication with two important sections of Manhattan, is apparently destined to have almost a revolutionary effect upon the growth of suburban Long Island. The removal of its principal handicap of inability to deliver passengers within a reasonable time to Manhattan will enable the road to assume the function, for which it is most admirably adapted, of furnishing quick and comfortable transportation to the permanent population along its lines. Its effect upon the values of real estate will be almost incalculable. Suburban Long Island will then enter upon an era of improvement appreciated at the present time only by those who have an eye to the future. It will be seen that both tunnels serve with equal facility the territory of Central Long Island, and it is here that the greatest growth in permanent population may naturally be expected. The rapid transit service, made possible by these improvements, will result in building up not only the permanent passenger traffic of the road but will insure a greatly increased summer traffic to all points within a radius of 10 miles to 30 miles of the East River.

CONCLUSION

It is of value and interest to know the probable traffic capacity of the combined transportation facilities leading toward Brooklyn, Queens and suburban Long Island. The number of passengers that can be carried per year or per month, while interesting, is not of particular value. The number that can be carried in one day is getting a little nearer to a fact of greater value. The number that can be carried in one direction in one hour is the concrete fact upon which all transportation calculations of real value must be based. While it is true that all calculations at this time are purely approximate estimates, founded upon known conditions of trackage and speed, they are sufficiently accurate for the present purpose.

The following summary gives the estimated maximum number of passengers that can be handled in one direction in one hour by each one of the bridges and tunnels now authorized leading from Manhattan to Brooklyn and Queens:

SUMMARY OF ONE-WAY HOURLY PASSENGER-CARRYING CAPACITY

Present Brooklyn Bridge (present conditions)	40,000
Williamsburg Bridge No. 3	63,800
Manhattan Bridge No. 2	92,600
Blackwell's Island Bridge No. 4	63,800
Pennsylvania-Long Island R. R. Tunnel	38,400
Municipal Rapid Transit Tunnel	19,200
Total	317,800

It was shown by the figures of present ferry and bridge travel to Manhattan, on page 67 of the issue of Jan. 10, that an average of 269,000 people go from Long Island and Staten Island to Manhattan in one day. This, it will be understood, is the present movement in one direction. The proportion of Staten Island passengers to the whole is exceedingly small. It was also shown that the present rush-hour movement to Manhattan was about 64,000 in one hour. Upon the completion of the new bridges and tunnels the number of people who now go from Brooklyn and Queens to Manhattan during an entire day could be accommodated in a single hour, with all the transportation facilities, over or under the East River, utilized to their full capacity. In the matter of removing the river barriers between Manhattan and Long Island it will be seen that the municipal authorities have planned, not for the immediate needs of the present, but for the future. They have planned largely and broadly and along the lines of an enlightened public policy.

It now remains for the transportation companies who are to be placed in practical command of these new means of communication with Manhattan to plan for the future upon an equally liberal and comprehensive scale. The traffic expansion which these new bridges and tunnels make possible cannot be realized unless the railroads do their part. The vast increase in the population foreshadowed by these improvements calls for liberal additions to car equipment and to power and trackage facilities. It is a fact well understood by experienced transportation men that to attract and hold any considerable increase of population the facilities of travel must be kept somewhat in advance of the actual requirements. With ample transportation facilities and quick through transit to Manhattan the Boroughs of Brooklyn and Queens, and all of suburban Long Island, should, within a few years, enjoy advantages far superior to those of The Bronx and its northern and eastern suburbs. If the transportation managements recognize these conditions and build wisely upon them it will hasten the inevitable exodus of hundreds of thousands from Manhattan, and secure to the railroads a tremendous increase in the number of their daily patrons. The public may safely assume that the railway managers are alive to the situation, and are animated by the desire to anticipate future requirements in a broad and liberal spirit.

In conclusion, the writer desires to express to all of those who have furnished him with information and data, especially the officials of the railway and ferry companies and the Board of Railroad Commissioners, his appreciation of their courtesy.

REPORT OF THE RAILROAD COMMISSIONERS ON THE BROOKLYN SITUATION

The report and recommendations of the Railroad Commissioners on the Brooklyn Rapid Transit Company, as a result of the recent hearing, were made public Jan. 29.

The Commissioners point out that this company operates 415¾ miles of surface and 74 miles of elevated track, and had available on Jan. 1, 1903, for winter service, 125 elevated motor cars and 397 elevated trailers, with combined seating capacity of 26,100, and 768 double-truck and 514 single-truck motor surface cars, with combined seating capacity of 37,940. There were fifty-eight elevated and 203 surface cars in excess of the maximum number being operated. The chief trouble has been that the company has not had sufficient power capacity to operate, heat and light all of its cars in service during the rush hours. The service during the non-rush hours has also been materially reduced during the last six months of 1902, and it should be immediately restored. While the power capacity will not permit an increase of service, it is possible (including current purchased from the Brooklyn Edison Company) for this service to be resumed. The total power generating capacity of the company from its own plant is rated at approximately 30,000 ehp, which is equivalent to an overload capacity of 37,500 ehp. This same plant supplies a storage battery capacity (during non-rush hours) of 1470 ehp, and the Edison Company furnishes 5100 ehp during rush hours only; the total available from all sources is thus 44,070 ehp. The total required to operate, heat and light all cars on surafce and elevated lines during the winter rush hours is 39,221 ehp. Add to this 2100 ehp for outside lighting and line losses, amounting to 16 per cent., or 7871 ehp, the total requirement is 49,192 ehp, or 5122 ehp more than the available maximum. Out of this total of power 2100 ehp are used for the lighting of stations, streets and highways, by 24,519 incandescent and 205 arc lights. In view of the present shortage of power the Commissioners recommend that the company should not be either required or permitted to light streets and public places.

The company is now erecting a new station, which will contain eight units of 4000 hp each. Owing to strikes and other causes completion of this station has been delayed, but one unit will soon be put in operation, and the company is also installing a 4000-hp unit in the Kent Avenue station. Even these additions, in the opinion of the Commissioners, will not be sufficient for the requirements of 1906-07, and the company is urged immediately to place additional contracts for power station equipment. Owing to the complaints as to premature putting in operation in the spring and fall of open or closed cars, the Board recommends that the company at once take steps to procure additional motor equipments, so that it shall have enough electrically-equipped cars of either kind to suit the weather conditions.

The eleven car houses owned by the company have capacity to give covered storage room for all of the rolling stock, and are equipped with the necessary pits for inspection and repair purposes. Each house is equipped with a wrecking-car outfit; but the board is of the opinion that valuable time can be saved by the use of wrecking wagons instead of cars. The shop force of men in the repair shops for surface cars was reduced last fall from 400 men to 216 men, but in the repair shops for elevated cars and engines the force was increased from 273 men to 376 men. There was, however, reduction made in the time service during the last half of the past year. The company's records show that Jan. 1, 1903, as compared with Jan. 1, 1902, these reductions had been as follows: Motormen, from 1720 to 1516; conductors, 1757 to 1613; inspectors, 90 to 59; starters, 70 to 48; division superintendents, 8 to 6; switchmen, 36 to 24. There was, however, an increase of 25 motormen, 14 conductors, 3 train despatchers and 1 inspector in the elevated service, and a decrease of 6 car couplers, 8 gate and platform men, 12 station porters and 8 car cleaners.

In comparing power capacity with passengers carried the following figures are given: 1895, 16,890 ehp to 100,879,646 passengers; 1898, same capacity, 141,033,452 passengers; 1899, 32,922 ehp, 173,823,286 passengers; 1900, same capacity, 207,752,822 passengers; 1901, 34,759 ehp, 230,365,005 passengers; 1902, same capacity, 240,825,228 passengers.

The report concludes with the following specific recommendations for immediate improvement:

1. That the company proceed energetically to the earliest possible completion of the installation and commencement of operation of each of the nine units of electrical power hereinbefore referred to as in progress; also, that it continue in the meantime to purchase all the available auxiliary power that it can procure.
2. That the company shall forthwith restore and resume the full service of surface cars on all lines, as shown by the schedules and passenger sheets of the first six months of the year 1902.
3. That the company shall during all other than the rush hours of morning and evening, whenever the temperature of the open air is as low as 45 degs., Fahrenheit, cause heat to be turned on in all of its cars. Further, that the company shall attach to the rear outer wall of each car a standard thermometer, exposed to the open air, and that the company shall instruct its conductors, whenever such thermometers shall indicate 45 degs., Fahrenheit, to call in the first inspector, who shall be under general instructions to turn on the heat in every car in every such case.
4. That the 271 coaches in the elevated service which are now lighted by oil lamps shall be lighted with electricity by installing incandescent lamps, with temporary wiring and contact-shoes, to take current from the third rail. That the practice of changing the oil lamps in cars and the carrying of oil lamps used for the tail lights through cars, while the cars are occupied by passengers, be discontinued forthwith.
5. That the operation of the so-called "loop" on the elevated lines at East New York be improved in certain details which are specified.
6. That all cars in use shall be thoroughly swept and dusted, dirty spots sponged off and windows cleaned once in twenty-four hours, and that they shall be washed inside and outside at least once in each week.
7. That the company take prompt measurer for the earliest practicable installation of a duplicate system of power transmission lines, and that, for increased safety, these duplicate lines be laid on routes separated from the present system.
8. An appeal for ordinances for the regulation of vehicular traffic is made to the Mayor and Common Council of New York City and the president of the borough of Brooklyn.

In the direction of permanent improvement the Board finds that while the surface car accommodations have been reduced during the latter half of 1902 there has been an increase in the number of trains and cars run on the elevated lines, attributable to the installation of electric power and motor equipment for a portion of this service. But the number of trains operated is still inadequate for the rush hour service. The congested condition of the elevated tracks on certain streets, and the lack of a third track and of terminal and switching accommodations for trains over Fulton Street and at the Bridge Plaza, as well as the company's present limitations of electric motive power, combine to make any present increase of the elevated service impossible. The Board is of the opinion that additional switching and terminal facilities can and should be acquired, and that a third track should be laid on Fulton and other streets. The Board also recommends for the surface cars an elevated approach to the Brooklyn Bridge terminal over Sands Street and the regulation of the vehicle traffic.

A particular form of complaint is made relating to the necessity for passengers paying two fares for short distances of travel over two separate lines of cars in the Williamsburg district, where the Brooklyn City and the Brooklyn, Queens County & Suburban lines connect, and where no transfers are given. This matter, the Board says, involves very complex legal questions, as does the whole subject of compulsory transfers. Nevertheless, it will receive attention at as early a day as is practicable. The Board also promises to watch the practical effect of the introduction of the measures proposed.

FINANCIAL ASPECT OF INTERURBAN ELECTRIC FREIGHT SERVICE

The Lake Shore Electric Railway, of Cleveland, is confronted with a serious problem in determining the future of its package express business, and the adjustment of the affairs of this department will be one of the first matters to be considered by the management when the road is taken out of the hands of the receiver.

As is generally known the Lake Shore Electric was formed by the consolidation of four roads; two of these are concerned in the present situation, namely, the Toledo, Fremont & Norwalk, operating from Toledo eastward, and the Lorain & Cleveland, operating westward from Cleveland. Both of these roads paid considerable attention to the handling of packages, but they operated on different plans. The Toledo, Fremont & Norwalk had an alliance with other Toledo roads, and handled goods as freight and at freight rates. As outlined in an article describing the Toledo freight station, published in the Souvenir Issue of the Street Railway Journal, all goods handled through this station are classed as freight, and rates which are approximately the same as steam freight rates prevail. Collections or deliveries are not made, nor are messengers maintained on the cars. The system on the Lorain & Cleveland was entirely different. The business was handled through the Electric Package Company, which operates on all the Cleveland roads. Goods are classed and handled as express, collections and deliveries are made and messengers are maintained on all cars. Agents are maintained in the towns served, and goods may be shipped from one line to another without reshipping, since there is but one operating company.

Although the Lake Shore Electric Railway has been operating through from Cleveland to Toledo for nearly a year, no change has been made in this heterogeneous system, owing to the Everett-Moore embarrassment, which forced the road into the hands of a receiver, and this precluded the possibility of important changes, as it was not the province of the receiver to establish a new policy. To cover the new connecting link the service of the Electric Package Company was extended to Norwalk and intervening towns, and while, at the present time, it is possible to ship goods from Cleveland to Toledo it necessitates a change and reshipment at Norwalk. Goods leave Cleveland as express and arrive in Toledo as freight. They go through without delays, but the man who examines his bill and checks up the rates notices that he is charged about three or four times as much per mile on the Cleveland end as on the Toledo end, and so far as he can see the service is about the same on one division as on the other.

Of course, the full development of the business cannot be attained under such methods, and obviously one or both of the systems in operation in the terminal cities must be disrupted. Here the question arises as to which is to be sacrificed.

As a matter of fact it is known that the Lake Shore Electric officials are not fully satisfied with either plan. While the freight rate is said to be profitable on the Toledo & Western Railway, one of the partners to the Toledo union freight station, it has not been found entirely satisfactory on the Lake Shore Electric. The reason for this is that the Toledo & Western handles bulky goods and car-load shipments in standard freight cars which are hauled in trains by electric locomotives, and the goods are delivered to the freight terminal yard at West Toledo. Only the less bulky articles are handled in the package freight cars, which operate to the center of the city. Another advantageous feature of the Toledo & Western is that all sub-stations are in the centers of towns, and the attendant combines the duties of electrician and freight agent.

While the Lake Shore Electric handles nearly as much freight as the Toledo & Western the conditions are different. The towns on the line are larger and more thickly populated, and will not permit the operation of standard freight cars as trailers, and all freight must be handled on power cars, which resemble passenger cars. Then, too, the engineers who laid out this portion of the road did not consider the freight and passenger service in locating the sub-stations, and in several towns the sites selected are at a distance from the business district; the reason which governed this decision seemed paramount at that time, namely, that the land was cheaper. In several of the largest towns independent freight stations have been established, but to extend this to all the towns and to install turn-outs, as some of the municipalities are now demanding, would necessitate an outlay which would only be warranted by immense growth of business, which is not now in sight. Moreover, to increase the amount of business to a point where it would became reasonably profitable would require additional rolling stock, power equipment and probably a double-track main line.

Regarding the extension of the package express service to all parts of the system, it must be admitted that there are also objectionable features to this plan. The Electric Package Company could not handle the bulky goods frequently carried on the Toledo end of the system because the rates are too high. Such goods are shipped from Cleveland as freight on the steam roads, or, during eight months in the year, they go by boat at very low rates. In some cases goods have even been shipped to Toledo by boat and then back to a town on the electric line. This can be done without much loss of time and at a lower rate than the express companies give from Cleveland; hence it is apparent that the Electric Package Company could not maintain the prestige on Cleveland to Toledo business that it now holds for the short-haul express business around Cleveland. Even if it could it would entail great expense to equip all the towns with express service, and there would be a loud complaint from the towns which have enjoyed the low rate in and out of Toledo; particularly would this be the case if the other Toledo lines maintained their freight service.

Several plans are being considered under which matters could be equalized. One is to extend the Electric Package service to all parts of the system, and utilize it for the smaller express packages, and then institute a freight service with freight cars hauled as trailers during the hours between 8 p. m. and 5 a. m., when the passenger service is light. This plan seems feasible, and it is claimed in its favor that it would have a tendency greatly to increase the earnings of the road, but it is doubtful whether it would be favorably received by the authorities of the cities and towns along the line.

Another plan is to institute a service which would be a compromise between express and freight in the matter of rates, but the system of calling for and delivering packages would be dropped. This would offer much better service than the ordinary steam road freight service, because of the frequency and promptness of delivery, and by reason of the higher rates it would be more profitable.

The Lake Shore Electric Railway has never attempted to determine the exact cost of operating its freight business, but figuring the power consumed and the cost of maintenance for a freight car to be about equal that of a passenger car, and taking into consideration the company's share in the cost of maintaining the Toledo freight station, it is estimated that it is impossible to realize very large profits on freight at freight rates, where all goods are handled in power cars.

An ordinance has been introduced in the Cleveland City Council providing for the laying of switches from the street railroads into church property. The author of the ordinance claims that many of the large Cleveland churches are desirous of having such switches placed in order to provide for the more general use of funeral cars.

PALLIATIVE MEASURES IN CONGESTION

BY LOUIS BELL, PH. D.

The large increase in urban population generally aggravated by the condensation due to the modern steel building has driven most large cities to desperate straits for transportation. Radical remedies for congestion are extremely costly and difficult of application and too often prove ineffectual from the very time taken to complete them. The daily press sometimes talks as if this unhappy condition of things were due to the negligence of the street railways, displayed in a hardened indifference to public convenience. But if the gentlemen of the quill could stand undetected alongside a division superintendent when a first-class blockade was under way they would see a new light and gain a new richness of vocabulary. Few people seem to realize that every citizen who is forced to walk cuts down the profits of the street car company, and that it does not enjoy losing a fare much more than he enjoys walking. If people will insist on herding together in cities and piling city upon city in their greed for crowding they cannot lay all the blame for congestion upon the transportation companies, who ordinarily have only one layer of street in which to work, and that, too, obstructed in many and exasperating ways. The people have a right to insist that the street railway companies shall work the facilities they have to the utmost, but there is no way of forcing a quart into a pint bottle even if a downtown car during the rush hours does suggest that interesting process.

When popular demand outpaces the normal capacity of the streets something has to be done, and the best thing for all parties is to get to work and lend a hand. The people want to be carried, and the companies want to carry them, if possible. Elevated roads and subways can be built in time, but it ought to be possible to work the streets to better advantage than has yet been attempted. The cities have grown and street railway service has been enormously improved, but traffic-teaming stays, save in amount, just where it was forty or fifty years ago. One overloaded dray can hold up a string of electrics just as readily as it held up the bob-tailed horse cars of the last generation. We daily vault over the heirs and assigns of the same old matudinal skids that tripped up our grandfathers. It certainly seems as if modern ingenuity and the stern necessities of modern life would long ago have devised improved ways of handling the heavy goods that fill our streets and creep at a snail's pace along the car tracks. Logically, it is the freight traffic rather than the passenger traffic that ought to go below the surface; but, be that as it may, there is no doubt that a determined effort at controlling and regulating heavy traffic would result in very material relief. Rigorous restrictions against obstructing street car tracks, mercilessly enforced, would do wonders in increasing the surface rapid transit facilities. This step would involve no class legislation, for it is a case of the whole people against the encroachments of the few who drive trucks and their employers. Better yet would be a considerable extension of the policy of keeping the traffic teams off certain streets entirely, during the rush hours at least, and preferably all the time. Two or three streets well cleared are capable of doing admirable relief work. In the comparatively few streets thus actually relieved it is no exaggeration to say that the street car speeds are 50 per cent greater than elsewhere, with a corresponding increase of carrying power. Here, again, it is the interests of the many against those of the few that should prevail.

Another very important remedy lies mainly in the hands of the street railways, though requiring, as does every reform, the cordial co-operation of the people at large. This remedy lies in an improved routing of cars. In New York, where the main routes are straight and parallel, comparatively little can be done by change of route, but in some other cities much can be done. It often happens that the longest way around is the shortest way home. The really important thing is good running time, and five minutes of increase in running time due to increased distance is no more than five minutes lost in blockades. Ordinarily the tendency is to send cars over the shortest route in point of distance, but the really important thing is not the distance, but the average time taken, and it often happens that the longer route can be made the quicker one. This often happens in suburban traffic, where the main problem is how to get clear of the congested district. Any such change is usually met by a popular clamor from sheer lack of real comprehension of the situation. In this matter, as in the matter of transfers, the street railway companies would do well to take the public into their confidence. Every one wishes a liberal transfer system and good street car facilities, but every one does not understand that his personal co-operation is needed to secure them. Changes and omissions on the part of railway companies often seem arbitrary, and sometimes they may be, but more often they are, for good reasons, unknown, however, to the public at large. If the public could be made to understand the importance of judicious, even though apparently indirect, routing, a most useful remedy for congestion could be readily applied. It would not be beside the mark to say that in many cases the working capacity of a street railway system during the rush hours could be increased nearly 50 per cent by the careful regulation of teaming and the careful choice of the routes of least resistance.

MATCHING TIME-CHANGED CAR COLORS

BY H. ARNOLD FRENCH.

One of the most interesting and yet most perplexing departments of car painting is that of mixing colors to match those on an old car. The previous paint, owing to the decomposition of its pigment from the sun, is usually changed many shades from its original color, yet that which is to be applied should resemble it so closely as to deceive the casual observer. To the expert it is, of course, quite impossible to make the deception complete, as there are indications other than those of color that enable him to perceive the presence of accumulated paint on the surface. But to the public who daily view the cars in the streets the presence of stains or abrasions which are unavoidable in the life of a street car may apparently be obliterated by cleaner painting.

The ability to secure even a good match in "touching up" old cars is more of a gift than an acquisition. It is safe to say that not more than one in fifty of car ornamenters has this valuable quality in its greatest degree. Instances have many times come under my observation where old, experienced painters who claimed to be conversant with all colors have utterly failed to secure good results in touching up cars. On the other hand, some young man, after a small amount of practice, has often made a most presentable job under the same conditions with apparently no special mental exertion.

The conditions presented by the surfaces of old cars are often such as completely to puzzle those who are not apt in recognizing them. For instance, the paint directly under the numerous mouldings and guards, being protected from the sun's rays, retains some vestiges of its former shade, while from this point to the middle of the panel, which has been severely exposed, there will nearly be such a fine blending of color as to defy detection from a casual observer. Again, the same condition sometimes exists, but in a greater degree, on open car panels, which in most cases are constructed by a combination of a convex and concave formation. The convex portion of the panel being at the top offers enough protection to the center to make a decided difference in the appearance of the latter, although the blending is so fine as to escape notice.

In touching up a car the object sought is, of course, to make it appear as nearly like new as possible. The condition in which it is usually received from the wood shop by the painter after a year's service is not always encouraging. And here, in passing, some points might be suggested of advantage to the woodworker whereby holes in panels may be repaired in such a manner that after being finished and painted the best results may be obtained. For an example, where a break has been made and the edges are more or less ragged, the opening should be trimmed with care so as to avoid breaking the paint from the edges of the hole during the trimming process. When the block is inserted in the opening, if it is left flush with the surface, no space is left for the paint stock. The result is that the grain of the wood will be much in evidence. This trouble may be avoided, however, by letting the block into the surface by, say, 1-64 of an inch. This depression is ample for a coat of lead priming and three coats of filling, or, if necessary to accelerate the work, the priming may be followed by filling in with hard-lead putty. Enough of either material should be applied to raise the surface a little more than flush with that of the car. When thoroughly hard the surface can then be "stoned" down to the exact level of the varnish on the rest of the panel without injuring the latter in the least. Finally, after the surface is painted and the car is varnished, it would take an expert to discover the spot where the patch is located.

A better appearance can often be secured if, when trimming the hole around a break, a joint, letter or stripe can be conveniently reached by enlarging the hole and bringing the edge of the hole even with the division line in the decoration.

One other optical fact should be borne in mind by the matcher of colors, and that is an exposure of the eye to one color for any length of time will create illusions which, if not recognized and counteracted by making allowances therefor, will often produce unsatisfactory results. To illustrate: A "Pullman car color" panel, if examined after looking intently at bright green, will appear brown. On the other hand, if examined after the observer has gazed intently for at least a half minute at a panel painted with bright vermillion, the "Pullman color" will appear to have a distinct olive green shade. This is only one of many instances that might be cited. Almost all tints and shades of paint can be effected in the same manner with the use of some color complementary or antagonistic to it. Considering this fact, the failure to match paint accurately can to some extent be understood. It is certainly advisable, when at this work, to avoid as far as possible impressing the optic nerves with any bright primary or secondary color for any length of time.

TEMPORARY TRACK CONSTRUCTION IN HAMBURG

The city of Hamburg, which is the second largest city in the German Empire and one of the most important ports in all of Europe, has always been badly off in the way of steam railroad stations, as the two principal lines which enter the city have had separate terminals, and neither of them has been adequate to the traffic. Construction has recently been commenced, however, on a large union station, which will cost $10,500,000, and which is being built by the Prussian Government Railways, the Lubeck-Hamburg Railway, and the city of Hamburg.

INTERESTING TRACK WORK IN HAMBURG

The site selected is adjoining one of the busiest points on the line of the Hamburg Street Railway, where there is a triangular double crossing, at which ninety-eight cars pass in each direction per hour during the rush hours. This point, at the corner of Glockengiesserwall, Georgsplatz and Ernst-Merckstrasse, is illustrated in the accompanying engraving, which is also of particular interest from the fact that the company is installing at that point some elaborate special work. The site of the proposed steam railroad station is indicated by the black star at the right-hand side of the engraving.

As will be seen, a temporary track has been built over the new special work which is being installed. This track is supported on wooden blocks, which are mounted on ties or rest directly on the concrete base on which the new track is being laid. The temporary track is kept in gage by brace tie-rods.

The large numerals on the cars indicate the route upon which the car is running. All cars are marked in this way, and it is undoubtedly a great convenience to intending passengers, who can thus easily identify the car either by the sign board or by the number which is carried on the main panel and also on the front of the hood. This paper is indebted for the accompanying article and photograph to Mr. Weltzien, engineer of track construction of the Hamburg Street Railway Company.

SHAFT STRAIGHTENING IN THE LAKE STREET ELEVATED SHOPS, CHICAGO

A new shaft straightener for taking the bends out of motor shafts has been recently devised and put in use by F. D. Ward, master mechanic of the Lake Street & Northwestern Elevated Railroad Companies, of Chicago. These roads are equipped principally with General Electric 55-motors. When motor shafts are bent the bend is usually just inside the pinion. The new straightening device is intended to take out such bends without removing the axle from the armature.

Fig. 1 shows sectional drawings of the shaft straightener assembled, and Figs. 2 and 3 the appearance of the finished apparatus. It consists of two parts. The outer part, which is slipped onto the shaft first, is of such a shape as to fit in under the overhanging armature of the General Electric 55-motor, so as to get as far in on the shaft as possible. The second part slips inside the first, and is fitted so as to allow only a loose sliding fit in the outer shell one direction, but to allow considerable motion in the other. The outer part is provided with a jack-screw, which, upon being tightened, forces the inner part to one side, so straightening the bent shaft if applied in the proper direction. Both inner and outer parts fit upon the shaft with an easy sliding fit, being bored 1-64 in. larger than the new armature shaft.

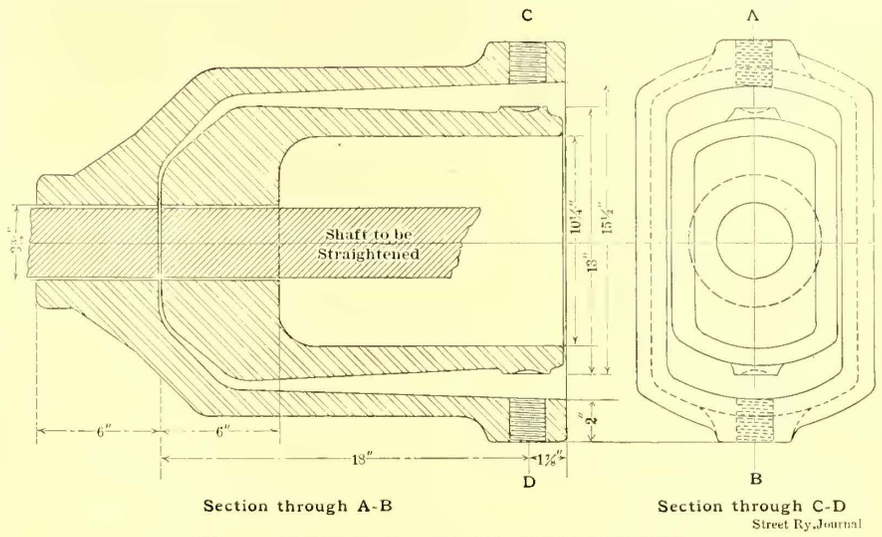


FIG. 1.—SECTION OF SHAFT STRAIGHTENER

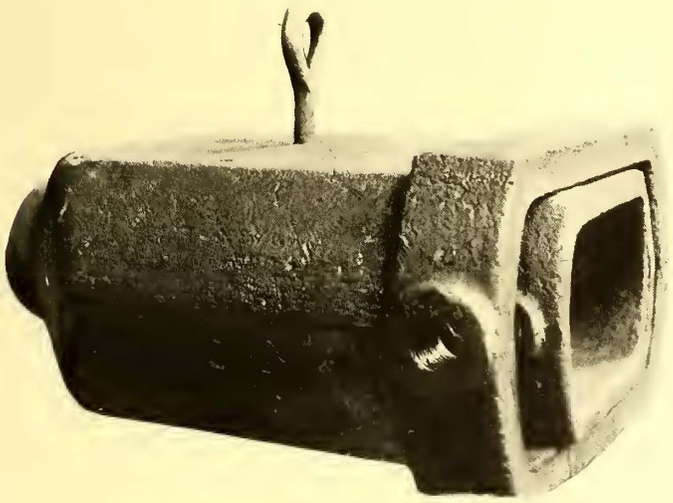


FIG. 2.—SHAFT STRAIGHTENER ASSEMBLED

These shells are all made of cast steel, and being rather heavy for manipulation by hand an eye-bolt is provided on the outer shell, so that it can be carried around with the traveling crane.

FIG. 3.—PARTS OF SHAFT STRAIGHTENER

The straightening is, of course, done in a lathe, the armature being put in the lathe with the shaft straightener on the shaft. The straightening of the shaft is then simply a question of turning the strightener to the proper angle and applying the jack-screw enough to accomplish the straightening. It has been found to work very well and to save much labor and risk of damage to armatures incidental to other methods.

The steel castings used for pulling off pinions in these shops are also shown here in two sizes. Their mode of operation is apparent from the engravings and drawings. Fig. 4 is from a photograph of the two sizes, and Fig. 5 is the working drawing of one of them.

All the motor cars of the Northwestern Elevated Railroad are being equipped with General Electric type M control, with a master controller in each cab, and the main current carrying contacts operated by magnets under the car. The primary object of this change is to secure a more satisfactory controller for heavy currents than was the old type L. It will also put the equipment in line for the use of a mixed multiple unit system, should such a move ever seem desirable.

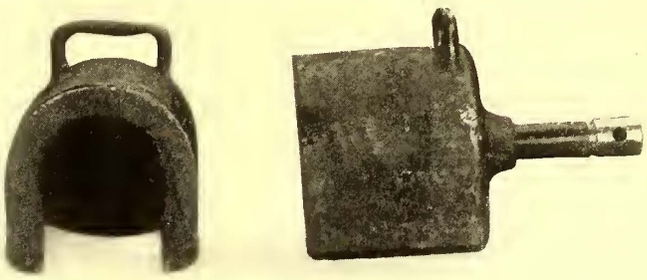


FIG. 4.—STEEL CASTINGS FOR PULLING OFF PINIONS

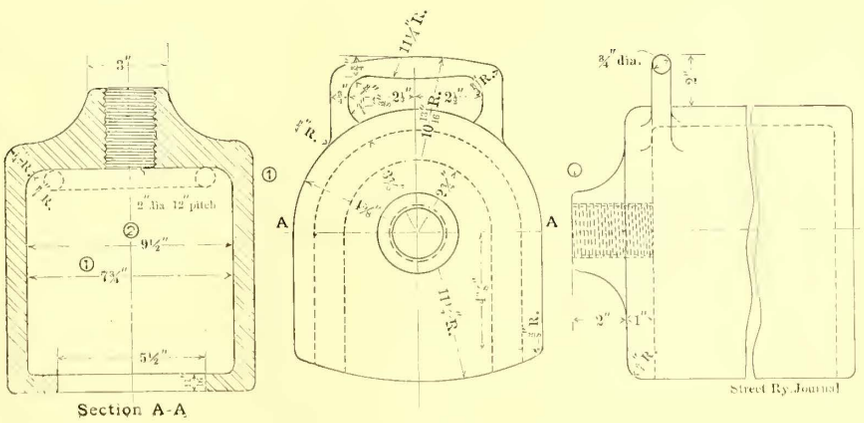
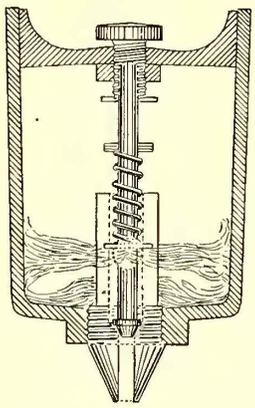


FIG. 5.—PINION DRAWING DEVICE

MOTOR LUBRICATION IN COLUMBUS

After an extensive experience covering three years the Columbus Street Railway has adopted oil for lubricating motor bearings and finds it superior to grease for this purpose. This matter has been developed along very simple lines by Charles E. Hott. No changes are required in the grease boxes, as the oil receptacles are made of rectangular form to fit into the grease box on the motor.



SECTION OF OIL CUP FOR MOTORS

The supply of oil to the bearing is regulated by wicking, which passes through a valve chamber, as shown in the accompanying cut. The oil is fed to the bearing by the capillary action of this wick. A valve is also provided, being seated in this oil chamber, which stops the supply of oil when the equipment is not in service. The oil used is Galena car oil, the lighter oil being used for winter and the heavy oil for summer. The economy effected by the substitution of oil for grease has been a reduction from 16½ cents to 11 cents per 1000 miles, and the life of the brasses have been increased 50 per cent. In addition there is a saving in the time required to apply the oil instead of grease.

The Columbus Street Railway Company is doing a considerable amount of electric welding of track. In this work the opportunity was improved to weld the cross-connecting bonds of the special work. The ends of these cables were placed in lugs and were welded under pressure. This was found to be a most effective way of connecting these cables to the rails.

SHOP KINKS ON THE GRAND RAPIDS, HOLLAND & LAKE MICHIGAN

Various means have been devised for holding armature bearings during the turning out process after the babbitt has been cast. One of the simplest in operation is that used on the Grand Rapids, Holland & Lake Michigan Rapid Railway, by G. E. Hardy, master mechanic at the company's shops at Macatawa Park. A frame for holding the bearing shell has been made, which rests and is bolted on the tool carriage of the lathe. The bearing shell is clamped into the middle of this frame. On each side of the bearing shell is a bearing of the right size for a 1¼-in. shaft. These two bearings have passed through them a boring bar, which is a piece of 1¼-in. shafting, with a boring tool mounted on a slot in it, and which is rotated in its bearings by a lathe-dog driven from the face plate of the lathe. As the boring bar is fixed in bearings which are in line with the newly-babbitted shell, and as this has been clamped in to be bored out, there is no delay in getting the shell correctly centered.

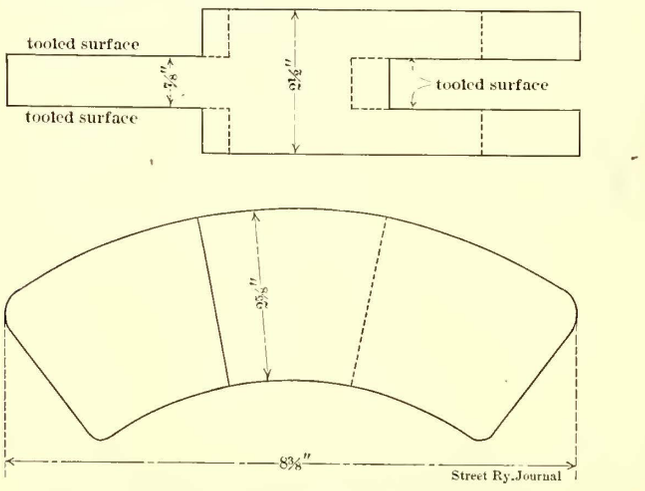


FIG. 1.—SECTIONS OF COMMUTATOR CLAMP

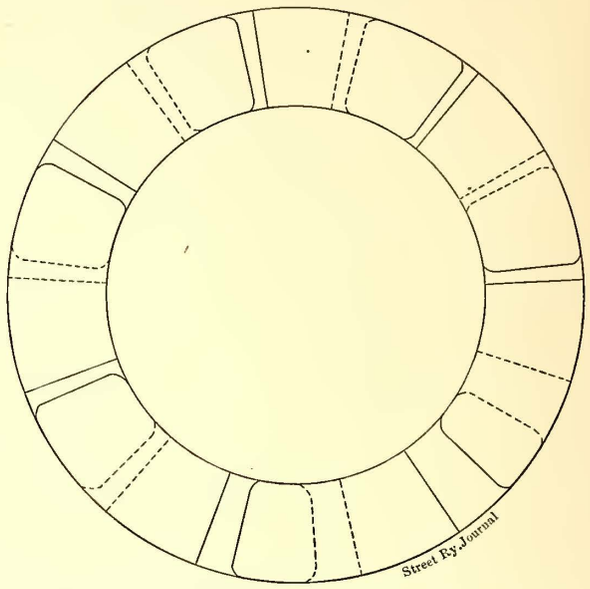


FIG. 2.—PLAN OF SECTIONAL CLAMP FOR COMMUTATOR

The sub-station at Macatawa Park adjoins the repair shops, and the sub-station attendant is also the armature winder. There is sufficient extra room in the sub-station for him to carry on his work. Thus an economy is practiced which has been frequently talked of in connection with sub-station attendance, but which is perhaps not found as often as was anticipated when distribution from sub-stations was first proposed.

For assembling commutators Mr. Hardy has made a sectional clamp, which is shown assembled in Fig. 2, and one of the sections with sizes is also shown in Fig. 1. The various sections, which are of cast-iron, dovetail into each other. When placed around a commutator a steel ring with set screws is put around it, and the set screws are brought down onto each segment of the clamp.

A similar arrangement has been for some time employed by W. W. Annable, master mechanic of the Grand Rapids Railway Company, except that the sections in Mr. Annable's device do not dovetail into each other but simply overlap on one side, so that one section can be temporarily taken out at any time during the operation by loosening the set screw over it.

REPORTS OF THE PENNSYLVANIA STREET RAILWAY COMPANIES

In the issue of the Street Railway Journal of Jan. 3, 1903, advance figures showing the operation of the street railway companies in New York State for the year ending June 30, 1902, were published, and in the issue of Jan. 17 a similar table was printed, giving information of the railway companies in Massachusetts. Through the courtesy of the Department of Internal Affairs of Pennsylvania this paper is able to present on the opposite page a table compiled from the returns of the street railway companies of Pennsylvania for the year ended June 30, 1902.

The table comprises operating companies only, and eighty roads are reported. As will be seen forty-eight of these companies show a surplus as a result of the year's operation, and thirty-one a deficit. The income and expenditure of one company just balances, making the total of eighty companies. Of the forty-eight companies showing a surplus as a result of the year's operation fifteen only paid dividends. The amount of the dividends paid is given but the rate is not published, as it is not called for in the form of return made by the companies to the Secretary of Internal Affairs.

FINANCIAL REPORTS OF THE OPERATING STREET RAILWAYS OF PENNSYLVANIA FOR THE YEAR ENDING JUNE 30, 1902

NAME	ON JUNE 30, 1902		YEAR ENDING JUNE 30, 1902				
	Capital Stock	Funded Debt	Total Receipts All Sources	Operating Expenses	Charges on Earnings	Dividends Paid	Surplus for Year
	$	$	$	$	$	$	$
Allentown & Kutztown	250,000	195,000	56,850	23,734	15,029	.....	8,088
Altoona & Logan Valley	415,350	490,500	155,462	80,139	33,491	41,535	297
Ashland & Centralia Electric	60,000	60,000	12,086	5,600	4,461	.....	2,025
Beaver Valley Traction	1,000,000	1,000,000	161,604	89,489	74,246	.....	def. 2,131
Bradford Electric	130,000	130,000	50,099	29,242	8,295	.....	12,562
Butler Passenger	50,000	.....	19,302	19,427	1,737	.....	def. 1,862
Carlisle & Mt. Holly	100,000	100,000	18,576	9,462	9,026	.....	88
Chester Traction	500,000	250,000	305,048	180,568	107,303	20,000	def. 2,823
Citizens' Traction (Oil City)	150,000	.....	50,455	42,291	300	.....	7,864
City Passenger (Altoona)	200,000	50,000	117,560	89,150	7,876	20,000	535
Conestoga Traction (Lancaster)	4,000,000	1,887,500	344,227	225,248	140,901	.....	def. 21,921
Connellsville Suburban	25,000	175,000	20,147	14,492	4,829	.....	826
Cumberland Valley Traction	446,400	277,500	27,114	26,412	1,005	.....	def. 333
Delaware County & Philadelphia Electric	300,000	64,000	79,136	57,382	11,521	21,000	def. 4,766
Doylestown & Willow Grove	500,000	500,000	56,487	22,114	50,623	.....	def. 16,250
Du Bois Traction	17,500	16,800	13,998	9,572	1,778	.....	2,647
East End Passenger (Williamsport)	18,000	18,000	4,627	5,117	1,341	.....	1,831
Easton & Nazareth	250,000	250,000	27,986	11,119	13,106	.....	3,760
Erie Electric Motor	1,250,000	1,000,000	214,172	113,343	132,559	.....	def. 31,731
Erie Traction	500,000	500,000	62,033	42,308	31,241	.....	def. 11,517
Franklin Electric	60,000	50,000	34,424	27,851	3,312	.....	3,261
Gettysburg Transit	100,000	100,000	4,214	3,373	22,861	.....	def. 22,020
Hanover & McSherrytown	30,000	.....	7,830	4,791	3,023	.....	16
Harrisburg & Mechanicsville Electric	144,500	144,500	48,201	36,434	11,360	.....	406
Harrisburg Traction	2,000,000	75,000	466,530	198,673	167,858	100,000	.....
Holmesburg, Tacony & Frankford	750,000	400,000	120,430	63,506	30,747	21,000	5,177
Johnstown Passenger	1,993,950	1,780,000	274,168	126,283	69,905	18,000	59,981
Kittanning & Ford City	50,000	27,500	35,865	23,610	5,533	.....	6,722
Lebanon Valley	500,000	500,000	69,901	29,734	28,625	11,000	942
Lehigh Traction	1,000,000	585,000	129,653	62,681	46,512	.....	20,460
Lehigh Valley Traction	2,654,080	3,000,000	740,017	351,128	352,613	95,181	def. 58,905
Lewisburg, Milton & Watsontown Passenger	150,000	150,000	22,843	18,665	8,627	.....	def. 4,449
Lewistown & Reedsville	150,000	275,000	44,473	23,992	8,748	.....	11,733
Lykens & Williams Valley	188,500	168,000	20,676	11,126	11,632	.....	def. 2,083
Mauch Chunk, Lehighton & Slatington	600,000	500,000	23,724	23,372	11,796	.....	def. 11,444
Meadville Traction	350,000	300,000	29,591	21,388	7,500	.....	703
Media, Middletown, Aston & Chester	183,000	.....	54,397	45,416	20,642	.....	def. 11,660
Montgomery & Chester	100,000	100,000	14,045	15,402	5,000	.....	def. 6,357
Montoursville Passenger	75,000	75,000	16,006	13,700	600	.....	1,705
New Castle Traction	500,000	500,000	139,626	84,553	30,688	.....	24,386
Newton Electric	300,000	300,000	64,587	42,640	22,878	.....	def. 931
Oil City	90,000	25,000	39,290	33,007	1,580	.....	def. 4,704
Patterson Heights	6,000	4,800	1,425	1,701	457	.....	def. 733
People's (Nanticoke)	100,000	100,000	28,580	20,633	6,695	.....	1,252
Philadelphia & Chester	350,000	270,000	16,504	24,625	17,034	.....	def. 25,154
Philadelphia & Lehigh Valley	1,500,000	1,932,000	74,182	88,497	5,097	.....	def. 19,412
Philadelphia & West Chester	565,175	390,000	110,409	85,092	29,525	.....	def. 4,209
Pittsburg, McKeesport & Connellsville	1,650,000	1,649,500	203,796	153,394	89,130	.....	38,728
Pittsburg, McKeesport & Greensburg	500,000	250,000	75,428	47,769	1,502	.....	26,157
Pottstown Passenger	87,500	75,000	32,945	23,604	6,056	.....	3,286
Pottsville Union Traction	1,250,000	701,000	173,769	98,103	66,463	.....	9,204
Punxsutawney Passenger	160,000	.....	34,950	26,719	1,485	.....	6,747
Ringing Rocks Electric	50,000	54,000	8,196	10,253	.....	.....	2,057
Riverview Electric	75,000	.....	6,859	6,897	2,046	.....	def. 2,084
Roxborough, Chestnut Hill & Norristown	248,400	371,000	97,487	46,430	34,488	46,624	def. 36,055
Schuylkill Traction	2,000,000	549,000	130,757	81,225	43,807	.....	5,724
Schuylkill Valley Traction	500,000	245,000	197,279	136,353	66,268	.....	def. 5,341
Scranton Railway	3,000,000	3,000,000	422,561	390,578	226,648	.....	df. 194,665
Shamokin & Edgewood Electric	60,000	60,000	32,066	27,873	3,594	.....	599
Shamokin & Mt. Carmel Electric	700,000	300,000	71,478	33,787	50,741	.....	13,050
Sharon & Wheatland	50,000	50,000	56,713	35,291	3,211	.....	18,211
South Side Passenger (Williamsport)	25,000	25,000	15,901	12,606	2,065	.....	1,231
Southwestern Street (Philadelphia)	400,000	400,000	49,222	36,406	25,123	.....	def. 12,307
Stroudsburg Passenger	51,200	7,000	7,104	5,921	238	.....	944
Sunbury & Northumberland Electric	125,000	125,000	25,074	20,664	5,144	.....	def. 733
Susquehanna Traction (Northumberland)	200,000	100,000	21,824	18,043	4,320	.....	def. 538
Tamaqua & Lansford	200,000	200,000	53,153	32,070	10,567	10,000	516
Tarentum Traction Passenger	50,000	100,000	31,525	17,768	8,165	.....	5,593
Titusville Electric Traction	100,000	100,000	31,552	17,006	6,164	.....	8,382
Union Traction (Philadelphia)	10,500,000	.....	14,118,158	6,402,338	6,637,782	.....	1,078,039

FINANCIAL REPORTS OF THE OPERATING STREET RAILWAYS OF PENNSYLVANIA FOR THE YEAR ENDING JUNE 30, 1902—*Continued*

Name	On June 30, 1902		Year Ending June 30, 1902				
	Capital Stock	Funded Debt	Total Receipts All Sources	Operating Expenses	Charges on Earnings	Dividends Paid	Surplus for Year
	$	$	$	$	$	$	$
United Traction (Reading)	400,000	149,900	509,212	261,921	220,138	20,000	7,154
Vallamont Traction (Williamsport)	101,700	100,000	22,125	12,990	7,032	.....	2,103
Valley Street (Sharon)	150,000	150,000	34,230	23,954	8,746	.....	1,529
Warren	200,000	200,000	62,332	43,573	7,079	.....	11,680
Washington Electric	125,000	125,000	50,402	21,592	6,965	.....	21,845
West Chester	60,000	34,000	15,237	13,082	3,346	.....	def. 1,191
Wilkesbarre, Dallas & Harvey's Lake	200,000	150,000	45,028	25,624	10,797	8,000	607
Wilkesbarre & Wyoming Valley Traction	5,000,000	1,817,000	634,216	299,935	148,127	212,500	def. 26,346
Williamsport Passenger	338,550	169,000	104,656	77,217	14,330	.....	13,109
York	200,000	150,000	89,035	52,935	14,945	6,000	5,155

CORRESPONDENCE

TRANSFORMERS FOR TESTING ARMATURES

Jan. 15, 1903.

EDITORS STREET RAILWAY JOURNAL:

I have built a transformer for testing armatures, following specifications as laid down in the November issue of the STREET RAILWAY JOURNAL in all except one thing, and that is, I put a wrought iron angle-plate on the outside of each end of the sheet iron, to give it rigidness, and put four ¾-in. bolts to hold all together in a solid mass. I insulated the plates of sheet iron from each other with tissue paper, although I left the paper short at alternate ends, so as to give each piece of iron a short contact with that on one side. I then put on 100 turns of No. 8 wire, well insulated. I put a 110-volt current of about 60 cycles through the transformer, and thus far I have been unable to heat any wire larger than a No. 20, and that but slightly. I placed the No. 20 in with the armature just to try what size would heat up on a short circuit, and it got barely warm. The armature was one just taken out of a motor with a short-circuited coil. Are my ¾-in. plates and bolts the cause of my non-success, or is it the lack of insulation between plates at the corners? I am anxiously waiting a solution to the difficulty, as it means a lot of money saved.

REPAIR SHOP SUPERINTENDENT.

[Answer]: We think that the trouble is due to two causes. First, the iron plates on the ends of this magnet have prevented you from getting the armature sufficiently close to the magnet to get good results. The closer the armature is to the magnet the more powerful will the induced currents in the armature be. A second reason why the results were not satisfactory was that you probably did not wait long enough for the bobbin to warm up. Even if you only succeeded in getting one-fourth of the generated magnetism in the armature you still have about one-fourth of a volt per turn. This should generate about 85 amps., or thereabouts, through a short-circuited coil of a 35-hp motor, and would heat the coil to 40 degs. Centigrade above the temperature of the atmosphere. If you would prefer to have the bobbin heat up more quickly and find it inconvenient to get the clearance between armature and magnet any less you will find that the magnetic effect increases as turns are taken off the coil. With one-half the number of turns on the coil you can expect practically double the induced currents in his armature bobbin, other conditions remaining the same.

This fact, however, should be borne in mind, if the short circuit is only partial, the coil in the armature will, of course, heat up slowly, owing to the resistance of the bad contact. But if, during the test, the resistance of this bad contact suddenly diminishes and the transformer is wound with a low-resistance coil, the armature coil will heat up with tremendous rapidity, and it may burn out during the test. If the short circuit in the armature is complete we believe there should be no difficulty in heating up the coil of the armature with the original winding. If, however, you want to detect a partial short circuit rapidly and are willing to take the chances of a completely short circuited coil heating up too rapidly, we suggest that you wind your transformer with thirty turns of No. 6 wire. Then if you put your armature into the field and use a good-sized fuse in your primary circuit, we believe you will have no difficulty in feeling heat in the armature coils.

WHEEL AND AXLE FITS

Cleveland, Ohio, Jan. 17, 1903.

EDITORS STREET RAILWAY JOURNAL:

Where can I find a table showing what size to bore wheel so that it will press on an axle at a definite pressure. If there be no such table published can you tell me what should be the difference of diameter between the hole in a wheel and diameter of the axle where the axle is 5 ins. in diameter so that the wheel can be pressed upon the axles with about 35 tons. The length of the hub is about 5 ins. G. H. K.

[Answer]: The "old rule of thumb" method still applies to mounting wheels on axles, and as a matter of fact seems to be better than the more scientific methods of doing this work. Different companies have tried in numerous instances to bore a lot of wheels to a certain size and turn a lot of axles to another size, expecting to get what is known as a "pressure fit." But while this may be obtained in perhaps 75 per cent of the cases, in the other 25 per cent either there was no pressure at all or else the pressure secured was so great as to burst the wheel. The method of mounting wheels in all shops that we know about, is first to bore the wheel and then caliper the axle to fit. Machinists have an expression that they can "tell by the feel" as to how much metal to leave on the axle, this, of course, being the result of experience. We have never seen such a table as you suggest, and do not think it would be of value if made up, as it would only apply to the wheels from one manufacturer. Every make of wheel varies in density of iron, and hence in its elasticity. This is shown by the trouble experienced by railway companies when they change the make of wheels they have been using for a long time. We might say, however, in the case you mention that for 35-ton pressure the axle should be about one one-hundredth of an inch (0.01 in.) larger than the bore of the wheel.

The cars of the Boston & Northern Street Railway Company are to be equipped with red bullseye lanterns, which will be hung on the rear dash.

ALLEGED AMERICAN CONSERVATISM

Boston, Mass., Jan. 15.

EDITORS STREET RAILWAY JOURNAL:

One is prone to look back on the prodigious growth of electric railways in this country, and smile the smile of complacency that American enterprise has wrought so great a work. And truly the feat has been one that we may well be proud of, but with our patriotic fervor there comes at least a shadow of regret that the daring enterprise and resourceful ingenuity of the American pioneer has not inspired the present as it did the past. As a matter of fact, so far as electrical engineering is concerned, the electric railway in this country has for the past five years remained on a dead level of self-satisfied standardization. It is not necessary for engineers and investors to go in for all sorts of costly experiments, but they should be reminded that no art has ever yet been advanced by sitting down in well-fed contentment and letting well enough alone. And that is precisely what Americans have been doing in the electric traction business. To be sure, we can count up a yearly score of some hundreds of miles of track and more hundreds of cars, but the track and the cars and the rest of the plant show little evidence of the restless enterprise by which the way to electric traction was won. If our present methods and equipments could be regarded as full, perfect and complete, there might be some excuse for the present national attitude, but, as every practical man fully realizes, there is still much to be desired. We have not reached or even remotely approached finality in the evolution of electric traction, and yet we seem to be content to let improvements slide.

Truth to tell, the most important advances are now being made by foreign engineers on foreign soil. One may denounce their work as needless or damn it as experimental—that last epithet of outraged conservatism in the presence of dreaded innovations—but good, bad, or indifferent, it is not ours but theirs, and if any great advances come through their labors theirs will be the reward. Americans cannot hope to repeat indefinitely the story of the Inner Circle. Abroad engineers are busy with innovations—traction by alternating motors, high-speed service, surface contact systems, monorail elevated roads and locomotive systems to invade the domain hitherto held undisputed by steam. Americans having no practical experience with such things are disposed to denounce them as impractical, visionary or experimental—but no one of them looks half so hare-brained as did the trolley system itself barely fifteen years ago. Engineers look wise and say they are unsuited to American conditions; which may be true, but cannot be proved by any amount of assertion. Meanwhile in this country we wrangle over whether the same old motor should be rated on a heating limit of 56 degs. for three hours or for three hours and twenty minutes, or how much better Smith's system is than Brown's, when the one will give acceleration sufficient to pitch the passenger over two seats and the other merely flattens him against the front door. We read long-winded papers on the conversion of trunk lines to the third-rail system, when a few hours of sleet recently disorganized half the traffic of the metropolis. And in general we are contented to believe that we are the whole thing in electric traction, and that no improvements are needed save in what we are pleased to called minor details.

Now this attitude is unquestionably based on very great and striking success, and just now when we are on the crest of a tidal wave of industrial supremacy it will pass for vice-regal dignity, but the day will soon come when we shall have to show cause, and that day may prove to be one of tribulation. It is doubtless a good thing in the progress of an art to sit down for a while when all goes well and to calmly smooth out one by one the minor difficulties. But it will not do to be caught napping at the task, and unless we much mistake there is some danger of such a denouement. American enterprise came near to getting a severe setback in the Inner Circle affair, and escaped only by the potent interposition of Pull—the deus ex machina of American life. The final decision in that famous case was doubtless sound, but it was a precious close call, all the same. There are indications that the lesson has not been altogether lost, and that American engineers are recovering some of the old-time hustle. The Zossen tests, the Elberfeld-Barmen road, and the recent choice of the monorail system for an important line ought to serve as additional goads to experimental activity. If American electric traction is to be the world's model we must do something besides standardizing existing apparatus and buying roads to install it on. Now, every-one of the innovations we have cited may prove in the last resort to be unwise, but they cannot safely be assumed to be so without further proof. Our contention is that the art must keep moving, and that doing even radical things is preferable to doing nothing at all in the way of innovation. There is much still untried in electric traction, and there are many obvious improvements still to be made. It is time to be up and doing.

AN OBSERVER.

[We cannot agree with the opinion of our correspondent, so fervidly expressed in the above letter. Not only are the most important commercial installations abroad at present being equipped with apparatus which practically follows the same standards as are in force in America, but American engineers themselves have and are showing no marked tendency toward the self-complacency to which our correspondent refers. The wide adoption of polyphase systems of power distribution for railway work, and the development of high-speed trolley and third-rail roads are examples only of the progress which has been made in this country during the past two or three years; while the future promises to be even more fertile in important results in electric railway development. In our opinion it is to a large extent due to the fact that American engineers and investors have not been mislead into installing, on a large scale, many of the delusive schemes with which the progress of electric traction in other countries have been burdened that the American electric railway industry occupies the position which it now possesses.—Eds.]

AMERICAN CAPITAL IN HOLLAND

The Netherlands Tramways Corporation has recently been organized, under the laws of the State of Connecticut, with a capital of $3,500,000 to purchase, build and operate electric lines in Holland and elsewhere. The officers of the company are: Directors, Henry J. Pierce, W. Caryl Ely, Pendennis White and Charles W. Goodyear, of Buffalo; William B. Rankine, of Niagara Falls; G. L. Boissevain, F. S. Smithers, N. W. Halsey, J. G. White and James M. Edwards, of New York, and M. J. Boissevain, of Amsterdam, Holland. The officers are: Henry J. Pierce, president; G. L. Boissevain, vice-president; W. Paxton Little, secretary, and Edwin Henderson, treasurer.

The company has purchased all the street railroads in the city of Haarlem, consisting of part horse and part electric lines, and will equip the former with electricity. It has also purchased a road running from Haarlem 5½ miles to Zandwort, on the North Sea, the second largest Dutch seaside resort. Franchises have been obtained, through F. Anderheggen, Jr., and L. J. Neümeyer, of Amsterdam, for a double-track road, to run from the center of the city of Amsterdam to Haarlem, a distance of 10 miles. The contract for the construction of this road has been awarded to J. G. White & Co. The speed of the cars will be about 22 miles an hour. The line, which will be known as the "Electrische Spoorweg Maatschappy," will probably be in operation early in 1904.

STREET RAILWAY ACCOUNTING

CONDUCTED BY J. F. CALDERWOOD, ASSISTANT TO THE PRESIDENT, BROOKLYN RAPID TRANSIT COMPANY, AND MEMBER INSTITUTE OF SECRETARIES OF LONDON

THE ACCOUNTING DEPARTMENT

BY J. F. CALDERWOOD

The Accounting Department of the Street Railway Journal was commenced by the writer in the issue of May, 1902, and has, therefore, been conducted for ten months. During this time, from three to six pages have been devoted each month to a discussion of various topics of interest to street railway accountants, and the contributors to the department have included many of the best known street railway accountants in this country. One of the main objects in the establishment of this department was to give prominence to the accounting end of street railway operation and to emphasize the undeniably important function which the modern street railway accountant occupies in the successful conduct of the affairs of a well-organized and operated railway company. In the opinion of the writer, the mission of this department, as outlined above, has been accomplished. Accounting methods are now generally recognized as being as much integral features of street railway operation as are management or construction; and mistakes or errors of judgment in the conduct of the affairs in this department will exercise just as disastrous effects upon the fortunes of a company as if committed in the others mentioned. It seems, therefore, unnecessary, and even to a certain extent unwise, to continue the separation of articles on this subject in these columns, for the same reasons that the separate departments of "Construction" and "Operation," which were formerly conducted in this paper, were omitted.

This in no sense signifies that articles on different subjects connected with street railway accounting will not be welcomed by the editors or by the writer for publication in future issues of this paper. On the contrary it is because the importance of the subject is so great the opinion has been reached by the writer and those with whom he has consulted that these articles should not be confined to the limits of a single department. The writer will continue to act in an advisory capacity to the editors of the Street Railway Journal in the discussion of matters of this kind, and all accountants who have problems to suggest or information to give on methods which have proved of value on their roads are cordially invited to use the columns of this paper for the purpose. These articles will be given the same prominence as those on construction or operation or any other important branch of railway work.

HANDLING THE MONEY FROM THE CONDUCTOR TO THE BANK

In standard steam railway practice the revenue from passengers is handled almost entirely by the ticket agents. So convenient and so perfect is the ticket system that it is seldom found necessary for the conductors to handle cash. In fact a premium is placed upon the purchasing of tickets by the cheaper rates for limited tickets, excursion or round-trip tickets, mileage books, etc.; and there is likewise a small penalty for paying cash to the conductors, which, however, is usually refunded upon the presentation by the passenger to any ticket agent of the conductor's duplex cash receipt. On the elevated roads the revenue is also handled almost entirely by ticket agents.

The principal distinguishing feature of the handling of street surface railway revenue from passenger service is that no way has ever been found to avoid the necessity of conductors receiving the money. In many cities inducements are offered for passengers to purchase tickets, but it is not done to any great extent. On a large street railway system with passenger earnings of $20,000 to $40,000 per day, the revenue is collected by 1500 to 3000 conductors. To call attention to some of the customary methods of handling the money after it leaves the conductor's hands and to indicate the strong points of each is the present purpose.

The two methods in general use of taking the money from the conductors are:

First. Having the conductors turn the money over to receivers at the depots, or, on smaller roads, to the cashier at the company's headquarters.

Second. Having the conductors place their money in a bag and deposit it, properly tagged, in a safe of special construction, at the depots or at the company's headquarters.

Under the first plan the transfer between the conductor and the company's authorized fiscal agent is direct. The money is counted in the presence of the conductor, and any errors or omissions are corrected on the spot. Furthermore, it is the usual custom under this method of having the conductor's day card or trip sheet handed with the money to the receiver, who sees that the money turned in agrees with the face of the day card. The receiver does not, as a rule, attempt to "prove" the day card or the conductor's figures, leaving this work to be done at headquarters. The receiver's function, so far as the conductor is concerned, is to see that the money turned in agrees with the face of the conductor's report of the day's collections, and to be sure that the money is legal tender. The strong point claimed for this plan is the counting of the money in the conductor's presence, and the immediate detection of shortages or counterfeit money. The directness of the plan and the immediate settlement between the conductor and the company's fiscal representative of any errors is to be considered its principal recommendation.

Under this plan it is usually customary for the receivers to recount and verify the total amount of all money received, and at the end of their day's work to put it in shape for transmission with the proper reports. The transmission is made in two ways. Some roads prefer the plan of having each receiver transmit direct to the bank, each receiver being charged or credited with any short or over amounts discovered. Other roads believe it better to have each receiver transmit to the main office, where the money is rehandled and all money sent to the bank at one time, the bank charging or crediting the company with any short or over amounts discovered.

Under the second plan the money in the bag is not usually accompanied by the day card. It is, however, usually accompanied by a blank form, giving the necessary information concerning the run number, the line, the number of trips made, the conductor's name and badge number, and the total collections. There is also usually a more or less definite description of the money as, so many bills of the denomination of $5 and over, so many $2 and $1 bills, and so many coins of each denomination. The bag is tied, sealed and tagged by the conductor and placed by him in a safe (through a protected rolling slot somewhat like a United States mail box), from which it can be removed only by the company's authorized agent. The day card is forwarded by the conductor under separate cover to the accounting department. It is claimed for this method that by throwing upon the conductor the responsibility of counting and describing his returns by the denominations of the bills and coins there is less liability of error on his part. The manner in which the money must be handled and transmitted, it is claimed, makes the conductor exceedingly careful. Where this method is in vogue there are no receivers at the depots. The concentration of the receivers' work at the main office under the supervision of the cashier enables this part of the work to be performed with fewer receivers and at less expense. The strong point claimed for this plan is its economy and the con-

centration of the handling of the money at one central point. It is also claimed that by its operation the conductors are not delayed by standing in line at busy hours waiting their turn to reach the receiver's window. They can "turn in" promptly and go home.

Under this plan, it will be seen, errors and omissions cannot be corrected in the presence of the conductor. He may be ever so sure of his correct remittance, but must in the end take the word of the receiver for the accuracy or inaccuracy of his returns. It is claimed by the advocates of this plan that with proper methods of supervision of the work of the receivers each and every error discovered is immediately called to the attention of the chief of the department, and the count is by him verified and certified to, and with this certification the account is sent to the conductor, who, in the case of a shortage or a counterfeit, must make good. In the operation of this plan the money is handled only once between the conductor and the bank, but there are two transmissions.

The fact that some of the larger roads have changed from the first to the second plan, while others have retraced their steps and changed back from the second to the first plan would appear to indicate that no definite conclusion has been arrived at as to which of the plans is the better. Of course, local conditions in some cases may become the determining factor, but this, like other questions of accounting and finance, is less susceptible to the influence of local conditions than are matters of operation and construction. As a rule, correct theory is more easily applied to questions of accounting and finance than to questions of another character. The primary consideration in all methods of transmitting money through several different hands is the question of safety of transmission. The secondary considerations relate to accuracy of accounting and economy of handling in order of importance named. As a general proposition it will not be disputed that the more hands through which it passes the greater is the opportunity for loss and for error. Each additional transmission and handling increases the risk.

It may be assumed that any company working under either of the plans mentioned will safeguard the actual transmission of the money from one point to another, or from the hands of one person to another, in a manner which, in the judgment of its officers, is thoroughly reliable. At the same time the fact is indisputable that to reduce the number of transmissions and handlings is to reduce the risk. It would appear, therefore, that the correct theory is to make the number of transmissions and handlings as few as possible between the conductor and the bank. Carried to its logical conclusion this would make it appear that the ideal method would be to require the conductors to put up their money in shape for direct transmission to the bank. But such a method being impracticable it appears that one handling and one transmission are necessary. Whether additional handlings and transmissions are desirable seems to be the question open for discussion. The plan of having the receivers at the depots remit direct to the bank requires only one handling and one transmission. If the receivers at the depots remit to the main office and the main office rehandles and remits to the bank, there are two handlings and two transmissions. If there are no receivers at the depots and the conductors remit direct to the main office, and the main office handles the money and remits to the bank, there is one handling and two transmissions.

The method of having receivers at the depots remit to the main office may be left out of consideration, because it makes at least one unnecessary handling. The decision seems to rest between the depot receivers remitting direct to the bank, and the conductors remitting to receivers at the main office, who in turn remit to the bank. Assuming that the additional transmission required by the latter method can be safeguarded beyond question the choice between these two plans would appear to rest primarily upon considerations of accuracy in accounting and economy of operation. Other minor considerations dependent upon local conditions may also have to be taken into account by certain roads. It was not the intention to undertake to render a decision or express a preference as between these plans, but rather to indicate those points in each which are worthy of discussion.

STANDARD FORM OF REPORT

BY H. L. WILSON

The discussion of the income account adopted at the Detroit convention, taken up by Mr. Emerson and continued by Mr. Smith, is one that may be carried on indefinitely and no conclusion would probably be reached that would be thoroughly acceptable to all, but if uniformity of system is to be obtained individual ideas must be waived in favor of what the majority of the accountants think is correct.

If power is sold as a commercial product to outside parties it seems perfectly proper to put the returns into the income account. But there are many companies who have no charter that permits them to go into the power supply business, and yet are so situated in relation to other companies that it is absolutely necessary that they both supply power to and receive power from another. It would hardly be proper to put the amounts received for the use of this power into income account and the amounts paid into operating expenses as no proper comparison (which is the object of the uniform system) could be made with the accounts of another company which supplies only the power it consumes. Again, as Mr. Smith points out, some companies pay a tax on gross earnings, and burdens of this kind are now heavy enough to bear without unnecessarily adding to the load.

This brings up again the old question of where taxes belong in the accounts. Mr. Emerson says in operating expenses, the Interstate Commerce Commission says in charges, the Street Railway Accountants first said operating expenses, and when they found this was not acceptable to the Association of Railroad Commissioners, transferred the account into charges, where the highest authorities seem to agree it belongs.

There are so many methods of levying taxes that many arguments may be brought forward in individual cases to prove that one or the other is the only correct place for it to appear.

If taxes are paid on a basis of a percentage of the earnings, a per car mile or car day basis, operating expenses would seem to be the proper place; if the tax is on real estate or personal property or on the value of the capital stock of the company such a disposition would not be correct, as taxes of this kind would be assessed whether the property was operated or was idle. It would be undesirable to put part of the taxes in one place and part in another, so taking all things into consideration it seems better to call it a fixed charge.

There is still another account or rather three accounts that may be considered together. These are the "interest on deposits" and "income from securities owned," under "miscellaneous income," and "interest on floating debt," under "deductions from income."

The question that might be brought up is whether or not, if there is a charge to the latter account, it would not be proper to take part or the whole if necessary of the credits to the former two to offset or cut down this charge on the ground that it would not have been necessary to borrow money if the securities had not been purchased and that there would not have been any or as large a sum of money on deposit if none had been borrowed.

While a standard system is greatly to be desired in order to facilitate comparisons, it must always be kept in mind that there

are many reasons why no thoroughly satisfactory results are to be obtained from this source alone and that a knowledge of the individual conditions that govern each separate property must be considered.

Frequently directors of one company wish to know why it is that their property is not operated as cheaply as some other from whom they have obtained a carefully prepared analysis of expenses, and it is difficult or impossible for the accounting officer to tell them without a personal knowledge of the local conditions under which both operate, and these same local conditions, I am sorry to say, frequently have a very direct bearing on some accounting methods.

Mr. Smith's suggestion for a final ending of the income account seems to have no advantages over that adopted. On the other hand it would have the disadvantage of making the person examining it go to a little trouble to discover whether the dividends declared had actually been earned during the fiscal year or whether some previous prosperous year or some premium account was called upon to help the invalid out.

STANDARD CAR IN DENVER

The standard type of car employed in Denver for city and suburban service differs materially from that in any other city in the country, but it has proved very popular in that city.

From the views and plans which accompany this article it will be seen that the car is both a combination and semi-convertible car. That is to say, it is divided into two sections like a combination car, but each end is fitted with a very deep sash to secure the convertible feature in either end as desired.

The seating capacity of the car is forty-eight, twenty-four in each end of the car. The seats in the forward end, or that usually run closed, are of the Hale & Kilburn reversible rattan type, and those in the rear end are reversible oak, manufactured by the same company. The forward part of the car has one set of eight Consolidated heaters; the rear end not heated.

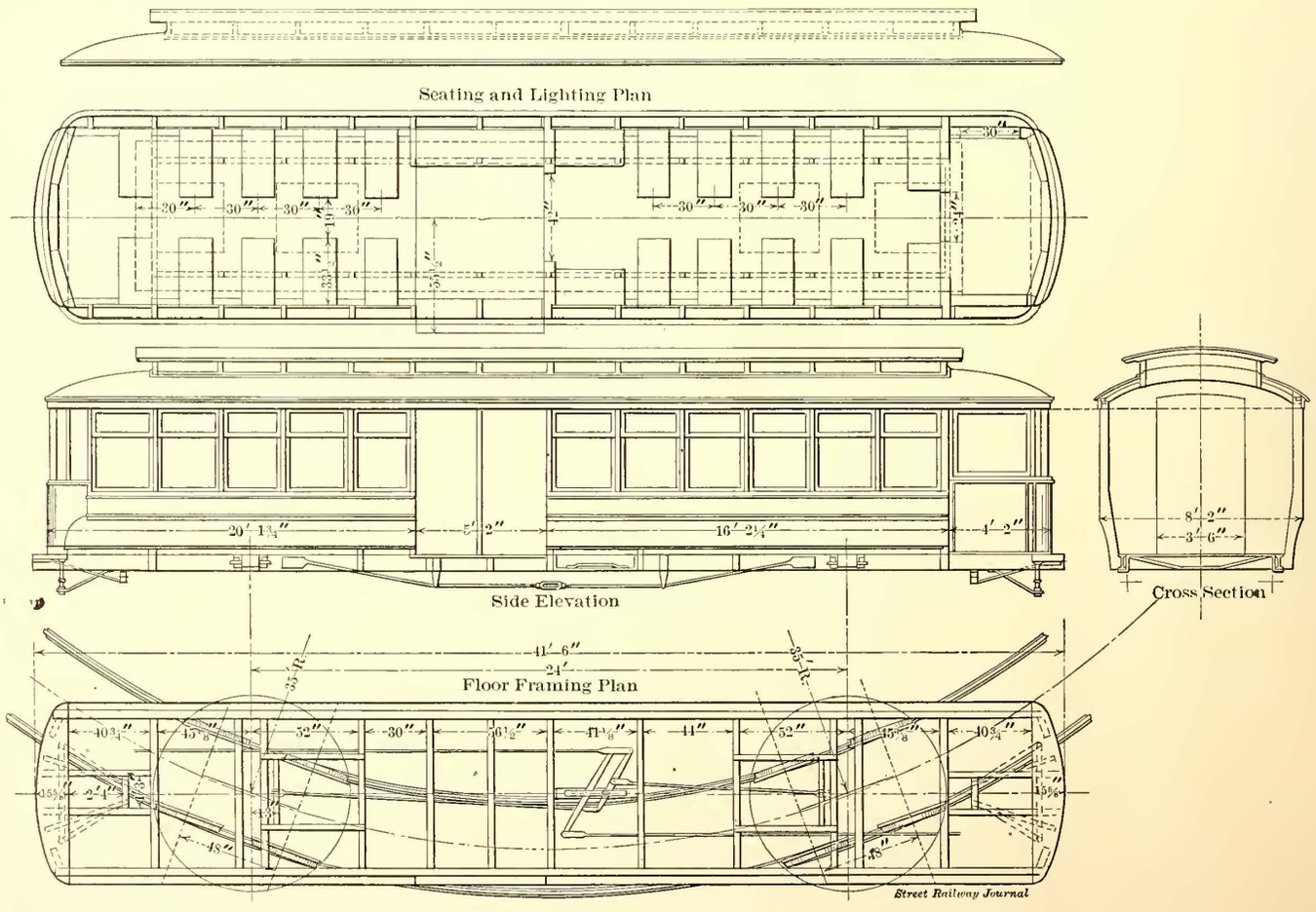
The car has an entrance in the middle of one side, 5 ft. 2 ins. in width. This is one of the features of the car. Mr. Beeler, manager of the Denver Tramway Company, is very enthusiastic over the use of side entrances, as the conductor, it is thought, can keep better control of the passengers by standing in the

INTERIOR OF FORWARD END OF DENVER CAR

middle of the car. The sash rail is only 26 ins. from the floor, and is fitted with sash pockets, so that when the sash are down practically all the advantages of an open car are obtained. The system of sill construction used is illustrated in the section of the sill, which shows that it is made up of a 7-in. I-beam, with a 3¾-in. x 7-in. Oregon pine timber.

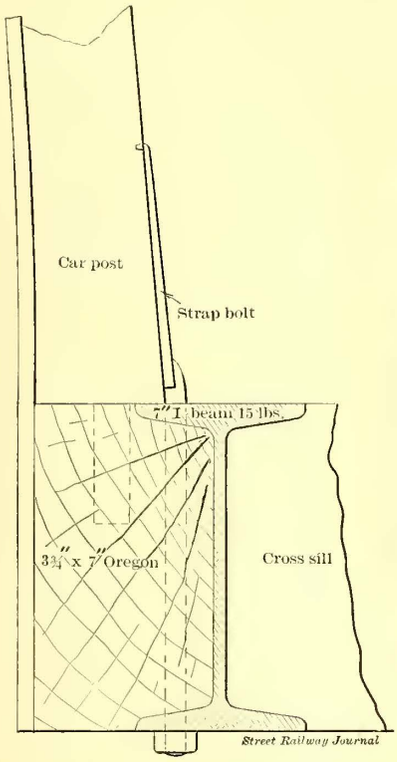
The car is painted the standard Denver Tramway color, which is coach painters' red for the main panel, and a dark straw color for the lower panel and upper framework. The interior of the car is finished throughout in antique oak.

Some of the cars are equipped with four G. E.-58 motors, and

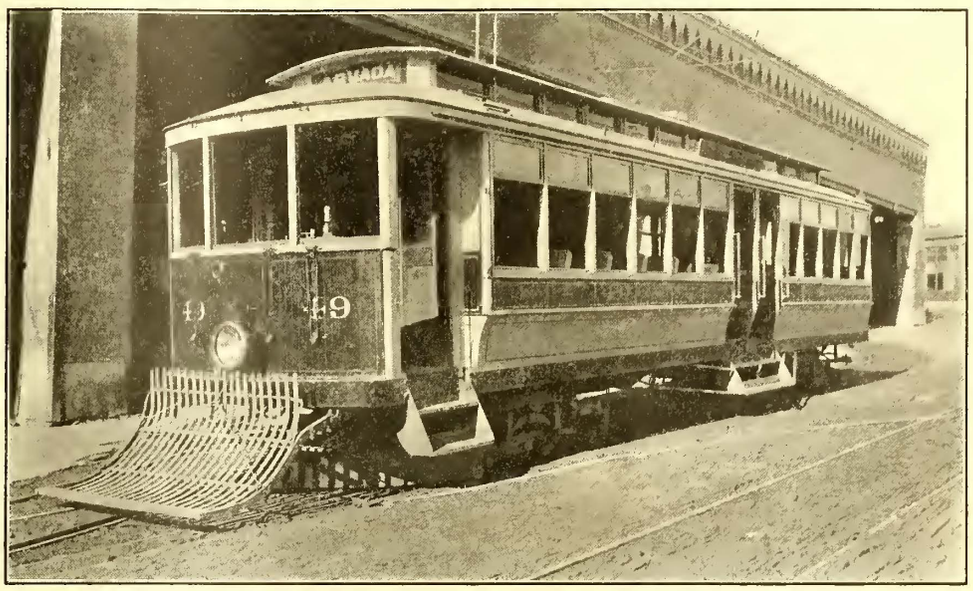


PLAN, SIDE ELEVATION AND SECTION OF DENVER CAR

are geared for 30 miles an hour. Other cars, intended for city service only, are equipped with only two motors of this type, and are geared for 18 miles an hour. K-6 controllers are used.



SECTION OF SIDE SILL



SIDE VIEW OF STANDARD DENVER CAR

The cars were built by the Woeber Carriage Company, of Denver, and are mounted on Brill No. 27-G trucks, with 33-in. plate wheels. The cars are equipped with Christensen air brakes.

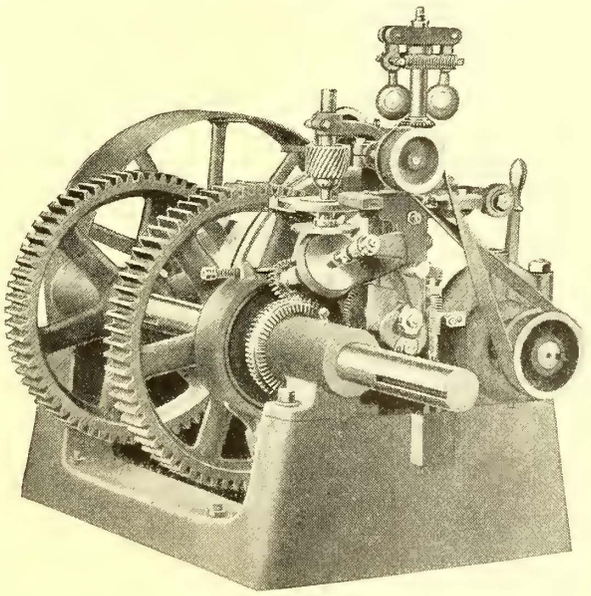
WATER-WHEEL GOVERNOR FOR ELECTRIC PLANTS

The accompanying illustration shows the latest design of a friction water-wheel governor, which is especially designed for the exacting requirements of electric light, railway and power service. This governor has been subjected to severe commercial tests during the last year, including one at the three-phase power plant at the United States arsenal at Rock Island, Ill., which proved highly satisfactory to the officers in charge. The installation, when complete, will consist of twenty 50-in. turbines and four size B governors, and will furnish power, light and heat for all of the arsenal buildings. The total capacity of the station will be 1750 kw. At present fourteen wheels and three governors are in use. The governors are geared to close the gates from full-open in six seconds, and with the severe changes due to the operation of large induction motors the largest temporary fluctuation does not exceed 3 per cent.

The Ottawa & Hull Power & Manufacturing Company, of Hull, Que., has had one of these governors in use for some time on a temporary plant, and is now installing two of them on a large station, which, when complete, will have an output of 10,000 hp. Each governor will control four 51-in. horizontal cylinder gate turbines, operating the full range of the gate in five seconds. Each set of four wheels is connected to 1500-kw generator. Two small vertical-type governors are installed on the exciter units.

The Rochester (N. Y.) Gas & Electric Company has had one of this type in successful operation for some time. It is controlling a 1000-hp horizontal turbine under 90 ft. head, driving street railway generators.

INTERIOR OF REAR END OF DENVER CAR



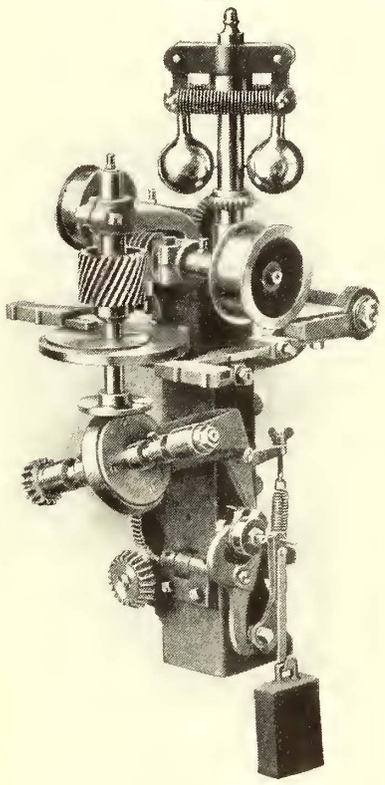
WATER-WHEEL GOVERNOR

This governor is large and powerful. The friction wheels are 24 ins. in diameter and 12 ins. wide, and are made with sufficient surface to transmit, if necessary, 5000-ft. lbs. per second to the turbine gates. The gears are cut from the solid, and are wide-faced and coarse pitch. The shafts are supported

on ample bearings. Ring oiling bearings are supplied for the friction shaft, which is the only one run continuously, and a continuous supply of oil is carried to the hubs and pans, which are loose on the shaft and are so constructed that it is impossible for oil which may work out of the bearing to get onto the friction surface.

Power is supplied from the main shaft of the water-wheel installation, and is delivered to the shaft of the governor by the large pulley. On this shaft is mounted a compressed paper friction. Supported by sleeves on this main shaft are two pans, which, when pressed against the friction, moves the gates of the turbines in either direction through suitable gear connection to an intermediate shaft, shown in the front of the cut. This intermediate shaft is connected in turn to the turbine gate shaft.

The speeder balls of the governor are separately driven from the main shaft of the installation. There is also a cam continuously revolved by means of the belt. As the speed changes the rod of the speeder raises and lowers, carrying with it the tappets arms and tappets, and one of the tappets is engaged by the cam and forced out from its center. This motion is then conveyed through suitable crank shafts to the main shaft, on which is mounted the friction, and as this shaft is forced back and forth the friction is brought to bear on either the opening or closing pan. When the speed is normal this cam revolves between the upper and lower tappets without engaging either.



REGULATING DEVICE

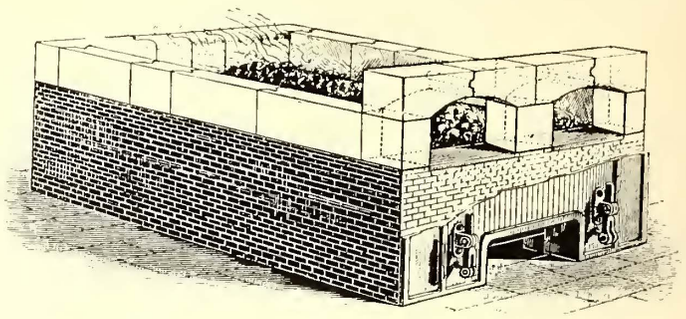
Just below the cam and fastened to the same shaft is a concave disc and a compensating wheel, which travels loosely upon an oblique shaft. This compensating mechanism is the same as that on the vertical model and is intended primarily to prevent racing. The apparatus is manufactured by the Woodward Governor Company, of Rockford, Ill.

STEEL MIXTURE FIREBRICK

In the construction of fire-boxes and furnaces it is of the greatest importance to have strong and durable, as well as refactory material. In an effort to combine these desirable qualities in a high degree, the McLeod & Henry Company, of Troy, N. Y., have put on the market the "steel mixture" block and arches manufactured especially for this purpose.

While iron boiler-door arches melt at a temperature of 2200 degs., it is claimed the "steel mixture" arches will not fuse until a temperature of 4000 degs. is reached.

The fire-box blocks are tongued and grooved, and come in sizes from 12 ins. to 16 ins. high and 6 ins. thick. When in place they make a wall the height of the fire all around the fire-box, and this wall is and remains smooth and solid, whereas, when ordinary small fire brick is used the clay shrinks and leaves space for clinkers. The accompanying engraving gives a good odea of the arrangement and appearance of this brick when used in furnace construction.

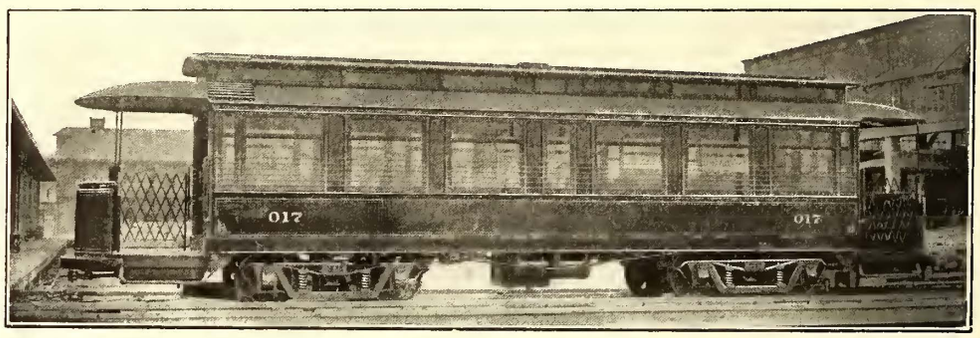


BOILER, WITH STEEL MIXTURE BRICK SETTING

NEW LONG CARS FOR NEW ORLEANS

The New Orleans Railways Company has recently been adding to its rolling stock and has secured from the St. Louis Car Company a number of long cars of the type illustrated in the engraving. The main dimensions of these cars are as follows: Length over corner posts, 34 ft.; length over bumpers, 45 ft.; width, 8 ft. As will be seen the cars do not have vestibules.

In spite of the fact that New Orleans is in a warm latitude open cars have never been popular in that city. The principal reason is that heavy showers are apt to come up very suddenly during the summer time, and when such storms do occur an open car is an extremely uncomfortable vehicle to be in. As a result, the semi-convertible car has proved very popular in New Orleans, and the car illustrated is of this type. The sills are of channel steel, of the Robertson pattern, in which the sash drop between the panels. The sash itself is of two sections, both being arranged to drop into the sash pocket, the top of which is within 24 ins. of the floor. The floor itself is double with a layer of felt paper between the floors.



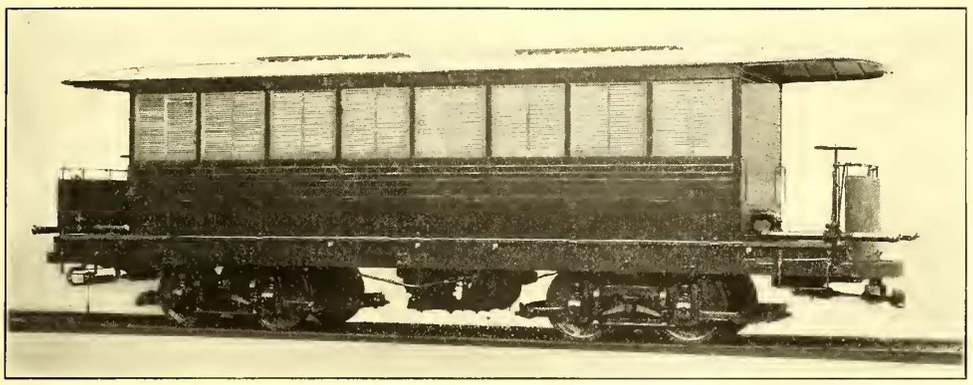
LONG CAR FOR NEW ORLEANS

The interior finish of the cars is in mahogany, and the same material is used in the ceilings. The cars are fitted with double door, St. Louis walk-over seats, Stanwood steps, Pantasote curtains and vertical ratchet-brake wheels. The car is mounted on 23-A trucks, M. C. B. type, and is fitted with Westinghouse air brakes and arc headlights.

The Lake Shore Electric Railway is considering the operation of belt cars running both ways, and making the circuit of Norwalk, Ceylon, Sandusky and Milan. This would not interfere with the schedule of the main line. At present each leg of the triangle is on a distinct division and is operated separately.

SPRINKLING CAR WITH CENTRIFUGAL FILLING PUMP

In getting ready for summer the subject of sprinklers is always important and sometimes a perplexing matter. Interurban lines, and lines which run far into the suburbs, are often left out of consideration entirely when the sprinkling schedule is made up, because of the expense, difficulty, and sometimes impossibility of obtaining a water supply. The need of laying the dust is doubtless generally appreciated so far as more fares is concerned; but the economy of operating over a dustless road, as regards truck and motor wear and non-arcing of current by keeping the wheels and rails in contact, is probably not so often considered. The friction which follows the entrance of dust into even the most carefully guarded motor bearings and axle-boxes heats the revolving parts, and not infrequently results in permanent injury. Arcing of the current, caused by dust and sand on the track, is a waste of power, and may even cause serious injury to generators, motors or even controllers.



SPRINKLING CAR WITH SUCTION PUMP

The sprinkler shown in the illustration is one of several of this type, built by the J. G. Brill Company, of Philadelphia. The novel feature in connection with it is an electrically-operated centrifugal filling pump, located under the car at the center. The purpose of the pump is to fill the tank from a stream or pond through a hose having a foot-valve. This makes the sprinkler independent of hydrants and the heavy tax usually imposed for their use, or saves the expense of elevated tanks and pumping outfits.

The Bergen Turnpike Company, of Hoboken, N. J., has ordered two of these cars, with 4000-gal. tanks, capable of sprinkling 6 miles to 8 miles of roadway, according to speed and character of surface. A 500-volt motor operates the pump, which has a capacity of 400 gals. per minute. The tank can, therefore, be filled in ten minutes. The cars are provided with special spraying devices, conical stop nozzles, having separate leads for washing rails and distributing the water uniformly over 9 ft. to 11 ft. outside the rails. The "Geyser" air compressor, made by the same company, for delivering the water 35 ft. to 45 ft. on either side, is also applicable to a double-truck sprinkling car, and may be mounted on a truck and axle-driven or operated by the motor which serves the centrifugal pump.

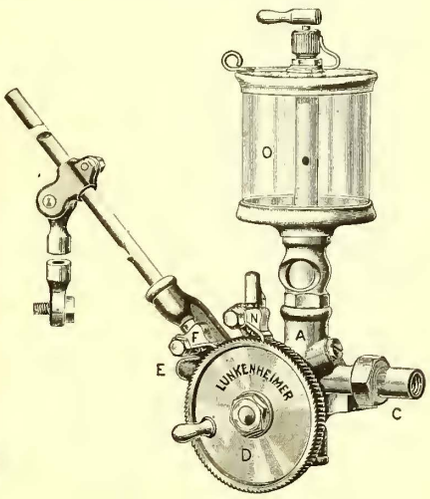
The tank in the Bergen cars is 5 ft. 4 ins. in diameter, and 24 ft. long, and is composed of ¼-in. sheeting, with 5-16-in. ends. Three swash plates are provided. An opening at the top is furnished in order that the tank may be filled in the usual manner. The car measures 24 ft. 7 ins. over the body, and 34 ft. 8 ins. over the bumpers. The width over sills is 7 ft. 6 ins. Doors at the ends are hinged down. As horses are liable to be frightened by unusual-appearing cars, the tank is enclosed and the cab provided with slat blinds.

The cars are mounted on No. 27-G trucks. The weight, without motors, is 32,200 lbs., and the total weight with motors and with tank filled 77,800 lbs.

MECHANICAL OIL CUP

The Lunkenheimer Company, of Cincinnati, has just brought out a mechanical oil cup for cylinder lubrication, which it recommends as more reliable than lubricators hydrostatically operated. When properly constructed the company believes that with mechanical lubricators all of the oil fed to the pump is bound to be forced to the steam chest or cylinder of the engine.

As will be seen the driving mechanism is of the ratchet type, and is operated by two clutches, that work co-operatively by the motion of a rod, which can be attached to the eccentric rod or other moving parts of the engine by couplings. The motion thus obtained is transmitted to the piston E by the crank-pin mechanism.



MECHANICAL OIL PUMP

The ratchet wheel D is provided with a handle whereby it can be rotated by hand in case it is desirable to force a quantity of oil at any time, as, for example, when starting the engine.

By moving the coupling up or down the operating rod, the stroke of the pump can be lengthened or shortened as desired, thus regulating the amount of oil fed by the pump independent of the feed from the oil cup. The joints of the cup are, of course, tight, the sight-feed glass being packed so as to prevent the access of air that would have a tendency to cause the cup to feed after the engine had ceased running. The outlet C is piped to the steam pipe or chest of the engine. The bottom of the pump is tapped ½-in. pipe thread to receive a stand so that it can be placed wherever desired.

A FINE FACTORY MACHINE SHOP

Street railway companies may study modern manufacturing methods with profit, because the car shops of the largest street railway companies approach the larger manufacturing enterprises in point of size and in the nature of the work done.

The new factory of the Brown-Corliss Engine Company, at Corliss, Wis., the machine shop of which has been in operation for some time, is well worth the inspection of those interested in economical shop methods and machine work on a large scale. This machine shop, an interior view of which is shown herewith, is 442 ft. long by 118 ft. wide on the ground. On one side is a gallery, extending about half the total width of the shop. The rest of the shop is left clear from the floor to the roof, and is served by two 35-ton Pauling & Harnishfeger traveling cranes. In the ordinary operation of the shop these two cranes are kept busy most of the time, and this fact illustrates how important a factor the traveling crane is in modern machine-shop practice, and what an immense amount of labor it saves

In one end of the building there is a railroad siding, so that the crane can place heavy machinery on and off the cars. All the heavy machine tools, of which, of course, there are a number of very large ones for the manufacture of the largest sizes

VIEW IN THE BROWN-CORLISS ENGINE WORKS

of Corliss engines, are placed within reach of the traveling crane. The small machine tools are in a machine shop in the gallery. The gallery itself cannot be reached by the traveling crane, but the platform projecting out from the gallery enables machinery to be run from the gallery onto the platform, and there picked up by the crane.

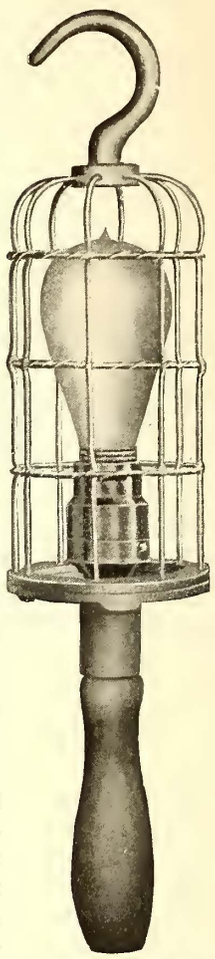
All the machine tools in this shop are driven by electric motors. The four-wire system of the Bullock Electric Manufacturing Company is employed, which gives a wide range of speed for each motor. The small machine tools in the gallery are driven in groups, but the large machine tools have their individual motors, geared directly to the tool.

During a recent visit of a representative of the Street Railway Journal to this shop, one of an order of six 3000-hp cross-compound vertical engines was being set up. One of these units in the first stages of erection can be seen at the left in the foreground of the accompanying engraving. This order was to go to the North Jersey Traction Company. These engines are 32-in. and 64-in. x 54-in. stroke.

The Brown-Corliss Engine Company is building its own foundry on land adjoining this machine shop.

AN IMPROVED PORTABLE LAMP GUARD AND HOLDER

The portable lamp guard and holder, which is illustrated herewith, is made in two sizes, suitable to take either 16-cp or 32-cp lamps. The guard is made very strong and compact, yet not too heavy to be handled conveniently. There are a good many places in and around car houses, pits, store rooms, shops, etc., where a portable light would be very convenient, and for this purpose the portable holder is especially adapted. The hook at the upper end of the guard is made of a size suitable to be attached to almost any form of support, and by this means a man using it can readily find a temporary place for it. This device is particularly recommended for 500-volt work, for the reason that the socket is thoroughly insulated from the guard, thus obviating any trouble from "grounds" on railway circuits.

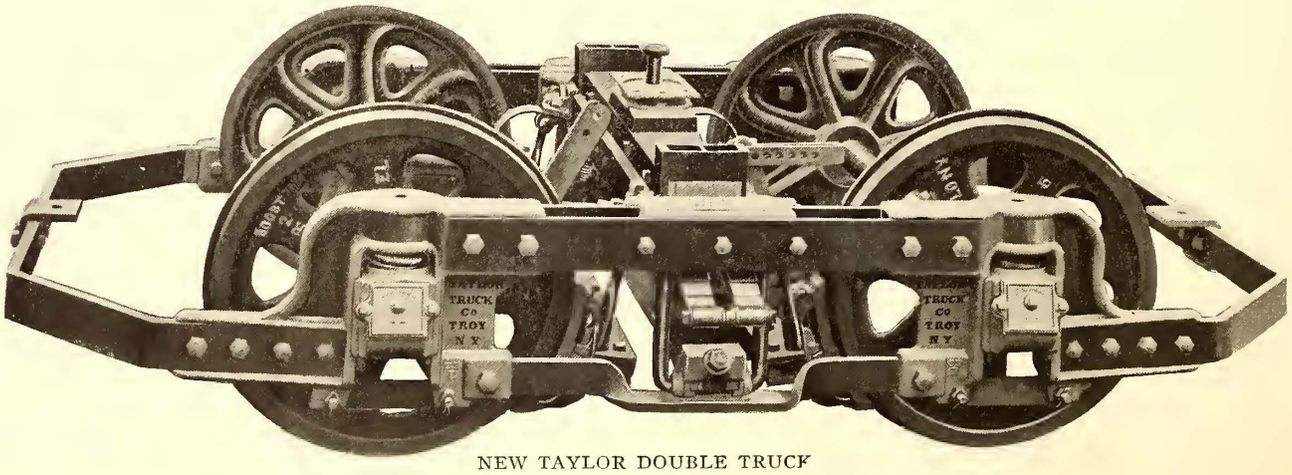


PORTABLE LAMP

The outfit, which is made by Porter & Berg, of Chicago, is furnished complete with the exception of the incandescent lamp, and in addition a soft rubber socket protector is supplied, the latter serving as a protection to the socket when used in exceptionally moist places.

A NEW TRUCK FOR LONG CARS

The accompanying illustration shows a truck of novel design, which has recently been brought out by the Taylor Electric Truck Company, of Troy, N. Y. It has been perfected after a long experience with the necessities of the service for which it is intended, and it is confidently expected to meet the requirements of all work where a small wheel-base truck is required. It is of such dimensions and its parts are so arranged that it can be applied to long cars that are framed narrow on the sills, and yet accommodate itself to curves



NEW TAYLOR DOUBLE TRUCK

having short radii. The truck is built in two sizes, one having 33-in. wheels and a 4-ft. 6-in. base, the other having 30-in. wheels and a 4-ft. 3-in. base.

A novelty of the truck is the swing motion of the bolster frame and the supporting elliptical springs. It is claimed that this is the only short wheel-base truck which combines these desirable properties. The elliptical springs from which the car body is supported rest against a beam, which is hung by the link shown in the engraving. The lower side-bar is twisted in the middle, so as to present a flat surface immediately below the end of this beam, and should the link break the car body could only descend a short distance, and no further injury could be experienced by the truck or car body. The springs which support the car are constructed according to the standard practice of the Master Car Builders' Association.

The brakes, which are placed on the inside of the wheels, are made extra strong, so that they can be operated by air or other automatic systems. They are of the live-and-dead lever type.

Both operating men and car builders will appreciate the advantage of having a short wheel-base truck which is applicable to narrow framed cars, and the manufacturers of the one illustrated think they have solved the problem. The truck is designed especially for long double-truck city cars, but it can be used with safety on high-speed interurban railroads as well.

ANNUAL MEETING OF THE BROOKLYN RAPID TRANSIT COMPANY

At the annual meeting of the stockholders of the Brooklyn Rapid Transit Company, held on Friday, Jan. 30, President J. L. Greatsinger withdrew from the board of directors and his place was filled by E. W. Winter. The election resulted in the following directorate: Directors to serve for one year, John G. Jenkins, Horace C. Duval, R. Somers Hayes and David H. Valentine; directors to serve for two years, Norman B. Ream, E. W. Winter, Henry Siebert and T. S. Williams; directors to serve for three years, Anthony N. Brady, H. H. Porter, E. H. Harriman, W. C. Oatman and Anson R. Flower. This board is the same as last year except for the change mentioned above and the substitution of Norman B. Ream for August Belmont. Mr. Ream is a Chicago financier who has been closely associated with Mr. Belmont, and it is not thought that this indicates the withdrawal of the Belmont interests from the directorate, but that Mr. Belmont's position as president of the Interborough Rapid Transit Company makes his place among the directors of the Brooklyn Rapid Transit Company anomalous. Mr. Winter, who succeeds Mr. Greatsinger on the board, was on Feb. 2 elected president of the company. Since Mr. Greatsinger came to Brooklyn Mr. Winter has been very closely associated with the management, and it was at his suggestion or by his advice that many of the changes which have occurred during the former administration have taken place. It is therefore probable that few other changes in the personnel of the company will be made, as the present organization, which was installed soon after the coming of J. F. Calderwood last summer, was made under Mr. Winter's direction. The new president, like the retiring one, is an old steam railroad man, having been president of the Northern Pacific Railroad, and having held many other important positions. He has long been in close touch with H. H. Porter, the dominant factor in the internal affairs of the Brooklyn Rapid Transit Company, and holds the confidence of the board of directors, which carefully attends to all questions of finance and operation on the road.

THE NEW MANHATTAN SCHEDULE

The new train schedule of the Manhattan Elevated Railway, of New York, as approved by the Railroad Commissioners, went into effect Feb. 2 on the Second, Sixth and Ninth Avenue lines of the company. The new schedule on the Third Avenue line will not go into effect until Feb. 9, because of the non-completion of the Bronx Park station and terminal. By the new schedule the rush-hour trains are not run on any shorter headway, the additional trains being all provided for the non-rush hours, but the longer trains are put in service earlier and continue later, and more cars are run in both rush and non-rush-hours.

Details of the schedule include an increase of trips on the Third Avenue line of eighty-two, with 53,952 additional seats; on the Sixth Avenue line of ninety-eight, with 79,200 additional seats, and on the Ninth Avenue line of ninety-seven, with 33,436 additional seats. No increase of trips is given on the Second Avenue line, but 186 cars are added, giving 8928 additional seats. The total carrying capacity of the various lines will be:

	Trips	Cars	Seats
Second Avenue	538	2,652	127,296
Third Avenue	1,062	5,824	279,552
Sixth Avenue	1,118	6,018	288,864
Ninth Avenue	669	2,945	141,360
Total	3,387	17,439	837,072

On the Second Avenue line fourteen extra six-car trains will be run during the rush hours between 4:37 a. m. and 9:34 a. m., but from that hour until 3 o'clock in the afternoon the number of trains is reduced from the present schedules. The schedule for the rest of the day remains unchanged.

On the Third Avenue line, the South Ferry service from midnight to 5 a. m. is reduced by two three-car trains, but from 5 a. m. to 10 a. m. it is increased by twenty six-car trains. From 10 a. m. to 2:30 p. m. there is a reduction of eighteen trains, but an additional car is placed on each train, so that the car capacity is little lessened. From 2:30 p. m. until 8 p. m. there is an increase of twenty-eight six-car trains. From that hour until midnight there is a decrease of twenty trains.

In the City Hall service on the Third Avenue line the principal changes made between 5 a. m. and midnight are in increasing the headway of trains by putting on nearly seventy-four additional trains.

On the Sixth Avenue lines, the changes are mostly made in the headway of trains between the hours of 5 a. m. and midnight. On the South Ferry and Rector Street service, fifty trains are added, with 1080 cars.

In the Fifty-Eighth Street service there will be an increase in the electric trains of four and an enlargement of all the trains from three to five cars, giving an increase of 344 cars on the day. The steam service to Fifty-Eighth Street will be increased by 220 cars and forty-four trains.

On the Ninth Avenue line there will be an increase of seventy-six trains for the local service, with 592 cars, while in the express service there will be an increase of five trains of five cars each in the morning hours, or an increase of twenty-five cars. There will also be run as specials sixteen five-car trains between 7:02 and 9:50 in the morning.

FIRE AT THE NIAGARA FALLS PLANT

The Niagara Falls Power Company was compelled to shut down temporarily Jan. 29 owing to a fire in the transformer room of its plant at Niagara Falls, N. Y. It is said that the fire was caused by a bolt of lightning which entered the transformer room and set fire to one of the cables upon which the insulation was worn. The flames communicated to the cables in the stone arch over the intake, and in a short time the roof of the arch and the transformer house were ablaze. The cables were destroyed in a short time and it was necessary to shut down power house No. 1. Operations in power house No. 2 were not interfered with in any way. There was no damage to machinery in either power house. In all, about 7000 ft. of cable were destroyed.

As a result of the cutting off of power the many industrial establishments in Niagara Falls, Buffalo, Lockport and North Tonawanda that depend on the plant for power were also compelled to suspend operations. The International Traction Company, which also depends on the plant for power, was compelled to suspend operations almost entirely. At 6:30 p. m. Jan. 30 temporary repairs had been completed.

STRIKE AT WATERBURY ASSUMES SERIOUS ASPECT

The strike of the employees of the local lines of the Connecticut Railway & Lighting Company at Waterbury, Conn., assumed a very serious aspect Jan. 30. The strikers and their sympathizers, who up to that time had been held in restraint to a degree that did not admit of much open violence, concentrated their forces and conducted a series of assaults on cars that resulted in much damage to the company's property. Crowds surrounded the cars run by non-union men in the center of the city, while in the outskirts cars were stoned and open assaults were made on those operating the cars. A torpedo was used at Hopeville in an effort to wreck a car. Every pane of glass in the car was broken and the motorman and conductor were slightly cut by flying glass. There were no passengers on the car. On Jan. 31 the State militia was called on to preserve order.

LONDON LETTER

(From Our Regular Correspondent.)

The London Motor Omnibus Syndicate has had a number of motor omnibuses running between Cricklewood and Oxford Circus for some time, and they seem to be meeting with considerable success. This is a new syndicate for London and not an outcome of any of the large omnibus proprietors who have from time to time experimented with large double deck-motor omnibuses, without, however, incurring any success. This was generally owing to the large, lumbering nature of the omnibuses which they adopted, which made a hideous noise and did not attract passengers. The London Omnibus Syndicate has contented itself with small buses capable only of conveying twelve passengers, somewhat like the type of motor buses which are running on Princes Street, Edinburgh, with the difference, however, that they are covered in the winter time. They present a somewhat neat appearance and are able, in a journey between Cricklwood and Oxford Circus, to pass several of the horse-drawn buses on the route.

Though the new tube of the Great Northern & City Railway is not yet ready for service, an experimental trip recently took place, when a number of persons interested in the line traveled in one of their new trains from the city terminus at Moorgate Street to Drayton Park station, which is as far as the line is at present finished. There is consideration of the question of opening the line from the city to Drayton Park, but no decision has yet been rendered. We have already described the interesting features of London's newest tube, but it might be well to recall here that the tube is considerably larger than any tubes in existence at present, having a diameter of 16 ft. and being capable of accommodating the regular rolling stock of the Great Northern Railway. Last month we illustrated the train of carriages which has been built by the Brush Electrical Engineering Company, which reflected great credit on the builders. This tube has been built by S. Pearson & Son, E. W. Moir, one of the directors of the company, having had special charge of this work. Mr. Moir is the originator of the peculiar construction of this tunnel, the top half of which is iron and the lower half of brick.

The city of Bournemouth has now got its system of tramways in operation, and is therefore the first city in Great Britain to have an underground electric conduit system. The slot of the Bournemouth tramways conduit is at the rail and not midway between the rail, like the system now being installed by the London County Council. This conduit system is installed through the central potions of the city, though on the outskirts of the city the overhead system has been adopted. The cars are, therefore, fitted both with plows to go into the conduit and with trolleys to connect with the overhead system. The plows have been specially designed by Mr. Connett, of J. G. White & Company, who are the contractors for the work, and the operation of changing from the underground to the overhead system is easily accomplished in a fraction of a minute.

The Colchester Town Council has adopted, by a vote of 18 to 9, an electric tramway scheme involving an expenditure of £63,414 and an estimated annual loss of £300.

Important electric tramway developments are expected to ensue from negotiations in progress between the Bolton Tramway Department and those of Manchester, Bury and South Lancashire. The proposals are to the effect that a junction of the Bolton and Bury systems be made at Black Lane, thus adding a link to a prospective connection with Yorkshire, and also to provide for the transport of cotton and bleaching goods between Bolton and Manchester and to secure a parcels service between Bolton and the South Lancashire towns.

The tramways committee of the Brighton Town Council issued its report yesterday respecting the tenders received for the construction of tramroads and laying down wood paving in certain streets, which have been considered in conjunction with the works committee. The committee recommends that the tender of E. Alcott, of Westminster, for the sum of £24,983 19s. 9d., be accepted.

The bill to incorporate the Nottinghamshire & Derbyshire Tramways Company has been duly deposited for next session in the private bill office of the House of Commons. The proposed tramways amount in the aggregate to just over 79 miles of new lines. In connection with these tramways power is sought to acquire numerous strips of land for widenings along the route of the proposed lines. The gage of the proposed tramways is to be 4 ft. 8½ ins. The capital of the company is fixed at £750,000, with the right to raise a further sum of £250,000 by the issue of debenture stock. Provision is made to enable the company to acquire the tramway or light railway authorized by the Mansfield & District Light Railway Order, 1901, and for adapting the tramways of the Corporation of Ilkeston, which are constructed on a gage of 3 ft. 6 ins., so as to enable the company to run over these tramways.

Mr. J. Clifton Robinson, of the London United Electric Tramway, has been elected a director of the Metropolitan District Railway Company.

The negotiations which have been pending since autumn between Mr. William Murphy and the Paisley Tramway Company as to the purchase of the local tramway system preparatory to the introduction of electric cars have now been practically completed, and the definite terms of purchase will be made known in a few days. Plans of the new system, it is understood, will shortly be laid before the Town Council. The eastern terminus is expected to reach the end of the burgh boundary and there effect a junction with the Glasgow Corporation line when continued from Crookston. At the western terminus the extension will be to Johnstone, a distance of 2½ miles.

The service of electric tramcars between Manchester and Middleton, provided the Manchester Corporation, was recently inaugurated. The through fare is fixed at 3½d., making 7d. for the double journey. The lines in Middleton are owned by the Middleton Corporation and are leased to Manchester for a period of twenty-one years, and the current in the Middleton area is supplied by the corporation of that town, who charge the same price per unit as is charged to the department by the electricity committee of the Manchester Corporation.

Mr. Arthur Jacoby recently resigned his position with the Johnson-Lundell Electric Traction Company and has been appointed general manager of the British Schuckert Electric Company, whose offices are at Clun House, Surrey Street, Strand. Mr. Jacoby has had a large experience in heavy electrical engineering and is a valuable acquisition to the Schuckert Company. He is now engaged in thoroughly reorganizing the company.

The Manchester Corporation tramways committee has decided to reduce the hours of the men in their employ from sixty to fifty-four per week and has sanctioned increases of wages amounting, it was officially stated, to £60,000 a year. The changes come into effect on April 1.

A meeting of representative men from various parts of Lancashire, convened by Mr. Alderman Petrie as chairman of the special committee of the Liverpool Corporation tramways committee appointed to consider the question of the carriage of merchandise on the electric tramway systems of Lancashire, was recently held in the town hall, Liverpool. It was unanimously resolved "That this meeting of gentlemen connected with various towns of South Lancashire and the County Council of Lancashire approves of the principle of the scheme for the transport of merchandise from the Liverpool docks to the towns of South Lancashire by means of the Liverpool Corporation and other tramways, and recommends that a committee be appointed to consider the details of the scheme and with authority to take such action in the matter as they in their opinion may think desirable in the interests of the scheme." The committee appointed subsequently met, when Mr. Alderman Petrie was appointed chairman, Mr. Alderman F. Smith vice-chairman, Mr. Pierce (deputy town clerk of Liverpool) honorable secretary, and Mr. Bellamy (manager of the Liverpool tramways) honorable treasurer.

The Hamilton, Motherwell & Wishaw Tramway Company, who are constructing a line between Blantyre and Wishaw, passing through the burghs of Hamilton and Motherwell, are now promoting a larger scheme, of which the original Blantyre-Wishaw line will form a very small part, which will not only unite the various communities on both sides of the Clyde, but will also meet the Glasgow system at Cambuslang. If powers for these schemes are granted, the result will be that in the near future one will be able to travel from Glasgow by tramway, not merely to Cambuslang, but also to Hamilton, Motherwell, Wishaw and the other important Lanarkshire business centers.

The eighth annual convention of the Incorporated Municipal Electrical Association will be held at Sunderland on July 15-18, 1903. Members or associates willing to read a paper must send in their names to the secretary before Jan. 31, 1903, together with the title of the paper, for the consideration of the council. Prizes of the value of 5 guineas, 3 guineas and 1 guinea are offered by the council of the Incorporated Municipal Electrical Association for the best papers presented by associates on some approved subject connected with municipal electrical engineering.

The Huddersfield Corporation tramway committee has ordered ten covers for the electric cars. They will be of wood and after the style of the old steam car tops, but removable.

The report of the tramways committee of the Leicester Corporation shows that the tenders for the first section of the electric tramways have been accepted, as follows: Erection and mainte-

nance for a limited period of overhead trolley wires, etc., R. W. Blackwell & Company, Ltd., of London, £23,194 12s. 2d.; bolts, nuts and bars, R. W. Blackwell & Company, £1,921 5s.; stoneware pipes and conduits, T. Wragg & Company, Swadlincote, £3,368 14s. 4d. (less 2½ per cent discount); feeder cables, telephone and test wires, etc. (with twelve months' maintenance), W. T. Glover & Company, Ltd., Manchester, £7,382 14s. 2d.; engines, generators, condensing plant, motors, switchboards, etc. (with one year's maintenance), Dick, Kerr & Company, Ltd., London and Preston, £28,417; Lancashire boilers, economizers, etc., Yates & Thom, Blackburn, £9,609. A. C. S.

BRITISH TRAMWAYS STATISTICS

For the first time we have a complete analysis of the accounts of electric tramway undertakings which enables comparison on a common basis to be made of the working of the principal systems throughout the United Kingdom, the *Electrical Times*, which has hitherto published frequently consulted tables dealing with electric supply undertakings, having issued corresponding figures for traction schemes. Glasgow occupies a very satisfactory position among local authorities owning electric tramways. It is true that the length of the track is greater than in any other town; the nearest approach being Liverpool, with 93 miles of single track, as compared with 103 miles, and further that the volume of traffic is greater than in any other city.

According to the *Electrical Times*, of London, the rides per capita per annum in different British cities is as follows: Glasgow, 155; Liverpool, 148; Halifax, 126; Blackpool, 123; Sunderland, 93; Hull, 87; Bolton, 72; Southport, 69; Aberdeen, 59; Dundee, 48. The gross receipts per passenger are as follows: East Ham, 0.69d.; Glasgow, 0.90d.; Dundee, at 0.95d. for the electric lines and 0.86d. for the steam lines; Aberdeen, 0.98d.; Sunderland, 0.99d.; Hull and Halifax, a penny; Liverpool, 1.11d.; Southport, 1.13d.; Bolton, 1.17d., and Blackpool, 1.11d. The cost of producing power per kw-hour is: Glasgow, 0.60d.; Dublin, 0.63d.; Hull, 0.99d.; Liverpool, 1.43d.; Dundee, 1.50d.; Bolton, 1.64d.; Southport, 1.67d.; Sunderland, 2.04d.; Halifax, 2.12d.; East Ham, 2.25d.; Blackpool, 2.37d., and Aberdeen, 2.52d.

ANNUAL MEETING OF J. G. WHITE & COMPANY

The third annual meeting of J. G. White & Company, Ltd., of College Hill, London, was held Dec. 29. The secretary of the company, A. H. Beatty, stated that the business of the company continues to be very satisfactory. The profit and loss account for the year, including £3,649 carried forward from the previous year, amounted to £29,480. Dividends to August 31, 1902, at the rate of 8 per cent per annum on the preference and ordinary shares, were declared; £10,000 were placed to the reserve fund, and £11,469 were carried forward to next year's account. J. G. White and W. C. Burton, the retiring directors, were re-elected.

RAILWAY EMPLOYEES DANCE AT BUFFALO

The International Railway Employees' Association, of Buffalo, gave its second annual ball on the evening of Jan. 8. The function was held in Convention Hall, and was one of the pleasantest events of Buffalo's midwinter season, the spacious auditorium being elaborately decorated with flags, bunting and holly, beautifully lighted with hundreds of electric lamps, arranged artistically in clusters, and other designs, and hidden behind the decorations was the music, furnished by the Sixty-Fifth Regiment Band, leaving nothing to be desired. Many of the officers of the company attended the ball and added greatly to the enjoyment of the evening by the evident pleasure which they took in witnessing the success of the entertainment. Among those in the boxes were the Hon. Caryl Ely, president of the International Traction Company, T. E. Mitten, general manager, and many of their friends, while it was estimated that at least 6000 were present on the floor. An elaborate collation was served during the intermission. The association contains members from every grade of employee of the Buffalo lines, as well as the Niagara Falls, Tonawanda and Lockport routes, from the president down to the trackmen. The objects, as set forth in its constitution, are to collect and disseminate knowledge of the construction and maintenance of street railways and street railway equipment, to promote good fellowship and to aid its members and their families in case of injury, sickness or death. In April, 1901, a handsome suite of rooms was opened for the use of the members, which included card, billiard, reading and reception rooms, together with a large and fully equipped gymnasium. These accommodations were described in these columns soon after the opening. Since that time many additions have been made to the facilities in all the departments, and the membership of the association has been more than doubled.

NATIONAL CONVENTION ON MUNICIPAL OWNERSHIP AND PUBLIC FRANCHISES

This convention, of which a preliminary notice was published in the STREET RAILWAY JOURNAL for January 17, will be held under the auspices of the New York Reform Club, committee on city affairs, in the rooms of the Reform Club, 233 Fifth Avenue, New York, on Wednesday, Thursday and Friday, Feb. 25, 26 and 27, 1903. The meetings of the convention will be open to the public.

A series of very interesting papers are announced from authorities on this subject. The programme in detail follows:

Wednesday, Feb. 25.—Morning Session, 10 a. m.—Address of welcome by Mayor Low, of New York, and John G. Agar, chairman.

"Recent History of Municipal Ownership in the United States." Brief contributions by William Wirt Howe, former president American Bar Association, New Orleans, La.; Clinton Rogers Woodruff, of Philadelphia, secretary of the National Municipal League; L. N. Case, manager of water and light plants, Duluth; members of the staff of the New York School of Commerce and by others.

"Recent British Experience of Municipal Ownership," by Robert Donald, editor of the Municipal Journal, London.

"Recent German Experience of Municipal Ownership." Ed. T. Heyn, of Berlin.

"Comparison of European and American Methods and Results." Hon. Robert P. Porter, director of the Eleventh Census of the United States.

Discussion.

Afternoon Session, 2:30 p. m.—*Transportation.*—Paper by Chas. T. Yerkes, of London and New York.

Address by Mayor Harrison, of Chicago.

Discussion.

"City Owning and Leasing of Transportation Lines," by Edward M. Shepard, counsel to the Rapid Transit Commission, New York.

"Massachusetts' Experience," by Louis D. Brandeis, of Boston.

Discussion.

Thursday, Feb. 26.—Morning Session, 10 a. m.—*Gas and Electric Lighting.*—"Electric Lighting," by Lieutenant J. B. Cahoon, secretary and ex-president of the National Electric Light Association.

Discussion.

"Gas Lighting," by Walton Clark, general superintendent Gas Improvement Company, Philadelphia, Pa., and past president American Gas Lighting Association, and Alton D. Adams, engineer, Boston, Mass.

Discussion to be opened by Professor Ed. W. Bemis, water commissioner, Cleveland, Ohio.

Afternoon Session.—*Water and Telephones.*—"European Experience of Public Ownership of Telephones," by Mr. Bennett, engineer for Glasgow and other British municipal telephone systems.

"Argument for Public Ownership of Telephones," by Professor Parsons, of the Boston Law School.

"The Superiority of Corporation Ownership of Telephones," by U. N. Bethell, general superintendent New York Telephone Company.

"City Ownership of Water Supply," by William R. Hill, president of the American Water Works Association.

Discussion.

Friday, Feb. 27.—Morning Session, 10 a. m.—"How Should Public Service Corporations Be Controlled?" by R. K. Bowker, formerly of the Edison Electric Illuminating Company, New York.

"Regulation and Taxation of Public Service Corporations," by Allen Ripley Foote, editor of Public Policy.

Discussion to be opened by Professor John R. Commons, secretary taxation committee National Civic Federation.

Afternoon Session.—"Labor Clauses in Franchise Grants and the Labor View of Municipal Ownership," by ex-Mayor Chase, of Haverhill, Mass.

Discussion.

"Taxation of Franchise Values," by Frederick Howe, of Cleveland.

Discussion to be opened by Wheeler H. Peckham, president of City Club, New York.

CHICAGO TRACTION MATTERS

It is becoming generally understood in Chicago now that the matter of granting a franchise to the Chicago City Railway Company will be taken up soon without waiting for the action of the Union Traction Company's protective committee. The Chicago City Railway is willing to accept a twenty-year franchise; the Union Traction Company desires a longer grant. There is a serious question whether the city will grant this latter.

A protective committee has been selected by the stockholders of the Chicago City Railway Company to represent their interests. Part of the stock of this company being held by persons not posted on the situation, there was some fear that these stockholders would sell out because of the rumors that Union Traction interests were securing control of the company for purposes of consolidation, hence the committee was formed to secure concerted action and confidence on the part of as many stockholders as possible. This committee is as follows:

James B. Forgan, president First National Bank.
Ernest A. Hamill, president Corn Exchange Bank.
Byron L. Smith, president Northern Trust Company.
Nelson Morris, president Nelson Morris & Company.
Levi Z. Leiter.

As indicating the popular sentiment, the suggestions formulated for the settlement of the franchise question by the Chicago Record-Herald are herewith given, since they are claimed to represent, as near as anything can, the average views of the citizens of Chicago as to what the franchise renewal ordinances should be.

The Record-Herald is of opinion that the traction question should be settled on lines substantially as follows:

First—When the council has formulated a measure acceptable to it, a pause should ensue and an opportunity given voters to demand a referendum.

Second—Such an ordinance should provide for municipal ownership and operation (or municipal ownership with operation by a lessee) if desired by the voters of Chicago, after a fixed period, probably not more than ten years.

Third—The franchise should be for a period not exceeding twenty years, and should provide that at the expiration of that time.

(a) The plant should be taken over by the municipality on the payment of the arbitrated value of the tangible property as a going concern, or

(b) A new franchise should be granted to the existing company or to another company with which more desirable terms could be made, the new company to pay for the plant at the same arbitrated value, or

(c) In default of the acceptance by the municipality of either alternatives, a or b, the company should be permitted to continue as tenant at will until the city availed itself of one of these options.

Fourth—The ordinance should require a compensation to the city of a percentage of gross receipts, such compensation to be in lieu of all license and franchise taxes, but not of real estate (aside from right of way) or personal taxes as paid by private citizens.

Fifth—The traction companies should be required to waive all alleged rights under the ninety-nine-year act, and all franchises should be made to expire at one time. In fixing the rate of fare and compensation to the city due weight should be given the equities of the companies in their unexpired franchises, the present tangible property and even to their alleged rights under the ninety-nine-year act, but the enormous overcapitalization of the Union Traction Company and its underlying companies should be entirely disregarded.

Sixth—Above all, the franchise should provide for the very best attainable service from the beginning to the end of its term, and this should include unification of the various lines, at least so far as service is concerned, a complete system of subways (possibly owned by another or subsidiary company) in the congested district and the use of the underground trolley in the densely populated section of the city.

Seventh—The council should ask for whatever enabling legislation is necessary to carry out this general programme, and no more.

THE STANLEY GENERAL ELECTRIC DEAL

As this paper is going to press the best evidence tends to show that the proposed sale of the Stanley Electric Manufacturing Company to the General Electric Company, which was currently reported last week as having been fully accomplished, is not yet completed. It is admitted that negotiations for a change of ownership of control of the Stanley Company are pending, but that any change of this kind has yet been effected is denied. It is also reported that the plan to increase the capital stock of the company to $10,000,000 has not been abandoned, and that the permanency and enlargement of the works at Pittsfield is one of the details agreed upon in any event.

ANNUAL REPORT OF THE DETROIT UNITED RAILWAY

The annual meeting of the Detroit United Railway was held Jan. 21. No change was made in the officers of the company, and the directors are the same as last year. H. A. Everett retains the chairmanship of the board. The officers re-elected are as follows: H. A. Everett, of Cleveland, chairman of the board; J. C. Hutchins, of Detroit, president and general manager; Arthur Pack, of Detroit, vice-president; George H. Russel, of Detroit, treasurer; Edwin Henderson, of New York, secretary; A. E. Peters, of Detroit, assistant secretary; H. A. Everett, of Cleveland; E. W. Moore, of Cleveland; H. R. Newcomb, of Cleveland; R. A. Harman, of Cleveland; J. C. Hutchins, of Detroit; George H. Russel, of Detroit; Arthur Pack, of Detroit; R. B. Van Cortlandt, of New York, and H. S. Holt, of Montreal, directors. The only new name in the list of directors at the annual meeting is that of H. S. Holt, of Montreal. Mr. Holt was elected some months ago to replace J. G. Schmidlapp, of Cincinnati.

The report of the treasurer shows that on Jan. 1, 1902, the number of miles of street railway operated was as follows: Detroit United Railway, 379.46; Rapid Railway, 109.57; Sandwich, Windsor & Amherstburg Railway, 11.89; total, 500.92. There has since been added: Detroit United Railway, 1.84; Rapid Railway, 11.14, making the total number of miles in operation, including side and yards tracks, Dec. 31, 1902, 513.902. The passenger statistics show:

	D. U. Ry.	R. R. Sys.	S., W. & A. Ry.	Total
Revenue passengers...	71,891137	3,495,828	1,463,824	76,850,789
Transfer passengers...	20,133,999	185,114	128,228	20,447,341
Employee passengers.	1,010,681	49,153	20,463	1,080,297
Total passengers....	93,035,817	3,730,095	1,612,515	98,378,427
Receipts per rev. pass..	.0469	.1019	.0448	.0494
Receipts per pass.....	.0363	.0955	.0406	.0386
Car mileage.....	18,016,870	1,889,517	437,211	20,343,598
Earnings per car mile..	19.28	22.34	15.14	19.47
Expenses per car mile.	10.92	13.43	9.20	11.11
Net earn's per car mile.	8.36	9.91	5.94	8.36

The following is a summary of the business for the year ending Dec. 31, 1902:

DETROIT UNITED RAILWAY

Gross earnings.		$3,473,140
Operating expenses, including taxes		1,967,532
Net earnings from operation		$1,505,608
Income from other sources		28,614
Gross income from all sources		1,534,222
Deductions—		
Interest on funded and floating debt	$815,004	
Dividends.	500,000	$1,315,004
Surplus income.		$219,218

RAPID RAILWAY

Gross earnings.		$422.070
Operating expenses, including taxes		253,003
Net earnings from operation		$169,067
Income from other sources		3,850
Gross income from all sources		$172,917
Deductions—		
Interest on funded and floating debt	$127,319	
Dividend to Detroit United Railway	2,750	130,069
Surplus income.		$42,848

SANDWICH, WINDSOR & AMHERSTBURG RAILWAY

Gross earnings.	$66,192
Operating expenses, including taxes	40,250
Net earnings from operation	$25.942
Income from other sources	9,409
Gross income from all sources	$35.351

Deductions—		
Interest on funded debt	$6,580	
Dividend to Detroit United Railway	7,875	14,455
Surplus income		$20,896

DETROIT UNITED RAILWAY, RAPID RAILWAY SYSTEM AND SANDWICH, WINDSOR & AMHERSTBURG RAILWAY

Gross earnings		$3,961,403
Operating expenses, including taxes		2,260,786
Net earnings from operation		$1,700,617
Income from other sources		31,247
Gross income from all sources		$1,731,864
Deductions—		
Interest on funded and floating debt	$948,902	
Dividends	500,000	
		$1,448,902
Surplus income		$282,962

The Detroit United Railway earned in 1901, after providing for expenses, fixed charges and dividends, a net surplus of $170,129.

Following is a balance sheet of the Detroit United Railway of date of Dec. 31, 1902:

Capital stock		$12,500,000
Mortgage bonds		17,380,000
Current liabilities		1,565,455
Accident fund		969
Insurance fund		93
Unredeemed tickets		29,688
Surplus		444,895
Investment	$28,920,433	
Current assets	2,499,367	
Suspense account	19,160	
Discount on bonds	176,693	
Prepaid taxes, insurance, etc	72,500	
Stores	4,586	
Cash	228,361	
	$31,921,100	$31,921,100

Balance sheet of the Rapid Railway System:

Capital stock		$2,000,000
Mortgage bonds		2,465,000
Detroit United Railway		138,911
Current liabilities		15,625
Surplus		37,988
Investment	$4,618,794	
Current assets	1,309	
Stores	25,612	
Prepaid taxes, insurance, etc	7,338	
Accident fund	4,471	
	$4,657,524	$4,657,524

Balance sheet of the Sandwich, Windsor & Amherstburg Railway:

Capital stock		$297,000
Mortgage bonds		140,000
Accident fund		729
Detroit United Railway		149,271
Accrued interest		1,097
Unredeemed tickets		53
Surplus		33,518
Investment	$615,461	
Accounts receivable	1,225	
Stores	3,325	
Prepaid taxes and insurance	647	
Cash	1,010	
	$621,668	$621,668

ANNUAL REPORT OF THE TORONTO RAILWAY

The annual meeting of the Toronto Railway Company, of Toronto, Ont., was held Jan. 21. The annual report was presented, together with the financial statement for the year ended Dec. 31, 1902. The gross earnings amounted to $1,834,908, as compared with $1,661,017 for the previous year, being an increase of $173,891 during the year. The net revenue of $506,443 is accounted for mainly by the higher prices paid for material used in maintenance and repairs, by the abnormally high price of coal and a very large increase in wages of employees in the several departments. The company has declared out of the net profits four quarterly dividends of 1¼ per cent, aggregating $302,439, leaving, after deducting pavement charges paid to the city, the sum of $133,729. The total expenditure on capital account during the year amounted to $191,656, which has been devoted to the purchase of motor equipments and the construction of additional mileage of track, overhead system, new rolling stock and buildings to accommodate the increased business.

The directors consider it advisable to set aside a portion of the accumulated earnings for the purpose of providing against heavy or special renewals, and have adopted the policy of establishing an account for such contingencies by transferring $75,000 from the surplus to the credit of a contingent account. On Oct. 6, 1902, they sanctioned an increase in the capital stock of the company by $1,000,000 and authorized the issue of the additional shares. An allotment of 6000 new shares out of the amount authorized has been subscribed in full. The company paid to the city during the year, under the terms of the franchise, the sum of $255,551, as compared with $226,453 last year, and also paid the provincial tax levied under the revenue act.

A comparative statement of the gross earnings, operating expenses, net earnings, passengers carried, transfers and percentage of operating expenses to earnings for 1902, 1901, 1900 and 1899 follows:

	1902	1901	1900	1899
Gross earnings	$1,834,908	$1,661,017	$1,501,001	$1,333,542
Operating expenses	1,015,361	857,612	775,981	650,324
Net earnings	819,547	803,405	725,020	683,278
Passengers carried	44,437,678	39,848,087	36,061,867	31,826,940
Transfers	15,974,220	13,750,038	12,570,704	10,538,279
Percentage of operating expenses to earnings	55.3	51.6	51.0	48.8

The general balance sheet shows:

ASSETS.

Road and equipment, real estate and buildings, including pavements and suburban lines		$10,835,767
Stores in hand		108,555
Accounts receivable		362,304
Cash in bank	$97,153	
Cash in hand	22,167	
		119,320
		$11,425,946

LIABILITIES.

Capital authorized	$7,000,000	
Capital allotted	6,600,000	
Capital issued		$6,268,414
Bonds—Tor. Ry. Co., 4½% sterling	$2,030,373	
Tor. Ry. Co., 4½% currency	843,000	
Tor. Ry. Co., 6 % debentures	600,000	
Tor. & Mim. Elec. Ry. & Lt. Co.	100,000	
Tor. & Scar. Ry., L. & P. Co.	40,000	
	$3,613,373	
Less bonds not sold and in hands for future requirements of the company	$140,000	
		3,473,373
Mortgages		70,000
Accrued interest on bonds		61,577
Accounts and wages payable		113,710
Unredeemed tickets		12,925
Dividend No. 26, payable Jan. 2, 1903		77,439
Contingent account		75,000
Profit and loss as at Dec. 31, 1901	$1,255,514	
Less payment of pavement charges to city withheld during yrs. of litigation	$37,236	
Less directors' fees for 1901	3,500	
	40,736	
	$1,214,777	
Balance Dec. 31, 1902	58,729	
		1,273,507
		$11,425,946

The old board of directors and officers were re-elected, as follows: William Mackenzie, president; James Ross, vice-president; E. H. Keating, manager; J. C. Grace, secretary-treasurer; Hon. George E. Cox, Frederic Nicholls, W. D. Matthews, H. M. Pellatt and James Gunn, directors.

LAKE STREET ELEVATED EARNINGS AND FINANCIAL CONDITION

The Lake Street Elevated Railroad, of Chicago, makes the following financial statement for the year ending Dec. 31, 1902:

PROFIT AND LOSS ACCOUNT FOR YEAR ENDING DEC. 31, 1902

Cost of operation		$430,292
Taxes (reserved)		24,235
Interest on floating debt and car trust notes		64,794
Interest on first mortgage bonds outstanding (including interest accruing Jan. 1, 1903)		236,727
Rental of leased roads		84,385
Mileage tax (reserved)		1,767
Passenger earnings	$796,621	
Miscellaneous income: Advertising and news privileges, etc	18,663	
Deficit	26,916	
	$842,200	$842,200

COMPARATIVE STATEMENT OF TOTAL EARNINGS, OPERATING EXPENSES AND NET EARNINGS FOR THE YEARS 1902 AND 1901

	1902	1901
Total earnings	$815,284	$786,462
Operating expenses	430,292	388,799
Net earnings	$384,992	$397,663

Percentage of operating expenses to total earnings, 52.78 per cent in 1902, as against 49.43 per cent in 1901.

Total passengers carried, 15,849,411 in 1902, as against 15,394,038 in 1901.

The daily average for 1902 was 43,423, while the daily average for 1901 was 42,175.

As seen, the statement shows a deficit of $26,915.

President Knight, at the annual stockholders' meeting, made the following statement, which led up to the appointment of a committee on reorganization. There was some talk of a receivership for the road, but this has been postponed, pending action of this committee.

Prior to recommending the appointment of a committee President Knight had the following to say:

"Another stage has now been reached in the history of the company as to what should be done with reference to adjusting its present affairs. At the present time there are outstanding bonds amounting to $4,627,000. In addition, there is a floating debt, consisting of notes payable amounting to $1,321,000. In addition to these amounts we have car trust notes out for the balance due on the purchase of twenty trailers and eight motor cars, amounting to $116,000, $14,000 having been paid.

"There are other liabilities that must be provided for to the amount of $607,192.27. The account would therefore stand about as follows:

Notes payable	$1,321,000
Car trust notes	116,000
Amount noted above	607,192
	$2,044,192
Brought forward	2,044,192
For first mortgage bonds outstanding	4,627,000
Total	$6,671,192

"In addition to the above there is of other accounts matters that must be paid, about $40,000, making a total of $6,711,192.

"It is safe to say that in order to meet the necessities of the company in clearing up its floating liabilities and its bonded debt, and to complete during the coming year the necessary repairs to the structure, stations and rolling stock, there should be raised, in round numbers, $7,000,000. In this computation we have not taken into acocunt the income bonds outstanding to the amount of $1,026,050.

"By an examination of the balance sheet we find that we have paid out in labor items alone during the year $21,590 more than we paid in 1901. On July 1 we increased the wages of the conductors from 17½ to 19½ cents an hour. This accounts for some of the increase in the labor account. The cost of electric current during 1902 over that of 1901 was $33,943, which more than offsets our deficit of $26,915.

"During the year we operated 4,346,505 car miles, as against 4,078,880 in 1901. This is owing to the fact that we had in operation more trains.

"Our gross receipts for the year were $815,284, as against $786,462 in 1901."

The committee appointed to consider plans for reorganization was as follows: H. N. Higinbotham, H. A. Haugan, president State Bank, of Chicago; Thomas Templeton, Cory E. Robinson, of Joliet. A committee of this character has been under consideration for some months.

NORTHWESTERN ELEVATED ANNUAL REPORT

The Northwestern Elevated Railroad Company, of Chicago, which held its annual meeting last week, makes the following showing for the year ending Dec. 31, 1902:

INCOME ACCOUNT OF THE YEAR ENDING DEC. 31, 1902

Passenger earnings		$1,167,529
Other earnings (including loop net earnings)		243,470
Total earnings		$1,410,999
OPERATING EXPENSES		
Maintenance of way and structure	*$58,068	
Maintenance of equipment	51,261	
Conducting transportation	306,143	
General expenses	48,934	464,401
Net earnings		$946,598
CHARGES		
Loop account (½ cent per pass. carried)	$116,774	
Taxes	86,309	
Interest on bonds	554,091	757,174
Surplus for year		$189,424

* Includes $36,000 which has been set aside in monthly instalments, incash, for betterments and maintenance of structure.

GENERAL BALANCE SHEET—DEC. 31, 1902

ASSETS	
Cost of road and equipment	$24,789,321
Bonds in treasury	1,000,000
Due from companies and individuals	420,137
Current assets	91,768
	$26,301,226
LIABILITIES	
Capital stock: Preferred, $5,000,000; common, $5,000,000	$10,000,000
Bonds	15,000,000
Mortgages	119,000
Current liabilities (including contracts for new equipment and additions to power house)	387,457
Reserved for taxes and interest	272,040
Reserved for maintenance	51,000
Surplus	471,729
	$26,301,226

COMPARATIVE STATEMENT OF DAILY AVERAGE PASSENGER TRAFFIC PER MONTH DURING THE YEARS 1900, 1901 AND 1902

Month	1900	1901	1902	Increase over 1901	Per cent of increase
January		52,022	62,010	9,988	19.20
February		55,256	64,760	9,504	17.20
March		57,193	65,362	8,169	14.29
April		58,623	65,430	6,807	11.59
May		56,999	63,199	6,200	10.87
June	41,972	53,586	60,813	7,227	13.48
July	40,816	48,559	56,110	7,551	15.55
August	43,961	49,770	57,911	8,141	16.35
September	47,092	54,065	63,950	9,885	18.28
October	50,808	59,044	69,562	10,518	17.82
November	53,345	59,857	67,236	7,379	12.33
December	53,798	63,375	71,607	8,232	12.99

Total number of passengers carried in 1900 (seven months), 10,185,141; total number of passengers carried in 1901 (twelve months), 20,327,005; total number of passengers carried in 1902 (twelve months), 23,354,729.

Daily average passengers carried in 1901 (twelve months), 55,690; daily average passengers carried in 1900 (seven months), 47,594; average daily increase, 8,096, equal to 17 per cent.

Daily average passengers carried in 1902, 63,986; daily average passengers carried in 1901, 55,690; average daily increase, 8,296, equal to 14.9 per cent.

Ratio of operating expenses to earnings (including maintenance reserve), 38.80 per cent; ratio of operating expenses, maintenance reserve, loop account and taxes to earnings, 55.77 per cent.

This road shows the largest per cent of increase in traffic of any transportation line in Chicago.

MAYOR JOHNSON'S NEW TACTICS

Mayor Tom L. Johnson, of Cleveland, has adopted new tactics in his fight against the existing street railways of Cleveland. Through his lieutenant, Charles P. Salen, director of public works, he has issued a manifesto to the public announcing that "by reason of numerous complaints regarding the service given by the street railway companies the city officials had decided to take action to take away the franchises of the companies unless they improved the service." All good citizens were asked to keep a careful record of dates and times when unsatisfactory service was noted and turn same into headquarters to be used as evidence. In view of the fact that it is universally acknowledged that the street railway service of the city is as good, if not better, than that of any large city in the country, the manifesto created considerable comment and is being commonly set down as a political play preparatory to the opening of the spring election campaign.

Almost in the same breath the wily Mayor made a slip which is likely to cost him more votes than he could have gained had his crusade against the street railways been justified. In an unguarded moment he expressed the opinion that the recent report of the committee chosen by the Allied Trades and Labor Council to investigate the street railway situation had been compiled out of whole cloth in the offices of the attorneys for the street railways. The Allied Trades and Labor Council, which represents all the leading trades unions in the city, is exceedingly wrathy over the statement, and the Mayor has been invited to appear before the organization and make good his statements reflecting on the committee. If he does not apologize he is likely to find the organization openly arrayed against him.

AN EXTENSIVE SYSTEM IN WESTERN PENNSYLVANIA

Inside of a year Western Pennsylvania will have an electric railway system equaling those of some of the Central States. This system will have Pittsburg as its western terminus and will likely be controlled by a corporation having $30,000,000 capital, to be formed in the spring. The Pittsburg, McKeesport & Connellsville Railway and the old Greensburg, Jeannette & Pittsburg Railway will form the chief stems of this system, which will be joined by the early completion of the line from Connellsville to Greensburg. It is stated that arrangements have been made with the Pittsburg Railways Company by which the 70-ft. vestibuled cars, seating 100 persons and running on a fast schedule, will start from some central point in Pittsburg and run in both directions, making a complete belt line, covering the most important manufacturing and mining districts of this section of the State. The through cars leaving over the Monongahela route will pass through Wilkinsburg, East Pittsburg, Turtle Creek and North Versailles Township to McKeesport, there striking the almost completed double-track line between McKeesport and Connellsville, which follows the Youghiogheny several miles off.

LARGE RAILWAY CONTRACT IN ENGLAND

The most important contract which has ever been awarded by a steam railroad company for electrical equipment has just been given out by the North Eastern Railway Company, of England. It will be remembered that several engineers of this company were in this country last summer inspecting American electric railway installations. Largely as a result of this investigation the company has decided electrically to equip 40 miles of track between Newcastle and Tynemouth. The contract has been awarded the British Thomson-Houston Company, of London, and calls for fifty complete motor car equipments and two electric locomotives. Trains will be run and the speed with stops is to be 22 miles per hour.

ANNUAL REPORT OF THE LOUISVILLE RAILWAY RELIEF ASSOCIATION

The Louisville Railway Relief Association, composed of employees of the Louisville Railway Company, of Louisville, Ky., has made public its report for the year ending Dec. 31, 1902. A vast amount of good was accomplished by the association during the year in the way of relief to members. More than $1,800 was paid out in sick benefits alone, while $750 was paid in death benefits. The association begins the year 1903 with the most flattering conditions; the magnificent gift of $2,000 by the directors of the Louisville Railway Company has placed the institution upon a most solid basis, and it now has on hand and in the treasury $4,395. The report of the financial secretary shows that the receipts from all sources amounted to $4,902. The amount paid in dues was $2,839. The total receipts were $4,902, and the disbursements were $2,931. One hundred and twenty-three members drew sick benefits amounting to $1,807. The general expenses for the year were $374.

THE BOSTON & WORCESTER ELECTRIC COMPANIES

The Boston & Worcester Electric Companies, organized after the plan of the Massachusetts Electric Companies and the Boston Suburban Companies, has acquired control of the Boston & Worcester Street Railway Company, Framingham Union Street Railway Company and Framingham, Southboro & Marlboro Street Railway Company. The association has outstanding 18,786 shares of 4 per cent preferred stock and 19,989 shares of common stock; total authorized issue of each, 50,000, no par value. The company has been financed and the securities will be listed on the Boston Stock Exchange. The officers are: James F. Shaw, president; George A. Butman, secretary and treasurer; N. W. Jordan, Philip Stockton, J. E. Toulmin, H. L. Burrage, Percy Parker, Robert Treat Paine, Jr., Charles Hayden, P. W. Moen, Arthur E. Childs, William M. Butler, H. Fisher Eldridge, James F. Shaw, E. P. Shaw, Phineas W. Sprague and W. H. Trumbull, trustees.

PLAN FOR CONSOLIDATION AT HARRISBURG

At a meeting of the board of directors of the Harrisburg Traction Company, of Harrisburg, Pa., Jan. 27, it was unanimously decided to submit to a special stockholders' meeting the first week in April a proposition for the organization of a holding company to take over the present Harrisburg company and all the smaller independent lines in the vicinity of Harrisburg, including the Harrisburg & Mechanicsburg, Harrisburg & West Fairview, West Fairview & Marysville and Linglestown & Blue Mountain Railways. The capital stock of the new company is to be $5,000,000. New lines will also be built to Dauphin, 9 miles above Harrisburg, and to Hummelstown, 9 miles east of Harrisburg. A number of new cars will be purchased, and an additional power plant is to be erected. Under the plan proposed, the present stockholders of the company will be guaranteed an annual dividend of 6 per cent on their total holdings of $2,000,000, and, in addition, will receive a stock dividend of $100,000, representing surplus earnings over and above operating expenses, fixed charges and dividends already paid. Not all of the $5.000,000 capital stock of the new company would be issued at once. It is the design of the promoters of the new organization to so finance it as to be able to equip the lines in the best possible manner and provide for the future growth of the system. The Mayor has just signed an ordinance providing for about 15 miles of street paving within the next two years, and as the trolley company is required to pave between its tracks on paved streets and for a certain distance on either side, this work will entail a heavy expenditure. It will be optional with the present stockholders whether they retain their present stock or exchange for shares of the new company. Each stockholder of the present company will be entitled to subscribe for an equal number of shares of the proposed corporation. Improvements and extensions will be considered after the organization of the new company. Heretofore, money for equipment and extensions has been taken from the earnings. The board of directors declared a semi-annual dividend of 3 per cent Jan. 27.

A NEW BENEFIT FUND IDEA

The Corning & Painted Post Street Railway Company, of Corning, N. Y., operating 5 miles of line, has established a voluntary disability benefit fund, to which the employees are not asked to contribute. All employees who have been regularly employed by the company for one year are entitled to share in the fund. In case of sickness or injury incapacitating an employee for longer than one week a sick benefit equal in amount to his average weekly wages is to be paid for a period not to exceed four weeks at any one time and not to exceed eight weeks in any one year. In the case of disability caused by any injury received in the company's service, the right to a sick benefit is to accrue at once, and in case of the death of an employee his widow is to be entitled to draw a sum equal to eight weeks' wages, less any such sum as may have been drawn by the employee himself within the preceding twelve months. Any employee who for a year draws nothing from the fund because of disability is to be entitled to a week's vacation at full pay or to a bonus of one week's wages, as he may elect.

PERSONAL MENTION

MR. P. ALBERT POPPENHUSEN, president of the Green Engineering Company, of Chicago, was in New York on business recently.

MR. A. E. WORSWICK, electrical engineer of the Federal District Railway Company, of Mexico, has resigned from that position.

MR. H. K. SURBECK, passenger solicitor for the Lake Shore Electric Railway, has resigned from that company to accept a position with another company.

MR. H. M. BRINCKERHOFF, general manager of the Metropolitan West Side Elevated Railway Company, of Chicago, was married on Jan. 20 to Miss Florence Louise Fay, of Chicago.

MR. E. IRVING DOW has been appointed to the position vacated by Mr. F. J. Green as superintendent of construction for the various properties controlled by the Appleyard syndicate.

MR. F. O. NOURSE, of Boston, has been appointed purchasing agent for the various roads controlled by the Appleyard syndicate in Ohio. He will probably make his headquarters at Columbus.

MR. R. N. BROWN has been appointed superintendent of the Dayton, Springfield & Urbana Railway, of Dayton, O. He was formerly superintendent of the Columbus, Buckeye Lake & Newark Traction Company.

MR. JOHN B. JUDGE, who has been connected with the Fair Haven & Westville Railroad, of New Haven, Conn., for a number of years as starter, has been appointed assistant superintendent of the entire system of the company.

MR. GRAFTON W. APPLER, who has been connected with the Westinghouse Electric & Manufacturing Company for the past four and one-half years, has accepted a position with the Northern California Power Company as electrical superintendent.

MR. CHARLES UPDYKE, formerly superintendent of the Toledo & Maumee Electric Railway, has been appointed to succeed Mr. H. H. Smith as superintendent of the Cleveland-Norwalk division of the Lake Shore Electric. Prior to his going to the Toledo & Maumee, Mr. Updyke held the position of superintendent on the Toledo & Monroe, which at one time was part of the Everett-Moore system.

MR. W. P. JACKSON, general manager of the Marion Street Railway Company for the past six years, has resigned here to accept a position with the Union Traction Company of Indiana as local superintendent at Anderson. As a token of their esteem, the employees of the Marion Street Railway Company last week presented Mr. Jackson with a handsome watch chain and diamond-studded charm. Mr. Jackson leaves for his new position in Anderson on Feb. 1.

MR. GEORGE H. GIBSON has resigned his position with the Westinghouse Companies' publishing department, of Pittsburg, Pa., to accept a position with the B. F. Sturtevant Company, of Jamaica Plains Station, Boston. Mr. Gibson was formerly a member of the editorial staff of the Engineering News, of New York City, and is a graduate of the engineering school of the University of Michigan. Mr. Gibson is a frequent contributor to the technical journals, especially those devoted to electrical engineering, as he is particularly interested in that department.

CAPTAIN JOSEPH M. DICKEY, of Newburg, shipping commissioner of New York, was appointed State Railroad Commissioner by Governor Odell on Jan. 29 to succeed Colonel Ashley W. Cole, of Brooklyn, who has resigned this place. Colonel Cole was Governor Morton's private secretary, and was first appointed Railroad Commissioner by Governor Morton Dec. 29, 1896, in place of Mr. Samuel A. Beardsley. Colonel Cole was appointed to his present term by Governor Black Feb. 16, 1897. This term expired Feb. 16, 1902, but no successor was nominated. Colonel Cole has proved an exceptionally able officer in the position from which he now retires. Many very important problems have been solved by the Commissioner during his term. Captain Dickey has been a successful business man of Newburg and a prominent Republican leader in Orange County. He was elected a member of the Assembly from the First Assembly District of Orange County in 1880, and was also a member in 1881. The Senate railroad committee considered Captain Dickey's nomination and decided, by a vote of 7 to 3, to confirm it. The nomination was later confirmed by the State Senate as a body.

MR. WILLIAM J. WILGUS, who has been chief engineer of the New York Central Railroad for many years, has been appointed fifth vice-president of the company, an office created at the last meeting of the board of directors. Owing to the constantly growing importance of the position occupied in the organization by Mr. Wilgus and the magnitude of the new work in connection with the New York terminal improvements which will be immediately under his supervision, it was deemed advisable to confer upon him an office whose title and dignity would be in keeping with the responsibility of the position. Moreover, the work now under consideration will bring the engineering department into closer relation than ever before with the executive department, and it was believed that it would be of advantage to have the head of this department represented in the executive branch of the organization. Mr. Wilgus will, accordingly, have general charge and supervision of all construction work and will assist the third vice-president, Mr. W. C. Braun, in matters pertaining to the maintenance of way and structure. The fifth vice-president will also perform such other duties as may be assigned to him from time to time by the president, subject to the approval of the board of directors or of the executive committee. Mr. Wilgus was empowered to appoint a chief engineer to succeed himself.

NEW PUBLICATIONS

Steam Power Plants; Their Design and Construction. By Henry C. Meyer, Jr., M. E. 160 pages, 16 plates and 65 illustrations. Price, $2. Published by the McGraw Publishing Company, New York.

This book is an elaboration of a series of articles which appeared originally in the Engineering Record, and is intended to assist owners and managers of manufacturing plants or buildings requiring power installations. From time to time they are called upon to specify or purchase the machinery needed for the equipment of their buildings with a view to efficiency and economy in operation. It is not the intention of the author to offer this work as a substitute for the recommendations or services of an expert or consulting engineer, but more as a supplementary aid and guide in mechanical and power matters. It is recognized that the great bulk of steam installations are made under the direction of men experienced in the details of manufacturing in their special lines, but devoid of expert knowledge in power plant engineering. To this class it is believed the information presented will prove suggestive and valuable, as well as to the engineer, architect and student who desires general information on the subject treated This will give some idea of the manner in which the subjects are treated, but it should not be assumed that the work is interesting only to this class. Experts will find much valuable data, in accessible and convenient form.

Traité Pratique de Traction Electrique. Vol. I. By L. Barbillon and G. J. Griffisch. 752 pages. Illustrated. Price, Frs. 30. Published by E. Bernard & Company, 29, Quai des Grands-Augustins, Paris.

The present tendency in America in electric literature is toward the publication of books on subdivisions of the art. In France, so far as electric railway construction and operation is concerned, the complete treatise seems to be more popular. As a result, we have the large and complete volume just from the press of Bernard & Company, as well as the exhaustive treatise in two volumes by Blondel and Paul DuBois, published by Beaudry & Company, in 1898. If we should attempt to draw a distinction between these two books, we might say that that by Messrs. Barbillon and Griffisch was descriptive, while the earlier book was analytical. No disparagement is intended to either work by these definitions, for both are very complete, and by their difference in treatment cover the field very thoroughly. The authors of the present volume are well fitted for the task, Prof. Barbillon being conected with the University of Grenoble, while Mr. Griffisch is chief engineer of mechanical traction, with the General Omnibus Company, of Paris. American practice is naturally referred to to a considerable extent in the treatise under consideration, but European methods, particularly those employed on the Continent, are given more prominence. The chapters on track construction, power stations, etc., are concluded in each case with an extended set of tables giving statistics of the amount of material required, cost of construction, etc. We can recommend this work without qualification to the engineer and student of traffic problems. It is understood that the second volume will be issued in a few months and will be sold for Frs. 10 or both books for Frs. 40.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. *a* Comparison is made with 1900 because in 1901 the earnings were abnormal on account of the Pan-American Exposition. *b* Exposition opened Dec. 1

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. Co.	1 m., Dec. '02	64,155	35,650	28,505	13,817	14,688
	1 " " '01	53,484	30,968	22,516	13,259	9,257
	6 " June '02	318,937	185,362	133.575	77,556	56,018
	6 " " '01	268,967	164,458	104,510	63,494	41,016
	12 " Dec. '02	745,044	410.793	334,251	155,068	179,183
	12 " " '01	617,011	350 845	266,166	136,162	130,004
ALBANY, N. Y.						
United Traction Co.	1 m., Sept. '02	132,606	81,990	50,616	23,866	26,750
	3 " " '02	414,635	251,739	162 897	71,598	91,299
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., Nov. '02	15,975	9,135	6,840	------	------
	1 " " '01	15,107	8,304	6.803	------	------
	5 " " '02	98,335	53,810	44,525	------	------
	5 " " '01	95,150	48,621	46,529	------	------
BOSTON, MASS.						
Boston Elev. Ry. Co.	12 m., Sept. '02	11,321,030	7,862,571	3,458,458	2,836,560	621,898
	12 " " '01	10,869,496	7,336,597	3,532,899	2,896,359	636,539
Massachusetts Elec. Cos	12 m., Sept. '02	6,090,168	3,827,372	2,262,796	1,391,239	871,557
	12 " " '01	5,778,133	3,915,486	1,862,648	937,206	925,442
BROOKLYN, N. Y.						
Brooklyn R. T. Co.	1 m. Dec. '02	1,076,193	655,896	420,296	------	------
	1 " " '01	1,038,158	686,623	351,536	------	------
	6 " " '02	6,836,370	3,785,175	2,051,194	------	------
	6 " " '01	6,513,239	4,083,729	2,429,510	------	------
	12 " June '02	12,789,705	*8952214	3,837,490	------	------
	12 " " '01	12,101,198	*7970635	4,130,563	------	------
BUFFALO, N. Y.						
International Tr. Co.	1 m., Dec. '02	309,871	169,957	139,914	132,822	7,092
	1 " " '01	270,651	174.824	95,827	128,241	†32,444
	6 " " '02	1,923,690	999,655	924,035	774,555	149,480
	6*a* " " '00	1,557,057	722,790	834,267	764.428	69,839
CHARLESTON, S. C.						
Charleston Consol'ted Ry. Gas & El. Co.	1 m., Dec. '02	45,872	29,364	16,508	12,605	3,903
	1 " " '01	*b* 60,092	29,957	30,134	12,673	17,461
	10 " " '02	524,654	312 584	212,669	125.921	86,148
	10 " " '01	427,174	267,941	159,233	128,092	31,141
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., Dec. '02	12,859	6,580	6,280	------	------
	1 " " '01	12,719	5,781	5,938	------	------
	12 " " '02	190,110	79,364	110,746	------	------
	12 " " '01	171,172	74,015	97,157	------	------
CLEVELAND, O.						
Eastern Ohio Traction Co.	1 m., Oct. '02	17,365	10,142	7,224	6,033	1,190
	10 " " '02	161,071	89,603	71,468	54,574	16,894
Cleveland, Elyria & Western	1 m., Dec. '02	24,711	16,249	8,462	------	------
	1 " " '01	19,406	11,098	8,309	------	------
	12 " " '02	300,846	171,074	129,771	64,250	65,521
	12 " " '01	249,260	136,865	112,394	57,023	55,371
Cleveland, Painesville & Eastern	1 m., Dec. '02	12,473	8,435	4,038	------	.....
	1 " " '01	11,920	6,681	5,239	------	------
	12 " " '02	189,187	105,670	83,518	74,552	8,966
	12 " " '01	164,971	87,102	77,869	71,296	6,573
COVINGTON, KY.						
Cincinnati, Newport & Covington Ry. Co.	1 m., Nov. '02	99 15'	*53,192	45 959	21,223	24,736
	1 " " '01	68,131	*40,287	27,844	15,416	12,427
	11 " " '02	1,008,408	*556,495	446,913	231,987	214,925
	11 " " '01	749,403	*443,089	306,314	172,139	134,175
DETROIT, MICH.						
Detroit United Ry.	1 m., Dec. '02	302,665	176,214	126,451	70,627	55,825
	1 " " '01	273,889	153,404	120,485	64,229	56,256
	12 " Dec. '02	3,501,754	1,967,532	1,534,222	815,004	719,218
	12 " " '01	3,063,503	1,684,453	1,379,050	726,744	652,307
Detroit and Port Huron Shore Line (Rapid Ry. System)	1 m., Nov. '02	32,117	*21,187	10,930	------	------
	1 " " '01	27,979	*17,446	10,533	------	------
	5 " " '02	204,644	*117,364	87,280	------	------
	5 " " '01	184,935	*99,350	85,585	------	------
DULUTH, MINN.						
Duluth-Superior Tr.	1 m., Dec. '02	48,769	28,699	20,070	10,054	10,016
	1 " " '01	40,541	25,042	15,499	9,212	6 287
	12 " " '02	538,031	288,373	249,658	116,275	133,382
	12 " " '01	453,704	251,315	202,389	109,967	92,422
ELGIN, ILL.						
Elgin, Aurora & Southern Tr.	1 m., Dec. '02	34,999	22,414	12,585	8,333	4,251
	1 " " '01	30,199	18,579	11,621	8,333	3,287
	12 " " '02	410,431	243,653	166,778	100,000	66,778
	12 " " '01	361,665	206,005	155,660	100,000	55,660
FINDLAY, O.						
Toledo, Bowl'g Green & Southern Traction Co.	1 m., Nov. '02	24,289	13,173	11,116	1,991	9,126
	1 " " '01	15,833	11,067	4,766	635	4,130
	7 " " '02	142,108	76 228	65,880	28,989	36,890
	7 " " '01	105,329	67,679	37,649	20,752	16,898
HAMILTON, O.						
The Cincinnati, Dayton & Toledo Trac. Co.	1 m., Dec. '02	36,452	21,377	15,075	15,952	+ 877
	1 " " '01	31,117	17,926	13,191	16 456	† 3,264
	7 " " '02	302,668	155,951	146,717	113,860	32,857
LONDON, ONT.						
London St. Ry Co.	1 m. Dec. '02	15,042	7,820	7,222	1,939	5.283
	1 " " '01	12 947	6,280	6,667	1,859	4 808
	12 " " '02	154,704	93,248	61,456	25,983	35,473
	12 " " '01	141,846	84,557	57,289	23,835	33,454
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 " Dec., '02	282,484	118 747	163,738	71,257	92,480
	1 " " '01	243,927	105 659	138 267	67,162	71,105
	12 " " '02	2,776,293	1,286,035	1,490,258	803,546	686,713
	12 " " '01	2,442,342	1,185,534	1,256,808	755,139	501,669
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m., Dec. '02	331,331	151,456	179,875	60,518	119,357
	1 " " '01	294,341	114,106	180,235	46,850	133,385
	12 " " '02	3,612,211	1,630,170	1,982,041	711,718	1,270.324
	12 " " '01	3,173,976	1,415,452	1,758,524	666,637	1,091,886
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., Dec. '02	177,367	113,917	63,450	17,406	46,044
	1 " " '01	158,196	105,607	52,589	15,185	37,404
	3 " " '02	531,645	313.965	217,680	49,474	168,207
	3 " " '01	479,169	287,307	191,862	44,536	147,326
NEW YORK CITY.						
Manhattan Ry. Co.	12 m., Sept. '02	11,583,546	5,545,395	6,038,151	2,712,089	3,326,062
	12 " " '01	10,455,872	5,328,649	5,127,223	2,683,132	2,444,091
Metropolitan St. Ry.	3 m., Dec. '01	3,887,936	1,723,972	2,143,964	1,151,140	992,824
	3 " " '00	3,786 030	1,699,649	2,086,381	1,138,467	947,914
	12 " June '02	15,866,641	7,385,883	8,480,758	4,815,421	3,665,337
	12 " " '01	14.720,767	6,755,131	7,965,636	4,534,068	3,431,567
OLEAN, N. Y.						
Olean St. Ry. Co.	1 m ,Dec. '02	6,347	4,274	2,073	1,268	805
	1 " " '01	4,638	2,884	1,753	1,146	608
	6 " " '02	36,383	19,047	17,336	8,303	9,033
	6 " " '01	30,513	13,961	16,553	8,305	8,247
PEEKSKILL, N. Y.						
Peekskill Lighting & R. R. Co.	1 m., Oct. '02	9,023	5,706	3,317	2,083	1,234
	4 " " '02	37,696	21,586	16,110	8,333	7.777
	12 " June '02	86,795	*56,392	30,402	23.125	7.277
PHILADELPHIA, PA.						
Union Traction Co.	12 m., June '02	14,118,159	6,402,338	7,715,820	*6637781	1,078,038
	12 " " '01	13,431,681	5,836,186	7,595,494	*6734328	861,266
American Railways	1 m., Dec. '02	96,159	------	------	------	------
	1 " " '01	82,262	------	------	------	------
	6 " " '02	639,655	------	------	------	------
	6 " " '01	501,210	------	------	------	------
	12 " June '02	1,009,509	------	------	------	------
	12 " " '01	844,298	------	------	------	------
PUEBLO, COL.						
Pueble & Suburban Traction & Lt. Co.	1 m., Nov. '02	37,584	24 348	13,236	4,583	8,653
	1 " " '01	23,733	15,590	8,143	3,388	4,755
ROCHESTER, N. Y.						
Rochester Ry.	1 m., Dec. '02	103,156	52,913	50,242	29,037	21,205
	1 " " '01	98,002	49,833	48,169	29,135	19,034
	12 " " '02	1,107,738	576,922	530,816	302,061	228.754
	12 " " '01	1,022,009	589,199	432,810	301,138	131,671
SYRACUSE, N. Y.						
Syracuse R. T. Co.	1 m., Dec. '02	67,405	36 804	30,601	19.025	11 576
	1 " " '01	63,471	34,374	29,097	19,025	10,072
	6 " " '02	371,734	203,068	168,666	114,150	54,516
	6 " " '01	346,670	188,286	158,384	114,096	44,288
TOLEDO, O.						
Toledo Ry. & Lt. Co.	1 m., Dec. '02	139,608	*63,889	75,719	------	------
	1 " " '01	126 378	*63,031	62,747	------	------
	12 " " '02	1,459,091	*726,779	732,312	------	------
	12 " " '01	1,311,084	*636,407	674,677	------	------
Lake Shore Elec. Ry. Co.	1 m., Nov. '02	42,540	30,982	11,558	------	------
	1 " " '01	27,778	20 064	7,714	------	------
NEW BRIGHTON, S. I.	11 " " '02	416,390	275,693	140,697	------	------
	11 " " '01	329,376	217,518	111,858	------	------
Richmond Light & R. R. Co., formerly Staten Island Elec. Ry.	3 m., Sept. '02	73 687	43,950	29,737	18,930	10,807
	3 " " '01	80,197	42,103	38,094	27,221	10,873
YOUNGSTOWN, O.						
Youngstown - Sharon Ry. & Lt. Co.	1 m., Dec. '02	47,857	*24,729	23,129	------	------
	12 " " '02	444,986	*244,972	200,014	------	------

CONSTRUCTION NOTES

LOS ANGELES, CAL.—Henry E. Huntington, president of the Pacific Electric Railway Company, has purchased a large, highly-improved ranch property of 664 acres, about 12 miles east of Los Angeles, for more than $200,000, which he proposes to sub-divide into high-class suburban property. It lies out beyond Pasadena, being about 2 miles east of Alhambra, and the same distance north of San Gabriel. It is the declared intention of the Pacific Electric Railway Company to add to its transportation facilities so as to bring the land into direct and constant communication with Los Angeles.

FLORENCE, COL.—The Florence Electric Street Railway Company, which plans to build between Florence and Canon City, a distance of 25 miles, will award contracts for construction in ninety days. The president of the company is Thomas Robinson, and the secretary is Harry Robinson.

WILMINGTON, DEL.—The Keystone Electric Railway Company, of Wilmington, Del., has been incorporated, with a capital stock of $2,000.

GAINESVILLE, GA.—Considerable track has been laid in the city by the Gainesville & Dahlonega Electric Railway. The plan of the company is to begin work on the line to connect Gainesville and Dahlonega at an early date.

ROCHESTER, IND.—Henry Township, Fulton County, has voted an appropriation of $15,000 in aid of the Wabash & Rochester Traction Company, which this spring is to build an electric railway to connect Rochester and Wabash, via Roann. There had been subsidies aggregating $95,000 previously voted, and this makes a total of $110,000. President Tuttle, of the company, says nearly all the right of way has been secured, and that work will commence as soon as the frost leaves the ground. The distance is 35 miles.

MOUNT VERNON, IND.—The City Council has granted a fifty-year franchise to the Evansville, Mount Vernon & Union Town Traction Company. The company will enter the city over Third and Fourth Streets and along Main Street. The power house and machine shops are to be located at Mount Vernon.

RICHMOND, IND.—The Richmond Street & Interurban Railway Company is planning an extension to Connersville from Milton, the present terminus of its lines. The extension is to be completed by July.

WARSAW, IND.—The Huntington & Winona Traction Company has secured nearly all the right of way for its line from Huntington to Winona by way of South Whitely. Construction work will start in the spring.

FORT WAYNE, IND.—The International Construction Company, of New York, is preparing to construct the Goshen & Indiana Railway. The project has been financed and many of the contracts for material have been placed.

JEFFERSONVILLE, IND.—Preliminary surveys have been started for the Jeffersonville & Madison Electric Railway. The road will be constructed by way of Charleston, New Washington and Hanover.

WABASH, IND.—Surveys have been completed for the Wabash-Rochester Electric Railway. Construction work will start as soon as the weather permits.

FORT WAYNE, IND.—Senator S. B. Fleming has secured an extension of the time in which to construct the interurban railway in which he is interested until four months after May 1. The franchise provided originally that the line should be completed from New Haven to the center of the city by that date, but litigation interfered and caused delays. Since the original grant negotiations have been practically closed for consolidation of the Fleming line and Fort Wayne, Van Wert & Lima line. The same persons interested in these two companies are also interested in the purchase of the Fort Wayne Traction Company, controlling the city lines.

INDIANAPOLIS, IND.—The Indianapolis Northern Traction Company expects to have its line ready for operation by July 1, 1903. Johnson & Berry, of Anderson, have the contract for the construction of the roadbed from Indianapolis to a point south of Carmel, and the line from Carmel to Noblesville practically has been completed by R. G. Kirkpatrick & Company. The forces of the traction company are working on the division from Noblesville to Tipton. R. J. Forrestal is preparing the road between Kokomo and Peru. The traction company itself has practically finished the grade from Kokomo to Galveston. Eaton, Campbell & Henderson have the contract from Galveston to Logansport and will work all winter preparing the line. J. N. Bick & Company, of Chicago, are working between Bunker Hill and Peru. One-half the poles for the entire line have been delivered and contracts have been let for erecting the overhead system from Indianapolis to Tipton and from Tipton to Logansport. The rails and ties for the entire line have arrived and track work will begin early in the spring. Contracts have been let for erecting substations at Tipton, Noblesville and Broad Ripple. These stations will be brick structures. The one at Tipton has been completed and the one at Noblesville is very nearly finished. The Westinghouse Electric Company will equip the Anderson power plant and the six sub-stations along the line. The Electric Storage Battery Company, of Philadelphia, will install the storage batteries at each of the sub-stations.

CEDAR FALLS, IA.—The Cedar Falls & New Hartford Railway Company has been incorporated to build an electric railway to New Hartford.

WORCESTER, MASS.—The Worcester & Northern Street Railway Company, which plans to build 11 miles of line to connect Holden and Westminster, will award contracts in February or March. The office address of the company is 452 Main Street, Worcester.

GREENFIELD, MASS.—After a hearing of the Railroad Commission, the Greenfield & Turners Falls Street Railway Company and the Conway Street Railway Company have come to an agreement over the joint use of tracks in Greenfield. Each Company owns a single track line, and the plan is to operate the two as a double-track system.

UXBRIDGE, MASS.—It is stated here that the Linwood Street Railway Company, of Whitinsville, will ask for franchises to extend its line through Sutton and Douglas to East Douglas.

UXBRIDGE, MASS.—The Uxbridge, Whitinsville & Douglas Street Railway Company has petitioned for a location in Sutton.

WESTFIELD, MASS.—The Woronoco Street Railway Company will extend its track during the coming year. The company plans to purchase a dynamo and an engine.

GREENFIELD, MASS.—The Huntington & Westfield River Street Railway, which was originally intended to be built from Huntington to Shelburne Falls, will, it is said, have Greenfield as its northern terminus.

HOLYOKE, MASS.—The Holyoke Street Railway Company has voted to petition the Railroad Commissioners for authority to issue bonds to the amount of $265,000.

WORCESTER, MASS.—The Boston & Worcester Street Railway Company has appealed to the Legislature for authority to cross the Boston & Albany Railroad tracks at grade in Newton and Natick.

WORCESTER, MASS.—The Worcester & Northern Street Railway Company is asking for locations from the terminus of the Worcester & Holden Street Railway in Holden to connect with the Gardner, Westminster & Fitchburg Street Railway at Westminster.

WORCESTER, MASS.—The Worcester Consolidated Street Railway Company has placed an order for six thirteen-bench open cars with the Laconia Car Company, of Laconia, N. H.

SPRINGFIELD, MASS.—It is believed that the Springfield & Eastern Street Railway will renew its efforts to secure an independent entrance into Springfield, instead of using the tracks of the Springfield Street Railway Company. A petition for a separate location was brought and denied over a year ago.

CLINTON, MASS.—A proposition is being considered by the Worcester Consolidated Street Railway Company to build a branch line in Clinton, reaching the Clinton-Lancaster Driving Park and one of the largest cemeteries in the town.

TAUNTON, MASS.—The Norton & Taunton Electric Railway in the spring plans to extend its lines from their present terminus in Norton, through East Norton, to a point beyond East Mansfield, where connections will be made with the present Easton branch.

HOLYOKE, MASS.—The Holyoke Street Railway Company has bought from the American Thread Company, of Holyoke, a centrally located lot containing 76,000 sq. ft. for about $28,000. No announcement has been made as to the purpose to which the lot will be put.

JACKSON, MICH.—The Jackson & Battle Creek Traction Company, through Spitzer & Company, of Toledo, has placed a contract with the G. C. Kuhlman Car Company, of Cleveland, for six interurban cars of the latest pattern.

GREENVILLE, MISS.—The Delta Electric Light, Power & Manufacturing Company is said to have completed all arrangements for building a 4-mile electric railway here.

KANSAS CITY, MO.—The Metropolitan Street Railway Company has opened its Twenty-Fourth Street electric line. The new line extends from the stock yards, across the Allen Avenue Viaduct, north to Nineteenth and Main Streets, and thence east to Cleveland Avenue, returning on Eighteenth Street.

OMAHA, NEB.—It is said that plans have been perfected by the Omaha Street Railway Company for building a new power house in the city and that the work of preparing the site will be begun in the spring.

NEW YORK, N. Y.—A franchise has been granted to the New York Interborough Railway Company by the Board of Estimate and Apportionment for the operation of an electric railway in the Bronx. The franchise is for a term of fifty years, and gives the company the right to run cars across Macomb's Dam Bridge and other Harlem River structures, and contains the provision that at the expiration of the franchise the city can purchase the plant necessary for the operation of the road at a fair price, to be fixed by the Board of Estimate and Apportionment.

TROY, N. Y.—The Forest Park Railway Company, recently incorporated, has applied to the Council for a street railway franchise. The purpose of the company is to build an electric railway to accommodate patrons of Forest Park Cemetery.

UTICA, N. Y.—D. W. Lewis, of New York, and his associates, are said to have in contemplation the construction of an electric railway from Utica to Deposit.

TOLEDO, OHIO.—The Interurban Construction Company has been incorporated, with $10,000 capital stock, by H. R. Klauser, A. E. Klauser, N. Schmidt, J. H. Pheat and H. F. Shunck. The company will promote and construct electric railways, build bridges, etc.

YOUNGSTOWN, OHIO.—The Youngstown Consolidated Gas & Electric Company and the Youngstown & Sharon Railway Company have moved into a fine new office building at Boardman and Champion Streets, which was constructed expressly for their service. Street car and light-supply shops have been established in the basements of the building.

CLEVELAND, OHIO.—The Cleveland Construction Company has elected the following officers: Will Christy, president; W. E. Davis, vice-president; C. W. Foote, treasurer; R. E. Inskeep, secretary. The above, with J. R. Nutt, are directors. The company builds electric roads.

TOLEDO, OHIO.—The Toledo & Western Railway Company has re-elected the following directors: Hon. Luther Allen, Judge C. M. Stone, J. R. Seagrave, W. L. Hayes and E. B. Allen, of Cleveland; F. E. Seagrave and C. E. French, of Toledo. At the recent annual meeting plans were discussed for the financing and building of the Garret, Auburn & Northern and the Chicago & Indiana, which will be a part of the proposed through system from Toledo to Chicago.

COLUMBUS, OHIO.—The State Board of Public Works has adopted a resolution giving the consent of the State, as an abutting property owner, to the construction of the proposed Miami & Erie Terminal Railway, which will connect the canal with the Ohio River.