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*THE STREET RAILWAY JOURNAL,*
*114 Liberty Street, New York.*

## The Rear End of the City Car

An article in our last issue, in which the type of car used in Des Moines, Ia., is described, gives food for some peculiar reflections as to the tendency in recent years on certain roads to modify the rear platform so that it really forms part of the car, or, in some cases, to do away with it entirely, as has been done at Des Moines. Ever since mechanical traction was introduced there has been a tendency to lengthen the rear platform so as to accommodate a large standing load in rush hours and also offer an outdoor ride to smokers and others who prefer standing on an open platform to riding in a closed car. What is known as the "Detroit platform," which is an extra long platform with a division hand railing through it, has been extensively used. In St. Louis, General Manager Dupont, of the St. Louis Transit Company, has gone even further than he did when he introduced the Detroit platform, and now has platforms 7 ft. long, with two sets of hand railings dividing the platform into three divisions for the convenience of the large standing load which these platforms accommodate. That such platforms are liked by a large number of the male passengers is an undoubted fact. From a mechanical standpoint, of course, such a large overhang is not desirable, but mechanical considerations are of secondary importance when questions of convenience and comfort and ability to carry large loads during rush hours are considered.

The European cars, especially those on the Continent, have developed the platform to a greater extent even than in the most extreme Detroit type. The usual rule prohibiting passengers from standing in the car but allowing a certain number on the front and rear platforms, depending on their size, has produced cars which, in many cases of single-truck cars, are almost 50 per cent platform. The result is that these cars carry per square foot nearly as many passengers as in a crowded car of the American type.

The Des Moines car is adapted for conditions of a city where there is no such congestion as in St. Louis. Here the overhanging rear platform has been done away with entirely, and for it there has been substituted a half-open smoking compartment with seats. The entrance is at the side of the car so that there is no annoyance to ladies in passing through the smoking compartment or through a crowd of smokers to get into the car. As a matter of fact the Des Moines idea is merely carrying out the Detroit and St. Louis platform idea a little further and putting in seats. At Denver the side-entrance car has also been adopted. It will be interesting to note in the future just the course of evolution of the side entrance car and the long rear platform and whether the two are worked together into some common form which retains the desirable features of both.

## Libel by Implication

The opportunity to stab a street railway company in the dark with the poisoned knife of insinuating slander seems bound to be utilized these days on every possible occasion by the sensational press. This time the Boston Elevated is the victim of one of the meanest innuendoes that recent months have brought to light. A few days ago an electric car, operating some 40 miles or 50 miles from Boston, left the rails while on a trestle, and after a decidedly startling journey along the edge of the structure, came to a stop just in time to avoid pitching off into the street or road below. Here was the chance of one of the yellowest of the Boston papers to set afloat an abominable canard against the elevated. In massive glaring capitals the bulletin board and headlines of this paper informed the gullible public that 200 passengers faced death on an elevated car, and described in thrilling detail how the unfortunate conveyance hung to the structure by its finger tips, while the terror-stricken passengers were hauled out of the death trap which was about to spring. Although the details of the affair were properly placed in regard to the correct geographical location of the accident, when one finally reached the fine print, the impression given in both headlines and bulletin rendered the unoffending elevated road subject to no small amount of unsparing and entirely undeserved criticism. To cap the climax the story closed by stating that the car which had left the rails was of just about the same construction as those in use on the Boston Elevated, and that the heavy trucks had been of little use as an accident preventive.

To characterize properly such contemptible attempts to injure the reputation of a road, which is known as one in which the safety of its passengers is the most vital feature of its operation, would require a list of adjectives that would tran-

scend the limits of those remarks. We believe, however, that calumnies of this kind will revert on the heads of their authors, as after the deception is appreciated the public will naturally look with suspicion on all other statements which emanate from the same source.

## The Use of Scrim

One of the weak features of the modern street-car building and of car repairing as well is in the application of canvas to the panels. Canvas, when properly applied to a wooden panel, trebles, or perhaps quadruples, the strength, and accomplishes this result with no appreciable addition to the weight, but when badly put on is of no earthly use. By canvas we mean "scrim," burlap or any of the woven materials used for the purpose. The careless application of any form of the cloth to a panel is actually injurious, because it forms a resting place for dirt and also for moisture.

Canvas, under the action of glue and paint, may undergo a complete change of structure. Some kinds of paint appear to completely destroy its strenth. Then, instead of being a strong, durable material it becomes brittle and quickly decays. Red iron-oxide paints have a peculiarly destructive action. Some of them make canvas brittle as soon as they harden upon it.

When the "scrim" is left with projecting or rough edges, no matter how heavily they may be coated with paint, the threads become very sensitive to both air and moisture. They yield rapidly to the latter, becoming so brittle as to break like sticks. Both air and moisture follow the threads long distances into the body of the cloth under the paint. Even where no threads are left hanging, if the edge is left loose, decay rapidly begins.

The application of canvas to panels is a dirty job; it is hated by woodworkers, and is usually given to the youngest worker or to a man who has the least pull. When ordinary glue is used, little attention is paid to keeping it warm. Often a liquid glue of poor character is considered good enough for the purpose. The foreman usually looks upon this part of the work as a job to be put out of sight as soon as possible. There are a few shops in the country, and only a few, where the value of this part of the work is appreciated. There are still fewer where it is well done. In making repairs the application of the "scrim" or canvas is often merely done in deference to public opinion.

When properly put on the canvas should fit as closely to the surfaces on which it is placed as a coat of paint. The edges should be trimmed smoothly with a sharp chisel and not a thread left projecting. In the shop where this work is better done than in any other in the country, success has been attained by putting it into the hands of one man who was taken from the ranks of the laborers. He was shown "how," given first-class facilities, and had an increase of pay and position, which was stimulating to both pride and pocket. The resulting workmanship justified the pains taken, while the better men were relieved from what is, essentially, a disagreeable task. Canvas put on in this way never parts company with the wood to which it is applied unless it is soaked off. If taken away forcibly the canvas takes a layer of wood with it.

## Blood on Train Resistance

Our esteemed correspondent, Mr. Blood, writes mildly to protest against some criticisms we made in the matter of his so-called "rational" formula for train resistance. Now, as we before remarked, a rational formula would be an excellent thing, and we hope Mr. Blood will find one, but he has not yet done so, and from the communication, which it gives us pleasure to print in this issue, we judge that he is not likely to do so. Nothing approximating a rational formula has as yet been presented by anyone, and when sufficient data have accumulated to furnish one it will very probably be too complicated for convenient use, so that for most problems a good empirical simplification of it will be more useful, just as the parabolic formula for wire spans is, in most cases, more useful than the full equation of the catenary.

In the concrete problem before us Mr. Blood takes exception to some of our suggestions in a way that seems to call for a response. *Imprimis*, he questions our hint that the "stern factor" may vary with the length of the train. This was merely thrown out by us as a suggestion, with the introductory word "perhaps." We are willing to acknowledge that the weight of evidence now available tends to show that both head and stern resistance are independent of the length. The remark was intended to call attention to the fact that more complete experiments with actual high-speed electric trains would be of great assistance in determining the relation of air streams to trains, and that at present the construction of a rational formula, in which each term represents exactly a separate factor in the resistance encountered by a moving train, is an extremely difficult undertaking.

As regards the fractional exponent we would merely repeat that it is a concession to the well-known discrepancy between linear formulæ and those in $l^{\frac{3}{2}}$. Like any other fractional exponent it is a useful abbreviation of a series of integral powers, but there is no reason to suppose that it represents any rational relation between speed and train resistance. In dealing with the other terms of his formula Mr. Blood seems to fall again into the very errors that we have been striving to correct. All the recent experiments seem to indicate that the coefficients, $A$ and $B$, sliding and rolling friction respectively, when taken as constants, do not account for the facts. Mr. Blood furnishes five values for the former and two for the latter. There may or may not be constant terms representing sliding and rolling friction, but they are not Mr. Blood's $A$ and $B$, the varying values of which speak for themselves. $A$ and $B$ are really aggregations of terms, about which up to the present very little is known save that they vary. A considerable amount of evidence has accumulated tending to show that the track resistance as a whole does vary irregularly with the speed, although purely for convenience the contrary is often assumed, and the whole variation is charged to atmospheric resistance. In the light of practically all the results at very high speed it is now clear that the total track resistance is often singularly small, and that current ideas of its magnitude must be revised. The effect of this knowledge is shown in formulæ like those of Vauclain and Sinclair, where a linear equation with a small absolute term meets the experimental facts in spite of the known existence of an atmospheric term in $V^2$.

As regards the general form of Mr. Blood's equation, especially the propriety of introducing an exponent of less than two in the "air resistance" term, we believe that a more satisfactory form for general use is that of the Maclaurin type. The chief advantage of the Maclaurin type of formula is that it makes very easy the computation of numerical results by the use of tables of square and cubes, whereas with fractional coefficients logarithms have to be employed. A mathematical consideration of the determined results of train resistance shows that the Maclaurin series, when applied, converges so rapidly that it is useless for practical purposes to carry the ex-

pansion beyond $V^2$. In other words, if the coefficients be properly selected for this type of equation no practical advantage is secured by the use of a fractional exponent in the third term, as employed by Mr. Blood. On the other hand, such a type of formula has several disadvantages. In the first place, in combination with the first power, it is a form for which there is no mathematical precedent. In this respect it is unlike the Aspinall formula, which is of the recognized $y = a + bx^n$ type. It also has the objection of making the computations more complicated, as stated above, and it differs in form from all other formulæ of the kind in use.

We heartily appreciate the efforts of Mr. Blood to get the train resistance matter on a sounder basis than that furnished by many of the earlier formulæ which have lingered in use. It is extraordinary that some of these, long discredited by experiment, are still solemnly quoted as authorities. Mr. Blood's formula we regard as a useful one, even although as empirical as its predecessors. The real speed-resistance curve is theoretically, and experimentally so far as it has been worked out, a somewhat complicated affair. Now, to obtain working formulæ three courses are open. One can wait for a rational formula which will take into account all the irregularities; one can construct an approximation curve, as Mr. Blood and others have done, more or less correct according to the assumptions, or finally, one can approximate the curve by a series of right lines, giving a set of linear equations. We incline to the last process in the present state of data on the subject. Meanwhile we need data very badly indeed; in particular, data on the variations of track resistance and on air resistance, the two groups being cleared of mixed factors as far as possible. Then, perhaps, a rational formula to meet all the facts can be constructed.

## Conservatism in Railway Building

We feel it necessary to sound a note of warning against the vice of overconfidence in building electric railways. There have been many jibes of late about the promoter of the Hot-Air Line, and perhaps the public is sufficiently acquainted with his devious, not to say crooked, ways. But this is not enough, for there are not a few really rash enterprises undertaken in wholly good faith but with quite insufficient caution. It is no extraordinary thing that such is the case, for the remarkable success achieved by some electric roads and their very evident importance to the public makes them singularly attractive, as a class, to the imagination. Steam railroad building went through exactly such a phase a score of years ago, in the days when the great West was growing with magnificent rapidity. Great it still is and still growing, but the "boom" spirit is less rife and the growth is of a sounder grain. In the last five years the amount of electric railway building has been something startling, and while by no means all the roads have been successful, there have been some very conspicuous examples of prosperity. It would be a thankless and unkind task to draw up a muster roll of the failures, but it would be, we fear, a lengthy one. Most of the roads will sooner or later be put on a sound, paying basis, but the tale of struggles and reorganizations will be a long and strenuous one. It is somewhat instructive to consider the causes of success and failure and thus to get a somewhat clearer view of the perils that beset the path to success and dividends. It is a story not unlike that which was characteristic of the early electric lighting promotion, and from that ancient history some useful parallels may be drawn.

Perhaps the commonest cause of hard luck has been misjudgment of the possibilities of the traffic. This was the efficient cause of most of the failures in steam railroading, and is equally operative in this latter development of electric traction. It does not follow that because an interurban line between two cities of a quarter of a million inhabitants each has proved a money-making enterprise, that a line between two towns of a tenth the size will earn its salt. Perhaps it will but more often it will not. In a regular city road not only is there a larger public to draw upon, but there can safely be reckoned far more rides annually per person. Probably the same ratio is not true for pure interurban traffic, but the general fact is the same. It takes a good many nickels to pay the interest on an investment of a million or so of dollars and to keep the investment intact by taking care of the depreciation. This latter rock is one upon which not a few roads have already gone to pieces, and we fear that it will be the graveyard of many more ere the tale is complete. In this particular large urban roads stand in better case than the rank and file, a point which is not generally appreciated at its full importance. A big tramway system has, perforce, to do more in the way of steady up-keep, and with the present strong tendency of the population toward the larger cities, its income keeps to a certain extent pace with its necessities. Thus it happens that some such road, without having a sinking fund or other formal provision for taking care of depreciation, still manages to hold the property in first-class shape by current expenditures. And when a demand for re-equipment comes it frequently happens that the earning power has so increased that new work can be taken care of by an increase of investment without passing the danger point of inflation.

The smaller roads have no such luck on their side. Less dense traffic means that the fixed charges and depreciation are larger per passenger carried, and what is more important the rate of steady and natural increase in traffic is less than in case of an urban road. Hence it is harder to allow for up-keep properly out of the ordinary receipts, and there is less steady increment to depend upon when extensive changes become necessary. We know of no definite statistics on the subject, but we are inclined to think, too, that the urban road loses less traffic in hard times than one which depends on a less densely populated region. It, therefore, behooves one who plans an electric road to look after the matter of probable traffic much more sharply than is usual. Guessing is as often wrong as right in this particular, and many a road has found itself hard pushed because of too roseate a view of the traffic probabilities. Besides all this the somewhat speculative character that attaches to some projected lines causes a tendency to build on far too small a cash capital, and involves heavy actual burdens due to all kinds of ill-advised credits. From the same source come unskillful engineering and construction, hastily done by contractors who cannot be properly kept in line for lack of funds in hand. More than one road has had to be practically reconstructed by the representatives of its bondholders after the inevitable crash. Built for cash and carefully operated the vast majority of electric roads will pay, but the time for booming schemes has now pretty much gone by. It should not be forgotten, too, that the combination of two or more bad roads does not necessarily make a good system, particularly if the fixed charges are concurrently raised without a corresponding physical improvement in the properties. We are approaching the time when a cautious and sound conservatism should be at the bottom of the electric railway business just as in ordinary railroading. "Electric," as a word to conjure with, has somewhat lost its potency.

## THE SYSTEM OF THE NORTHERN TEXAS TRACTION COMPANY

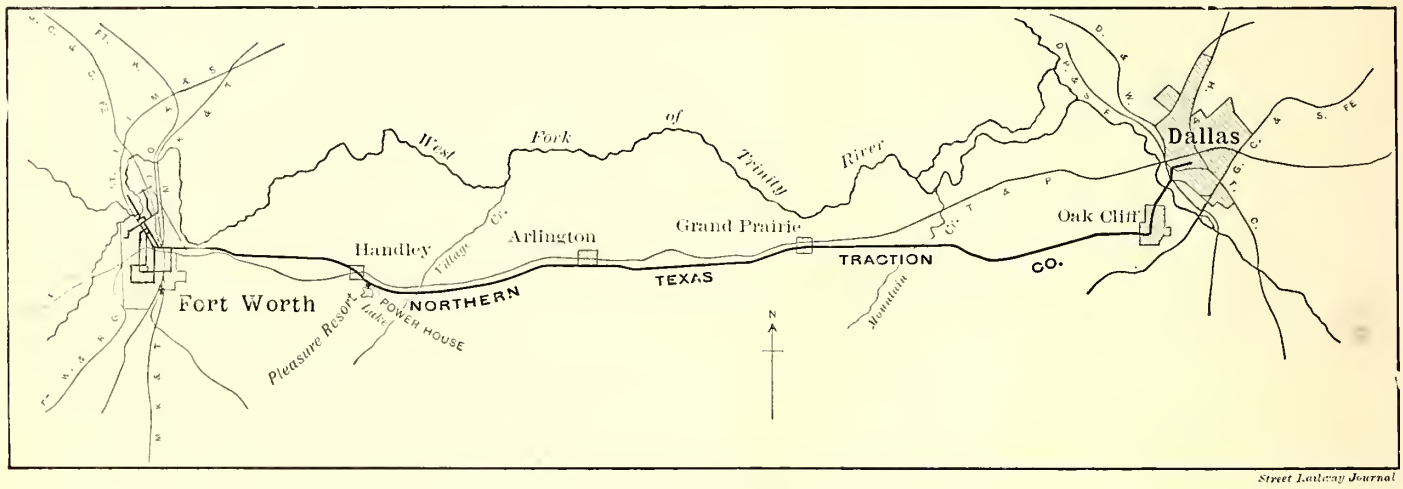
This road consists of an interurban line connecting Dallas and Fort Worth and a system of local lines in Fort Worth and a line in Dallas extending into the business center of the city. The Fort Worth system is a consolidation of three local roads, aggregating 17 miles of track.

The chief suburb of Dallas is Oak Cliff, which is on the southwest side of Trinity River, and, consequently, as seen by the accompanying map, toward Fort Worth. The Dallas & Oak Cliff Electric Railway Company formerly operated an electric line from the west line of Oak Cliff into the business center of Dallas. This is now part of the Northern Texas property. The roadway is that of the old steam road, and the right of way through Oak Cliff is in the center of an exceptionally wide street; each side of the track being practically a street in itself, though the grade line of the track conforms to that of the street. Between Oak Cliff and Dallas the right of way is private, there being heavy fills through the low ground adjacent to Trinity River. The length of this road is approximately 4 miles. It has double track for the portion over which the interurban cars operate, which is the only portion shown by the map, and in addition a loop for local service is to be built to the west of the main line.

The interurban is approximately 28.5 miles long between the corporation lines of Fort Worth and Oak Cliff, and the run of the interurban in Fort Worth about 1.8 miles, making a total run of the interurban of 34.3 miles. The line in Dallas is being extended, and when completed the run will be approximately 35 miles.

Dallas and Fort Worth are the two largest and most important cities in Northern Texas. Each is a county seat, has a large wholesale and retail business, and also is an important steam railroad center. Only one steam road, however, the Texas & Pacific, connects the two cities, though shortly the Rock Island will also run through both. This new line, owing to its location, will not affect intermediate traffic, but the competition between the interurban and the Texas & Pacific has been very aggressive, especially on the part of the Texas & Pacific, though the interurban has obtained the business.

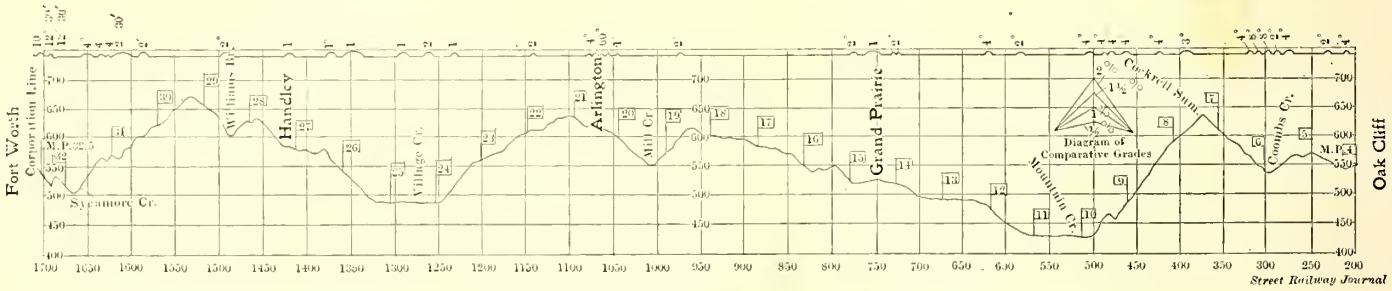
Dallas is the more important wholesale and retail center, and does a large trade in agricultural instruments, being, it is claimed, the second city in the country in this line. It has also extensive banking and financial interests, as well as being an important social and educational center. Fort Worth is also prominent for features similar to those mentioned above for Dallas, though possibly to a less degree, but it is more important




MAP OF NORTHERN TEXAS TRACTION COMPANY

as a railroad center, and especially as a center for live stock interests. The latter have greatly increased since the Northern Texas Traction Company purchased the Fort Worth roads. The Fort Worth Stock Yards Company has erected exceptionally large yards, and both the Swift and Armour Companies have erected large packing houses, including cold storage buildings. In the future, instead of sending cattle north to be fattened and distributed, they will be corn-fed in Texas, and shipped from Fort Worth packing houses.

The towns between Dallas and Fort Worth are small, the residents either doing business in the city or supervising farms in the neighboring country. This section, however, is quite important in the raising and shipping of cotton. In Arlington




PROFILE MAP OF INTERURBAN LINE

there are two compress companies, and one making cotton oil, and the shipments of cotton from Arlington are stated to be even greater than from Fort Worth. Grand Prairie also has a cotton compress. The land between Dallas and Fort Worth is a splendid farming country and yearly produces large crops of wheat and cotton, oats and corn. A tendency has recently set in, however, towards the raising of garden truck and poultry, dairy farming, cheese making, etc., the proximity of the city markets and the advantages of the refrigerator-car service on the trunk lines, now made accessible, placing these new and more remunerative interests at the disposal of the farmer. The ground and climate will produce almost any crop, the variable factor being water, and the crops are remarkable when the rainfall is evenly distributed or where water is available for irrigation. The latter has not yet been developed to any considerable extent.

TRACK

With the exception of short distances, where the line passes through intervening towns, the entire 28.5 miles of interurban road between Fort Worth and Oak Cliff is on its own right of way. This right of way in general is 66 ft. wide, and it has been so obtained that but few sharp curves or heavy grades were necessary, and the stretches of straight track could be made especially long, the majority of the tangents being from 1 mile to 4 miles in length. Outside of the tracks in the terminal cities the curves are 4 degs. or less, with the exception of an undergrade crossing of the line of the Texas & Pacific at Handley, which required curves of considerable less radii at the approaches. In Dallas the interurban road crosses the main lines of two steam railroads at grade, but as the tracks of these two roads adjoin at this point it is practically a single grade crossing. This is the only grade crossing on the road with the exception of three crossings of steam railroad branch lines to warehouses.

The average grade is less than 1 per cent. At the entrance to Fort Worth there is a maximum grade of 3.7 per cent for about 700 ft. The excavations and fills by which this result was obtained necessitated considerable work on many portions of the line, as shown by the views of certain sections reproduced in the illustrations. The roadbed is 16 ft. wide on embankments, with slopes of 1½:1, and in cuts is 20 ft. wide, with slopes of 1:1, except, of course, in rock cuts. There are three steel bridges on the line, one spanning Trinity River, one at Sycamore Creek, and one at Mountain Creek; the latter two being constructed by the King Bridge Company, of Cleveland, Ohio. At other streams pile trestles are employed. Smaller water courses have stone or concrete culverts or extra heavy sewer pipe.

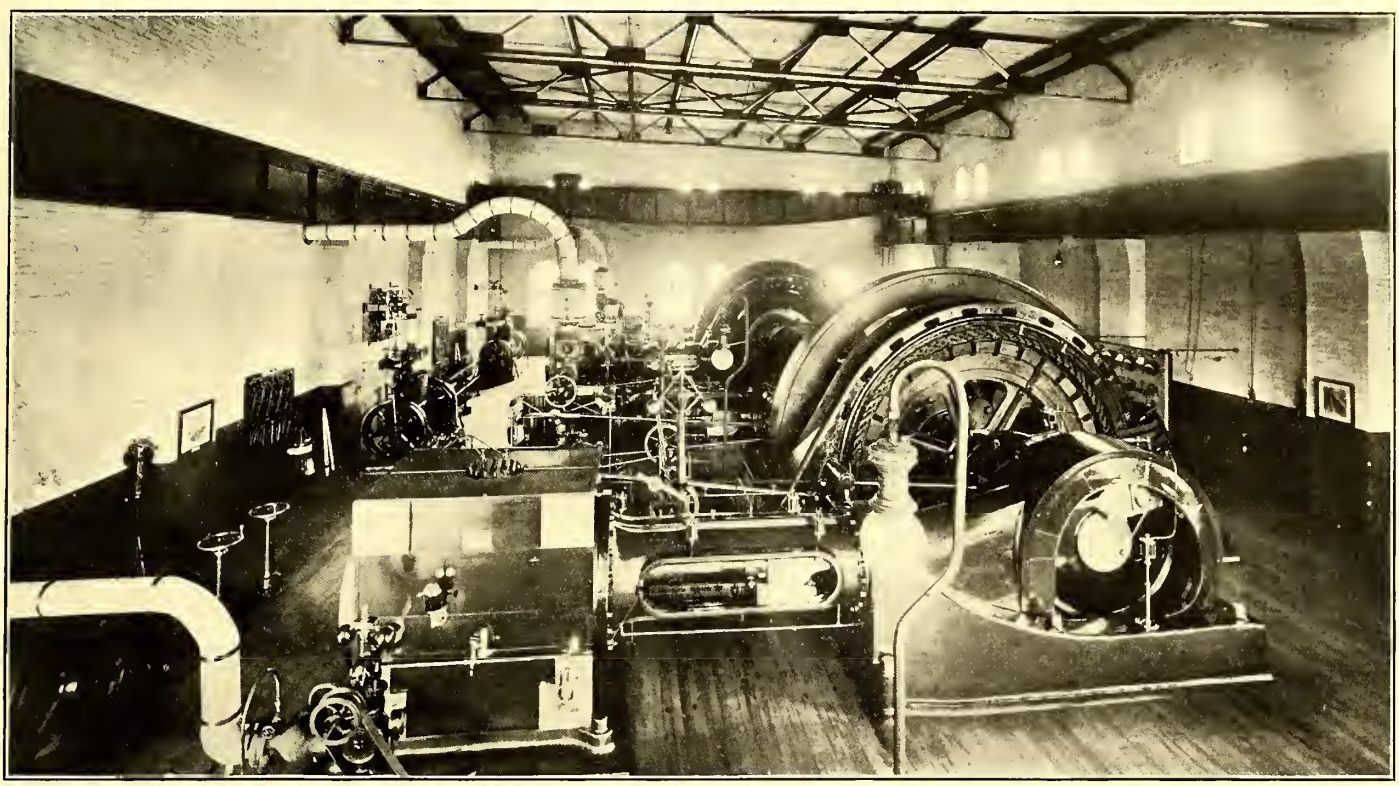
The rail is 70-lb.-T, A. S. C. E. section, 30-ft. lengths, and is jointed by standard six-bolt splice bars. The ties are sawed Southern pine, 6 ins. x 8 ins. x 8 ft., except where special ties are used on switches, bridges, etc. No. 10 spring frogs and 15-ft. split switches with spring connecting rods are used at all turnouts, so that cars can take the siding at high speed. The ballast consists of 8 ins. of gravel under the ties crowned up at the center. At Fort Worth there is a branch track to the Sante Fe Railroad, and at Handley there is a connection to the Texas & Pacific. These two connections with steam railroads very materially facilitate the delivery of fuel and other supplies to the power station and other parts of the line.

GENERAL SYSTEM OF GENERATION AND DISTRIBUTION OF ELECTRICAL ENERGY

The power house is situated at Handley, its location being determined by the ability to obtain water. It was also somewhat affected by the fact that at such point was the most available location for a park, and the development of a lake for the water supply would be a very desirable adjunct to the park. At the same point is located the car house and repair shop and a waiting station for the park business. The latter includes in connection with it the despatcher's and superintendent's offices.

The generators are alternating-current, three-phase direct-connected, there being rotary converters in the power house and also in two sub-stations at distant points on the line. One sub-station is placed close to the corporation line of Fort Worth, and the other near the Cockerell Hill Summit, approximately 3 miles from Oak Cliff. The location of the first was governed by the decision that it was undesirable to take high-voltage wires into Fort Worth, and of the second by the fact that it is a reasonable distance from the Dallas end of the line. Furthermore, in the latter case, cars approaching this point in either direction have to climb grades, it being down-grade practically all the way to the Dallas terminus, and there being about 2½ miles of rather heavy up-grade for cars approaching the summit from Fort Worth.

The sizes of the rotaries in the power house and sub-stations No. 1 and No. 2 were based on the predetermination of the momentary maximum load, two rotaries being sufficient for the resident schedule, and two for any probable extra schedule. At the power house one rotary is sufficient for the regular interurban cars on hourly headway, package freight car and the shifting of cars about the car house. In the Cockerell Hill Summit sub-station one rotary is sufficient for interurban cars on hourly headway, a package freight car and the local



INTERIOR OF POWER STATION

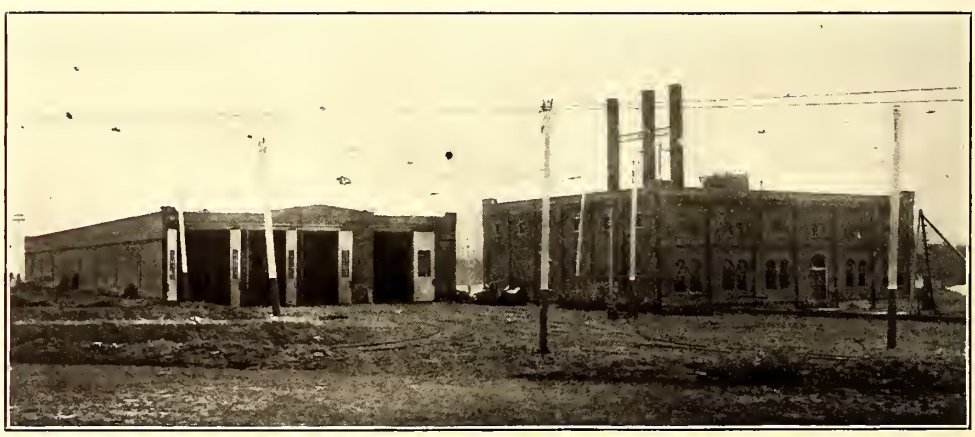
traffic between Oak Cliff and Dallas. One rotary in the Fort Worth sub-station is sufficient for interurban cars on hourly headway, package freight car and local traffic in Fort Worth, based on demands at the time the road

EXAMPLES OF TRACK AND OVERHEAD CONSTRUCTION

was planned, but since such time other local lines have been purchased and the requirements greatly increased. Owing to the building of the stock yards and packing houses large passenger cars with four 35-hp motors have been placed on the line thereto, and these cars at times pull heavy trailers. On this line there is a grade of 6 per cent, with a sharp curve on the grade, so that the momentary maximum has greatly exceeded that originally anticipated, measurements on individual cars showing a momentary maximum of 215 amps., whereas previously the cars on this line were small single-truck cars (14 ft. to 16 ft. body), having two 25-hp motors and not hauling trailers. The result is that the momentary maximum at the Fort Worth sub-station is greater than was, or could have been, anticipated, and two rotaries are required for a portion of the regular daily run. This increased momentary maximum also necessitates, or at least makes desirable, the operation of two generators oftener than originally intended, there being a general tendency with all operators to avoid such a high momentary maximum as will throw circuit breakers. Although same may not be injurious to the mechanism, it is annoying to the attendant as well as the motorman, even though the schedule is not injuriously affected. In this connection it should be noted that in the original design it was contemplated that when the requirements should exceed the provision then being made, it might be desirable to add one or more storage batteries, thereby reducing momentary maximums as well as increasing the efficiency of output. If such a battery were installed at Fort Worth the second rotary would seldom have to be operated, and a second generator would less often be required, but it is, for the present, considered preferable to operate under the conditions stated, as the resulting saving in fuel possibly would not yet justify the installation of the battery. If one rotary or one generator should be injured the regular schedule could be maintained with a little more care in the operation of cars, so as to avoid throwing circuit breakers. Moreover, the power house in Fort Worth, formerly used for local service, is still in position, and could be used in case of emergency, providing all the energy needed in Fort Worth. Arrangements are being made for the increase on the local road from Oak Cliff to Dallas, and, when completed, it may be found advisable also to place batteries at the Cockerell Summit sub-station and the power house, or, possibly even better, to add a third generator and rotaries. Decision on these matters is, of course, an engineering problem, which, as is generally the case, includes both financial and technical factors, and the matter is here presented not only on account of its being interesting in itself, but because of its application to the consideration of the tests hereinafter described, and it is again referred to in connection with those tests.

### POWER STATION

The power station is of brick with steel trusses and gravel roof, having a traveling crane in the engine room. The building was originally designed to be a self-supporting steel structure, but, owing to the difficulty in obtaining steel work in the time desired, the design was changed so that the steel trusses rest on brick pilasters. The building is divided into three general sections. Boiler room, 88 ft. x 50 ft., and 32 ft. high from the floor to the under side of the roof trusses at the lower end. The engine room is 53 ft. x 88 ft., and 24 ft. high from the engine floor to the under side of the roof trusses at the lowest point. A room for the static transformers, which is practically an addition to the main building, and is a fireproof structure,

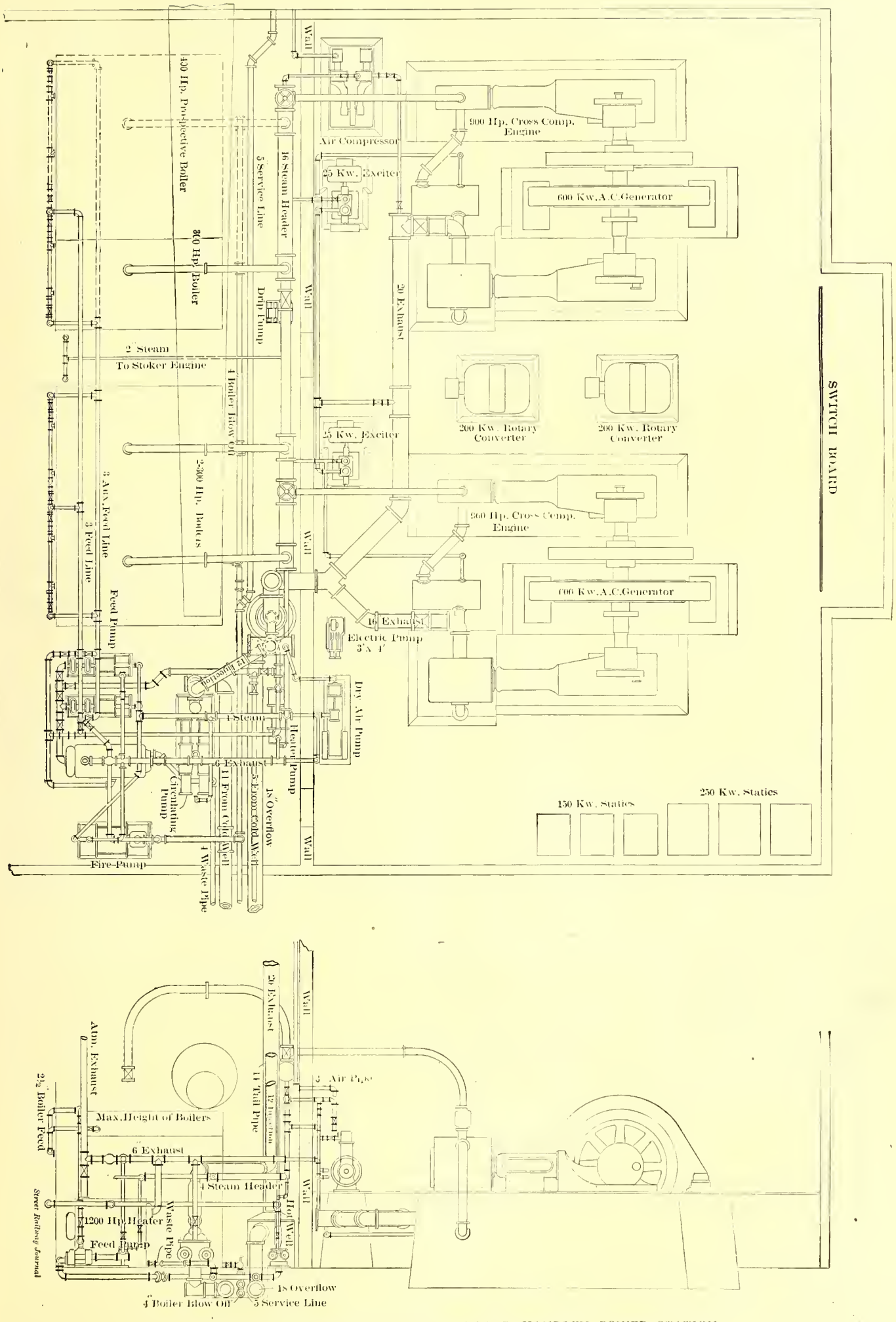


CAR HOUSE AND POWER STATION

is 55 ft. 9 ins. long over all and 12 ft. wide, the statics being in the lower portion. Above them is a gallery, and above the gallery the high-voltage switches and the high-voltage lightning arresters. In a portion of this addition, which is separated from the remainder by a brick wall, is the toilet room.

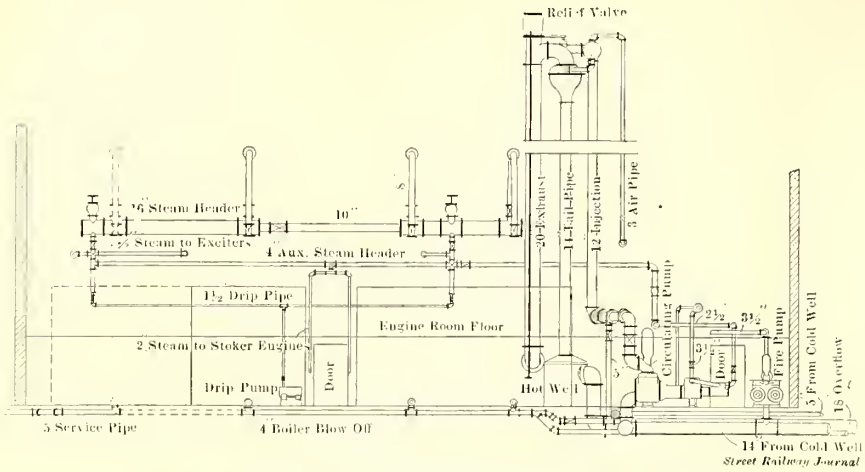
### CAR HOUSE AND OTHER BUILDINGS

The car house is a brick structure, consisting practically of two buildings divided by a fire wall; the larger portion is used for car storage, 208 ft. long by 40 ft. It has three tracks, and




PLAN AND ELEVATION OF STEAM PIPING, HANDLEY POWER STATION

is of sufficient size for twelve interurban cars. The rear portion has a cinder floor, and the front portion, 72 ft. long, has washing down and inspection pits under the entire floor. The



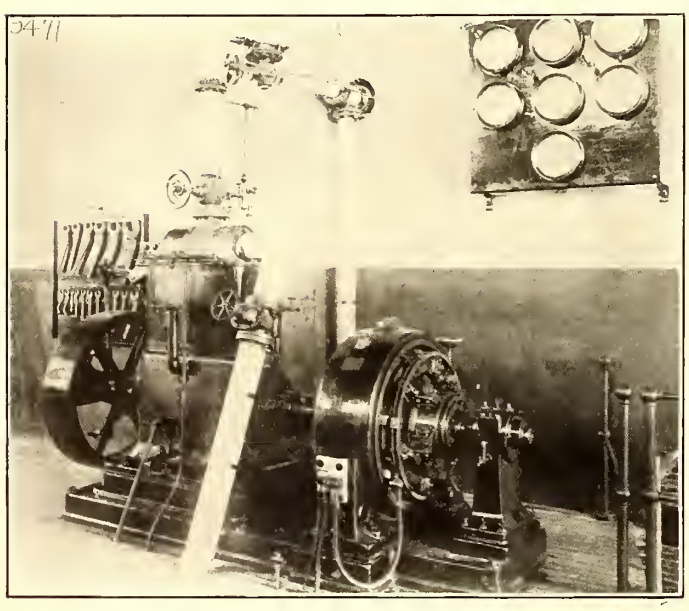

ARRANGEMENT OF AUXILIARIES IN POWER STATIONS

smaller portion of the building consists of a repair shop, 143 ft. 4 ins. x 24 ft., and a stock room, 15 ft. 4 ins. x 24 ft.

The repair shop is of sufficient size for two interurban cars, and has a pit 92 ft. long, and an inclined runway from the bottom of the pit up to the floor level. The repair shop has two 3-ton jib cranes and a complete equipment of tools, including two lathes, a wheel press, a couple of drill presses, a shaper, a forge, etc., operated by a direct-current motor.

About 400 ft. from the power house is the passenger station for the park. This is a frame building with a long covered platform, and contains waiting rooms for men and for women, a baggage room, superintendent's office and despatcher's office, all of these being on the ground floor.

In the second story of the waiting station is a suite of apartments for the general manager, which consists of a bed room, bath room, and a room which, for any but an official of an



EXCITER SET IN POWER STATION

electric road, might be termed a lounging room, but, as in this case the general manager is also the second vice-president and the local executive officer, such designation would possibly be a misnomer. There is also a balcony connected with these rooms, which commands a view of the track, power house, car house and park. The general manager being a bachelor, the above rooms were considered sufficient for his lodging, and it was not considered necessary to make any provision for his board. Consequently he is able, without disturbing domestic arrangements, to take his meals at Dallas or Fort Worth, or at such intermediate point as he may happen to be, and at such time as most convenient. This condition may be of value for the efficient supervision of operation, and, consequently, satisfactory to the president of the company, though possibly not to the President of the United States.

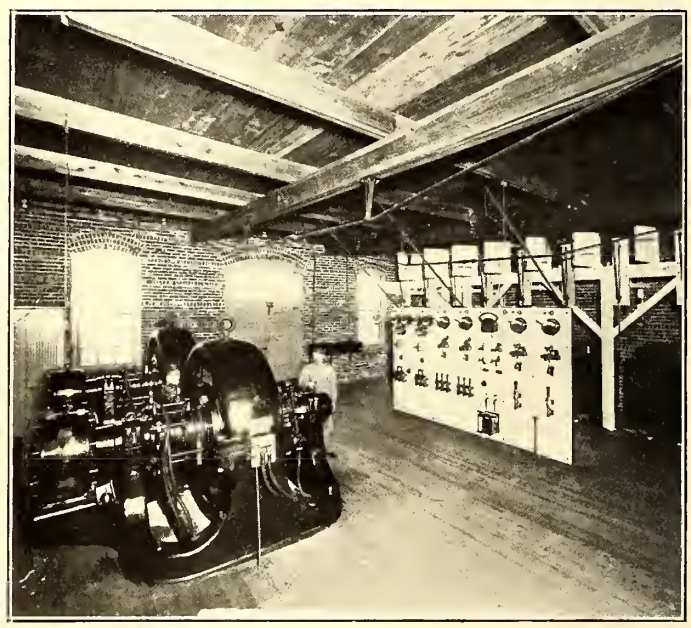
The sub-stations are brick structures with gravel roof, 37 ft. x 33 ft. Near the Cockerell Summit sub-station is a residence for the attendant. This is a frame structure, and is shown in one of the illustrations.

The buildings were erected by William Bryce, of Fort Worth, the structural steel and crane being furnished by the Browning Engineering Company, of Cleveland, Ohio.

### MECHANICAL AND ELECTRICAL EQUIPMENT

The boiler equipment consists of four 300-hp Stirling boilers. Each boiler has a heating surface of 3000 sq. ft.

It was originally intended to use coal for fuel, and the design included a brick stack, stokers and coal feeding by gravity from the coal bins into the stokers. After this design was com-



INTERIOR OF SUB-STATION

pleted the Beaumont oil fields were developed, and it was decided to use oil, but also to make provision for using coal in case the price of oil should be increased to such an amount as to make coal more economical. This is now the condition and coal is being used.

The modified design omitted the coal bins, provided individual stacks for the boilers and a fan system of forced draft, the setting of the furnaces being as shown by the accompanying illustration. The stacks are sufficiently high to give a draft that will prevent undue pressure within the boilers and the forcing of gases out through the boiler settings.

Outside the building and approximately 200 ft. distant are provided three large oil tanks, the oil flowing into same from oil-tank cars by gravity. The oil-burning system was provided by A. M. Lockett & Company, New Orleans, and duplicate pumping sets were provided, each set consisting of two duplex pumps, 3 ins. x 2¾ ins. x 3 ins., pumping oil from the tanks and supplying the oil burners. Each boiler was equipped with six No. 2 Reid burners and necessary steam connections for atomizing the oil. These burners are shown by the accom-

panying drawing. A Worthington meter was also provided for measuring the oil.

Owing, as before stated, to the increased price of oil, its use has been discontinued, the oil burners removed and the brick work on the grate bars removed, and coal is now fired by hand.

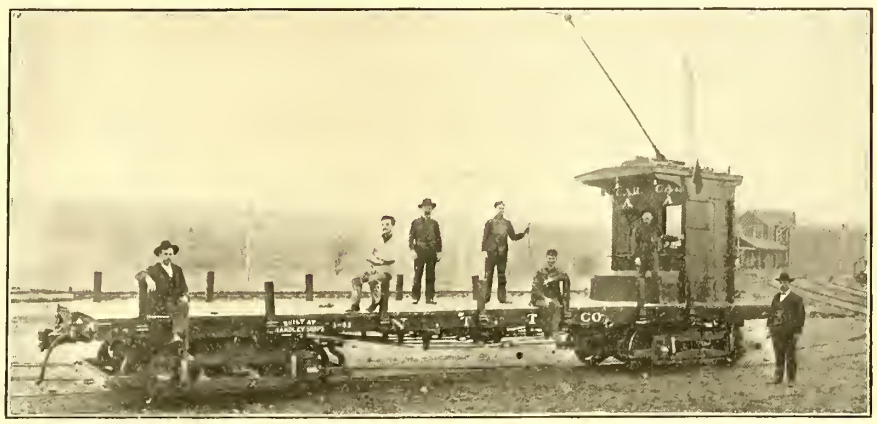
The engines are two C. & G. Cooper Company cross-compound condensing Corliss engines. The cylinder dimensions are 22 ins. and 44 ins., with 48-in. stroke, and the speed is 100 r. p. m. The rating is 900 ihp at 150 lbs. steam and 26-in. vacuum.

Each cylinder is provided with a Phœnix automatic oil pump and a hand oil pump. Tanks are placed in the upper portion of the boiler room, and from them oil is fed by gravity to all bearings. After being passed through a cross filter it is pumped back to the tanks. The exciter engines are Westinghouse junior, direct-connected to 30-kw Westinghouse exciters.

The piping and auxiliaries were furnished by the Best Manufacturing Company, of Pittsburg, and the auxiliaries are as follows: One 20-in. Worthington elevated injector condenser with a 12-in., 17-in. x 22-in. x 15-in. Worthington compound-circulating pump, and one 8-in. x 16-in. x 12-in. Worthington rotating dry vacuum pump. The boiler feed pumps are two 10-in. x 6-in. x 12-in. duplex Dean outside end-packed pumps. There is also a Worthington duplex, 6 ins. x 7½ ins. x 6 ins., which draws from either the cold well or the hot well,

A STRAIGHT ROCK CUT

and discharges into the feed-water heater, which is a 1200-hp Cochran make. There is also a 16-in. x 9-in. x 12-in. duplex Dean underwriter's pump, discharging into the fire line, with connections to the various buildings on the grounds. The cold water supply is obtained from either one of two cold wells adjacent to the building. One is fed by gravity from the lake, and the other is fed from deep well pumps, the overflow passing into the first well and out to the lake. The lake water is not desirable for boiler feed, and the water from the deep-well system is used. This being the case the low-service pump nominally feeds cold water to the heater, but it is also



WORK CAR AND CREW

connected to the condenser hot well. The piping is so cross connected that either or both feed pumps can feed the boilers or one can draw from either the hot well or the cold well and discharge into the heater, thereby acting as reserve for the low-service pump. Also the fire-pump discharge line is cross connected to the feed-pump discharge and to the condenser injector line. The low-service feed water and fire pumps are provided with Fisher automatic governors, and there is a Worthington hot-water meter in the boiler-feed line.

All the high-pressure pipe is extra heavy with long radius bends. Flange fitttings are used for all pipe 3 ins. and over; the gate valves are Best's, and the globe valves, Jenkins Brothers. The pipe covering was furnished by the Philip Carey Manufacturing Company, 85 per cent magnesia being used on the high-pressure steam lines, and asbestos magnesia on low-pressure steam and on hot water lines. The lines to the main engines have vertical live steam Cochran separators.

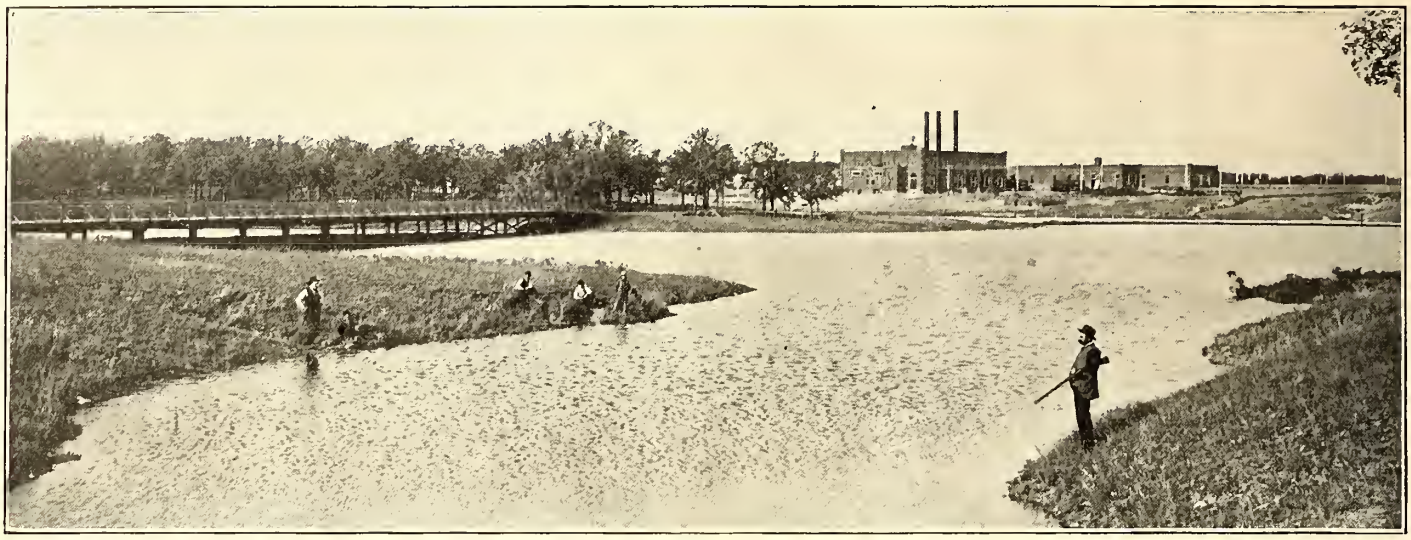
The general piping scheme consists of long-sweep bends from the boilers to the upper side of the header, and the connections to the main engines are also taken from the top of the header. The header is divided into two sections, each 16 ins. in diameter, and they have a 10-in. intermediate connection with a valve between. All high-pressure drips are drained by the Holly system, and, in addition, there is an auxiliary steam header below the main header, and steam to the pumps is obtained from this auxiliary header, the result being that in case of the Holly system being unable to act with sufficient rapidity or repairs being needed, the header drains to the pumps where water in the steam will not cause accident. A direct drain to atmosphere is provided for emergency.

As above stated, the boiler feed is obtained from deep-well pumps, but because of the cost of fuel it was desirable to operate condensing. On the ground selected there was a grove of considerable size, which was desirable for a park, and there were few obtainable places between Dallas and Fort Worth which had trees. Near the grove was a small valley, through which was the bed of a stream, where at some seasons there was merely the bed, and at other times a considerable stream. At a convenient point a dam was constructed, and a beautiful lake produced, the water from which is used for the condensers. The lake is supplied partly by the stream, partly by surface drainage from the adjacent land, and, to some extent, by the overflow from the deep-well pumps.

In the engine room is an Ingersoll-Sergeant air compressor for supplying the storage air-brake system on the passenger cars. Connection is also made to the car house for cleaning the

cars, and in the power house for cleaning electrical equipment with compressed air.

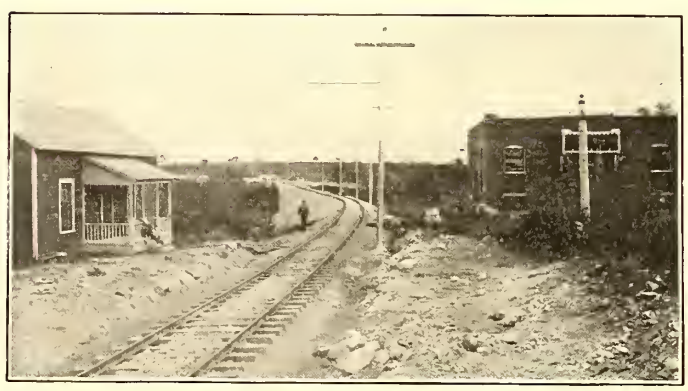
The electrical equipment was supplied by the Westinghouse Electric & Manufacturing Company. The generators are two 600-kw, alternating-current 25-cycle, 400-volt, direct connected to the Corliss engines, and also two 30-kw, 125-volt, direct-current exciters, direct-connected to the Westinghouse junior engines, either of the latter being sufficient to excite both alternating-current generators. These exciters also furnish current for the lighting of the power house, car house, waiting room and park.



POWER STATION, PARK AND ARTIFICIAL LAKE

In the power house are two 250-kw rotary converters and seven 200-kw step-up static transformers, one being an extra, the transmission voltage being 15,000. The switchboard has a complete equipment of controlling and indicating apparatus, and also recording wattmeters for registering the output of generators, exciters and rotaries.

Cockerell Hill (sub-station No. 1) has two 400-kw rotary converters and six static transformers. At Fort Worth (sub-station No. 2) there are two 300-kw rotary converters and six static transformers.



SUB-STATION AND ATTENDANT'S DWELLING

A view of a sub-station presented herewith shows the high-voltage lines entering the building, and the barrels shown on the left of this picture were used as water rheostats when making tests. The switchboards of the sub-station have recording wattmeters.

### LINE WORK

The contractor was the Electrical Installation Company, of Chicago, which furnished all the material except the wire. The brackets, hangers, etc., or what is generally termed "overhead material," was obtained from the Ohio Brass Company, and the high-voltage insulators are of glass, manufactured by Locke. Bracket construction was installed on private right of way and cross suspension in the terminal cities and in intermediate towns.

The poles are 35-ft. Idaho cedar, with 100-ft. spacing on straight line. Above the bracket are two cross arms, carrying the high-tension transmission. On the outer side of the upper cross arm is placed one of the three-phase high-tension wires, and on the outer side of the lower cross arm the other two high-tension wires. At present the trolley feeder wire, or wires, are on the inside of the lower cross-arm, this provision being made because it was considered that later it might be desired to run another set of high-tension wires, and at such time the feeders could be dropped onto brackets placed on the side of the pole. This contemplated condition has not yet arisen. The high-tension wires are transposed.

The telephone line is placed on brackets outside of the pole, slightly below the level of the bracket arm, and transposed. Double trolley wire is used, it being of the figure 8 type and 2-0 B. & S. gage. The feeder wires and the high-tension wires are aluminum cable.

### ROLLING STOCK

The rolling stock for the interurban road consists of eight standard passenger cars, one private parlor car, "Sagamore," one package freight car and one work car. All of the above are motor driven, the general dimensions and equipment being as follows: The parlor car "Sagamore" is 59 ft. 6 ins. over all, 8 ft. 5 ins. wide, is equipped with four Westinghouse No. 6 motors, and weighs, complete with equipment, 31 tons. The standard interurban closed passenger cars measure 44 ft. 5 in. over all, and have a width of 8 ft. 4 ins. These cars are equipped with four Westinghouse No. 56 motors, and weigh, complete, 25.4 tons. The interurban express car has a length of 40 ft. over all, and is 8 ft. 4 ins. wide.

There are also three fifteen-bench open passenger trail cars and a number of flat cars. The city cars are varied in size, character and make.

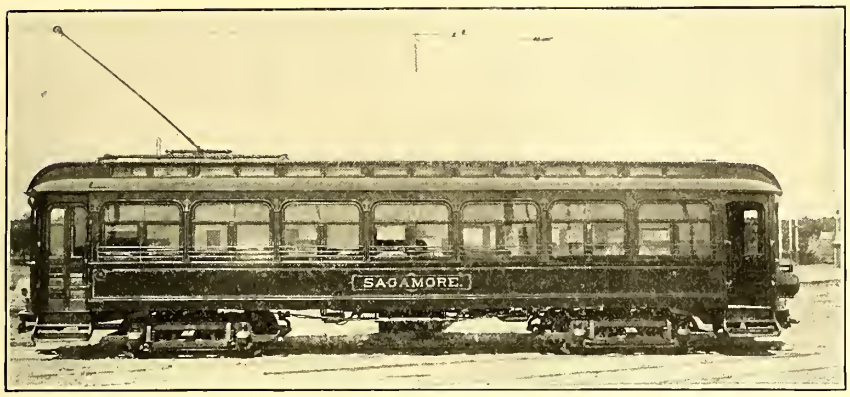
All the interurban cars, with the exception of the work car, were built by the G. C. Kuhlman Car Company. McGuire trucks are used, except for the trailer cars, which have Brill trucks. The work car was built in the shops of the Northern Texas Traction Company.

All the motor cars have Christensen air brakes. The standard passenger cars have stored air; the package freight, parlor car and work car have motor-driven compressors. The seats are Hale & Kilburn, and the registers New Haven. Arc headlights are used and Consolidated Car Heating Company's electric heaters.

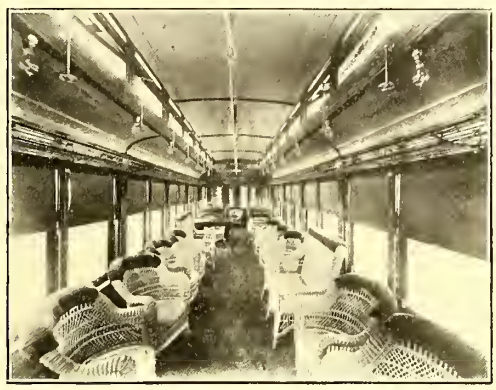
OPERATION, PLEASURE PARK, ETC.

The schedule time between termini is 85 minutes one way and 95 minutes the other, and cars are ordinarily run on hourly headway. The package freight car is run regularly and as necessary to provide the required service, and material is delivered to and from the cars in Dallas and Fort Worth by the William McVeigh Express Company.

The artificial lake at Handley is about 25 acres in area, and



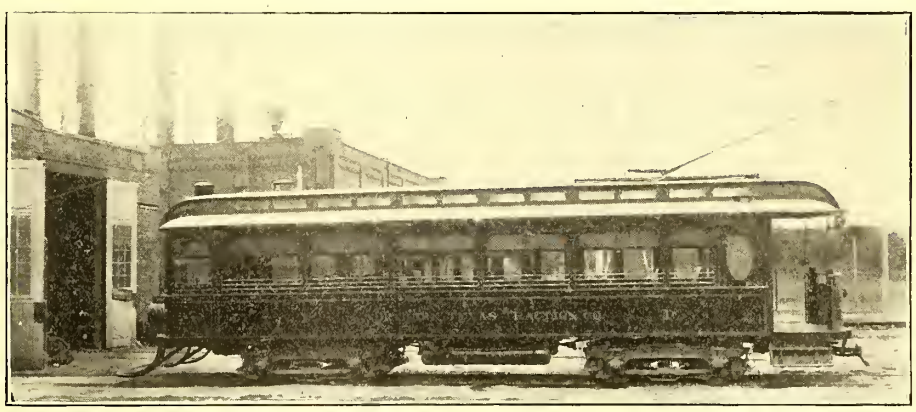

PARLOR CAR



INTERIOR OF PARLOR CAR

has been named "Lake Erie." On the shore is a beautiful grove, and a handsome dancing pavilion, with restaurant, has been erected. This building is arranged so as to be admirably adapted for the use of conventions, public and private entertainments by clubs or individuals, and special provision can be made with the general passenger agent of the road for the accommodation of parties wishing to secure these privileges. The lake is also surrounded by several hundred acres of forest and field, which is reserved by the railway company for picnic parties, and forms an especially attractive spot for encampments of a military or religious nature, and the free use of which is given by the company. The lake provides opportunity for boating and other aquatic sports, and ample room for athletic games, such as baseball, football and golf has been made in the park. This pleasure resort is reached only by the cars of the company and is situated about 7 miles from Fort Worth. There is excellent hunting and fishing along the route of the railway, and sportsmen are in the habit of leaving cars at one point, where, if unsuccessful, they can board the next car and try their luck at a point many miles distant. Much ingenuity has been shown by the management in attracting traffic, and special inducements have been offered to nearly every class of patronage.

INTERIOR OF INTERURBAN CAR



STANDARD INTERURBAN CAR

TESTS ON POWER-STATION APPARATUS

Complete power house and sub-station efficiency tests have been made by E. P. Roberts & Company, with the object of ascertaining whether or not the apparatus was in accordance with the contract, and the detailed data and results are not included in this article, but merely such results as are considered of general interest.

From the foregoing description it will be noted that arrangements were made to burn either oil or coal, and tests were made using each, the results being given below. The length of the run was rather short for boiler tests, more especially when using coal, but these special tests were made to obtain only approximate comparative values and not for exact efficiency. Owing to the gradually increasing cost of oil since the plant was started it has now been found more economical to burn coal, and the tests were made in order to ascertain when it would pay to change from oil to coal.

TESTS WITH COAL AND OIL, MADE UNDER OPERATING CONDITIONS IN JANUARY, 1903

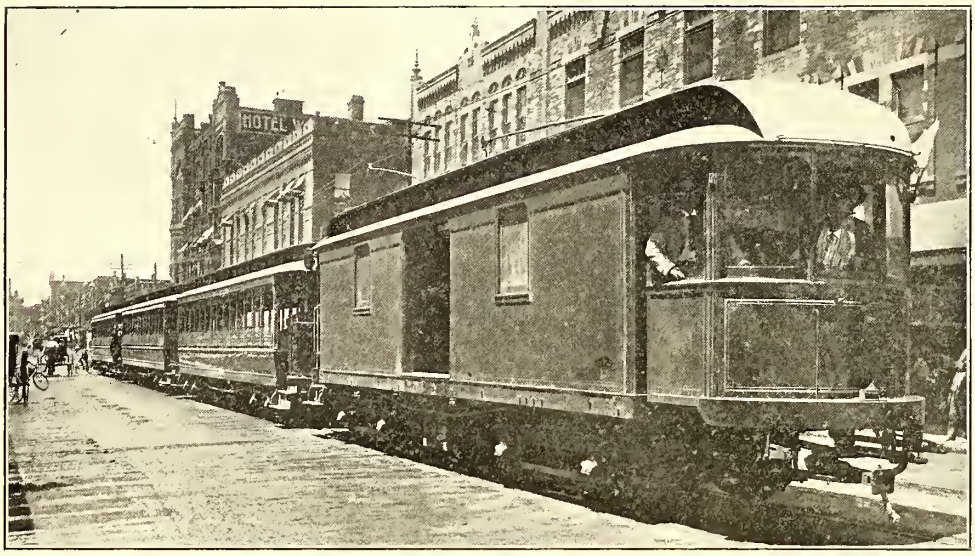
| | Test with Beaumont Oil | Test with Coal |
|---|---|---|
| Duration of test | 7 hrs. | 6 hrs. |
| Heating surface of one boiler | 3000 | 3000 |
| Grate " " " " | ..... | 60 |
| Steam pressure | 139 lbs. | 136 lbs. |
| Draft pressure in inches of water | 0.4 | ..... |
| Temperature of stack | 497° F. | ..... |
| Feed water per lb. of fuel actual | 14.2 lbs. | 8.2 lbs. |
| " " " " from and at 212° F. | 15.4 lbs. | 9.0 lbs. |
| Steam used by oil burners | 11.7 per cent | ..... |
| Efficiency of boiler | 77 per cent | ..... |

It will be noted from the above that 1 lb. of coal equals .66 lbs. of oil, based on steam obtained for use, exclusive of amount used by oil burners. During the month of November, 1902, the run was made entirely on oil. During the month of April, 1903, entirely on coal, and the comparative value based on kilowatt output was 1 to .67, or practically the same figure.

The agreement between the two above stated figures is closer than it was reasonable to anticipate, as the kilowatt output in April was greater than in November, but on the other hand

only one generator was operated in November, and in April two were often in use. The condition of greater output was, of course, in favor of economy, but the operation of two generators operating on lighter average load than one was against economy. Nevertheless, apparently, the conditions were such that the one about offset the other. Consequently the results of actual operation checked the pre-determined figures obtained by test.

The coal per kilowatt-hour in April was 5.8 lbs., which, considering the character of the coal and especially the low ratio of average load to rated load, was a very satisfactory performance. The power above considered includes both the alternating-current delivery and the direct current of the exciter generators. The latter, moreover, is considerably in excess of the amount needed for excitation, as the exciter generators also furnish current for all the lights in the power house, car house, office building and waiting station, and also outside lights, including those in the adjacent park. The total kilowatt-hours of the exciters was 14,645, and the amount needed for excitation was probably 9000 or less, and on the basis that it was 9000, the coal per kilowatt alternating current was 5.97 lbs.



TRAIN WITH OPEN PASSENGER TRAILERS

The accompanying table gives the result of a test made Dec. 31, 1902, and also the record obtained from the log for the entire month of April, 1903, and it will be noted that the efficiency from alternating-current generator to direct current delivered at sub-station switchboards was practically the same. These tables are not in every respect strictly comparative, as the record on Dec. 31 was obtained during the time of heaviest run and operating one generator only, whereas the run for the month includes the light runs in the early morning and late at night, which reduces the average. As a matter of fact, however, during the heavy hours the average per hour was greater than for a single day's run, to such an extent as to generally necessitate the operation of both engines, and in the Fort Worth sub-station (sub-station No. 2) the operation of both rotaries. This increased load was due to the extension of business in Fort Worth to a greater extent than originally expected, caused mainly by the building of large stock yards and the consequent necessity of providing large cars for the run to same. An additional line in Fort Worth was also purchased. The increased load was, however, mainly due to the large cars above noted, which operate for a portion of the run on a 6 per cent grade, and during the rush hours also haul trailers, consequently not only increasing the average load but especially the momentary maximum, tests made on such cars showing momentary current up to 215 amps.

TEST OF EFFICIENCY OF ALTERNATORS AND ROTARIES

| | During test Dec. 31, 1902. | Entire month of April, 1903. |
|---|---|---|
| Average load of generator recorded by A. C. Wattmeter | 595.7 kw | * 547 kw |
| Average load of P. H. rotary D. C. Wattmeter | 98.5 kw | 108.3 kw |
| Average load of S. S. No. 1 rotary D. C. Wattmeter | 173.1 kw | 150.4 kw |
| Average load of S. S. No. 2 rotary D. C. Wattmeter | 222.0 kw | † 191.6 kw |
| Combined efficiency of rotaries, statics and transmission lines | 82.9 per cent | 82.3 per cent |

* During greater part of time two generators were in use.
† During greater part of time two rotaries were in use.

It is impracticable to give all the details relative to the different conditions at the time of the test, but the above is stated in order to show the danger of making comparisons or drawing conclusions other than those to which attention is directly called.

The April record showed the alternating-current kilowatt-hours and the direct-current kilowatt-hours in each sub-station, and calculating the ratio of average to rated load of static transformers and rotary converters, and using the figures stated as the probable efficiencies at such loads, the following result is obtained:

| | |
|---|---|
| Output of generators | 547 kw |
| Input of P. H. rotaries at 86 per cent efficiency | 126 kw |
| Input step-up transformers | 421 kw |
| Output of statics 96.5 per cent efficiency | 406 kw |
| Input S. S. No. 1 rotary at 88 per cent efficiency | 171 kw |
| Input S. S. No. 2 rotary at 88 per cent efficiency | 218 kw |
| Input S. S. No. 1 step-down transformers at 96 per cent efficiency | 178 kw |
| Input S. S. No. 2 step-down transformers at 97 per cent efficiency | 225 kw |
| Total input of statics in S. S. | 403 kw |

This would give the efficiency of transmission line as 99 per cent.

The calculated transmission line losses for the above average loads is as follows:

| | |
|---|---|
| Calculated line loss to S. S. No. 1 | 1.5 per cent |
| " " " " " 2 | 1.25 " |

This makes a close check, although indicating the probability of the efficiency of some of the apparatus being slightly less than the figures used, but the difference is so small as not to have any material value.

It should also be noted that both at the test made on Dec. 31 and the record for the month of April the power house rotary had much less output than the sub-stations No. 1 and No. 2. Consequently by far the greater portion of the energy passed over the high-voltage transmission lines, and, in this connection, the location of the power house and the sub-stations should also be noted on the profile. The power house location was determined by the ability to obtain water. The Fort Worth sub-station was located approximately at the corporation line in order to avoid the necessity of taking high-voltage wires into the city, and the location of sub-station No. 2 at Cockerell Summit, near Oak Cliff, was based largely upon the long grade on the Fort Worth side of Cockerell Summit.

The size of the rotaries in the power house was based upon the number of regular cars which would be in operation on

this section, together with the neeessary provision for a package freight car and for shifting cars in the car house, also, as in all cases, making allowance for curves and grades shown by the profile. It was assumed that when operating on hourly schedule one rotary would be sufficient, both being required only when cars are operated on more frequent headway, either for through traffic or in trains to the park, open trailers being provided to make up such trains, hauled either by motor passenger cars, the package freight car or the work ear.

The size of the rotaries in sub-station No. 1 was determined principally by the large momentary maximum caused by the fact that cars approaching this sub-station, both from the east and west, travel up-grade, also making allowance for the probability of considerable increase of local service between Oak Cliff and Dallas.

The size of the rotaries in sub-station No. 2 was determined by the provision for the interurban cars and the requirements of the local road in Fort Worth, as it existed when the plant was designed. As elsewhere stated the requirements of the local road have been very materially increased, not only as to the average, but also, and especially, as to the momentary maximum due to placing large cars on the road to the new stock yard, which cars climb a steep grade and haul large trailers.

The following combined efficiencies were calculated from the data obtained during the efficiency tests, one engine and generator being in operation, and the two rotaries in the power house operating on a water rheostat, the engine and generator being at rated load and the rotaries being 8 per cent overload:

| | | |
|---|---|---|
| Combined efficiency of engine and generator (excitation not included) | 86.4 | per cent |
| Combined efficiency of engine and generator (excitation included) | 85.1 | " |
| Combined effi iency of engines, generators, wiring, inductance coils and rotaries in power house | 76.6 | " |

OFFICERS AND ENGINEERS

The road was constructed under the general financial management of George T. Bishop and John Sherwin, both of Cleveland, Ohio, acting as syndicate managers, Mr. Bishop later being elected president of the company. F. M. Haines, second vice-president and general manager, was also civil engineer for the road. W. A. Kappler is auditor, and C. A. Taylor secretary and treasurer. D. H. Lavenberg is superintendent of the interurban and Oak Cliff divisions, and Mr. O'Hara is superintendent of the Fort Worth division. W. C. Forbes is general passenger and ticket agent.

E. P. Roberts & Company, consulting engineers, of Cleveland, Ohio, had charge of the mechanical and electrical engineering and of the buildings, with the exception of the terminal station at Dallas, which was designed by Searles & Hirsch, architects, of Cleveland, Ohio. The resident engineer for E. P. Roberts & Company, when the work was commenced, was C. F. Fredericks, who had the supervision when the overhead line work was started and until most of it was erected, after which Bret Harter was resident engineer.

William Barclay Parsons, chief engineer of the New York Rapid Transit Commission, says that if the contractor, John B. McDonald, has further labor or other troubles between now and Jan. 1, all hope of having the rapid transit subway in running order by that time will vanish. He states that for some weeks the work has been practically at a standstill, and now that the troubles have been partially settled difficulty is experienced in getting the workmen together where needed, many of them having left the city for other work. This view is borne out by the fact that the amount of money drawn from the city for May for work done was but $300,000, whereas under normal conditions the withdrawal for the month should have reached nearly $1,000,000.

## A REVIEW OF STREET RAILWAY LEGISLATION IN MASSACHUSETTS DURING THE RECENT SESSION

The Massachusetts Legislature of 1903 this year referred to its committee on street railways seventy matters, and, as is the usual case, a number of other measures of interest to street railway operators were referred to different committees. The street railway committee of this year had as its Senate chairman Hon. Herbert E. Fletcher, of Westford, who acted in the same capacity a year ago, while its House chairman was Representative Louis A. Frothingham, of Boston, who, although new to the committee this year, proved a very efficient member. The remaining members were Senators Carlton F. How, of Haverhill; George K. Tufts, of New Marlboro, and William T. A. Fitzgerald, chairman of the Democratic city committee of Boston, with Representatives Hunt, of Worcester; Quinlan, of Boston; Chace, of Fall River; Warner, of Northampton (who acted as clerk); Hill, of Stoneham; Entwistle, of Framingham; Callender, of Boston; Castle, of Methuen; Dempsey, of Millbury, and Beck, of Chelsea.

As has been the case for many years a large number of associations of individuals petitioned for charters to enable them to construct new street railways. Among these petitions was one for a line through the hill country of Western Massachusetts, the title being the Huntington & Westfield River Railway Company, with a connecting line for which a special charter was asked between Shelburne Falls and Ashfield. Another ambitious petition was for a cross-country line between Fitchburg and Lowell, with a branch extending to Nashua, N. H., the name of the company to be the Fitchburg, Nashua & Lowell Street Railway Company. Other petitions were for charters for the Danvers & Malden Street Railway Company, the Lee & Winsted Street Railway Company, the Concord & Chelmsford Street Railway Company, the Sandwich, Hyannis & Chatham Street Railway Company, and the South Shore Street Railway Company. The earliest charter bill reported was for the South Shore Company, which was to operate in Bristol County and vicinity. This was reported in the House April 15, took its readings and reached the Governor April 28. On May 4 Governor Bates sent in a veto of this bill, founded on the ground that the general law at present makes ample provision for the organization of new street railway companies, and that the General Court is, therefore, not justified in passing a special act unless it gives special privileges, which he failed to discover in this measure. The result of the veto was the recall from the Governor's hands of measures which had subsequently reached him for the incorporation of the Danvers & Malden, and Lee & Winsted roads, and a holding up of several of the other charter bills. The veto of the South Shore measure was sustained on May 8 by a vote of 4 in favor to 170 against passing the bill despite the objections of His Excellency, the vote being taken in the House. An earnest effort was made to push through the Fitchburg, Nashua & Lowell bill to enactment, but after passing the House it was defeated in the Senate on the ground that the bill contained nothing that might not have been secured under general laws, while Senator Fletcher, who lives on the line of the proposed railway, further argued that the Lowell & Fitchburg Street Railway Company had already secured locations between the two cities under general laws, and two competing roads could not live in the territory. The bills granting charters to the Huntington & Westfield River and the Shelburne Falls & Ashfield Companies (designed for rather peculiar conditions and in a sparsely settled country, and, therefore, containing special provisions), were enacted.

A very important proposition made this year, as hitherto, contemplated broad extensions of the powers of various street railway companies as to the transportation of merchandise and freight. Spencer Borden and others asked a charter as the

Fall River Electric Freight Railway Company, with the right to construct an extensive system in that city, and the Old Colony Street Railway Company met this petition by one asking that it might have the right to transport freight in Fall River and vicinity, a privilege which could have been easily availed of by the construction of a few spur tracks connecting with its present system. One of the earliest bills to be reported on these freight carrying petitions was to permit the Fitchburg & Leominster Street Railway Company to act as a common carrier. This took all its readings in both branches, reached the Governor March 2, and was vetoed March 6, on the ground that if these privileges were to be extended it should be done by the Railroad Commissioners after hearing and careful examination. The veto was sustained by a vote of 177 to 2. Meanwhile the street railway committee took immediate action in the direction of passing a general law giving the Railroad Commissioners authority to grant freight carrying privileges after notice and hearing. The bill, which was founded on the petition of the Marlboro & Westboro Company that it might act as a common carrier, was drawn in consultation with the Governor, and gives the Railroad Board wide powers as to granting of privileges. The Fall River Freight Company petition was adversely reported, as were also all the other common carrier petitions which had been pending, including those of the Worcester & Holden, the Worcester & Northern, the Norfolk & Western Company, a charter for a freight railway company in Chelsea, the petition of W. A. Twombley and others that they might carry on an express business on street railways, and the Norton & Taunton Company. The earliest street railway charters granted in Massachusetts gave freight carrying privileges, the Lynn & Boston road being a case in point, its right to do this having passed into the hands of the Boston & Northern Company; but it has never been exercised further than in the transportation of street railway supplies.

As is usual a number of bills were offered for the compulsory use of automatic fenders, these going over to the next General Court, in accordance with the committee's recommendation. An attempt was made to secure a law to prevent the overcrowding of street cars, an odd provision in one of the petitions being that there should always be accommodations in these cars for all the women who ride. This was adversely reported, and the report was accepted without ceremony. A bill looking to the adoption of new types of fenders on street railway cars was sent over to the next General Court, in accordance with the committee's recommendation.

Another attempt was made to change the law as to street railway waiting rooms so as to transfer the power of compelling the establishment of such stations from the hands of the Railroad Commissioners, except upon appeal, to local authorities. The committee reported against this bill, but the House substituted the measure for the adverse report, and it passed that body, being rejected by the Senate.

A law was considered giving conductors of street railway cars additional power to keep therefrom newsboys and others of immature years, the measure not affecting the rights of news companies to have boys in their employ board the cars. It was rejected on its final stage enactment.

On the recommendation of the auditor of accounts a bill was passed repealing the provision in the street railway act which provides that a fee of $20 shall accompany the annual report of every street railway corporation to the Board of Railroad Commissioners, this being on the theory that the money is paid in another way.

A bill to make compulsory the use of automatic brakes, taken from the files of last year, was adversely reported and the report was accepted.

On the recommendation of the Railroad Commissioners a bill was passed to provide that a street railway company shall equip its cars when in use, unless propelled by horse-power, with such fenders and wheel guards, brakes and emergency tools in such cases as may be required by the board, and the board may from time to time modify its requirements.

In accordance with the recommendation of the Governor and with a petition of Representative Arthur P. Sleeper, of Natick, the street railway committee reported a bill which was enacted relative to the speed of cars and use of tracks of street railway companies, to make the requirements of local authorities subject to the approval, revision or alteration of the Board of Railroad Commissioners. Section 40 of Chapter 112 of the Revised Laws, as amended, reading as follows: "The Board of Aldermen and the Selectmen shall, from time to time, establish such regulations as to the rate of speed and as to the mode of use of the tracks within their city or town as the interest and convenience of the public may require, and subject to the approval, revision or alteration of the Board of Railroad Commissioners; and a street railway company whose servants or agents wilfully or negligently violate any such regulation shall forfeit not more than $500 for each offense."

On the initiative of Senator Fletcher a law was passed making the provision of the steam railroad act as to immediate notice of accidents apply also to street railway corporations, the effect being to provide that every railroad and street railway corporation shall give immediate notice of an accident on its road which results in a loss of life to the medical examiner of the county who resides nearest to the place of accident, and shall also within twenty-four hours give notice to the Railroad Commissioners of any such accident or of any accident of the description of accidents of which the board may require notice to be given, the provision being subject to a penalty of $100.

Early in the year the Waltham Street Railway Company, which had been endeavoring to secure certain locations through petitions to the Railroad Commissioners, asked legislation to permit it to build and operate in Newton, Wellesley, Weston, Lincoln and Concord. There were some very exciting hearings on this subject, but before the committee decided upon a report it was understood that the road, which has not yet been put in operation, had passed into new hands, and that a majority, at least, of its owners did not desire the extensions which had been asked, and which were ardently opposed by roads already in the territory or having pending petitions for locations. A majority of the committee, however, voted to report a bill, which was promptly rejected by the House.

A bill to authorize the Conway Street Railway Company to purchase the property, franchises, etc., of the Conway Electric Light & Power Company was favorably reported and approved by the Governor.

The Cape Cod Street Railway Company asked extended powers to construct and operate in Falmouth, Bourne, Mashpee, Barnstable and Yarmouth, act as common carrier, maintain wharves, docks, etc., doubtless on the theory that these privileges could be obtained under the general law as amended this year. The bill was adversely reported and rejected.

The Boston, Quincy & Fall River Bicycle Railway Company came in with a petition asking that it be given another year in which to build its road and also for freight carrying privileges. The committee cut out the freight carrying provision and reported favorably the bill, which took all its readings until it reached the enactment stage in the Senate, where it was rejected. E. Moody Boynton, the promoter of the scheme, will, therefore, be compelled to commence work of construction between now and December 31, or his charter will lapse.

A bill to provide for the transportation of letter carriers on street railways was introduced, adversely reported, and the report accepted.

A bill was reported reviving the charter of the Lowell, Acton & Maynard Street Railway Company and extending the time for its construction. A similar bill was passed legalizing the or-

ganizing of the Essex County Street Railway Company, and giving it further time to build. Additional time was given the Rutland Street Railway Company for construction and operation, and the Providence & Fall River Company was given authority to contract with connecting companies for the transportation of passengers and freight, this exception from the adopted policy being based on the fact that much of its location is outside the bounds of the Commonwealth.

Many hearings of this committee were in joint session with the railroad committee. One of the most important bills so considered was to permit railroad and street railway companies to purchase stock in other such companies having locations in their territory. This matter came in on the petition of William H. Coolidge, general counsel of the Boston & Maine Railroad. The committees jointly reported in favor of the measure, but with Senator Fitzgerald and Representatives Dempsey, Beck, Callender, Hill, Entwistle, Warner, Quinlan and Hunt dissenting. The Senate tabled the bill on April 22. Here it remained for many weeks and finally it was taken from the table and on motion of Senator Fletcher referred to the next General Court, his explanation being that it was too far-reaching a measure to be passed without more mature consideration.

Another bill considered by the two committees sitting jointly was also on Mr. Coolidge's petition and contemplated legislation relative to the establishment of railroad corporations and a consolidation, revision or codification of the laws relating to railroads and street railways. The two committees reported adversely on this petition without dissenters on March 30. The report was tabled in the Senate. There it stayed until the very close of the session, when the report was accepted.

Another petition of Mr. Coolidge was heard by the street railway committee and contemplated an amendment to the present law as to the extension of tracks of existing street railway companies into other cities and towns, the bill authorizing the Railroad Commissioners to decide whether public convenience and necessity require extensions into other cities and towns. This measure was adversely reported and tabled by the Senate April 16. It eventually was taken from the table and the report was accepted.

Quite early in the year the Amesbury & Hampton, Haverhill & Plaistow, Haverhill & Southern New Hampshire, Lawrence & Methuen, and Lowell & Pelham Companies asked authority to consolidate under the name of the Northern Massachusetts Street Railway Company, this scheme being understood to contemplate the final consolidation of the group of thirteen Southern New Hampshire street railway companies, many of them with termini in Massachusetts under the name of the Exeter & Hampton Street Railway Company. No sooner had the matter reached the point of a hearing when charges were made that a system of financiering, unsual to Massachusetts, had been adopted by the owners of the roads, and an order was passed requesting an investigation and report by the Railroad Commissioners upon the subject. This report was later submitted and tabled in the House, being finally filed. Soon after the committee favorably reported the bill, which passed the Senate and took its place in the House calendar. Eventually it was engrossed in concurrence and it was approved by the Governor June 3.

One of the most important bills which came in on petition was that for a charter for the Concord & Chelmsford Street Railway Company. In that measure, which was favorably reported, was a section as to the powers of the Selectmen to take land for street railway purposes, and the committee eliminated the section and reported a general bill to authorize Aldermen and Selectmen to empower street railway companies to take land for certain purposes. This bill provides that if a company applies to a local board with a statement that public convenience and necessity requires that certain land or interest in land be taken by the company in its work of construction to avoid dangerous curves or grades existing in highways in which it has received locations, and the board finds in favor of the petitioner after public notice and hearing, the company may apply to the Railroad Commissioners for a certificate that public necessity and convenience and for approval of the adjudication of the Aldermen or Selectmen as to the necessity or reasons for taking land or rights in such city or town in which such adjudication has been obtained. If the Railroad Commissioners grant the certificate as prayed for the petitioner may take the land or rights by eminent domain. This measure, popularly called the "eminent domain" bill, was the cause of long discussions, and did not reach enactment until the very close of the session. The House amended it by adding a referendum, but this later came out. The bill finally got into a conference committee on the question of amendments, and this committee recommended that the House concur with the Senate in striking out a requirement for approval of local voters, and that the Senate agree to strike out the section permitting railroad companies to run electric cars in streets without the consent of local authorities.

The street railway committee sat jointly with the committee on towns on a petition that the town of Dover may lay out special town ways for the use of street railways, and the bill was favorably reported and passed.

In joint session with the committee on metropolitan affairs the question of a metropolitan parks highway, to be constructed through the metropolitan parks system, was considered. A measure was finally reported authorizing the metropolitan park commissioners to investigate and report to the General Court on this measure.

One of the last measures to be considered was a bill to incorporate the Sandwich, Hyannis & Chatham Street Railway Company, which was opposed by many legislators on the ground that it gave the company extraordinary powers which could not be obtained under general laws. The route was largely upon a State highway, and crossed a bridge which was originally built to bear the weight of ordinary vehicles, but not electric cars. It was claimed that the company was seeking to avoid the supervision by the State Highway Commissioners, which would be imperative under general laws, and also the responsibility for reconstructing the bridge. After long consideration the bill was amended so as to eliminate these features and make the measure conform to the general laws, and it was passed, the principal gain to the company being in a saving of time in preliminary proceedings.

A large number of stringent employers' liability bills were introduced, tending to change the laws as to prima facie evidence in cases of injuries to employees of transportation companies, etc. Finally, all were reported with a recommendation for a special committee to be appointed by the Governor to revise the laws concerning the relations between employees and employers. This resolve, founded upon fifteen petitions and bills, was approved by the Governor May 4.

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The pipe calkers at work on the Rapid Transit Subway in New York city are on strike, despite their agreement with the association. Though only twenty-four men are out the strike is said to delay matters seriously in the subway. The strike was ordered in spite of the fact that the standing committees of the Central Federated Union and the Rapid Transit Contractors' Association at a joint meeting decided that the subcontractors in paying $3 a day were paying the prevailing rate of wages. The advance from $3 to $3.50 a day is therefore held to be 50 cents a day over the prevailing rate. This is said to be the first violation of the agreement between the Rapid Transit committee of the Central Federated Union and the Rapid Transit Contractors' Association since the agreement was made over two years ago.

## HOME-MADE AUTOMATIC STARTER FOR AUTOMATIC AIR COMPRESSOR

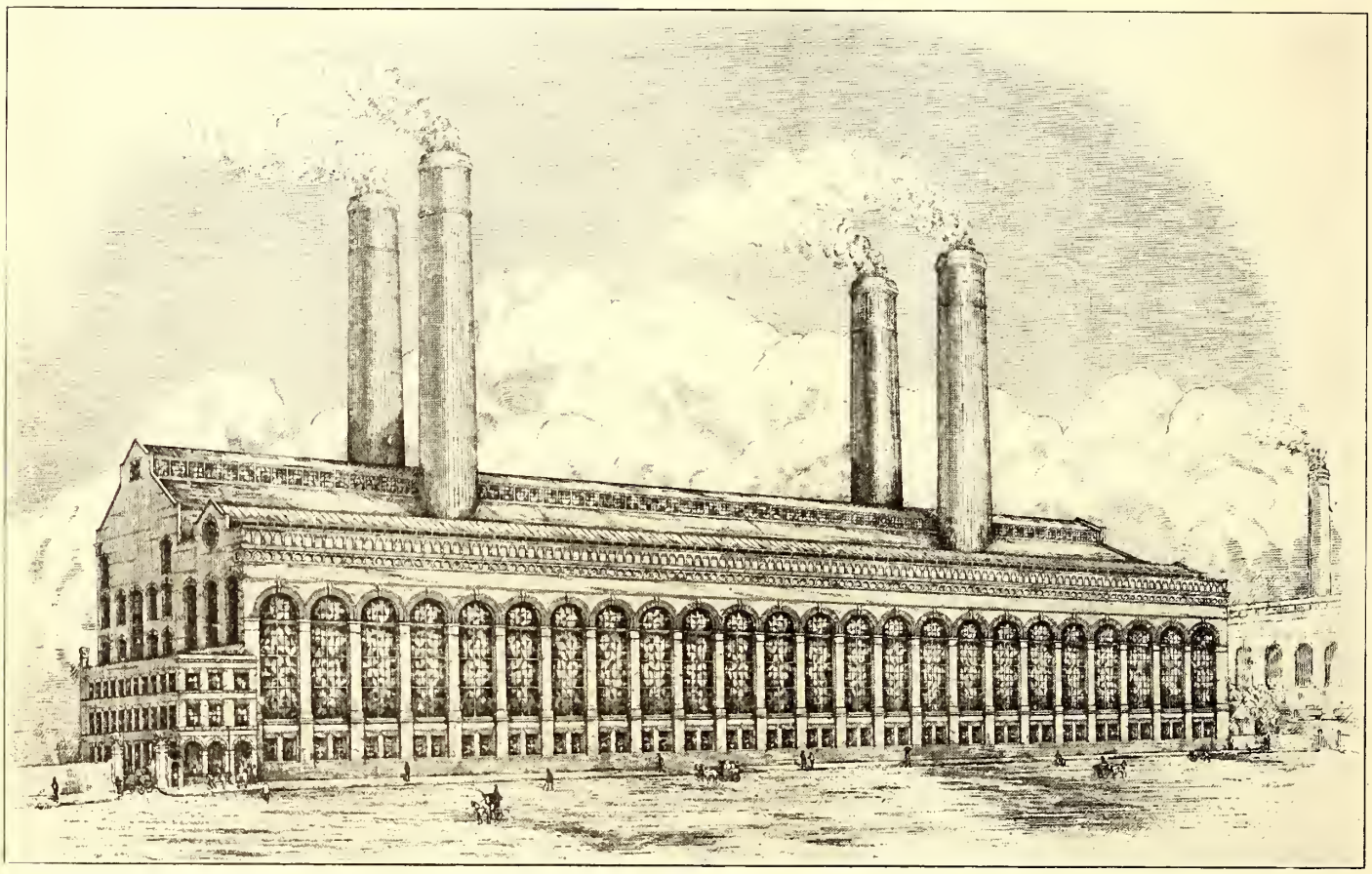
The St. Louis Transit Company has a large air compressor at its shops to supply air to compressed-air tools and for cleaning. This compressor is driven by an old D-62 generator run as a motor. It is provided with an automatic starter which is of interest, as it affords a means of automatically starting and stopping this large motor so as to keep the air pressure constant, which is very satisfactory and perfectly capable of handling a large volume of current. The shunt fields of this motor are connected permanently to the 500-volt constant-potential railway circuit. The armature is started through a rheostat. The cutting out of the rheostat is accomplished by contactors, such as are used on the General Electric Company's type-M system of train control. Each contactor is controlled by its own magnet, as is well known. The only function of the automatic governor, which is controlled by the air compressor, is to close the armature circuit. When the motor is idle, of course, all the type-M contactors which cut out or short circuit the rheostat are on open circuit. The magnet coils of these contactors are connected in shunt around the terminals of the motor. Of course, in starting the motor with all the resistance in circuit the voltage across the motor terminals is low, and as the motor speeds up this voltage automatically rises. The weights on the contactor magnets are adjusted so that as soon as the motor armature speeds up a little, with a corresponding rise of voltage, one of the contactor magnets pulls up its contacts and short circuits one section of the resistance. When the motor speeds up a little more, and the voltage across its terminal rises again, another contactor magnet draws up its contacts and short circuits another section of the resistance. Thus the various sections of the resistance are short circuited, one by one, by the contactors as the speed and voltage of the motor armature rise, until finally all of the resistance is short circuited. The arrangement works admirably and is extremely simple.

## POWER STATION FOR THE UNDERGROUND ELECTRIC RAILWAYS COMPANY OF LONDON

The work on the electrical equipment of the Yerkes underground railway system in London is being carried forward rapidly under the supervision of G. F. Chapman, chief engineer. Particulars were published in a recent issue of the cars and third-rail system adopted, and views are given herewith of the immense power station which is now being erected on the Thames.

The site of the station comprises 3.67 acres of land with a water frontage on the Thames and on Chelsea Creek of 1100 ft. and a frontage on Lots Road, Chelsea, of 824 ft.

The building is 453.5 ft. x 175 ft. and 140 ft. in height from the ground floor to the peak of the roof. The office building adjoining on the east measures 81 ft. x 25 ft., and will have three floors, the lower of which forms the machine shops. The



LOTS ROAD ELEVATION—CHELSEA GENERATING STATION. UNDERGROUND ELECTRIC RAILWAYS COMPANY OF LONDON, LTD.

main building will have a self-supporting steel frame, weighing about 5800 tons. There will be four chimneys, each 19 ft. internal diameter and 275 ft. high; the foundations for these chimneys are 42 ft. sq. and 34 ft. 6 ins. below the ground floor level. There are 2200 cu. yds. of concrete in each foundation.

The capacity of the building at normal load is 57,000 kw. On this basis the cubic feet per kilowatt (including office building) is 139, and the square feet per kilowatt is 1.36.

The steel frame of the building will be closed in with brick and terra cotta; the roof and most of the floors will be concrete. In general details the building will be considered as a factory for the production of a commodity, and there will be no ornamental features.

The south side of the building will contain eighty water-tube boilers arranged two stories high and carried directly on the steel frame of the building. Each boiler has 5212 sq. ft. of heating surface and 672 sq. ft. of superheating surface. The boilers will be piped in groups of eight, each group supplying the steam for one electric generating set and one feed pump, there being no steam connections between the several groups

except that a supplemental header at the east end of the building is connected to two groups. This header supplies the exciter engines, air compressors, house pump, etc. Chain grate stokers will be used under each boiler, and will have 83 sq. ft. of surface.

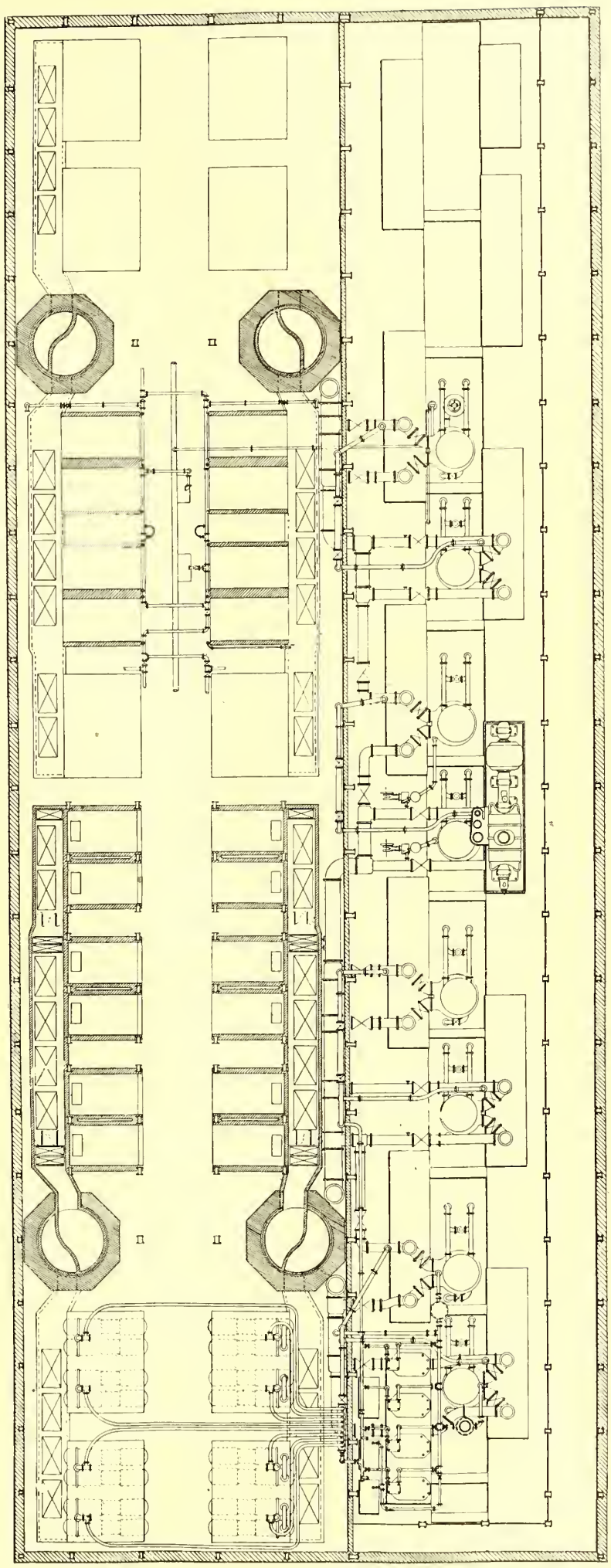
Economizers with tubes, 10 ft. long and placed wider apart than the usual practice, are grouped behind the boilers, with the customary by-pass flues; 1540 sq. ft. of heating surface is provided for each boiler. The boiler feeders are placed on the ground floor and supply ring mains on both the boiler room floors.

The main generating sets consist each of a Westinghouse horizontal steam turbine running at 1000 r. p. m., and a three-phase generator, wound for 11,000 volts 33 1-3 cycles. There will be ten such sets, with floor space for one of half the size. The normal rating of each generator is 5500 kw, but they will carry an overload of 50 per cent for two hours at practically the same steam consumption per kilowatt-hour. There will be in addition four 125-kw, 125-volt steam-driven exciter sets, running at 375 r. p. m.

The condensing system consists of vertical condensers each with 15,000 sq. ft. of cooling surface, and located in pits between the engine foundations. The circulating water is supplied by 66-in. pipes laid to the edges of the channel of the Thames. Each condenser has a 20-in. centrifugal pump; the duty of this pump is simply to overcome the friction of the pipes, as the system is arranged on the syphonic principle, the top of the condensers being within 29 ft. of minimum low tide, and the circuit is closed. The intake and discharge mains are arranged for reversible flow. The condensers are designed to work on the dry vacuum principle, the air pump and the water pump being separate. All the condenser pumps are electrically driven.

The switchboard is carried on three gallery floors extending across the north side of the engine room with returns across the east end. All high-tension switches will be motor operated, and the feeder system extending to the twenty-three sub-stations will be in duplicate. A line of sixty-four ducts is being constructed to carry these feeders to the nearest point on the District Railway at Earl's Court.

Coal will be received on lighters in a tidal basin at the east end of the station, or by rail at an unloading point of the West London Extension Railway on the opposite side of Chelsea Creek. For unloading barge coal the basin is spanned by two traveling cranes, each working a 1-ton grab; the coal is weighed in the tower at one end of each of these cranes and dropped onto a belt conveyor, thence by duplicate inclined elevators, 140 ft. high, to the top of the building. Rail coal will be taken from a hopper under the coal wagons by an inclined elevator to the top of the building at the opposite end. The distribution over the bunkers is by duplicate belt conveyors, so arranged that the direction of travel of both belts can be reversed so as to handle coal coming in at either end. The storage capacity of the bunkers is 15,000 tons. The daily consumption will reach 800 tons, and six of the largest river barges can be placed in the basin at each tide.



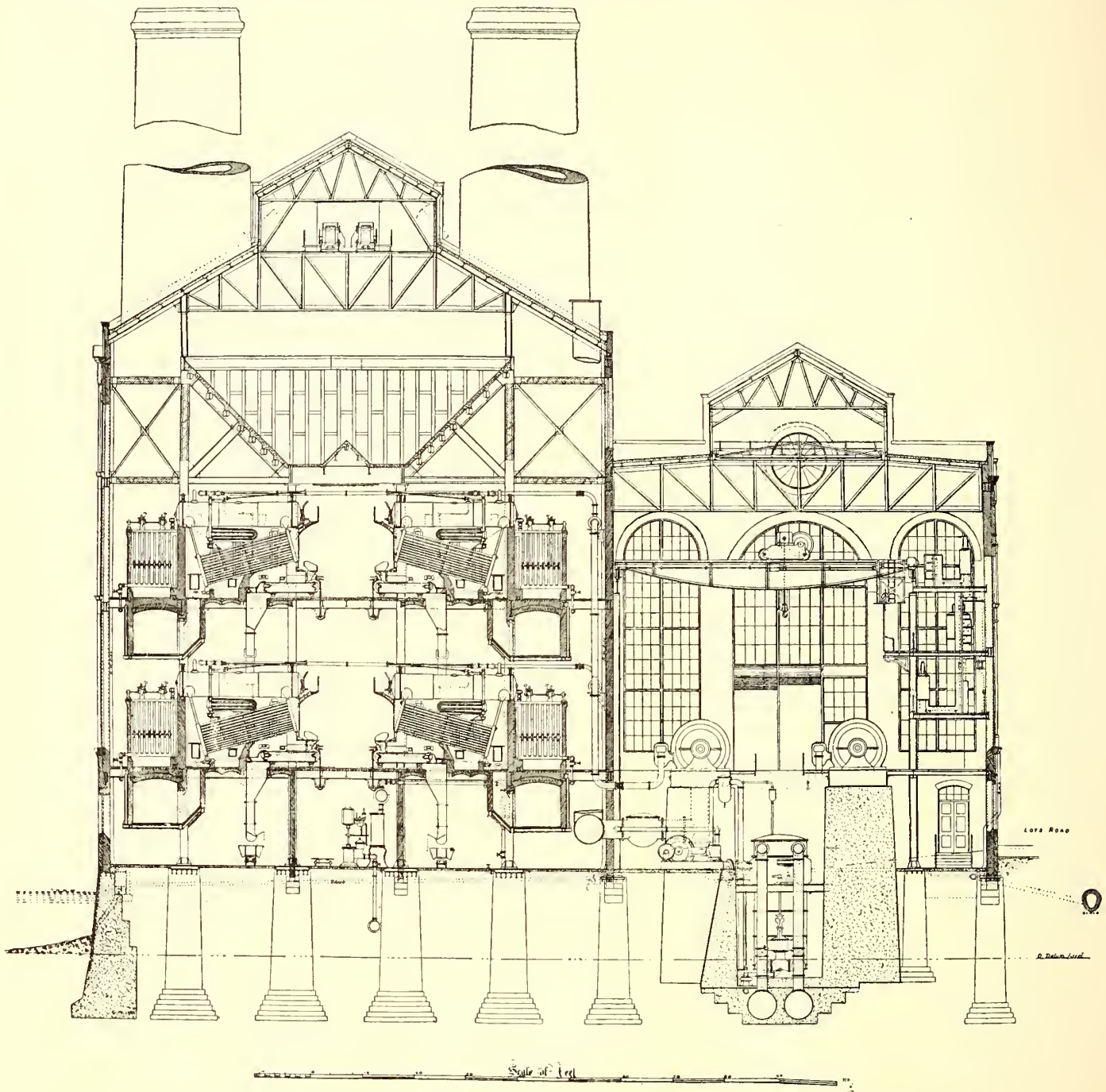
PLAN OF CHELSEA GENERATING STATION, UNDERGROUND ELECTRIC RAILWAYS COMPANY OF LONDON, LTD.

Ashes will be removed by an industrial railway worked by a storage battery locomotive; two lines of rails will be laid under the ash hoppers on the ground floor. The ashes will drop into self-dumping buckets, to be unloaded into barges by pneumatic hoists on the dock wall at the west end of the premises or stored in an adjoining bin if no barge is available.

The capstans, barge basin gate mechanism and many of the large valves in the building will be worked by pneumatic motors.

The electric motors on the traveling cranes over the engines, as well as those on the oil switches, will be direct current, 125 volts. All other motors will be three-phase 220 volts; most of the lighting will be on the latter circuit.

It is expected that a portion of the plant will be in working order by the latter part of 1904.



CROSS SECTION THROUGH ENGINE AND BOILER ROOMS, CHELSEA STATION

It is announced that a sub-commission of the Royal Commission on London Street Traffic will go to the United States in the Autumn to study the street railroad systems of the principal cities there.

## THE ELECTRIC RAILWAYS ON LONG ISLAND

For a territory so closely contiguous to New York it is indeed remarkable that there has not been greater development of the electric railway on Long Island. Of course, there is a boom on now that the Pennsylvania Railroad, as owner of the Long Island Railroad, has so greatly improved the service of its lines on the island, and since the construction by that company of its proposed tunnel and the tunnel to be built by the city between New York and Brooklyn is assured. Up to the time of the development of these projects, however, the only electric railways on the island worthy of mention were those operated by the New York & Queens County Railway and the Brooklyn Rapid Transit Company, whose lines extend from Long Island City and Brooklyn respectively.

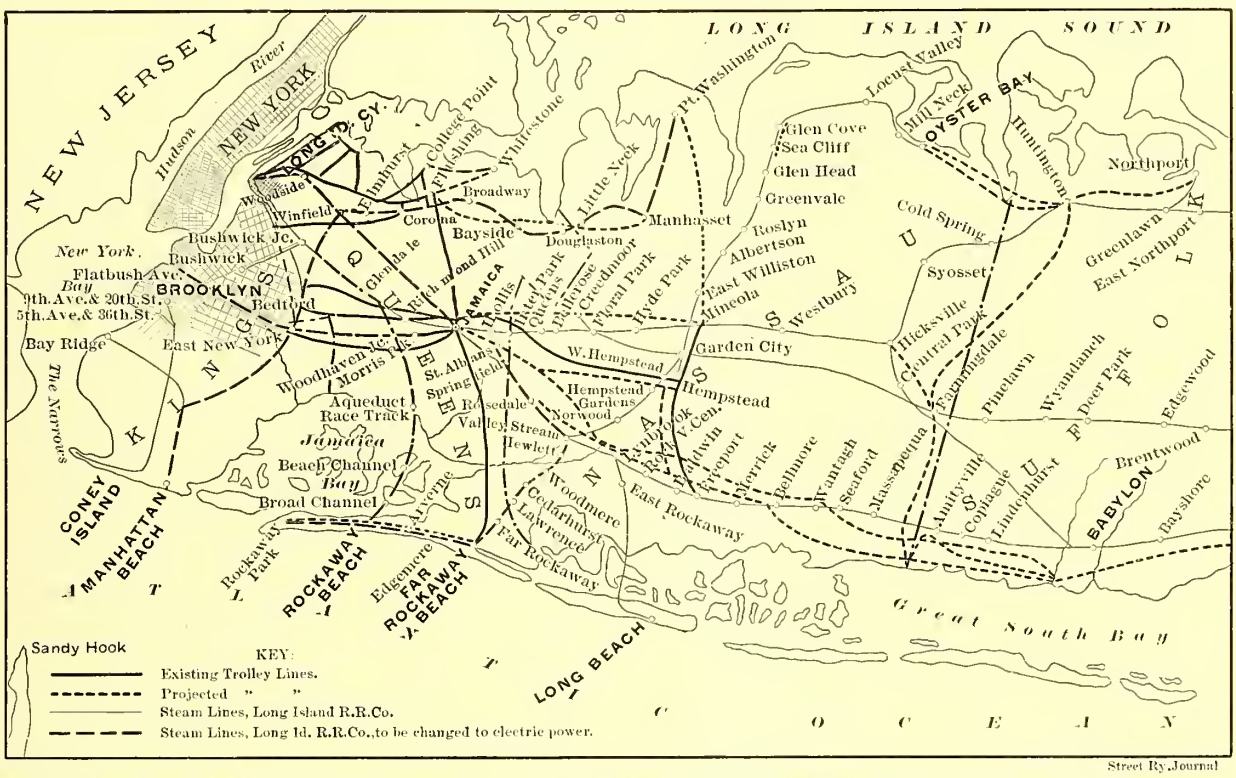
At the present time there are about 140 miles of electric railway in operation on the island outside of Brooklyn Borough. Of the above named the New York & Queens County system has 74½ miles, the New York & Long Island Traction Company, 16 miles; the Long Island Electric Railroad, 19; the

Brooklyn Rapid Transit Company, 20; the Ocean Electric, 8; the Huntington Railroad, 3; the Northport, 2½.

The New York & Queens County's lines extend from the East River ferries, at the foot of Borden Avenue, Long Island City, to Astoria, Steinway and North Beach, by way of Ravenswood, and between the same terminals by way of Dutch Kills; a line from the ferries to Flushing and College Point by way of Elmhurst, and another between the same points, a more direct line, over Jackson Avenue; a line from the ferries to Calvary Cemetery, Newtown, and another from Flushing to Jamaica. The company has franchises from Flushing to Whitestone and Willetts Point, and from Flushing to Bay Side and Manhasset, and has promised soon to construct these lines.

The Long Island Electric Railroad Company operates a line from Queens to Jamaica, from Jamaica to Far Rockaway, and from Jamaica to the terminus of the Kings County Elevated line at a point near Rosedale, and it has made an application for a franchise for an extension through South Jamaica, in Queens Borough, to the Brooklyn line at the terminus of the Kings County Elevated Railroad. It has also applied for a franchise for an extension from the Queens Village through Jamaica and thence to the Brooklyn line, not far from the line of the Long Island Railroad. It has a franchise for building a line over the Jericho Turnpike from Mineola to Jamaica.

The company has also applied for franchises for the building of a line from Freeport to Babylon. The completion of this line in connection with the one now under construction from Freeport to Rockville Center and the Queens Borough line, would form a continuous line 31 miles in length from Babylon to the terminus of the Kings County Elevated line of the Brooklyn Rapid Transit Company, and with the other proposed lines would give three parallel east and west routes through




MAP OF WESTERN END OF LONG ISLAND, SHOWING EXISTING AND PROPOSED ELECTRIC RAILWAYS OUTSIDE OF THOSE IN BROOKLYN

Railroad at Liberty Avenue and Crescent Street, Brooklyn. At Far Rockaway the lines of the company connect with the Long Island Railroad, which operates in summer an electric service between that place and Rockaway Park, thus making possible a trip entirely by electric railway from the City Hall, New York, to Rockaway Beach, a popular summer resort that ranks with Coney Island for its attractions.

The Brooklyn Rapid Transit Company operates, of course, in Brooklyn, also from East New York to Jamaica, on Myrtle Avenue from Brooklyn to Richmond Hill, from Ridgewood to Flushing and North Beach, and from Brooklyn to Maspeth, Newtown, Corona and North Beach. The company also has franchises for several other lines in the town of Newtown. It was over part of this company's line between Brooklyn and Jamaica that the Jamaica & Brooklyn Railroad operated electric cars under the Van Depoele system as early as Jan. 1, 1888.

Of the systems now in operation the New York & Long Island Traction Company, operating between Freeport and Mineola, by way of Hempstead, a distance of 9 miles, and a line between Hempstead and Queens, a distance of 7 miles, probably has in contemplation more construction work than any other company on the island. The company is now building a line from Freeport to Rockville Center and the Queens County a large portion of Nassau County and traversing an important section of Queens. The company gets its power from the Roslyn Light, Heat & Power Company's plant, but has under construction a power house of its own at Rockville Center. At Queens the company's lines will connect with the New York & Queens County Railway, thus completing electric railway connections with Long Island City, Brooklyn and New York. This system was described in detail in the STREET RAILWAY JOURNAL for June 26, 1902.

The electric railway between Far Rockaway and Rockaway Park, to which reference has already been made, is operated by the Ocean Electric Railroad, a subsidiary company of the Long Island Railroad. This line is to be extended next fall to Valley Stream and Mineola. The grading for a second track to Valley Stream is already finished, and the ties are laid along the line. Upon the completion of this work the motive power of the line between Far Rockaway and Mineola—now a steam railroad—will be changed to electricity.

Of the companies that have as yet done nothing in the way of actual construction work probably the most pretentious is the South Shore Traction Company, recently incorporated. The company is capitalized at $2,000,000, and it proposes to build about 60 miles of line in Suffolk County and Nassau

County, extending from Jamaica through Rockville Center, Hempstead, Babylon, Amityville, Islip, Patchogue and Brook Haven. Interested in this company are R. E. Lee Slingluff, of Baltimore; Charles H. Davis, of Petersburg, Va., and James F. Heyward, formerly general manager of the City & Suburban Railway, of Baltimore, Md. The company now has a right of way from Brook Haven west to the Nassau County line, with the exception of Babylon village, and has been granted a franchise through that portion of Babylon Town outside of the limits of the two incorporated villages of Babylon and Amityville. Oyster Bay, the home of President Roosevelt, has granted the necessary franchises in that town, and an application is now pending before the Nassau Board of Supervisors and the Hempstead Town Board. Franchises will also be asked for through the incorporated villages of Freeport and Rockville Center. The company has bought the Patchogue Electric Light Company's plant, the East Islip Electric Company's plant and franchises for lighting covering the whole town. It has also an option on the Amityville Electric Light Company's plant. The company will lay its line almost altogether over a private right of way, except in the villages.

There has long been in contemplation an electric railway between Patchogue and Port Jefferson, and at one time a company known as the Patchogue & Port Jefferson Traction Company is actually said to have begun work on the line. This was in 1897 or 1898, but the project has recently been revived. Now it is said an entire private right of way has been secured for the line, and that its construction is assured. The road will be 15 miles long.

A project for which franchises have been partly secured is the Huntington & Amityville Cross Island Railroad, in which Harry A. Hanbury, Robert A. Sharkey and other prominent Brooklyn politicians are interested. The company proposes to build from Huntington railroad station through Melville and Farmingdale to Amityville. It has secured franchises in the towns of Huntington, Oyster Bay and Babylon for the building of its entire line up to a short stretch of country road in Farmingdale.

A company is being formed to build a road on the north fork of the island, to run from Riverhead to Greenport. This road is to be built entirely by local capital. John H. Perkins is the most active promoter of the enterprise.

Of the projects that have as yet attained nothing like tangible shape may be mentioned plans to connect Farmingdale and Hicksville, Mineola and Port Washington and Oyster Bay and Northport. These are merely in the preliminary stages of promotion. As far as can be learned nothing has even been done toward securing franchises for them.

At Huntington and Northport the Long Island Railroad has built short lines that extend from the railroad stations at these places through the villages, and the company plans to build similar lines at Sea Cliff and Glen Cove, with a line between these towns.

The lines at Huntington and Northport, furnishing as they do a ready means of transit in these villages, have proved very popular with the residents, and the fact that more of them are to be built by the company also proves that they are creators of traffic. In passing, it might be well to mention that the Long Island Company plans to equip for electric operation by the third-rail system more than 70 miles of line. The names and the mileage of these lines follow: Long Island City to Manhattan Beach, 16.10 miles; Glendale Junction to Rockaway Park, 10.31 miles; Hammels to Valley Stream, 8.37 miles; Long Island City to Port Washington, 18.18 miles; Whitestone Junction to Whitestone Landing, 4.78 miles; Glendale Junction to Rockaway Junction, 4.34 miles; Flatbush Avenue (Brooklyn) to Jamaica, 9.63 miles.

As stated in the article, "The Passenger Traffic Problem of Greater New York, III—Brooklyn," by W. W. Wheatly, 1903, the present plan is to operate all trains on these lines by the multiple-unit system. The trains from the six lines first named will probably run to Manhattan 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's tunnel.

In all there are projected or under construction on Long Island at this time nearly 250 miles of new line in Queens County, Nassau County and Suffolk County, which do not include Brooklyn, in Kings County.

## POWER STATION TEST OF THE UNION TRACTION COMPANY OF INDIANA

Under the title of "Central Station Economies" Professor W. E. Goldsborough and P. E. Fansler presented a paper at the recent meeting at Niagara Falls of the American Institute of Electrical Engineers, summing up the results of some tests made under their direction by the students in the electrical engineering course at Purdue University. The station is provided with eight Babcock & Wilcox water-tube boilers, rated at 400 hp each, the principal dimensions of which are: Number of tubes, 102; arrangement, 16 wide and 12 high; size of tubes, 4 ins. diameter; two drums, 3 ft. diameter 16 ft. long; O. H. steel, tensile strength, 56,000 lbs.; steam pressure (rated), 160 lbs.

### ENGINE ROOM

There are at present in the engine room three cross-compound Corliss automatic cut-off condensing engines, with a maximum capacity of 2000 hp each, and space for a fourth unit of the same size. These engines are built under a guarantee of less than 1 per cent speed variation from no load to full load, with an instantaneous variation not greater than 2 per cent in any case. The economy guarantee is that the maximum steam consumption of engine, jackets, air-pump and reheating coils, when under normal steam and vacuum conditions, shall not exceed on an average the equivalent of 14½ lbs. of dry steam per indicated horse-power per hour, when the engine and pump under a constant load are together indicating 1500 hp.

The general dimensions of the main engines are: Diameter of cylinders, 26 ins. and 50 ins.; length of stroke, 48 ins.; speed, 100 r. p. m.; diameter of balance fly-wheel, 18 ft.; weight, 120,000 lbs.; diameter of shaft at middle, 24 ins.; dimensions of main bearings, 22 ins. x 58 ins.; crank pin, 8½ ins. x 8½ ins.; cross-head pin, 7 ins. x 8½ ins.; length of connecting rod, center to center, 12 ft. An improved Rites inertia-type governor gives a cut-off variable from zero to three-fourths stroke. Connected to the low-pressure cylinders of the compound engines are jet condensers, the condensed steam and condensing water from which is allowed to escape into a private sewer. However, special connections are made at all joints and at the separators in order that the water in the steam pipes may be drained into the Holly system and returned to the boilers to be evaporated.

Direct connected to each of the three engines is a 1000-kw three-phase generator with rotating fields, separately excited, designed for 100 r. p. m. With thirty-two poles this gives 1600 cycles per minute. Each generator has a normal capacity of 1600 amps. in each of the three phases, the full-load voltage being 400.

A summary of the boiler tests is given in Table I.

In explanation of this data it might be said that Item 4 is an assumption owing to the fact that it was thought no dependence could be placed upon the determinations of the moisture in the coal, made from the samples taken, inasmuch as when dumped upon the floor the coal was in a relatively dry condition on account of having been stored over the boilers for

a considerable number of hours previous to its being used. It was impossible, however, to seal up the samples at once, and consequently they had ample opportunity to absorb a considerable amount of moisture.

Owing to the fact that Item 27, which shows the equivalent water evaporated per pound of combustible from and at 212 degs. is rather high, it is thought that the actual amount of moisture in the coal was less rather than greater than the assumed value of 6 per cent. If the extreme condition is assumed and the coal taken to be dry when fired into the boilers, Item 27 will be reduced from 12.30 lbs. evaporated per pound of combustible, to 11.65 lbs. evaporated per pound of combustible, which is more nearly in accordance with the claims of the builders of the boilers.

Results reported by the Babcock & Wilcox Company indicate an average performance of 11.4 lbs. of water evaporated from and at 212 degs. per pound of combustible; the test figures, therefore, indicate an excellent performance. There are but few reports of boilers showing a maximum evaporation above 12 lbs. of water evaporated per pound of combustible from and at 212 degs., and 12.5 lbs. is about the highest evaporation that can be obtained from high-grade steam fuels. A few reports have shown as high a maximum as 13.25 lbs. of water evaporated per pound of combustible, but it is safe to say that an average record made during three days' test at Anderson, Ind., of 12.3 lbs. evaporated per pound of combustible from and at 212 degs. is an excellent showing under conditions of variable load.

Recent tests upon electric street railway properties show an economy somewhat less than this. For instance, a test made of the Oshkosh Electric Railway System about one year ago

TABLE I.—RESULTS OF BOILER TESTS

| No. | QUANTITY | April 17 | April 18 | April 19 | Total |
|---|---|---|---|---|---|
| 1 | Date of trial | April 17 | April 18 | April 19 | Total |
| 2 | Duration of trial | 24 Hrs. | 24 Hrs. | 24 Hrs. | 72 Hrs. |
| 3 | Weight coal as fired | 144,500 | 145 000 | 146,000 | 435,500 |
| 4 | Moisture in coal | 6 p.c. | 6 p.c. | 6 p.c. | 6 p.c. |
| 5 | Total weight dry coal | 135,800 | 136,300 | 137 200 | 409,300 |
| 6 | Total ash and refuse | 16,460 | 16,540 | 16,640 | 49,640 |
| 7 | Per cent ash and refuse | 11.4 | 11.4 | 11.4 | 11.4 |
| 8 | Total combustible | 119,340 | 119,760 | 120,560 | 359,660 |
| 9 | Dry coal per hour | 5,650 | 5,700 | 5,730 | 5,690 |
| 10 | Dry coal per sq. ft grate per hour | 14.25 | 14.40 | 14.48 | 14.39 |
| 11 | Total water to boiler | 1,242,000 | 1,256,600 | 1,256,600 | 3,755,200 |
| 12 | Water actually evaporated | 1,229,700 | 1,244,000 | 1,244,000 | 3,717,700 |
| 13 | Equivalent from and at 212° | 1,487,000 | 1,505,000 | 1,505.000 | 4,497,700 |
| 14 | Water per hour cor | 51,200 | 52,000 | 52,000 | 51,700 |
| 15 | Equivalent evap. per hour | 62,000 | 62,800 | 62,200 | 62,400 |
| 16 | Equivalent per sq. ft. grate | 157 | 158 | 158 | 157.8 |
| 17 | Average steam pressure | 137.7 | 141.5 | 139.4 | 139 5 |
| 18 | Temp. feed entering boiler | 88.7 | 88.5 | 88.6 | 88.6 |
| 19 | Moisture in steam | 99 p.c. | 99 p.c. | 99 p.c. | 99 p.c. |
| 20 | H.P. developed | 1,800 | 1,820 | 1,820 | 1,805 |
| 21 | Builders' rated h.p | 2,400 | 2,400 | 2,400 | 2,400 |
| 22 | Per cent b.r.h.p. devel | 75 0 | 75.8 | 75.8 | 75.3 |
| 23 | Water evap. per lb. coal | 8.51 | 8.58 | 8.52 | 8.53 |
| 24 | Equiv. evap. per lb. coal | 10.21 | 10 30 | 10.22 | 10.24 |
| 25 | Equiv. evap. per lb. dry coal | 10.86 | 10.96 | 10.89 | 10.90 |
| 26 | Equiv. evap. per lb. combustible | 12.27 | 12.36 | 12.29 | 12.30 |
| 27 | Calorific value coal | 12,500 | 12,500 | 12,500 | 12,500 |
| 28 | Calorific value combustible | 14,100 | 14,100 | 14,100 | 14,100 |
| 29 | Efficiency boiler based on coal | 79.1 | 79.7 | 81.1 | 79.6 |
| 30 | Efficiency boiler based on combustible | 83.0 | 84.6 | 84 3 | 84.3 |
| 31 | Economy feed water heater | 6 15 | 6.20 | 6.23 | 6.19 |
| 32 | Cost per ton of 2000 | $1.35 | $1.35 | $1.35 | $1.35 |
| 33 | Cost of coal required to evaporate 1000 lbs. of water from and at 212° | $.0655 | $.0651 | $.0657 | $.0654 |

by Professor Swenson, of Wisconsin University, and some of his students show the boiler plant to have developed an economic evaporation of 10.6 lbs. of water per pound of combustible from and at 212 degs. F. The boilers in this case were of Babcock & Wilcox manufacture.

An elaborate test was made in May, 1898, by the students of the Massachusetts Institute of Technology on the Harvard power station of the Boston Elevated Railway Company. This station is equipped with six Babcock & Wilcox water-tube boilers, developing a total capacity of 3000 hp. The report shows that 11.3 lbs. of water were evaporated from and at 212 degs. per pound of combustible, there being 1 per cent of moisture in the coal and 5.9 per cent of ashes and clinkers. Other points of comparison are that in the Harvard test the average boiler pressure was 168 lbs. against 158 lbs. at Anderson. The average temperature of feed water entering the boilers was 209 degs. F. at Harvard against 191 degs. F. at Anderson, and the heat gained in heaters and economizers as compared to the total heat acquired was 7.6 per cent at Harvard against 6.2 per cent at Anderson. The Harvard test offers the best comparison with the Anderson tests of any that has come to the attention of the authors, and the Anderson tests show the boilers to have developed a higher economy.

In Table II results are recorded which show the economy of the station in terms of the coal and water required to develop an indicated horse-power-hour and a kilowatt-hour for the different days and for the whole test. It must be remembered that the results here recorded include the steam used by the auxiliaries. The average coal consumption per indicated horse-power per hour is 2.85 lbs. The best economy was developed on the 19th, when an average of but 2.65 lbs. of coal was required in developing one indicated horse-power. This is probably due to the fact that the load was heavy and quite steady for a number of hours on the afternoon of the 19th.

The high value of 3.01 lbs. of coal per indicated horse-power per hour shown on the 18th inst. comes from the fact that on the 18th the variations in the load were heavy, and there was no balancing period of heavy load during the latter part of the day. In other words, the fires had to be built up to carry the heavy load at 5 o'clock, while immediately after 5 o'clock the load fell off. On the 19th the period of heavy load extended on until 9 o'clock, beginning as early as 2 o'clock in the afternoon.

The weights of water required to develop an indicated horse-power, as given in the table, vary from 22.6 lbs. on the 19th to 23.9 lbs. on the 17th. These values are high, even though they include the steam used by the auxiliaries.

In approximating the actual coal and water economy of the engines and generators the assumption has been made that the auxiliaries require 15 per cent of the steam generated. It is not believed that this percentage is too high, in view of the fact that a considerable amount of power is developed by relatively small engines in operating the crushing and conveying machinery, the automatic stokers, pumps, etc.

A great deal of data is not available as to the amount of power which auxiliaries consume. Results recently published by C. D. Taite and R. S. Doune* give a comparison between steam and electrically operated auxiliaries in central stations, and show that electrically-operated auxiliaries require from 6.5 per cent to 8.5 per cent of the total power generated, whereas steam-driven auxiliaries require upwards of twice this amount.

The records in Table III show that on April 19 an indicated horse-power-hour was developed with an expenditure of 2.25 lbs. of coal; and the average for the three days shows that an indicated horse-power-hour was developed by 2.42 lbs. of coal. The average of seven tests of compound condensing Corliss, Greene, McIntosh and Seymour and simple-valve motion compound engines reported by Professor R. C. Car-

TABLE II.—RESULTS OF TESTS MAKING NO ALLOWANCE FOR STEAM USED BY AUXILIARIES. TOTAL COAL AND WATER IS CHARGED TO ENGINES AND DYNAMOS OF MAIN GENERATING SETS

| Date Apr. | Coal Fired Lbs. | Boiler Water Lbs. | I. H. P. Hours Developed | Lbs. Coal Per I. H. P. Per Hour | Lbs. Water Per I. H. P. Per Hour | Kw-H Developed | Lbs. Coal Per Kw Per Hour | Lbs Water Per Kw Per Hour |
|---|---|---|---|---|---|---|---|---|
| 17 | 144500 | 1229700 | 51300 | 2.82 | 23.9 | 33000 | 4 38 | 37.2 |
| 18 | 145000 | 1244000 | 48000 | 3.01 | 25.9 | 32200 | 4.50 | 38.6 |
| 19 | 146000 | 1244000 | 55000 | 2.65 | 22.6 | 36700 | 3 98 | 33.9 |
| 3 days | 435500 | 3717700 | 153820 | 2.85 | 24.25 | 101900 | 4.28 | 36.8 |

penter, of Cornell University, in a paper read at the Cornell meeting of the New York Street Railway Association, 1899, is

* A paper presented at a meeting of the British Institution of Electrical Engineers, April 7, 1903.

2.6 lbs. of coal per indicated horse-power per hour. The lowest value reported by him is 1.8 lbs. of coal per indicated horse-power per hour, and the highest 4.06 lbs. of coal per indicated horse-power per hour. The low value was developed by an engine of 2000-hp capacity and the high value of an engine of 825-hp capacity. By comparison with these results the performance developed by the engines at Anderson is very creditable.

As regards steam economy Table III shows the best performance of the Anderson engines to have been on April 19, when they developed an average economy of 19.7 lbs. of water per indicated horse-power per hour. On this day the average indicated horse-power of each engine was 1230, and the maximum horse-power developed 1690. The engines were, therefore, on the average, working under but 60 per cent of their maximum capacity. Under these conditions an economy of 19.7 lbs. of water per indicated horse-power per hour is not so bad, and in fact may be taken as representing creditable performance. The average of the tests reported by Professor Carpenter was 18.8 lbs. per indicated horse-power per hour. The 2000-hp engine before referred to developed an indicated horse-power on 14.5 lbs. of steam, while the 825-hp engine required 22.7 lbs. of steam. Unfortunately, the condition of loading is not specified in these cases so that the comparison fails in some particulars.

In the case of the test on the Harvard station previously mentioned of engines made by E. P. Allis Company, each of which have a nominal capacity of 1800 hp, the engines are shown to have developed an indicated horse-power with a consumption of between 14 lbs. and 15 lbs. of water. The different results being for different days. This is a high economy for street railway work. Unfortunately, no curves or other data is given from which any determination of the character of the variations in the load upon the Harvard station during the tests can be made. On May 10 the Harvard test record shows the engines to have developed an indicated horse-power on 14.05 lbs. of steam when the engines were under an

Table III.—Results of Tests Figured on the Assumption That 15 Per Cent of the Steam Generated Was Used by the Auxiliaries

| Date, April | Lbs. Coal Per I. H. P. Per Hour | Lbs. Water Per I. H. P. Per Hour | Lbs. Coal Per Kw Per Hour | Lbs. Water Per Kw Per Hour |
|---|---|---|---|---|
| 17 | 2.40 | 19.23 | 3.72 | 31.6 |
| 18 | 2.56 | 22.0 | 3.82 | 32.8 |
| 19 | 2.25 | 19.7 | 3.38 | 28.8 |
| 3 days | 2.42 | 20.61 | 3.64 | 31.3 |

average load amounting to only 72 per cent of their normal rating. This performance is better than anything reported by Professor Carpenter, and shows a performance 29 per cent better than that of the Rice & Sargent Corliss engines in the Anderson station. In operating efficiency, however, the machinery in the Anderson station seems to be the equal of that in the Harvard station, as both average 90 per cent with the percentage of loading in favor of the Harvard station.

### FRICTION TESTS

Table IV gives the results of a special friction test run on engine No. 2 on the morning of the 19th, after all cars had ceased running. Ten readings were taken after the operators in every sub-station had been instructed to disconnect the direct-current leads of the rotaries, leaving them running free. The power indicated then was that used in engine friction, generator losses, transformer and transmission losses, and that required to run all the rotary converters in the system.

The operators were next telephoned to throw off the rotaries, leaving the transformers only on the line, and ten more readings were taken. The difference in the indicated power between these first two conditions is that required to run the rotaries.

The generator switches were then opened, and ten readings taken on "no load," with normal field excitation. The difference between the power indicated under conditions No. 2 and No. 3 is that lost in the transformers and the high-tension transmission lines.

Next, the field circuit of the generator was opened, and the engine ran free; ten readings being taken under these conditions. The power developed in this final set of readings is that consumed in overcoming the friction of the generating unit, and may be considered constant at all loads. The difference in the power under conditions No. 3 and No. 4 gives the hysteresis and eddy current losses.

The engine and generator friction loss of 64.2 horse-power is only 3.2 per cent of the maximum capacity of the engine and only 5 per cent of the average power developed by the engine during the test. Including, as it does, the friction in both engine and generator, this is a low value.

Table IV.—Special Test

| | Hp | Kw |
|---|---|---|
| Average power developed under conditions No. 1 | 341.4 or | 254.5 |
| " " " " " " 2 | 199.4 or | 148.8 |
| " " " " " " 3 | 100.5 or | 74.8 |
| " " " " " " 4 | 64.2 or | 47.9 |
| Power required to run the rotaries | 142.0 or | 105.9 |
| Power lost in transformers and transmission | 98.9 or | 74.0 |
| Power lost in hysteresis and eddy currents | 36.3 or | 26.9 |
| Friction loss in engine and generator | 64.2 or | 47.9 |

Table V contains a tabulation of the results which show the thermal efficiency of the plant. From this table the authors find that the efficiency of the furnaces and boilers is 79.6 per cent, i. e., 79.6 per cent of the total heat in the coal as fired is delivered by the boilers to the engines in the steam. The average thermal efficiency of conversion between the boilers and engine cylinders is 9.11 per cent, i. e., 9.11 per cent of all the heat delivered in the form of steam by the boilers is converted into work in the cylinders of the main engines. This value of 9.11 per cent credits against the engines the steam used in the auxiliaries. If we follow out the assumption that 15 per cent of the steam delivered by the boilers is consumed by the auxiliaries, the thermal efficiency of the engines works out to be 10.7 per cent. The total average thermal efficiency of the plant is 7.25 per cent from the coal pile up to the engine cylinders and the total average thermal efficiency of the plant from

Table V.—Station Efficiencies

| No. | Quantity | April 17 | April 18 | April 19 | Total |
|---|---|---|---|---|---|
| 1 | Coal burned, pounds | 144,500 | 145,000 | 146,000 | 435,500 |
| 2 | Water evap. from 11.45° C. | 1,229,700 | 1,244,400 | 1,244,400 | 3,717,700 |
| 3 | Water evap. per lb. coal | 8.51 | 8.58 | 8.52 | 8.53 |
| 4 | Equiv. evap. per lb. coal | 10.21 | 10.30 | 10.22 | 10.24 |
| 5 | Efficiency furnace and boiler | 79.1 | 79.7 | 81.1 | 79.6 |
| 6 | I. H. P. from area curve | 51,300 | 48,000 | 55,000 | 153,820 |
| 7 | Thermal efficiency engine | 9.14 | 8.55 | 9.65 | 9.11 |
| 8 | Total thermal efficiency | 7.23 | 6.82 | 7.82 | 7.25 |
| 9 | Kw-h from area curve | 29,200 | 29,500 | 34,450 | 93,150 |
| 10 | Kw-h from wattmeter | 32,000 | 32,200 | 36,700 | 101,900 |
| 11 | Error (W. M. as standard) | 11.5 p. c. | 8.4 p. c. | 6.9 p. c. | 9.1 p. c. |
| 12 | Efficiency engines, ratio areas | 87.2 | 90.0 | 90.5 | 89.2 |
| 13 | Efficiency engines, average instantaneous efficiencies | 86.1 | 89.4 | 89.1 | 88.2 |
| 14 | Total thermal efficiency | 6.23 | 6.08 | 6.96 | 6.39 |

the coal pile to the switchboard, i. e., the ratio of the energy delivered by the generators to the total heat in the coal, is 6.39 per cent. Although it is frequently stated that the thermal efficiency of the steam engine at a maximum is about 25 per cent, it is improbable that any engine of this class working under these conditions will convert more than 12 per cent of the heat of the coal into work. The thermal efficiency of 6.39 per cent up to and including the switchboard shows high economy as compared with other stations of a similar character.

The total thermal efficiency of the Harrison Street station of the Chicago Edison Company has been estimated to be 4.5 per cent, while the thermal efficiency of the generating station of the Blue Island Chicago Storage Battery road was found to be 5.5 per cent.

The Anderson power plant of the Union Traction Company uses Indiana block coal for developing power. It is delivered at a cost of $1.35 per ton. On the basis of this figure the cost of

developing a kilowatt-hour is as shown in Table VI. The cost of developing a kilowatt-hour may be taken as the final

TABLE VI.—COSTS

| | April 17 | April 18 | April 19 | Total |
|---|---|---|---|---|
| Cost coal per kw-h | $.00295 | $.00304 | $.00269 | $.00288 |
| Kw-h per pound coal | .229 | .222 | .251 | .234 |
| Cost coal to evaporate 1000 pounds of water from and at 212° | .0655 | .0651 | .0657 | .0654 |

estimate of the efficiency of any station, as the aim and end is to develop as much power as possible per unit of cost.

## A RATIONAL TRAIN RESISTANCE FORMULA

Boston, July 8, 1903.

EDITORS STREET RAILWAY JOURNAL:

Your number of June 27 contains an editorial on the paper I presented at Saratoga. It presents points and opinions which I believe would not have been stated in the form which they are given if the matter had been given attention it deserves. I should like to present the following on this subject:

The editorial charges the formula presented by me with being "about as far from being free of empiricism as it could well be," yet the points further on do not warrant such statement. Again, the editorial states that "Mr. Blood is obviously right in making a strong plea for the rational formula," but later on states, "to our mind the best formulæ are simple ones * * * and deliberately empirical." It would seem that these statements are at variance.

In my formula No. 8, which is as follows:

$$R = A + BM + \left(C + \frac{D}{T}\right)M_n$$

it is stated that $D$ openly groups a pair of terms arguing that such grouping is empirical. I would state that such is not the case, as the variables of the two terms are the same, and simply placing them together, giving the head and stern in one term instead of two, is perfectly rational. Of course, grouping the side resistance term with the term for head and stern resistance would be empirical after it were known that the variables of the two terms were not of identical functions. We do not know this at the present time, and it is a mooted question. Until it is known that they are different, we are as rational as we can be by assuming that they are the same and drawing the formula on that basis.

In my formula it will be noticed that a side resistance term, of which $C$ is the coefficient, is proportional to the length or weight of the train, inasmuch as the resistance per ton is independent of the length or weight of the train. The statement that the stern factor $D$ is proportional to the length of the train is entirely new, and it would seem that a statement of this nature being so far from natural observation, would require evidence to support it. At the same time it is presented "that whatever else $D$ may be, it is not a function of the weight of the train." This is in accord with common opinion, and most the formulæ now show this relation. My formula, by placing the weight in the denominator, makes the resistance per ton inversely as the weight, and consequently makes the total resistance independent of the weight. It is certain that the cross-section and shape of the front of the train has a bearing on the coefficient $D$, and the several values of the coefficient $D$, under paragraph nine of my paper, show that this coefficient varies for different cross-sections.

I quote as follows: "The presence of $T$ is purely empirical and merely serves to take account of various errors and omissions in the assumptions, which it does more or less well, according to the skill with which the constants are made to fit the experimental data." This statement is totally wrong, as any well-informed person on train resistance will acknowledge. The presence of $T$ in the denominator of any formula giving the resistance in pounds per ton, makes that factor in which it appears of such nature that the total resistance given in pounds is independent of the weight.

The statement that the fractional exponent of the higher term is a well determined fact is not in accord with existing opinions. One reason for presenting this paper was to obtain a discussion on this point. It is believed by the writer that best results will be obtained by a fractional exponent. At the same time this is not acknowledged to a large extent and would necessarily bear much discussion before it could be considered "as a well determined fact."

Some few remarks in your editorial make it appear that the definition of a rational formula at the beginning is not followed. It is stated that it is "quite certain that $A$ varies with the speed." This would be contrary to the hypothesis, for $A$ is that portion of the train resistance which is independent of the speed. A rational train resistance formula is made up usually of three terms, one term which associates all forms of resistance which are independent of the speed. The largest portion of this resistance is a journal friction. The second factor is taken as the one in which the resistance varies as the first power of the speed, and all portions of the resistance varying as the first power of the speed are associated together. The track friction is the largest portion of this first power resistance. The third term of the resistance formula is taken as varying with a power of the speed higher than the first power, and has usually been taken as the second power. This is largely the air resistance. Now, the statement that it is quite certain that $A$ varies with the speed is contrary to the definition of a rational formula and contrary also to experimenting. It has been definitely determined, if anything has been definitely determined, that there is a portion of the train resistance which is independent of the speed. Of course, the initial or starting resistance is not to be considered. It is known that it takes more power to start the train than it does to run it at an infinitely small speed.

A statement that $B$ is not strictly a lineal function of speed is at variance with common opinion, although one eminent experimenter on this subject thinks that possibly there is another term in the train resistance formula which will vary as the power of the speed less than the first power. There is no reason for making a statement that $B$ is not strictly a lineal function on the basis of any published results. It is, of course, known that the track is not a uniform rigid plane. If it were perfectly uniform and perfectly rigid the first power term would practically be eliminated. The fact that the first power term plays an important part is on account of the fact that the track is not rigid.

The statement that the air resistance varies with the length of the train but not with the weight is apparently contradictory, as trains are usually constructed so that the length is proportional to the weight. Of course, if the coefficients of the formula were calculated on the basis of length with a train of extremely light cars it would not apply to another train of cars built on an entirely different construction with different relation of weight and length. At the same time, for a given train, the weight is proportional to the length, and with coefficients properly chosen it is just as accurate to use the weight factor as the length factor.

It is, of course, true, that the track and axle resistance varies with the number and load of trucks, the condition of the roadbed, track and bearings, and it is just these various factors which it is attempted to rationalize by separating out the various coefficients in such manner that the proper coefficient for each feature of resistance may be placed in its proper relation in the formula.

The final recommendation is that a set of simple and empirical formulæ is the best. As against this I present that a single rational formula with a set of coefficients for different conditions is much better and more simple than any set of em-

pirical formulæ. An empirical formula is of necessity based on experiment and has no method of taking into account new or extraordinary conditions, whereas a rational formula with a set of coefficients can be made to represent new and unknown conditions.

The aim of a rational formula is to present the variables of the train resistance in such shape that they will be in accord with the actual conditions, relying on the choice of coefficients to give accuracy in accord with the present detail conditions. It would seem clear that the simplest possible method of arriving at given resistance would be this, and that a set of empirical formulæ would require in addition a system to know when and where such formula was appliable.

My paper was written to obtain discussion on the third or air resistance term. I believe that this term should have an exponent greater than one and less than two. I believe also that the coefficient should be sum of two coefficients, one of which is independent of the weight and one of which has a weight or length factor in the denominator.

In this connection I would like to state that my referring to C. O. Mailloux as an advocate of empirical formula is not in accord with his views on the subject and that he is an advocate of a rational formula. John Balch Blood.

## REINFORCED CAR SILLS

Brooklyn, July 9, 1903.

Editors Street Railway Journal:

The article on "Reinforced Sills" in your issue of June 5 omits mention of two excellent methods, perhaps the most widely used, of which I enclose sketches.

Fig. 1 shows a flat steel plate on the outside of sill and projecting below bottom of sill. The added depth gives much greater strength than a plate of the same weight and no deeper than the sill, without the disadvantages of a plate extending above the sill, as in Mr. Carpenter's Fig. 4. If bolts be run through plate, sill and knees attached to the cross-timbers, no tie-rods and no other bolts through sill and plate will be necessary.

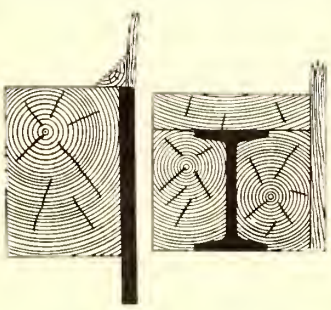


Fig. 1 Fig. 2

The reinforcement shown in Fig. 2 is specially adapted to cars with flush platforms, in which the intermediate I's can extend clear through to the bumper. The I-beams are braced together at end-sills, bolsters, needle-beams and by tie-rods, thus having the advantage of a steel framing, while the wood fillers make possible the use of wooden floor bridges (less expensive than all-steel framing), and the tie-rod and bolt-heads being sunk into the outer filler there need be no projecting heads on the outside of sill.

Both of these methods have been used largely and with satisfaction by the largest street railway systems in this country.

Construction.

## REPORT ON NEW YORK CITY STREET RAILWAYS

Report of the Board of Railroad Commissioners of New York State on the status of the New York city street railway companies was rendered June 30, 1903, and contains some interesting statistics on the different properties. The report is the result of a special investigation on the part of the Board of Railroad Commissioners and its experts during January and February of this year, as described in the Street Railway Journal at that time. Recommendations have been made from time to time to the several companies, and steps were taken to ascertain that they were carried into effect.

The Board states that in this investigation it has acted not only upon the many suggestions offered by the Merchants' Association and other organizations and citizens of New York, but has consulted some of the ablest experts in transportation matters in the country. While the result has to some extent been gratifying, the Commissioners believe that further improvement can be made, and will continue their efforts to bring it about.

Since the hearing in January the Board investigated the methods employed by the different railroad companies in Greater New York in keeping the records of the movements of cars and trains, with a view to suggesting such improvements as would give the Board at the earliest possible moment the detailed information and data necessary for its own action in suggesting further changes. The power supply also received attention, and the Board is of the opinion that this matter is of the greatest importance; from the report of operations, which is herewith submitted, it is evident to the Board that in most cases provision for additional power should be made at once, and companies whose power will be inadequate in a year from the date of this report have been urged to make such provision. This matter is at present being investigated by the electrical expert of the Board, and a report on the power conditions of each company will be submitted by him later, when the Board will issue a supplementary report on this subject.

### OPERATION

There has been an improvement on all of the lines. More cars are being moved, and there is now greater regularity in operating them. The matter of increased service during rush hours is still under investigation. As soon as it can be demonstrated that it is practical and that more trains can be operated with safety, orders will be issued to increase the number. As to the surface roads, the tables herewith submitted will show an improvement, and as subway construction progresses and conditions in the streets become more normal we believe a marked change for the better will be shown. The Board expresses its thanks to the Police Department and Street Department for their co-operation in trying to better the condition under which surface cars run. As a result of their efforts more cars are run on the Interborough lines, and reports show a decrease of causes of detention of cars.

### CAR EQUIPMENT

The matter of equipment has been gone into in a most thorough manner. Construction of cars used on the elevated lines has been investigated as well as the methods of repairs, with a view to adding to their strength and safety.

The new cars ordered by the Board for elevated service have nearly all been received and are in service. The new closed cars ordered by the Board to be used by the Interurban will have a different style of ventilation, similar to that used in steam roads. The ventilators are so arranged that the air will be drawn outward rather than in, as is done at times under present arrangements, and it is believed that under the new scheme cars can be ventilated in extreme cold weather without having a direct draught upon any of the passengers. The grab handle on the bell shaft has been remodeled so as to be about 7 ins. nearer the conductor. This enables him to stand in the middle of the car and ring up fares without interfering with passengers.

The Board has ordered that hereafter companies in their reports to the Board of equipments shall report only such as are actually fit for service.

### SPITTING ON CAR FLOORS

The Board calls attention to the good effects accomplished by the notices carried in the cars and to the enforcement of the law against violations of this ordinance. There is believed to be but little evidence of violation.

FIRE PREVENTION

The Board has investigated the construction of cars of the Manhattan Elevated line and finds the floors and bottoms of all cars covered with one-eighth asbestos board, which is treated with a highly insulated compound, also a special asbestos cloth tape designed and manufactured for the purpose of forming the wires into cables. Also that the single wires are carried from the cables to the connections on the apparatus, the braided asbestos being used, and at connection a braided asbestos sleeve embraces and covers all such connections. Each car before being put into service is subject to a test. All of the electrical apparatus and wiring are tested with 2000 volts alternate current for a period of from two to four seconds.

IMPROVEMENTS ON THE METROPOLITAN AND UNION

Eighty-Sixth Street line is being rapidly completed, and it is anticipated that the line will be complete and in operation July 20. Material for the Thirty-Fourth Street line is now on hand, and this will be changed from storage battery to underground electricity, and the work pushed to an early completion. The Kingsbridge power house has recently been completed and the company will now have ample power for several years.

The company has in preparation an increase in transfer system, and it is anticipated that this will be put into operation at an early date. Work on the changing of the Fourteenth Street line and several other downtown cross-town lines to underground electricity is promised as soon as the Thirty-Fourth Street line is completed.

The Union Company has recently constructed a sub-station at West Farms, which is substantially completed and equipped, and when operated to its full capacity will enable it to operate at least a hundred additional cars. Plans have also been prepared for two new sub-stations, and when these are completed the company will be able to double its car capacity upon its Yonkers and Mount Vernon divisions.

The necessary electrical machinery for both of these stations is now in course of construction by the Westinghouse Company, and it is expected that both of these stations will be in operation before Jan. 1 next.

The company has also recently built a new car house on 138th Street, with a storage capacity of 100 cars, and is now engaged in building another on the Bronx River Road with a capacity of 200 cars. It is also relaying a number of miles of track with 9-in. girder rails. Improvements are being made on 138th Street, west of Rider Avenue, and when the street improvements under way are completed it will enable it to operate cars from 135th Street and Eighth Avenue, in the Borough of Manhattan, to Tremont, Fordham and West Farms, in the Borough of the Bronx, doing away with the present inconvenient and undesirable change of cars at 138th Street and Third Avenue.

The rebuilding of the Tremont Avenue line from Third Avenue to Boston Avenue has just been completed, a distance of 4800 ft. of double track. One hundred new electrical equipments and trucks and fifty open cars have been recently added to the system.

IMPROVEMENTS ON THE BROOKLYN RAPID TRANSIT

Ninety-five new cars received this year and twenty-five are now promised by June 22, 1903. Until quite recently the company has been handicapped from lack of proper car repair shops, and the Board recently visited the new car shops at Thirty-Ninth Street and found them complete. Inspection was made of the manner of repairing cars, and the Board heartily approves of the improvement that is being made to strengthen those used on the elevated.

Several months ago the Board called the attention of the company to the danger from fire in the floor system. It at once took steps to guard against this danger by ordering that 4½ ins. of mineral wool be placed under the floors of all cars operated on the elevated. This is well under way, and about one-fifth of those in the elevated service have already been changed. This in addition to the ninety-five new cars which have been so constructed. All elevated cars are being equipped with fire extinguishers.

During the past year over 100 worn-out cars have been destroyed. Since Jan. 1, 1903, 1833 surface cars have been painted. The Board has ordered that this work be continued, and that the elevated cars be painted as early as practicable.

The Board has called the attention of the company to the need of having clearly legible signs reading, "Smoking on Five Rear Seats Only," placed in each car in which smoking is allowed. They are now being put in and in such a manner as to allow of their being read from any part of the car.

The Brooklyn Rapid Transit Company has been for several years seriously handicapped for want of power. This has to some extent been overcome, but the Board will insist upon additional power being provided so as to meet the requirements of rapidly growing traffic of the company. The Board has examined the contracts for the erection of power house and supply equipment, and believes that the company is using every possible effort to secure an early completion of plants. Strikes and other causes have occasioned serious and expensive delay.

TABLE I.—STATISTICS OF TRAFFIC FOR ALL ELECTRIC LINES IN NEW YORK CITY

| Road | Passengers Carried (Including Transfers) | | | | | | | | Car Miles in 1903 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | February | | March | | April | | May | | February | March | April | May |
| | 1902 | 1903 | 1902 | 1903 | 1902 | 1903 | 1902 | 1903 | | | | |
| Manhattan | 17,718,831 | 19,969,943 | 20,675,616 | 23,042,060 | 20,096,043 | 22,974,934 | 20,121,544 | 22,679,788 | 4,392,348 | 5,054,556 | 5,045,191 | 5,153,600 |
| Interurban | 37,862,765 | 40,127,983 | 43,992,730 | 46,217,524 | 44,100,999 | 47,260 303 | 47,132,850 | 49,967,987 | 4,524,480 | 5,266,470 | 5,202,766 | 5,347,005 |
| Union | 1,978,122 | 2,318,415 | 2,591,485 | 2,848,833 | 3,020,080 | 3,268,335 | 4,041,385 | 4,455,755 | 506,509 | 594,193 | 586,465 | 683,661 |
| Brooklyn R. T | 20,334,575 | 22,160,457 | 24,646,752 | 26,217,555 | 24,960,564 | 27,546,652 | 27,831,626 | 30,609,884 | 3,732,158 | 4,315,915 | 4,344,677 | 4,842,290 |
| Coney Island & Brooklyn | 2,063,264 | 2,278,277 | 2,569,595 | 2,743,592 | 2,848,667 | 3,023,465 | 3,579,688 | 3,984,551 | 380,885 | 435,244 | 457,600 | 586,636 |
| New York & North Shore | 79,400 | 104,942 | 134,304 | 145,812 | 153,047 | 188,381 | 193,877 | 241,990 | 41,473 | 48,176 | 53,153 | 63,615 |
| New York & Queens County | 619 831 | 800,172 | 900,946 | 1,040,025 | 1,008,621 | 1,164,213 | 1,328,203 | 1,534,250 | 216,614 | 256,235 | 258,953 | 300,578 |
| Staten Island Midland | 100,154 | 148,328 | 156,698 | 194,526 | 170,546 | 217,824 | 254,398 | 289,289 | 64,529 | 74,282 | 74,472 | 92,718 |
| Richmond Light & R. R | 202.490 | 266,293 | 299,640 | 322,874 | 328,752 | 350,688 | 427,197 | 428,164 | 78,302 | 89,738 | 89,209 | 100,116 |
| Total | 80,959,432 | 88,174,810 | 95,967,716 | 102,752,801 | 96,687,322 | 105,990,795 | 104,910,768 | 113,495,658 | 13,937,298 | 16,134,809 | 16,112,786 | 17,170,219 |

TABLE II.—GREATEST NUMBER OF PASSENGERS CARRIED IN ONE DAY DURING FIRST FOUR MONTHS OF 1903

| Road | Date | Passengers Carried |
|---|---|---|
| Manhattan | April | 917,060 |
| Interurban | May 9 | 1,790,464 |
| Brooklyn R. T | May 30 | 1,217,369 |

TABLE III.—STATISTICS OF EMPLOYEES AND CARS IN SERVICE FIRST FOUR MONTHS OF 1903

| Road | Employees | | | | Cars in Service | | | |
|---|---|---|---|---|---|---|---|---|
| | Feb. | Mar. | Apl. | May | Feb. | Mar. | Apl. | May |
| Manhattan | 1,599 | 1,633 | 1,643 | 1,602 | 1,152 | ---- | ---- | 1,512 |
| Interurban | 5,873 | 5,861 | 5,895 | 6,188 | 1,987 | 2,017 | 2,021 | 2,021 |
| Union | ---- | ---- | ---- | ---- | 117 | 117 | 163 | 210 |
| Brooklyn R. T | 8,433 | 8,394 | 8,758 | 9,502 | 1,549 | 1,609 | 1,690 | 1,744 |
| Coney Island & Brooklyn | 506 | 506 | 554 | 628 | 144 | 147 | 154 | 178 |
| New York & North Shore | ---- | ---- | ---- | ---- | 7 | 7 | 7 | 10 |
| New York & Queens County | 227 | 252 | 269 | 276 | ---- | ---- | ---- | ---- |

## PRIVATE CAR FOR AUBURN & SYRACUSE RAILWAY

The Auburn & Syracuse Electric Railroad Company, of Syracuse, N. Y., has purchased from the G. C. Kuhlman Car Company the handsome private car which the latter company exhibited at the Detroit convention. The car, which has been

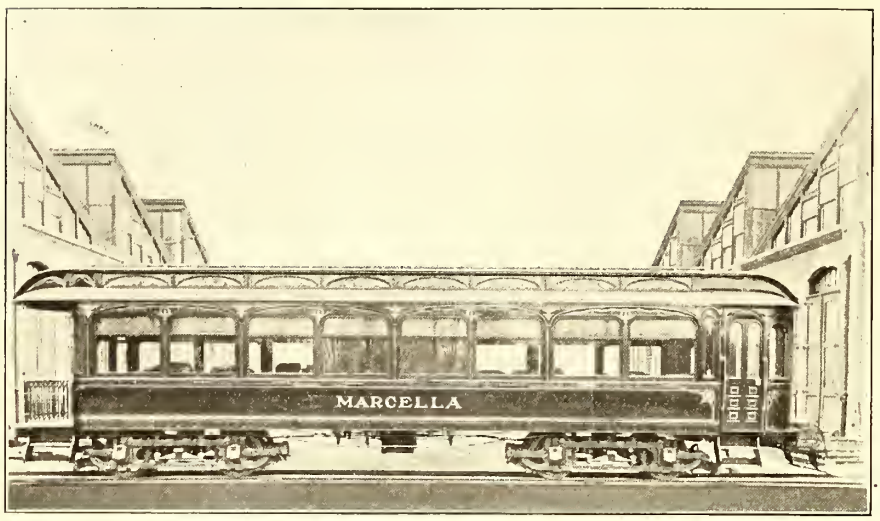



FIG. 1.—EXTERIOR OF PRIVATE CAR

named "Marcella," has been pronounced one of the finest ever built for electric traction.

Fig. 1 shows the exterior of the car. The principal dimensions are as follows: Length over all, 47 ft. 2 ins.; width over sills, 8 ft. 6 ins.; height from under sill to top of roof, 9 ft. 5 ins.; height from top of floor to head lining, 8 ft. 7 ins. The car is constructed according to the Kuhlman standard, having side sills of yellow pine, 4¾ ins. x 7¾ ins., faced with steel plates, 7 ins. x ⅝ in., and sills of white oak, 7¾ ins. sq.; intermediate cross sills are of white oak, 3¾ ins. x 7⅞ ins.; two intermediate longitudinal sills, made of 5-in. steel I-beams filled with yellow pine; cross sills of ⅝-in. tie-rods, with turn buckle on each rod, placed between intermediate sills; two needle beams of white oak, 4¾ ins. x 6 ins., each reinforced with M. C. B. under-truss. The end sills at rear end of car body are faced on outside with 7-in. x ¼-in. steel plates, bent around corners of car and bolted to main side sills. The end longitudinal intermediate sills, also corner sills, where they join under sills are all reinforced with ⅝-in. x 5-in. wrought iron angle corners, securely bolted in place under side and intermediate sills. This makes a very strong bottom. The body framing of the car and roof are along the same substantial construction.

The inside finish is of Mexican mahogany. The panelling between windows is curved, and the panelling at the corners of the car is all bent work. The ceiling is of Empire style, decorated in green tint with relief mouldings in gold. The globe fixtures and individual lamp fixtures are of carved gold-plated solid bronze. The globes and shades are of silver etched glass, Empire design. The lamps on individual fixtures are of ground glass.

As shown in Fig. 2 the front end of the car has an observation room on the left-hand side, occupying a little more than half of the vestibule, the other half being used as the motorman's cab.

The stateroom, which is illustrated in Fig. 3, is in the center of the car. It has a length of two windows, contains a bed and a complete toilet equipment, including a shower bath.

The rear platform of the car can be used as an observation platform, having a circular railing, with heavy gates on both sides, made of heavy, fancy wrought iron grill work. The base of the railing, dash cap, all hinges and locks for gates, together with hood stancheons and hood brackets, are all of heavy polished bronze. All glass is French plate, tastefully embossed. The window sash is equipped with Edwards' sash balance. The car is covered with green velvet carpet, and has movable cane chairs with leather and plush seats. It is equipped with the mahogany writing desk shown in Fig. 2, and a mahogany buffet with leaded glass windows, partitions below for ice-box, and a place for storing the good things so essential on private cars. This buffet is shown in Fig. 4.

On the whole, this car is a veritable palace on wheels, and the Syracuse Company is to be congratulated for having so fine a speciment of rolling stock.

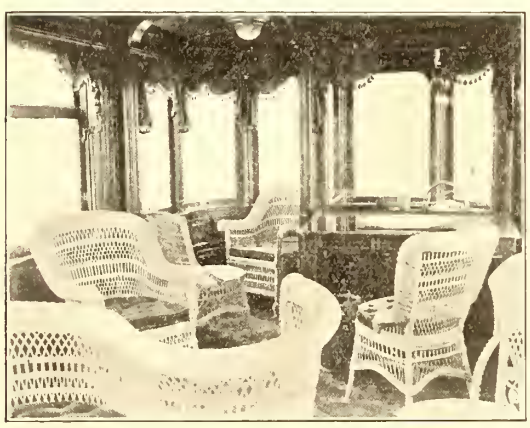


FIG. 2.—OBSERVATION ROOM AND MOTORMAN'S CAB

FIG. 3.—STATEROOM

FIG. 4.—BUFFET AND REAR SECTION

## THREE-WIRE TREBLE-GUARD BLOCK SIGNAL SYSTEM

Many electric interurban railways have in the past been deterred from installing block signal systems owing to the great expense usually involved. To overcome this difficulty W. D. Marks, of New York, has devised an electric block signal system which he believes to be both cheap and efficient.

This system consists of three wires stretched alongside the track, the lengths of which are determined by the length of the blocks established. Semaphores are connected in parallel to one side of this three-wire system together with white lights, which indicate safety when the current is on that side. To the other side are connected bells and red lights in series or parallel, which indicate danger when the current is on that side.

The polarity of the three wires is determined by means of a commutator box having two polarities, which are reversed each time the commutator is moved one step by the mechanical or electrical action of a car passing over the commutator box,

or making contact with a third rail or wire to the box for the length of the block, thus causing the current to flow first on one side and then on the other side of the three-wire system, operating in this manner the sounding and visible devices connected to them. In the cheapest form a key commutator box is moved by means of a key carried by the conductor, who stops the car for this purpose.

To understand the mode of operation it is assumed that a vacant track is equipped with two-pole commutator boxes connected to the three-wire system, which in turn has semaphores, lights and bells attached to its two sides. On turning the current on at the station it will be necessary to adjust the commutators so that the semaphore side of the three-wire system has current flowing from wire to wire. The semaphores will then show safety by being pendant and the white lights will burn. The bells and red lights on the other side will also corroboratively indicate safety by the bells remaining silent and the lamps unlit, since no current is flowing on that side. Thus, one set of signals will verify the indications of the other set. When a third rail or wire is used it is obvious that it is no longer a "track instrument" system, being similar in its action to systems used on steam roads.

If the current is cut off at the station the horizontal position of the semaphores will indicate danger, the bells will remain silent and both red and white lights will be out. These contrary signals show that either no current is flowing through the system or that it has broken down through some external cause.

Putting the current on at the station again, assume a car to pass over the first commutator box. Its action will be such as to reverse the polarity of the two wires leading forward and

FIG. 2.—INTERIOR OF CAR, SHOWING ARRANGEMENT OF SEATS

passing out of the box. The wire assumed positive becomes negative, and the wire assumed negative becomes positive, but the middle wire remains negative since it branches back from the negative side of box No. 2, one block ahead. The result is that the semaphores which have been at safety (pendant) go to danger (horizontal) at box No. 1 and the near side of box No. 2, the white lights are extinguished, the red lights light up and the bells in the bell box and at all road crossings begin to ring. When the car reaches commutator box No. 2 it reverses the polarity of its commutator and sets the danger signals ahead as before, reversing simultaneously the polarity of the middle wire, which extends backward one block, and showing safety in the block behind which it has just left.

This simple and cheap arrangement is obviously for single-track railways. For double track guarding the rear, only a single long wire is required for each track. The Marks system lends itself to an absolute block system, cutting off current or throwing switches or brake trips. This system is also adapted for passing any number of cars on switches.


FIG. 1.—COMBINATION OPEN AND CLOSED CAR FOR SEATTLE

## COMBINATION TYPE CAR FOR SEATTLE & RENTON RAILWAY

The combination open and closed car shown in Fig. 1 is a type lately built by the American Car Company, of St. Louis, for the Seattle & Renton Railway Company. Renton is about 12 miles south of Seattle, and at the lower end of Lake Washington, which is connected with Admiralty Inlet. The line runs over the peninsula—between the lake and inlet—through a fine and populous country, and as the winters are mild this form of car is suitable for service during the entire year. "Eureka" maximum traction trucks are used, as the grades are heavy in places, and the towns along the route too frequent to make high-speed service desirable. The trucks carry the car body low, and thus facilitate ingress and egress. This form of car has extra firmness imparted to the upper structure on account of body ends being set well in. The platforms, it will be seen, are not dropped, and therefore the sills and stringers extend from crown piece to crown piece. The side sills are 4¾ ins. x 7 ins., and plated with ½-in. x 7-in. steel. The sash in the vestibules, the ends and the sides are arranged to drop into pockets. The open portions are protected by curtains, which may be drawn to the floor. Guard rails are permanently fastened between the corner posts of the car and the side posts, and folding gates hinged against the vestibule posts. Double sliding doors are provided in the ends. The interiors are finished in cherry, natural color, and the open parts in ash. The ceilings are birch, handsomely decorated. As shown in Fig. 2, in the closed compartment, the spring cane seats are placed longitudinally, while reversible back ash slat seats are used in the open parts.

The length of car over end panels is 16 ft. 8 ins.; length over vestibules, 32 ft. 2¾ ins.; from end panels over vestibules, 7 ft. 9⅜ ins.; width over sills, 7 ft. 5½ ins.; width over posts at belt, 8 ft. 2 ins.; sweep of posts, 6⅛ ins. of closed compartment and 5¾ ins. of open; from center to center of posts, 3 ft. 3 ins.; thickness of corner posts, 3⅝ ins.; of side posts of open part, 2¾ ins.; of closed, 2¼ ins. The "Eureka" maximum traction trucks have 4-ft. wheel base, 33-in. drivers and 20-in. pony wheels, and are equipped with 35-hp motors.

## FINANCIAL INTELLIGENCE

Wall Street, July 15, 1903.

### The Money Market

Higher rates for time loans are the principal development in the money market of the week. There seems to be still a good deal of confusion over the exact position of the market for the longer maturities. This is due to the fact that lower rates are quoted regular bank customers for small borrowings than to some of the larger corporations which are applying for heavy accommodations. It is operations of the latter sort which constitute the principal source of demand at the present time. Several railroad companies which are in need of funds for improvements and other purposes, and which are afraid, owing to the disturbed condition in the investment market, to attempt to float any new securities, have had recourse to the expedient of borrowing what they need from the banks. The remarkable part of these transactions is the exceedingly stiff rates exerted from the borrowing companies. The Burlington Railroad has just announced a loan of $5,000,000, secured for six months, on which it has to pay an interest and commission amounting to 6 per cent. There are rumors of negotiations by the New York Central for a much larger amount on the same terms, and it is also not improbable that a similar method of financing will be resorted to by the Atchison. All this means a new complication of serious import for the monetary future. The Pennsylvania Railroad will pay off its $40,000,000 probably during the next few weeks. This had been counted upon to strengthen considerably local bank resources. But if, as now appears, the capital thus returned to the market is to be taken out again right away by other corporations, the outlook is by no means as promising as it seemed to be a short while ago. The extremely heavy liquidation still in progress in the Stock Exchange is bound to help the situation materially. Yet, even thus considering, the low state of bank reserves will not be sufficient. Our market must, evidently, draw heavily upon Europe to meet the needs of the coming autumn, and upon our ability to do this easily depends very largely the future movement of the money market. If the crop output is as abundant as is now indicated it will signify that we shall be able to draw freely from abroad without having to bid excessive premiums for money. Much depends, therefore, upon the crops coming out as well as is now anticipated. As for the immediate position of the banks, the principal source of drain during the past two months, which has been the gold exports, is now removed. Sterling exchange has fallen another three-quarters of a cent in the pound, and is now well below the level at which gold could be exported at a profit. Currency is still moving inward from the interior, and new gold is arriving from Alaska. The chances are, accordingly, that within the five weeks or so which remain before the harvest demands set in, the banks will be able to add a substantial sum to their reserves. Time money is quoted at 4 per cent for sixty to ninety days, and 5½ to 6 per cent for six months. Call money ranges between 3½ and 4 per cent.

### The Stock Market

The stock market continues its downward rush, and there is seemingly as much uncertainty as at any time as to when bottom is likely to be reached. Nearly the entire active lists has fallen below the previous low prices established early in June, and, as a whole, may be said to be at the very lowest of the year. In fact, some of the standard issues are below where they were selling three years ago, before the great boom in Wall Stret values began. No one any longer attempts to reason out any connection between market quotations and general financial and business conditions. The two movements are more clearly distinct from each other than at any stage of the decline. Measured by ordinary investment standards, stocks are selling far below their real merits, but investment capital is timid, because of the absence of initiative from powerful financial interests, and because of the fear that even though prices are below real values they may go still lower. Consequently, what Wall Street calls the buying power is exceptionally weak, and the aggresive and daring bear partly has things all its own way. Of course there will be an end sooner or later, and a more or less violent recovery will be due in order to restore equalization, but no one care to say just how far off this limit really is. The principal factor making for the decline is the situation already described in the money market. If corporations of high rank are unable to borrow for less than 6 per cent it is only natural that investors in securities should look for approximately a similar return in their money. Selling of the high grade investment stocks during the last few days, such as Lackawanna, Consolidated Gas, Northwestern and Pullman Palace Car, has reflected this view more clearly than anything else. The higher priced securities, indeed, have suffered more severely than the low-grade stocks all through the market. The culmination will not come until the investment process, now at work so slowly, absorbs the floating market supply. Many good judges feel that this end is near at hand, but few have the courage to make this a prediction.

### Philadelphia

The investment group of traction stocks have held very firmly during the week; the speculative group have declined. In the first category comes Union Traction, which has sold throughout at the one figure, 45, and Philadelphia Traction, which has remained without changing at 96. Among the speculative favorites Philadelphia Company common shares dropped 2 points under rather heavy liquidation, from 42⅜ to 40⅜; the preferred lost a point, from 47 to 46; American Railways dropped from 45½ to 45, and Rapid Transit sold off to 16 (equal to 11 with the recent $5 assessment deducted from the market price). Other minor transactions for the week include Pittsburg Traction preferred at 51 to 50, Railways General at 3½, and Consolidated Traction of New Jersey at 67¼ to 67. The trading, except in Philadelphia Company securities, has been too light to be significant. In the case of Philadelphia Company the selling represents liquidation by speculators who have been more or less confirmed by the fall in the general market.

### Chicago

Some new low prices for the season have been established among the Chicago traction stocks during the week. City Railway broke 10 points to 185, and West Chicago lost 1½ points to 60. Both of these are low records. Union Traction common, on the other hand, was comparatively steady. It fell at one time to 4 but rallied to 4½. South Side Elevated sold at 99, and later at 99¾. Lake Street at 5⅜ to 5½, Metropolitan common from 24½ to 22, and the preferred at 67. What is considered reliable authority says that the final details of the South Side Elevated increase in capital stock are being pushed vigorously. The fact that it is growing late in the season and that the delivery of material is becoming more difficult is said to be forcing the company to immediate action.

General Manager Roach, of the Union Traction Company, has submitted plans for improving the service to Judge Grosscup which it is believed will involve the expenditure of at least $1,000,000. It is not known just what the plans are, but it is the general opinion that cars from the outlying districts will be brought nearer the heart of the city by electricity instead of by cable, in case the court approves of the plan, and will allow the company to borrow the money for that purpose. In a long communication to the receivers of the Union Traction Company on Friday last Judge Grosscup practically upheld the validity of the ninety-nine-year act claimed by the traction lines of this city.

### Other Traction Securities

The Boston specialties, in common with the general market tendency, have sold down to almost their low points of the year. Elevated shares fell 3 points, from 144 to 141; Massachusetts Electric common dropped from 26½ to 25, the preferred from 83⅞ to 82½, West End common from 90½ to 89⅞, and the preferred from 110 to 109½. There was no news of a special nature to account for any of these declines. United Railway of Baltimore income bonds lost a point, from 64⅜ to 63⅜—the latter figure being close to the year's low record. The stock of the company fluctuated between 11 and 11½, and the 4 per cent mortgage bonds, after rising to 93⅝, fell to 92⅞. Other Baltimore sales for the week include City and Suburban 5s at 112, Knoxville Traction 5s at 100, and Petersburg Class B 5s at 124. On the New York curb the traction specialties, as a rule, have been rather neglected during the week. St. Louis Transit (about 1500 shares) changed hands between 23¼ and 23⅝, and other sales comprised American Light and Traction common at 70, the preferred at 96¾ to 95¾, New

Orleans 4½s at 85⅛ to 84⅞, Brooklyn City Railroad at 236, Brooklyn Rapid Transit 4s at 80¾ to 80, and Interborough Rapid Transit at 103 and 102½. Twin City Rapid Transit shares on the New York Stock Exchange sold up at one time during the week as high as 101, or 14 points above their recent low record. Subsequently they yielded sharply in sympathy with the general market. North American stock yesterday broke to 81½ on the forced liquidation of a small holding, but recovered almost immediately to 85.

### Security Quotations

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

| | Closing Bid | |
|---|---|---|
| | July 7 | July 14 |
| American Railways | 44½ | 45 |
| Aurora, Elgin & Chicago | 17 | a17½ |
| Boston Elevated | 143 | 140 |
| Brooklyn Rapid Transit | 57⅝ | 52⅜ |
| Chicago City | 190 | 185 |
| Chicago Union Traction (common) | 4 | 4 |
| Chicago Union Traction (preferred) | 30 | 30 |
| Cleveland Electric | 73¼ | 74 |
| Columbus (common) | 105½ | 104 |
| Columbus (preferred) | 102 | 102 |
| Consolidated Traction of New Jersey | 66½ | 66 |
| Consolidated Traction of New Jersey 5s | 105 | 105 |
| Detroit United | 73½ | 65 |
| Electric People's Traction (Philadelphia) 4s | 99 | .. |
| Elgin, Aurora & Southern | a48 | a48 |
| Lake Shore Electric | a13½ | a14 |
| Lake Street Elevated | 5¼ | 5½ |
| Manhattan Railway | 136¾ | 132 |
| Massachusetts Electric Cos. (common) | 26 | 24½ |
| Massachusetts Electric Cos. (preferred) | 83 | 82 |
| Metropolitan Elevated, Chicago (common) | 24 | 20 |
| Metropolitan Elevated, Chicago (preferred) | 67 | 66 |
| Metropolitan Street | 122½ | 118¾ |
| New Orleans (common) | — | 12 |
| New Orleans Railways (preferred) | 43 | 42 |
| North American | 85½ | 85 |
| Northern Ohio Traction & Light | 21 | 21 |
| Northwestern Elevated, Chicago (common) | 21 | 21 |
| Philadelphia Rapid Transit | †16½ | 15 |
| Philadelphia Traction | 96 | 96 |
| St. Louis Transit (common) | 23 | 20½ |
| South Side Elevated (Chicago) | 97 | 99 |
| Syracuse Rapid Transit | 24 | 25 |
| Syracuse Transit (preferred) | 76 | 73 |
| Third Avenue | 115 | 112 |
| Toledo Railway & Light | 25½ | 20 |
| Twin City, Minneapolis (common) | 98½ | 96⅜ |
| Union Traction (Philadelphia) | 44¾ | 44¾ |
| United Railways, St. Louis (preferred) | 72 | 71 |

a Asked. * Ex-dividend. † $10 Paid.

### Iron and Steel

Further reductions in both iron and steel prices have been announced during the past week. Cuts of 50 cents to $1 a ton went into effect last Thursday on the standard grades of foundry iron, while Bessemer pig iron and steel are each off $1 a ton. Consumption in the lower branches of the industry has at length failed to meet the pace set by producers. In most lines of steel and steel manufactures the situation still is very strong. But it is an open question at the moment whether the enormous demand for the higher products, such as rails and structural material will eventually serve to harden the rest of the iron market, or whether the weakness in pig iron will be the dominating factor. Quotations are as follows: Bessemer pig, $18.85; Bessemer steel, $28; steel rails, $28.

### Metals

Quotations of the leading metals are as follows: Copper, 14 cents; tin, 27¼ cents; lead, 4⅛ cents; spelter, 5¾ cents.

## THE RICHMOND CAR STRIKE

The cars of the Richmond Passenger & Power Company are now running as usual, and carrying many passengers. While there are still some disturbances from time to time, they are decreasing in frequency and violence. Several hundred troops have been withdrawn, but the remainder will be kept until the authorities feel sure that the rioters have been effectually quelled.

## CHICAGO UNION TRACTION MATTERS

Judge Grosscup has issued some orders and recommendations to the receivers of the Chicago Union Traction Company which will have an important bearing on the policy of the receivers as regards extensions and as regards franchise renewals. He has granted permission to the receivers to issue certificates in place of the floating indebtedness to the amount of $4,108,000, and he has further ordered improvements made to the amount of $580,000. This will be expended on increase in equipment, and the placing of trolley wires over some of the outlying cable lines to relieve congestion, and so permit more cars to be operated around the down town cable loops. Of the $580,000, about $480,000 is for purchase of new equipment, and $100,000 for equipping the cable lines with electricity.

POLICY TOWARD THE NINETY-NINE YEAR ACT.

Since the arguments presented before Judge Grosscup, June 18, he has had under consideration the probable rights of the companies under the ninety-nine-year act. The results of his consideration of the matter are embodied in the form of instructions and recommendations to the receivers issued July 10. While the conclusions reached by Judge Grosscup are not the final settlement of the controversy, nevertheless the opinion carries great weight, and will govern the policy of the receivers as well restrict the action of the city government. Judge Grosscup's recommendations are as follows:

"It is not my purpose now to announce any final judgment upon the questions raised and discussed. The absence of full discussion on the part of those who are said to believe the ninety-nine-year act to be invalid and inapplicable, makes final judgment at this time inopportune. Nor shall I take any step toward requiring the city to intervene to test the validity and scope of the act. I have not given up the belief that the railway companies and the city will ultimately, in spirit of fair play, get together upon a basis just alike to both, and without the delay of protracted litigation.

"My purpose, therefore, in this communication, after a preliminary statement of the general legal situation, is to give you such instructions in the matter of continuance of your possession of the street railway properties when the 30th of July arrives, and of immediate expenditure of money for the improvement of the system, as will, in my judgment, adequately conserve the property rights of the companies, while requiring them to fulfill their obligations to the public.

"Chicago's initial street car ordinance was passed by the City Council Aug. 16, 1858. The city then had a population of about 95,000, and the purpose of the ordinance was to install a street car service by granting to certain persons therein named, and to others to be associated with them, authority to lay tracks in certain streets, and to operate their railway system in the manner and upon conditions therein named. A period of twenty-five years was fixed for the life of the ordinance.

"But it turned out that at that time there was no State law authorizing municipalities to make such grants. Thereupon, Feb. 15, 1859, the State Legislature, instead of passing a general law conferring authority upon municipalities, proceeded to deal concretely with the Chicago street railway problem by incorporating the Chicago City Railway Company and the North Chicago Railway Company, with authority to maintain and operate their railways—with all necessary and convenient tracks, side tracks and appendages—in and over such streets as the City Council had already set apart or should thereafter set apart for such purpose, leaving it to the City Council and the companies to fix, by contract, the manner, terms, and conditions of such occupancy.

"The grant embodied in this act was for a period of twenty-five years. Supplementary to this, the Legislature, Feb. 21, 1861, created the Chicago West Division Railway Company, conferring upon it like powers and upon like conditions; the duration of the grant being also for twenty-five years.

"Feb. 6, 1865, the so-called ninety-nine-year act was passed. Its manifest purpose was to extend the period of the grants previously mentioned from twenty-five years to ninety-nine years. In express terms it provided that 'all contracts, stipulations, licenses, and undertakings entered into between the Common Council and any one of said corporations respecting the location, use, or exclusion of railways in or upon the streets or any of them, should be continued in force during the life of such act.' Other langauge of similar significance is used.

"It may be a matter of legitimate difference of opinion whether the Legislature meant to confine the legislative grant thus given to the streets named in the act, or meant to include, as well, the streets that must prospectively, in the natural evolution of a street railway system, come into additional use. However that may be, the legislative grant, when rightly interpreted, controls; any ordinance of the city to the contrary notwithstanding; for, under the constitution of 1848 the State, in the matter of control of streets, was the original depository of power, the municipalities having no power except such as was conferred by the State, and exercising that only as the arm of the State.

"Two questions then are presented: Are the granting acts of the Legislature constitutional; and, does their grant of rights to the occupancy of the streets reach not only those actually named in the acts and put into use at the time, but those also that prospectively were seen to be needful to the natural evolution of a street railway system?

"The constitutional points—so far as I have been able to dig any out—do not merit space for statement, much less for discussion. Upon that phase of the matter my judgment is at rest. But what is to be regarded as the legitimate scope of the legislative grants—what streets now used must be held to be in use under the grants thus obtained—is a matter of greater difficulty.

"The legislative grants, whatever their origin, are the existing law of the land. They constitute the contract between the people of the State and the railway companies. They have been the accepted basis for tens of thousands of transactions by people who never heard of the Legislature of 1865. To set them aside now, either covertly or openly, or to deprive them of their full meaning and effect, would be a judicial invasion of contract and a breach of public faith as reprehensible as the repudiation of some undoubted but unpopular public debt. There is no way left, then, to approach the interpretation of these grants other than as one would approach any plainly written contract between disputing parties.

"The legislative grants, taken together, look to the installation of a railway system in the city of Chicago, and, to that end, grant to the railway companies, for the period of ninety-nine years, the right to occupy certain streets, leaving to the city, by contract with the companies, the manner and conditions of such occupancy. Thus, when the companies entered into occupation under these grants, the underlying right of their occupancy was from the State, the manner of its exercise only being governed by the ordinances of the city. The State was the grantor, the city the supervisor. Now, while the power of the city over the exercise of the grant thus obtained from the State was made ample, it remained, and remains, a subservient power. Its function is to promote the uses of the grant; it cannot be made a means to defeat the grant; for the rights of both the city and the companies, under these legislative grants, are substantial rights, and the courts are bound to see that the substance of both is preserved. So much for the streets actually named in the legislative grants and entered upon by the companies at that time. This brings me to the streets subsequently occupied by the companies.

"There is much in the view that the Legislature had in mind in enacting the grants a street railway system, adequate not only to the then present but to the future needs of the city; that the natural growth of the city was foreseen, and a corresponding expansion of railway facilities forestalled; that the grants were meant to cover the branches and twigs as well as the trunks of a growing system.

"In this view the legislative grants were, when passed, already executed and vested as to the streets named in the grants, and though in fieri, as to streets not named, naturally falling in course of the city's growth under the system are none the less effective as vested grants when the new streets are occupied. In this view, too, the ordinances of the city, subsequent to the legislative grants, are to be held to be not independent city grants, but ordinances in execution of the legislative grants, and as such have the effect not of giving right of occupancy, but of prescribing the manner of such occupancy.

"However, I do not mean now to commit my judgment to this view of the legislative grants. I think it forceful enough to guide my action as conservator of this property always upon the understanding that it is open for further discussion on any joining of issues that will finally settle this controversy.

"I will go further. It is within the power of the court to compel the companies to accept any reasonable arrangement that does not involve confiscation of property rights. I am ready, in the interest of a just settlement of these street railway difficulties, to exercise that power.

"There has grown up in the public mind a good deal of confusion respecting the purpose of a waiver by the companies of the ninety-nine-year act and the character such waiver should take. Undoubtedly many think that the surrender of these legislative grants should be without condition and without compensation. On the other hand, there has grown up in the minds of some parties interested in the railway companies the belief that no concessions whatever can be made without the consent of every bondholder as well as the consent of the companies.

"Both of these views are, in my judgment, too rigid and too far reaching. The city can have no real interest in seizing, either by brute force or by superior advantage, that which lawfully belong to the companies, at least until the owner is fully compensated. I am sure the Mayor and a majority of the Aldermen entertain no such project.

"On the other hand, the bondholders, though interested in the legislative grants, are so interested to the extent only that such grants are part security for their debt. Any equivalent security—any arrangement, for instance, whereby the cash value of the unexpired term of the grants should be substituted for the grants themselves, as pledge to the debt—would meet the just claims of the bondholders. This leaves us, then, free to look about for such adjustment as will give to the city all it may fairly ask, without confiscation of property or invasion of vested rights. Fortunately, as I view it, such an adjustment is at hand.

"The feature of the so-called waiver of the ninety-nine-year act that really interests the city lies in the fact that the continuance of title to the companies under the legislative grants may interfere with the city's projects looking to municipal ownership and independently of municipal ownership, to the maintainance of a supervisory and warning hand over the character of service to be given.

"Indeed, so long as the companies have title under the legislation grants, municipal ownership may be impossible. Title to the streets having come from legislative grants and for street railway purposes, it is at least doubtful if the city could constitutionally obtain, even by act of the Legislature, the right to occupy by eminent domain the streets thus covered. Hitherto, eminent domain has been used, not to change the personnel of ownership, but the character of use. It is doubtful, also, if the so-called Mueller law even purports to convey such power. In this state of affairs, unless there be a surrender by the company of its title under the legislative grants, the city might find itself, even when actually ready for municipal ownership, at a complete standstill.

"But aside from municipal ownership, a surrender of title under the legislative grants is desirable to give the city the warning hand. Should the companies enter upon a new period, knowing that the city could not terminate the grant even at the end of twenty years, there might be temptation to disregard such claim for good services as the city has a right to demand.

"But all this can be accomplished by a full surrender, by the companies, of title under the legislative grants, accompanied with a stipulation either to assess presently the value of the unexpired term, or to make such assessment at the end of the new grant. If the grant is not to be renewed no legal difficulty need entangle such an arrangement.

"The right of the companies to occupy and their right to be compensated for a quit claim of such occupancy are distinct legal rights. The former can be surrendered in consideration, or part consideration, of the latter. When so separated, the right of payment becomes a claim against the city, secured possibly by a lien on the title surrendered, but is no longer tied up with the title surrendered. The title, except for purposes of lien, would become extinct; and there would be no payment adjudged until after judicial determination of the validity and scope of the legislative grants. For my own part, I cannot see why this is not a simple and effective way out of present complications.

LET PROSPERITY PAY THE OBLIGATION.

"Conscious of what this generation is doing for the reclamation of the streets of this city from the prairie and the marsh—trying heroically to make of it a finished and compact city—I can see no business or moral objection to leaving it to the next generation to discharge whatever money obligations these legislative grants may impose upon the city. The obligation is theirs as much as ours; we stand in need now, much more than will they, of money to put into actual improvement of street facilities, and the chances are many to few that the obligation will never mature; for, confronted with certain loss of the use of the streets unless good service is given it is almost certain that the companies will fulfill their obligations to the public and thus earn a renewal of the leases."

The court delivered to the receivers the following orders:

1. To suffer no interferenec with your possession of any of the streets named in the legislative grants, or occupied by the companies named in the legislative grants, or their successors, under ordinances of the city, which, in the view I have outlined, are to be treated as subservient to the legislative grants. Any attempted interference you will report immediately to me.

2. To pledge to the city, if the city wishes negotiation, the co-operation of the court to bring about a settlement on the lines indicated, or such other lines as will observe existing contract rights.

3. Since the receivership began eighty-five cars have been added to the regular service. These were old cars taken from the barns, quickly repaired and repainted, and though in some instances incongrous at this season, have added something to the comfort of the public. The report of the general manager, submitted to me July 8, 1903, shows that upon an expenditure of about $480,000, 100 new double-truck electric motor cars, each capable of seating comfortably more than fifty people, can be added. The general manager also reports that for something less than $100,000 he can equip electrically certain portions of the cable lines, so that cars on outlying lines may be brought electrically much nearer the business center, and, transferred as trailers to cable trains, bring their occupants into the business district without change of cars. This would add to the convenience of the public, and to the capacity of the companies' carrying facilities.

I instruct you to procure the equipment indicated.

## TO CONNECT THE TUNNEL WITH ELEVATED RAILROAD IN NEW YORK

The plans to connect the rapid transit subway with the Manhattan Elevated system at 149th Street, New York, so that through express trains can be run from West Farms to the City Hall over the Second Avenue line, have been indorsed by the subway committee of the Rapid Transit Commission, which has ordered a favorable report on the entire matter to be made this week at the meeting of the commission. It also has been decided to favor the proposition to extend the rapid transit subway down Broadway from Forty-second Street to Union Square and thus connect the system by a short cut at that point.

The rapid transit subway comes to the surface just north of 149th Street, near Westchester Avenue, and from that point on runs as an elevated line. It is projected to connect this elevated line at once with the Manhattan Elevated so that through express trains from the Bronx to City Hall can be run by late in the fall and take care of all the through travel to City Hall. Either the Third or the Second Avenue lines could be used, but it is desired to use the Second Avenue line, and thus keep all through traffic off of the Third Avenue elevated. This scheme includes the proposition to widen the Second Avenue line by 6 ft. from Chatham Square to 129th Street, so that three tracks can be used, and to build a double-decked station at Chatham Square so that neither the Second nor the Third Avenue line will interfere one with the other. Real estate experts are already working on the probable cost of the enterprise in the matter of damage to property, and if this is not deemed to be too great the Second Avenue project will be taken up in all its features. Otherwise it will go to the Third Avenue, which already is a three-tracked affair. The double-decker arrangement is a part of the terminal plans submitted to the Board of Estimate and Apportionment over a week ago by Bridge Commissioner Lindenthal.

In addition to this project the sub-committee has considered the proposed plans for a cut-off from Forty-second Street down Broadway to Union Square for a subway extension. At the meeting of the commission this week it will be reported favorably on the findings of Controller Grout and of William Barclay Parsons, the chief engineer of the Rapid Transit Commission. For the time being at least it has been decided to abandon the extension of the subway down Broadway from Forty-second Street to the Battery, and Union Square alone now will be the objective point, thus cutting off the elbow at Forty-second Street and Fourth Avenue.

If the commission favors the plan proposed by the sub-committee it will include the construction of the short-cut with a station at Thirty-fourth Street, from which shuttle trains will be run to the Pennsylvania Railroad station. This is an acceptance of the Interborough Company's offer in separate terms from those presented at the time of the entering of bids for the Brooklyn tunnel. At that time the offer of the Interborough interests was to build the Brooklyn tunnel for $2,000,000 as a flat proposition or for $3,000,000 if the cut-off at Forty-second Street to Union Square be given for $100,000. The former bid was accepted for the Brooklyn tunnel, and now plans and specifications will be prepared for the Forty-second Street cut-off. It is said by William Barclay Parsons that it will be nearly a year before bids can be advertised for on this work, but the scheme has been taken up with favor in its initial stages, and will be reported to the board this week.

## THE BRIDGEPORT STRIKE DECLARED OFF

The strike of the employees of the Connecticut Railway & Lighting Company, which has been in progress in Bridgeport and the surrounding suburban towns for two months, petered out July 11, when, after a fight among themselves, the strikers divided and a large majority of them returned to work as individuals. The meeting was productive of heated discussions. Personalities were indulged in, and one faction says that the ballot-box was stuffed. The fight, so report says, was occasioned over the vote on a motion that the strikers should return to work as individuals if the Connecticut Railway & Lighting Company would promise to take back all of the old men. According to the best information obtainable 75 per cent of the strikers voted for calling the strike off. The president of the union held that the action was unconstitutional, in that a majority vote of all members in good standing was necessary to declare the strike off. A large number refused to abide by his decision, saying that the majority vote of those present should be decisive. The public is patronizing the cars, and the company has won a complete victory over the strikers.

The strike went into effect on May 15, because of the refusal of the company to grant the demands of the men for a flat scale of $2.25 for a day of ten hours, a rearrangement of schedules, and recognition of the union. To these demands the company offered a counter-proposition embodying a slight increase in wages and a new schedule, but this was not satisfactory to the men.

## AN IMPORTANT DECISION IN CALIFORNIA

The street railway companies of California have won a victory in the Supreme Court, for it has been decided in a test case that companies, when operating in two or more counties, must be assessed by the State Board of Equalization and not by the local authorities.

The decision that has been handed down is the result of an attempt by the tax collector of San Francisco to secure the taxes on the property of the San Francisco & San Mateo Street Railway Company. The company refused to settle and instituted a civil suit to compel the tax collector to desist. The case was in the Superior Court for a long time, but was finally decided in favor of the municipal official. An appeal was then taken to the Supreme Court in order that the legal rights of the contestants might be finally determined.

The one question involved was whether under the State constitution the franchises, rails, machinery and rolling stock of street railroads operated in two or more counties should be assessed by the State Board of Equalization or by the the local officials. On all other points of the dispute the contestants waived argument and submitted the case on the understanding that this one question of jurisdiction be decided.

The attorneys for the corporation cited section 10 article XIII. of the constitution as authority for their stand in the matter. This provision declares that all railroads operating in more than one county of California shall be assessed by the State Board of Equalization. It is decreed that the counties shall receive taxes in proportion to the number of miles of track in their respective territories. The purpose of the provision was to make the work of assessment simpler and more accurate in the case of the big steam railroads. It all happened before the long-distance electric railways were constructed or even contemplated.

The case merely resolved itself into the question of what the term "railroads" means in the constitutional provision cited. To decide the question the record of the debates in the Legislature over the passage of the measure were called for and considered. It was shown that the kind of railroads at which the legislation was aimed was not specified, and hence the term is deemed general in its application by the Supreme Court. It is held that the motive power makes no difference in any case. Even if the electric railways were unknown, that does not alter the effect of the law. Accordingly the judgment of the trial court is reversed and a new hearing is ordered.

## PAWTUCKET STREET RAILWAY

The Rhode Island Company, which controls the street railway, electric light and power systems of Providence, Pawtucket, Central Falls and vicinity, has announced that it will expend $1,004,070 in the reconstruction of the street railway system at Pawtucket. This sum includes the cost of laying about thirty-two miles of standard gage tracks and installment of new rolling stock. Over the questions of compensation for grants and franchise requirements, the city has for years so persistently refused to treat the company with anything like fairness that to-day it suffers from an antiquated car service of five or six bench cars, operated over narrow gage tracks. Recently the differences were adjusted, however.

## STREET RAILWAY PATENTS.

UNITED STATES PATENTS ISSUED JULY 7, 1903

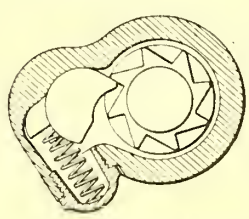
[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

732,882. Bogie or Truck for Tramway Cars, Railway Carriages, or the Like; Andrew S. Nelson, Albert Stewart and Thomas J. Foster, Motherwell, Scotland. App. filed Dec. 13, 1902. Relates to means for adjusting the brake to take up wear and for distribution of pressure upon the wheels.

732,914. Brake for Electric or Other Tram Cars or Vehicles; Giles Atherton, Stockport, England. A track brake whose shoe consists of a composition of rubber; also means for adjusting the shoe so as to take up wear.

732,967. Trolley Pole; Ernest Schlicker, Pittsburg, Pa. App. filed Feb. 21, 1903. Details.

733,015. Trolley; Arthur S. Deem, Reading, Pa. App. filed July 9, 1901. A trolley comprising duplicate contact wheels mounted in a frame pivoted in the trolley harp and carrying a pair of fingers capable of being thrown over the wire to retain the trolley in place.



PATENT NO. 733,185

733,048. Fender for Cars; William Johnston, Millersburg, Ohio. App. filed Aug. 30, 1902. A tilting netting frame mounted on a supporting frame, pivotally connected to a car truck independent of the car body, said tilting frame adapted to elevate a person falling thereon above the track.

733,185. Brake Handle; James Grady, New York, N. Y. App. filed Feb. 19, 1903. The upper end of the brake shaft is provided with ratchet teeth, and the base of the handle, which is made hollow, fits thereon, surrounding the teeth.

733,252. Motor Control System; William O. Mundy, Schenectady, N. Y. App. filed Jan. 2, 1902. The arrangements are such, in a multiple unit system, that the operation of the circuit controlling switches in all operations of the master controller will depend upon the proper operation of the reversing switch.

733,271. Electric Brake; William B. Potter, Schenectady, N. Y. App. filed Jan. 30, 1901. Current from an auxiliary source can be thrown into the braking circuit of the motors to hold the brakes after the motor has ceased to rotate.

## PERSONAL MENTION

MR. SETH BARHAM has resigned as superintendent and purchasing agent of the Kickapoo Transit Company, of Springfield, Mo., to engage in the lumber business in Kansas City. Mr. Barham will be succeeded by Mr. Jeremiah Fenton, late postmaster of Springfield.

MR. GEORGE A. SAWYER, who has been general freight and passenger agent of the Cincinnati, Georgetown & Portsmouth Railroad, of Cincinnati, O., has been appointed general manager of freight and express traffic of the Union Traction Company, of Indiana.

MR. CHARLES HATHAWAY, of Cleveland, O., the oldest street railway builder in the United States, is dead of pneumonia. He was the father-in-law of Mr. F. DeHaas Robinson, the baseball magnate, and former treasurer of the Cleveland Electric Railway. Mr. Hathaway was eighty-four years of age.

MR. LOUIS McFERRAN has been appointed assistant manager and auditor of the Fort Wayne & Southwestern Traction Company, of Fort Wayne, Ind., to succeed Mr. B. R. Stephens. Mr. McFerran was formerly in the Erie offices at Huntington, and he has had much experience in clerical work.

MR. CHARLES S. THRASHER, formerly auditor of the Cincinnati, Hamilton & Dayton Traction Company, of Hamilton, Ohio, and more recently auditor of the Western Ohio Railway at Lima, has been appointed general manager of the New York & Long Island Traction Company, of Mineola, N. Y.

MR. R. H. MYERS, who for seven months past has been connected with the Sandusky & Southwestern Electric Railroad, of Sandusky, Ohio, has been promoted to the position of general superintendent of the company, to succeed Mr. W. H. Wyke, who is looking after the business connected with the bonding of the road.

MR. GEORGE H. GIBSON has resigned as manager of the advertising and publication department of the B. F. Sturtevant Company, of Boston, Mass., to accept an appointment with the International Steam Pump Company, of New York City. Mr. Gibson was formerly connected with the Westinghouse Companies' Publishing Department, of Pittsburg, Pa., and was for two years a member of the editorial staff of the Engineering News, of New York.

MR. JOHN MAHANEY, who for many years has been connected with the St. Louis Transit Company, as superintendent of the second division, has resigned his position to become auditor of the St. Louis & Suburban Railway Company. On July 8 he was presented with a silver tea service by the employees of his former division. Mr. Mahaney's division included the Cherokee, Tower Grove and Jefferson Avenue lines, and was one of the most important in the operating department of the system. Charles Turner, superintendent of the Olive Street division, is slated to succeed Mr. Mahaney. These changes will go into effect at once.

MR. THOMAS CHALMERS, one of the founders of the Fraser & Chalmers Company, of Chicago, now merged into the Allis-Chalmers Company, died at Chicago on Tuesday, July 14. Mr. Chalmers was born in Dronley, near Dundee, Scotland, in 1816. He followed the trade of a machinist at the age of fourteen in Scotland and England, and came to this country in 1843. After settling in a farming site near Lockport he walked to Chicago and sought employment as a machinist in 1844. Later he was employed by Mr. P. W. Gates and was associated with him in business for thirty years. In 1855 he assisted in forming the firm of Gates, Warner, Chalmers & Fraser. In 1871 the firm of Fraser & Chalmers was organized. In 1901 Mr. Thomas Chalmers withdrew from active participation in the business.

MR. A. M. MATTICE, chief engineer of the Westinghouse Electric & Manufacturing Company, has just been appointed chief engineer of the Westinghouse Machine Works, but will continue his connection with the Electric & Manufacturing Company in the capacity of consulting engineer. Mr. B. G. Lamme has been appointed acting chief engineer for the Electric & Manufacturing Company. Mr. Mattice was graduated from the Naval Academy, of the class of 1874, and for a considerable period after graduation acted as assistant to the engineer-in-chief of the navy. After leaving the naval service he made a study of the application of electricity to power purposes, and as chief assistant of Mr. E. D. Leavitt, of Cambridgeport, Mass., chief engineer of the Calumet & Hecla copper mines, supervised the application of electric power to a number of the Michigan copper mines. He was appointed chief engineer of the Westinghouse Electric & Manufacturing Company about twenty months ago.

Mr. Lamme has been identified with the Westinghouse Company for a long time as its chief designer. He was graduated from the Ohio State University in the mechanical engineering course in 1888, and soon after entered the employment of the Westinghouse Electric Company. He has designed a great deal of the power apparatus of this company, including the early No. 3 railway motor; the 1500-kw generators installed in Philadelphia, the 5000-hp generators at Niagara, the 5000-kw generators and the 1500-kw rotaries for the Manhattan Railway.

MR. L. D. MATHES has been appointed general manager of the Union Electric Company, of Dubuque, Ia., to succeed Mr. F. L. Dame, resigned, who has become connected with the General Electric Company. Mr. Mathes formerly was general superintendent of the Trenton & New Brunswick Railroad, and before his connection with that company was general superintendent of the Norfolk & Atlantic Terminal Company, of Norfolk, Va. Mr. Mathes is thirty-two years of age, and was educated at the University of Tennessee. His first mechanical experience was in the shops of the Memphis & Charleston Railroad, at Memphis, Tenn. He soon abandoned the steam railroad field, however, and joined the forces of the Edison General Electric Company. With that company, its successor, the General Electric Company, and with the Westinghouse Electric Company, he engaged for five years in the construction, equipment and operation of electric railways in various parts of the country. Mr. Mathes, deciding then to take up the operating side, accepted an important position with the construction department of the Buffalo & Niagara Falls Electric Railway, at the time of its construction one of the most pretentious of electric railway undertakings. Later he was appointed superintendent of the Norfolk & Ocean View Railway, and by his economical management succeeded in placing the road in so substantial a financial position that it was taken out of the hands of the receiver, and transferred to its original owners. Mr. Mathes was connected with this company two and one-half years. After a short connection as general superintendent with the Charleston & Seashore Railroad, of Charleston, S. C., he accepted the position of general superintendent of the Norfolk & Atlantic Terminal Company, which does an immense freight and pleasure business. As manager of the Union Electric Company Mr. Mathes will be called upon to solve the trying questions of a combined street railway, electric lighting and power system, but he is well fitted by his varied experience for the duties that will evolve upon him.

MR. W. W. MILLER, of New York, who, as first vice-president of the New Orleans Railway Company, of New Orleans, La., has been in active charge of the affairs of that company since last March, and who now returns to New York, after having turned over to Mr. E. C. Foster, formerly general manager of the Massachusetts Electric Companies, the management of the property in his dual capacity of president and manager of the company, is a native of Washington, D. C. He was born in that city on May 14, 1870, and is a son of William J. Miller, who, for many years, was one of the leaders of the bar of the District of Columbia. Mr. Miller first attended school at the Sisters of the Holy Cross in Washington, D. C., where he went for about four years; after that he attended the public schools, passing through the common school and high school. He did not take an undergraduate course at college, but immediately upon finishing at the high school started in on a law course at the National University in Washington, D. C., and after the required two years' course took the degree of LL.B. in the spring of 1890. He remained another year in the law school, taking the post-graduate course, and gained the degree of LL.M. the following spring. When admitted to the bar he was just twenty-one years old. It seems that he had long been determined to go to New York to enter upon his professional career. His parents were very much averse to this, for it was expected that he would take a position with the law firm of which his father was a member. It was in April, 1891, that Mr. Miller arrived in New York, and immediately, through his own efforts, he secured a position with Messrs. Hornblower, Byrne & Taylor, prominent lawyers. Three years after entering the firm's employ Mr. Miller became a partner. At present the firm consists of five members, Messrs. Hornblower, Taylor, Byrne, Miller and Potter, and the office force consists of about thirty persons. The National University at Washington has conferred on Mr. Miller the honorary degree of LL.D., and in 1900 Princeton University conferred on him the honorary degree of A. M. In addition to his professional duties Mr. Miller is also a trustee in many large corporations. Beside his legal connections and the position he holds with the New Orleans Company, may be mentioned the fact that he is vice-president of the Lake Street Elevated Railroad, of Chicago.